Regional Rural Development Standing Working Group

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SOLID WASTE MANAGEMENT

In cross-border rural and coastal areas of South Eastern Europe

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ASSESSMENT METHOD

for cross-border adverse environmental and economic impact

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*This designation is without prejudice to positions on status, and is in line with UNSCR 1244/1999 and the ICJ Opinion on the Kosovo declaration of independence

Executive Summary

Floating debris (both marine and transported by rivers), regardless of the size, means any persistent, manufactured or processed solid material discarded, disposed of or abandoned in the marine, coastal and riverine environment.The majority of marine litter / floating debris consists of synthetic materials such as plastic, metal, glass and rubber. It originates from many different sources, circulates through a range of pathways, and accumulates at various locations known as endpoints - litter sinks or stranded waste.

It is often (sometimes erroneously) assumed that much of the litter in seas / rivers / reservoirs arises from foreign sources. It is due to the current lack of understanding of litter in the marine and riverine environment, which contributes to a continued lack of co-ordination and impetus to organise a coherent strategy to deal with the issue. The Environmental and Economic Impact Assessment Method (hereinafter "The Method") is developed to help in assessing the marine litter / floating debris lifecycle and potential adverse effects of mismanagement of solid waste in three pilot regions ("Sharra, "Tara-Drina-Sava" and "Adriatic "Coast"), in order to formulate suitable precautions which could prevent these effects from taking place. Application of the Method and the development of regional Environmental and Economic Impact Assessment Reports based on it should foster the stakeholder dialogue, facilitation and identification of knowledge gaps in the course of the project and possibly beyond.

The Method covers the *municipal[2] waste*, as it contains light fractions (mainly plastics) which constitute the *major share*[3] in the marine litter / floating debris.

This Method attempts to cover the full lifecycle of the marine litter / floating debris by incorporating the following issues:

1. *Root problem* identification, answering the question "why" and "how" the marine litter / floating debris is generated;
2. Identification of *sources* of marine litter / floating debris, to answer the question "who is responsible" (i.e. impacting municipalities / countries) and "where it comes from" (i.e. locations);
3. Identification of *pathways* to answer the question "how the marine litter / floating debris is transported in the transboundary context";
4. Identification of "*endpoints*" (sinks) of marine litter / floating debris to answer the question "who is suffering" the effects (i.e. impacted municipalities / countries);

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[2] http://ec.europa.eu/eurostat/web/waste/transboundary-waste-shipments/key-waste-streams/municipal-waste
Municipal waste consists of waste collected by or on behalf of municipal authorities, or directly by the private sector (business or private non-profit institutions) not on behalf of municipalities. The bulk of the waste stream originates from households, though similar wastes from sources such as commerce, offices, public institutions and selected municipal services are also included. It also includes bulky waste but excludes waste from municipal sewage networks and municipal construction and demolition waste.

[3] A study of Öko-Institut (2012; figures mainly from UNEP 2009) derives the following figures of the plastics` shares monitored at: beaches: 37-80% plastics; floating: 60-83% plastics; sea-floor: 36-90% plastics.

5. Identification and assessment of *environmental and economic impacts* and assessment of associated *costs;* the latter will help answering the question “what are the costs incurred to the society” to tackle the marine litter / floating debris” effects.

The transboundary impacts deriving from the floating waste in the pilot regions can be environmental and economic. The entanglement by and ingestion of marine litter by organisms are the most noticeable environmental impacts. Marine litter / floating debris can cause serious economic losses to various sectors and authorities. Among the most seriously affected are coastal communities (increased expenditure on beach cleaning, public health and waste disposal), tourism (loss of income, bad publicity), fishing (reduced and lost catch, damaged nets and other fishing gear, fouled propellers, contamination) and shipping (costs associated with fouled propellers, damaged engines, litter removal and waste management in harbours).

This Method should help in quantifying, where possible in economic terms, the impacts of marine litter / floating debris on the interestsof pilot countries and municipalities. Placing a monetary value on the effects of litter may be possible for some sectors (for example, costs for beach cleaning, damage to tourist trade, loss of energy production due to turbine breakdowns, etc.), but is more difficult for some other sectors (notably environmental impacts). The stakeholders in the pilot regionswill be instrumental in collecting information necessary to quantify the respective impacts.

However, finding usable data on impacts and quantities of marine litter remains a challenge. Systematic scientific research on marine litter in the pilot regions is relatively scarce. This makes quantifying the impacts very hard. Nevertheless, even the characterization of impacts based on assumptions can be a step forward in understanding the marine litter / floating debris problems.

Some municipalities, which are most plagued by litter, have no control over the production or disposal of that litter at the place of source. Furthermore, in the absence of a coordinated approach, efforts of some municipalities to reduce the intake of or remove the plagued debris may be undermined by the lack of action of the others. Therefore, an open, constructive and forward-looking dialogue on controversial topics is needed to identify joint visions and opportunities forsolutions related to marine litter.

1. Background

The Regional Rural Development Standing Working Group (SWG) and the Network of Associations of Local Authorities of South-East Europe (NALAS) are implementing a regional sub-project "Solid Waste Management in cross-border rural and coastal areas of South Eastern Europe" supported by the German Federal Ministry for Economic Cooperation and Development (BMZ) through the GIZ Open Regional Fund for South East Europe – Modernisation of Municipal Services (ORF MMS) and the Government of Switzerland.

The SWGis engaged in improving rural livelihoods in the SEE countries. To this end, it promotes innovative and sustainable agriculture and rural development through regional cooperationof respective Ministries of Agriculture and other stakeholders. It supports the EU integration in the SEE, by:

- fostering rural development policies;
- improving implementing structures and systems for agriculture and rural development;
- improving the understanding and use of implementation tools for agriculture and rural development;
- identifying and sharing information and application of good practice in agriculture and rural development to broaden the rural agenda.

NALAS brings together 16 Associations which represent roughly 9000 local authorities, directly elected by more than 80 million citizens of this Region. NALAS helps the associations to represent viably the local authorities vis-à-vis central governments. NALAS provides services to local governments and aspires to develop itself as the Knowledge Center for the local government development in the SEE. It promotes:

- the process of decentralization, considering the local self-government as a key issue in the transition process in the SEE;
- partnerships in order to contribute to the EU integration as well as the reconciliation and stabilization process.

2. Goals and Objectives

The overall aim of the sub-project is to "improve the conceptual and organisational framework conditions concerning Integrated Solid Waste Management (ISWM) in cross-border rural and coastal areas in SEE".

The specific goal of the sub-projectis to "assess and develop schemes (models) for integrated management of solid waste that are environmentally effective and economically affordable in order to reduce adverse environmental and economic impacts of solid waste mismanagement and support the ecological and socio-economic development of the cross-border rural and coastal areas in the SEE countries".

This Method for Environmental and Economic Impact Assessment (hereinafter "The Method") is intended to contribute to enhancing the knowledge of relevant stakeholders[4]on marine litter /

[4]The project stakeholders include: national government institutions, local authorities, public and private waste management operators, enterprises dealing with recycling, hospitality industry representatives and civil society.

floating debris[5] impacts and associated costs.A regional approach is applied,which is oriented towards the needs and perspectives of the countries contributing to the impacts of solid waste mismanagement (so called "impacting") and the countries suffering from the adverse effects (so called "impacted").Furthermore, three pilot regions are analysed: "Sharra", "Tara – Drina – Sava" and "Adriatic Coast" Region. The geographical scope is explained in more details in chapter 3 below.

This Method should help in developing actions to prevent and/or reduce the marine litter / floating debris generation at the source. It will foster the stakeholder dialogue, facilitation and identification of knowledge gaps.

The Methodis only the first step of a series of activities intended to formulate regionally accepted measures intended to improving the current inadequate waste management practices andreducing the deriving transboundary impacts. Other activities under this sub-project include:

1. Developing Environmental and Economic Impact Assessment Reports for each pilot region using the **Method**.
2. Drafting Integrated Solid Waste Management (ISWM) Models, Collection of Best Practices and Policy Recommendations, towards mitigating thetransboundary pollution.
3. Generating project proposals (i.e. fiches), deriving from the ISWM models, to support the relevant stakeholders in fundraising of follow-up activities.

3. The Pilot Regions

The project covers three pilot rural and coastal areas which share natural resources – a mountain range ("Sharra" region), transboundary river catchments ("Tara - Drina – Sava" region) and a sea coast ("Adriatic Coast" region).

Each pilot region is unique, yet they share common natural[6] and human capital[7] which represent a basis for economic development. Due to insufficient solid waste management practices and deriving environmental impacts, the pilot rural and coastal regions are not fully utilising their potential for economic development (i.e. tourism, sustainable agriculture, etc.).

The geographical scope as well as description of preliminary identified waste management problems and deriving transboundary impacts in the pilot areas are highlighted below.

- "Sharra"PilotRegion

The pilot region "Sharra" encompasses 6 municipalities from three countries: Macedonia, Albania and Kosovo* (Table 1).

Table 1"Sharra " Pilot region (Macedonia-Albania-Kosovo):*

Countries

[5]A distinction between "marine litter" and "floating debris" is made to indicate whether the litter is carried away by the sea currents and tides ("marine litter") or by the rivers ("floating debris").
[6]Natural capital comprises natural resources and ecological services.
[7]Human capital refers to the stock of education, skills, culture and knowledge.
*This designation is without prejudice to positions on status, and is in line with UNSCR 1244/1999 and the ICJ Opinion on the Kosovo declaration of independence.

Macedonia	**Kosovo*[3]**	**Albania**
	Pilot Municipalities	
Jegunovce	Shtrpce	District Kukes
Tearce	Prizren	
	Dragash	

The provisional territorial distribution of the pilot municipalities in the “Sharra” region is highlighted in Figure 1 below.

Figure 1“Sharra”PilotRegion

SharraMountain ecosystem providesdirect and indirect support to the people in terms of wide range of goods and services, including water, energy, timber, biodiversity maintenance and opportunities for recreation including aesthetic and spiritual needs of the people. The National Park Sharra is shared by the pilot countries.

Natural resources, wildlife and communities are being compromised by the illegal dumping in all pilot countries in the SharraRegion. Illegal dumps are mainly created by the population not receiving regular waste collection service.The major transboundary impact deriving from the illegal dumping in the pilot region is the floating debris carried by the rivers in the transboundary area. There are two main pathways of the floating debris: White Drin and Lepenec. The area most impacted by the accumulation of floating debris is the reservoir and Hydropower Plant Fierzelocated in the Municipality of Kukes. Floating debris transported by the Black Drin also enters the Fierze Reservoir.

*This designation is without prejudice to positions on status, and is in line with UNSCR 1244/1999 and the ICJ Opinion on the Kosovo declaration of independence

- “Tara – Drina - Sava”Pilot Region

The “Tara-Drina-Sava” pilot region is divided into two sub-catchments: “Drina-Tara” and “Drina-Sava”.

The “Drina-Tara” Region encompasses 14 municipalities from three countries: Bosnia and Herzegovina, Montenegro and Serbia (Table 2).

Table 2"Drina - Tara” River (Bosnia and Herzegovina-Serbia-Montenegro)

Countries		
BiH	**Serbia**	**Montenegro**
Pilot Municipalities		
Visegrad	Ljubovija	Bjelo Polje
Rudo	Bajina Basta	Pljevija
Gorazde	Prijepolje	
Srebrenica	Priboj	
Bratunac	Cajetina	
Milici	Uzice	

The provisional territorial distribution of the pilot municipalities in the “Drina-Tara” Region is highlighted in Figure 2 below.

Figure 2 “Drina – Tara” Pilot Region

The “Drina - Sava” Pilot Region encompasses 11 municipalities from two countries: Bosnia and Herzegovina and Serbia (Table 3). Originally the participation of two municipalities from Croatia was foreseen (Ilok and Lovas), but it was decided to exclude them due to objective reasons.

Table 3"Drina-Sava" Pilot Region

Countries		
BiH	**Serbia**	**Croatia**
Pilot Municipalities		
Brcko	Loznica	/
Bjelina	Sremska Mitrovica	
Zvornik	Sabac	
Ugljevik	Krupanj	
Lopare	Mali Zvornik	
	Bogatic	

The provisional territorial distribution of the pilot municipalities in the "Drina-Sava" region is highlighted in Figure 3 below.

Figure 3 Drina -Sava Pilot Region

The area is a unique natural resource:Drina River crosses three national parks -Durmitor National Park in Montenegro, Sutjeska National Park in Bosnia and Herzegovina and the Tara National Park in Serbia. Unfortunately, this important area has come under threat of many unregulated dumps of waste. Approximately 30%[9] of all flooding waste ends up in the riverbed.

The major transboundary impact deriving from the inadequate municipal waste management in the pilot region is the floating debris carried by Drina River, its tributaries and Sava River. Light

[9] https://www.icpdr.org/main/publications/drina-rivers-floating-problem

pieces of plastic - part of the dumped packaging material, float around on the surface and are carried by the river streams for long periods across great distances:a portion of the floating debris is washed onto the riverbanks and another ends up in reservoirs created by dams which are built onto the Lim and Drina Rivers -Potpec, Visegrad, Bajina Basta and Zvornik (Figure 4).

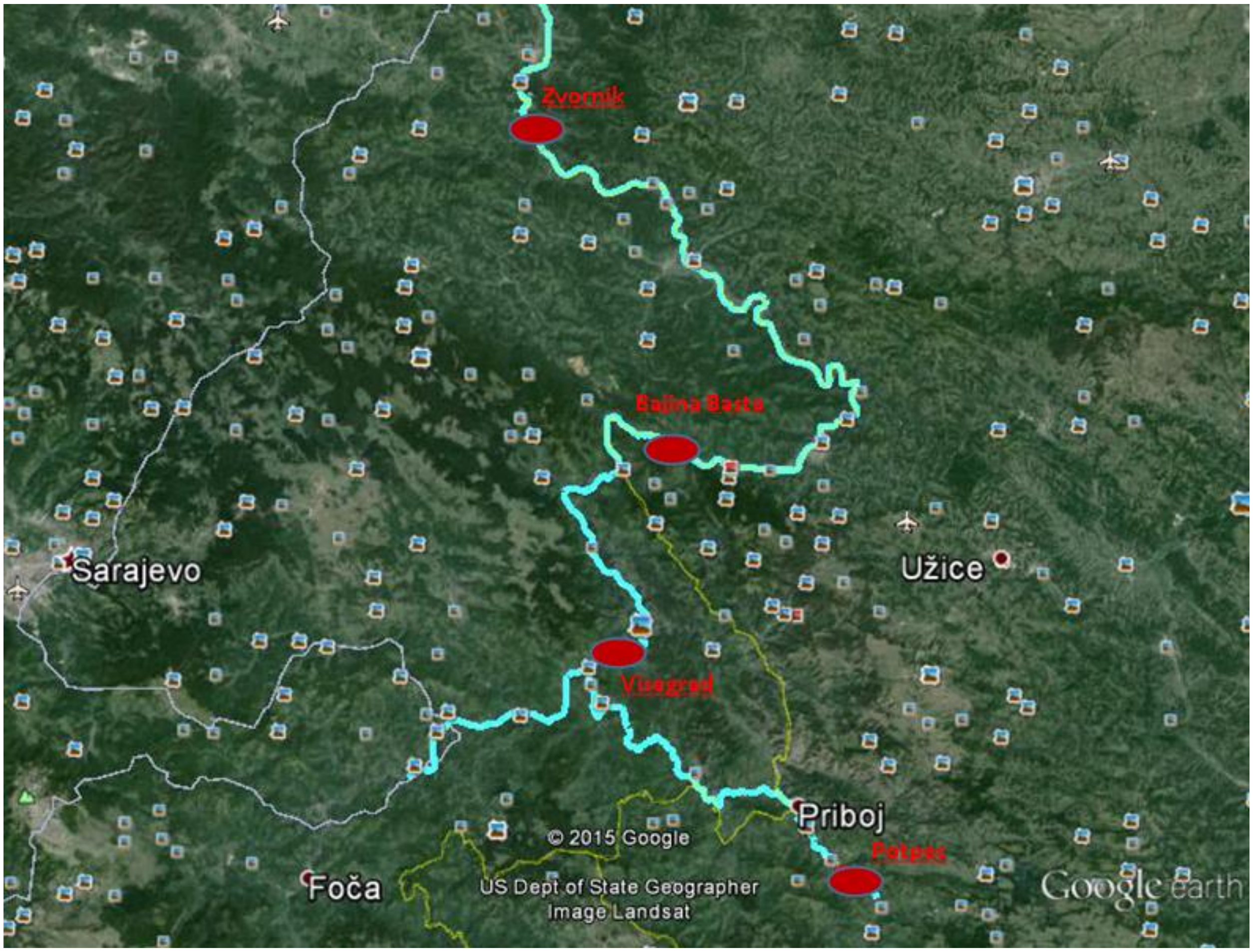

Figure 4 Reservoirs along the Lim and Drina River

- Adriatic Sea coastal region

The pilot region “Adriatic Coast” encompasses 9 municipalities from four countries: Albania, Bosnia and Herzegovina, Croatia and Montenegro, - (Table 4).

Table 4 Adriatic Sea Coastal Region (Albania – Montenegro – BiH – Croatia)

Countries			
BiH	**Croatia**	**Montenegro**	**Albania**
Pilot Municipalities			
Neum	Mljet	Ulcinj	Shkoder
	Slivno	Bar	VauiDejes
		Herceg Novi	Lezha

The provisional territorial distribution of the pilot municipalities in the "Adriatic Coast" Region is highlighted in Figure 5 below.

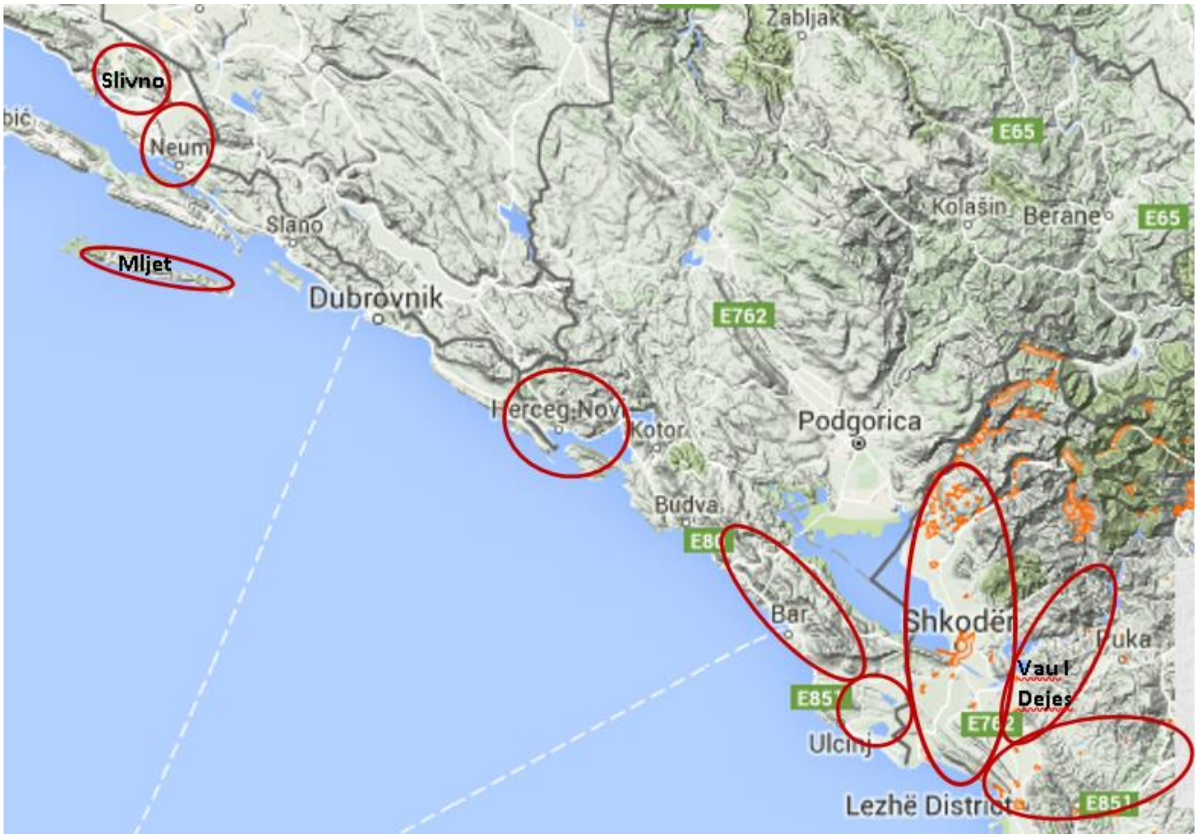

Figure 5 Adriatic Sea Coastal Region

Almost all economic activities in the "Adriatic Coast" pilot region are directed towards facilitating the development of tourism. Areas rich in biodiversity are found there: deltas of Buna/Bojana River (Montenegro and Albania), Drin River (Albania) and Neretva River (Croatia), as well as biodiversity hotspots, such as Lumi Buna-Velipojë (Albania), Shkoder / Skadar Lake (Montenegro), etc. The valuable biodiversity hotspots add to the tourism potential of the Region. However, these are threatened by the marine litter induced pollution.

The marine litter originating from land-based sourcesfloats on the sea surface, sinks on the seafloor or gets stranded at the sea coastlines (beach-litter). It causesvarious environmental and economic impacts in the transboundary area. Major pathways of marine litter are the rivers Buna/Bojana, (Albania and Montenegro), Drin and Mat (Albania) and Neretva.

4. The Approach

This chapter outlines the proposed method for the assessment of the transboundary impacts deriving from the current waste management operations in the pilot regions.

4.1 Introducing the Marine Litter / Floating Debris

Marine litter / Floating Debris, regardless of the size, means any persistent, manufactured or processed solid material discarded, disposed of or abandoned in the marine, coastal and riverine environment.

Box 1.Highlights on environmental and economic impacts of marine litter / floating debris

Municipal Solid Waste Management (SWM) System involves various activities like collection, transportation, storage,disposal, etc. These activities, even if properly controlled and with proper precautionary measures adopted, may have adverse impact on land, water and air environment, human and environmental health, aestheticsand quality of life. The current practices in all pilot rural and coastal regions show deficiencies and therefore negative environmental and economic impacts occur in the local and transboundary context.

The major transboundary impacts in the pilot rural and coastal regions are caused by the marine litter / floating debris.

Land - based sources mainly include non – compliant municipal landfills, illegal dumps or recreational areas (tourist resorts, beaches, etc.).

The *environmental impacts* encompass water pollution, threats to the marine wildlife / river ecosystems and protected areas, as well as human health problems in terms of potential injuries of people by sharp objects settled at the bottom of the sea / rivers or accumulated debris at the coast / river banks.

The *economic impacts* comprise costly clean-up activities (either in the sea / lakes / reservoirs or at the coast / river banks), declining fisheries, loss of tourism and related revenues, damage of nautical objects and costs of their rescue, declined energy production due to blockage of hydropower plants,etc.

The process of distribution of waste deriving from land – based sources in the form of floating waste which is blown or washed away and transported in the transboundary area is shown in Figure 6 below.

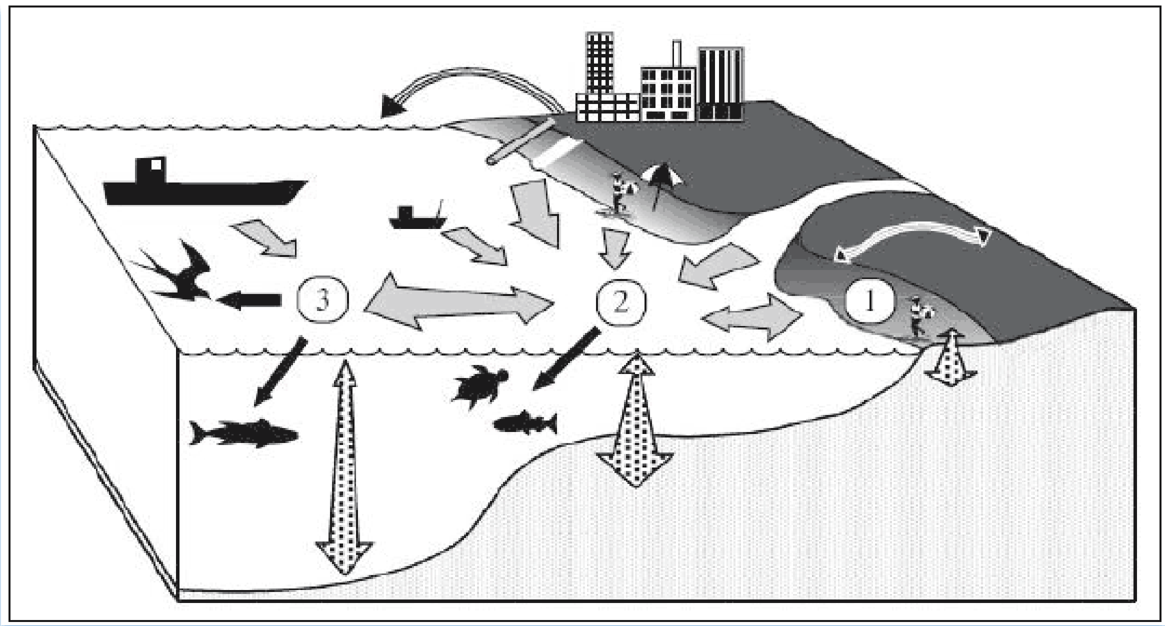

Figure 6 Origins, pathways and sinks of marine litter / floating debris

The origins, pathways and sinks of floating debris:

- Origins include land - based sources (landfills / dumps / recreational areas);
- Pathways are presented as wind-blown litter (curved arrows) and washed away litter transported by the river or sea current (grey arrows);
- Sinks into the seabed or riverbed (stippled arrows): 1) coast; 2) shelf, 3) open sea / reservoirs in the river watersheds of the pilot areas (stippled arrows);
- Impacted wildlife and shipping industry (black arrows).

4.2 Method`s Overview

Marine litter originates from many different sources, circulates through a range of pathways, and accumulates at various locations known as endpoints - litter sinks or stranded waste.

It is often erroneously assumed that much of the litter in seas / rivers / reservoirs arises from foreign sources. It is due to the current lack of understanding of litter in the marine and riverine environment, which contributes to a continued lack of co-ordination and impetus to organise a coherent strategy to deal with the issue.

The Method should help in assessing the marine litter lifecycle and potential adverse effects of mismanagement of solid waste in order to formulate suitable precautions which could prevent these effects from taking place.

The Method covers the *municipal*[10] *waste*, as it contains light fractions (mainly plastics) which constitute the *major share*[11] in the marine litter / floating debris.

[10]http://ec.europa.eu/eurostat/web/waste/transboundary-waste-shipments/key-waste-streams/municipal-waste
Municipal waste consists of waste collected by or on behalf of municipal authorities, or directly by the private sector (business or private non-profit institutions) not on behalf of municipalities. The bulk of the waste stream originates from households, though similar wastes from sources such as commerce, offices, public institutions and selected municipal services are also

Ad mentioned elsewhere, this Method attempts to cover the full lifecycle of the marine litter / floating debris by incorporating the following issues:

6. *Root problem* identification, answering the question “why” and “how” the marine litter / floating debris is generated;
7. Identification of *sources* of marine litter / floating debris,to answer the question “who is responsible” (i.e. impacting municipalities / countries) and “whereit comes from” (i.e. locations);
8. Identification of *pathways* to answer the question “how the marine litter / floating debris is transported in the transboundary context”;
9. Identification of “*endpoints*” / sinks of marine litter / floating debris to answer the question “who is suffering” the effects (i.e. impacted municipalities / countries);
10. Identification and assessment of *environmental and economic impacts* and assessment of associated *costs;* the latter will help answering the question “what are the costs incurred to the society” to tackle the marine litter / floating debris” effects.

A snapshot of the method is presented in the Figure 6 below:

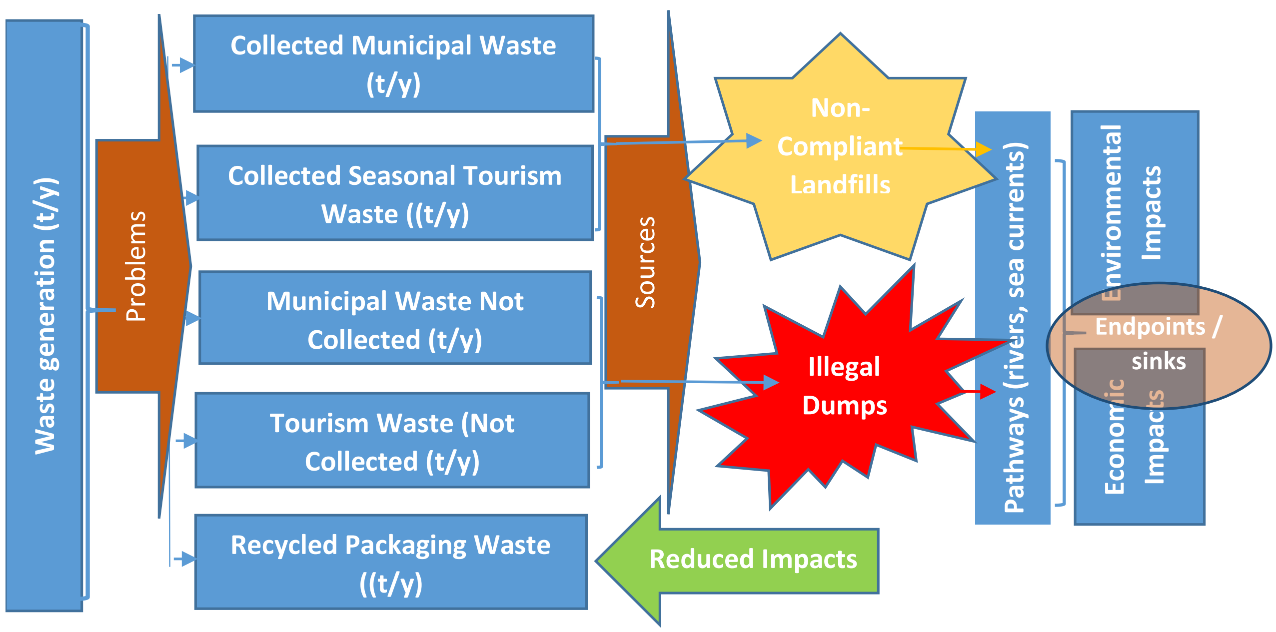

Figure 7 Method for Environmental and Economic Impact Assessment

4.2.1 The Root Problems

The litter from landfills / dumpsites, recreational beach and roadside litter, which is inadvertently released into the rivers and sea, is causing various transboundary impacts. The root problems of the marine litter / floating debris are the insufficient organisational capacities of local authorities and waste management operators,funding, as well as awareness ofenvironmental and economic impacts.

included. It also includes bulky waste but excludes waste from municipal sewage networks and municipal construction and demolition waste.

[11]A study of Öko-Institut (2012; figures mainly from UNEP 2009) derives the following figures of the plastics` shares monitored at: beaches: 37-80% plastics; floating: 60-83% plastics; sea-floor: 36-90% plastics.

Box 2. Waste management problems in pilot regions

The waste management problems in the pilot regions comprise:

- Insufficient municipal waste management planning, poor local regulations and enforcement;
- Improper solid waste management practices which contribute to illegal dumping and littering:
    - Inadequate volume and distribution of waste collection vessels;
    - Insufficient refuse vehicles collection capacity and configuration to adjust to the steep terrain and narrow roads in rural areas;
    - Lack of organisational and financial capacity to improve the connectivity of remote and scattered (rural) areas (and islands) to the existing regional waste management systems;
    - Insufficient refuse vehiclescollection capacity and volume of vessels to meet the service demand during high tourist season;
- Inability of public utilities to exploit the recycling to its full potential:
    - Insufficient refuse vehiclescollection capacity and volume of vessels for segregated waste collection;
    - Low organisation capacity and resistance to change the routine;
    - Lack of determination to involve the service users in recycling operations;
    - Lack of experience and distrust in cooperating with the private sector;
- Insufficient engagement of service users and other stakeholders in SWM planning:
    - Setting the standards and scheduling the services without prior consultation;
    - Lack of adequate complaint mechanisms;
    - Lack of incentives for segregated collection of recyclables;
- Dysfunctional public utilities (and private operators working under service contracts):
    - Inadequate tariff setting and lack of suitable economic instruments to recover costs of SWM operations;
    - Overstaffing;
    - Insufficient access to finance for the development of (costly) infrastructure (facilities for waste recovery, recycling and environmentally safe disposal).

Key to understanding the root causes of the transboundary impacts from the improper waste management in the pilot municipalities is the following:

1. **Waste generation** in every pilot municipality.
2. **Waste collection rate** (service coverage)is the most important indicator of the possible occurrence of *illegal dumping*by the population not receiving regular waste collection service.
3. **Waste disposal practice**: in case of EU non-compliant disposal methods applied by the municipalities, there is a possibility for the waste to be blown or washed away and transported across the borders.
4. **Recycling rate** of packaging waste (paper, plastics, etc.). If the recycling rate is low, there is higher possibility for migration of the waste from the land-based sources in the transboundary areas. Otherwise, recycling is a method for preventing the transboundary impacts.

These deficiencies result in poor waste disposal, illegal dumping and littering. Dumps and non-compliant municipal landfills are source of various environmental and economic impacts on national, but also regional scale.

In order to analyse the root problems of the marine litter / floating debris generation the following information will be collected for each pilot country / municipality:

Table 5 Policy and Legislation

Country				
What documents are in place to guide waste management in the country?	**Document Title / Content etc.**	**Date Published**	**Date Due for Revision**	**Comments**
What are the key pieces of waste legislation?	**Waste Management**	**Special Waste Streams**	**Waste Treatment and Disposal**	**Others**
What are the main institutions involved in the governance of waste management - describe roles and responsibilities?	**National Government**	**Regional Authorities**	**Local Authorities**	**Waste Utilities (public or private)**
Recycling Targets	**Packaging Waste**		**Organic Waste**	
Are there additional revenues for the local authorities for wastemanaging?				**Yes / No**
Is there producers` responsibility for special waste streams?				**Yes / No**
Is there any landfill tax?				**Yes / No**
Local Regulations (e.g. Decision on Communal Order, Ordinance on Public Hygiene, etc.)				**Yes / No**

Table 6Waste Generation

Municipality	
Population	
Economic activities	
Waste generation per capita (per day and year)	
Waste Composition (%)	
Organic	
Paper	
Plastic	
Glass	
Metal	
Other	

Not all the municipalities have sound records of the waste statistics. During the data collection process estimations may need to be made using information from suitable literature and expert judgment.

Table 7Financing of Municipal Waste Management

Public Utility (name)	
Does the population pay waste management charges?	
Charging Method: – **flat rate;**	

– based on frequency of service; – based on waste volume (container);	
Payment efficiency (%)	
Cost Recovery	**Yes / No**
Is there any private waste management operator?	**Yes / No**
Waste Collection Rate (Service Coverage) (%)	

A regional common framework, in tune with on-going efforts, is necessary to create the conditions for curbing the problem of transboundary pollution in terms of proper solid waste management practices, education and public awareness.

The solutions to these problems will be sought in the aforementioned regional ISWM models.

4.2.2 The Sources

The sources of floating debris are diffuse including offshore and land-based. According to the Joint Group of Experts on the Scientific Aspects of Marine Environmental Pollution (GESAMP) (1991), land-based sources account for up to 80 percent of the world's marine pollution. In the Mediterranean, reports from Greece (Koutsodendris et al., 2008; Ioakeimidis et al, 2014) classify _**land-based**_ sources (up to 69%) and _**vessel-based**_ sources (up to 26%) as the two predominant litter sources, depending on the area.

However, the ability to identify a particular source from an individual litter item is difficult. Existing methodologiesfor monitoring of marine litter / floating debris focus on abundance, types and concentration rather than analysing by potential source, as in many cases it is very difficult to connect a debris item to a specific debris-generating country or activity.Many published studies have attempted to attribute beach litter to a broad source, but this has often been based on local knowledge, assumptions and seemingly an absence of a rigorous methodology. For example, Willoughby (1986), found that rubbish slicks on islands surrounding the city of Jakarta, Indonesia, contained large quantities of freshwater hyacinth, a plant which does not grow on the islands, thus linking the source of the litter to rivers of the mainland. The litter itself can also serve as indicator for potential sources. For example, if a large fraction of floating AMD carries foreign labels, this is often used as indicator to infer sea-based activities, in particular shipping (Santos et al., 2005; Kei, 2005). The type of litter can also hint at the possible sources, e.g. plastic cups, beverage bottles, sun lotion and other items likely come from touristic activities on the beach (e.g. Gabrielides et al., 1991; Nagelkerken et al., 2001). However, there are very few published studies that have set out to determine the precise source of beach litter using a specific methodology. At present there is no accepted methodology that enables researchers to link litter items to their source.

This Method proposes to identify all **Locations (so called "hotspots")** from where the waste disposed in a non-complaint manner or illegally dumped can be washed or blown away and becomes a source of transboundary impacts. As an initial step, the existing knowledge of stakeholders in the pilot regions should be exploited to collect the necessary information (Table 8).

Table 8 Sources of Marine Litter / Floating Debris

Municipality	
Name of non-compliant landfill(s), illegal dump(s)	

Area (m²)	
Waste origin (settlements, industry, healthcare establishments, etc.)	
Typical landfill operations (e.g. compaction, daily coverage)	
Typical technical measures applied (e.g. bottom sealing, leachate drainage, landfill gas extraction and flaring, etc.)	
Likelihood for transboundary impacts (high, medium, low)	

The (known) *locations of non – compliant landfills and illegal dumps* located nearby[12] the rivers, lakes (i.e. Shkoder Lake, reservoirs Visegrad, BajinaBasta, Zvornik and Fierze) and sea shore (beaches, tourist areas) will be mapped out in a google earth file to allow for prospecting the sources of marine litter / floating debris in a regional context.

As a follow up action and subject to available funding, a monitoring methodology should be developed and applied in order to allow for better allocating sources to litter items monitored.

4.2.3 The Pathways

Pathways of marine litter / floating debris can be sea currents, rivers, drains, sewage outlets and storm water outflows, road run-off.This Method will focus onto major rivers and sea currents only.

After the initial arrival in the sea / river / reservoir, several factors contribute to the post-entry displacement of marine litter / floating debris. Seaand river currents,wind, tides& waves and floods can carry marine litter / floating debris over long distances from their original point of entry (Ryan, 1988; Haynes, 1997; Aliani et al., 2003; Maximenko et al., 2012).

The pathways will be analysed concurrently with the identified sources. The required data is presented in Table 9 below.

Table 9 Pathways of Marine Litter / Floating Debris

Municipality	
Pathways (rivers, cannels, drains, gullies, reservoirs, aquifers, sea currents, atmosphere, etc.)	
Migration Drivers (wind, precipitation / flood, erosion)	

The pathways (the rivers Lim, Drina, White Drin, Lepenec, Drin, Buna/ Bojana, Mat and their tributaries, as well as the sea currents) will be mapped out. The migration drivers that influence the distribution of the marine litter / floating debris in the pilot regions (precipitation / floods – for rivers, Bora / Jugo winds for the Adriatic Sea) will also be analysed. These drivers may be important to identify the seasons when the generation, settling / sinking and stranding of floating waste is taking place.

The Method acknowledges the need to analyse these drivers; however, due to time and resource limitations, analyses will be based on existing knowledge of stakeholders on the relative importance of the pathways and drivers for the marine litter / floating debris generation and distribution.

4.2.4 The Endpoints

[12] The term "nearby" means a relative distance of 500-1,000 m from the source to the pathway (river or sea).

After voyages, marine litter / floatingdebriswill finally sinkor become deposited on the coast / riverbanks / reservoirs; a large proportion of marine litter / floating debrisaccumulates on the coast / riverbanks around the world.After stranding, it generally becomes trapped in/under sand or might be blown farther inland (Merrell, 1980; Williams and Tudor, 2001; Kusui and Noda, 2003).

These endpoints / sinks may or may not be permanent. Strong onshore winds could sweep coastal waters clean while accumulating large quantities of floating marine litter / floating debris on local beaches (e.g. Aliani et al., 2003). Indeed, on a Japanese beach, the abundances of marine litter / floating debris were strongly correlated with onshore winds (Kako et al., 2010). However, few studies have systematically examined the abundances and proportions of marine litter / floating debrissimultaneously at sea and on the shore.Beach clearance operations, such as the removal of litter at a temporary sink, may in the long term be ineffective as the beach is replenished periodically from offshore sinks.

This Method envisages two approaches to identify the sinks / endpoints of marine litter / floating debris:

1. Mapping of sea currents and winds in conjunction with available studies on monitoring the marine litter and existing knowledge of stakeholders will provide insights into possible endpoints where the litter is stranded or trapped. The countries / municipalities on theterritory of whichthe marine litter sinks / strandsaccumulateare considered "impacted" from the sources located elsewhere in the pilot regions ("impacting" countries / municipalities).
2. Obvious endpoints of floating debris in the riverine environments are the locations of hydropower plants and reservoirs. Here, the "impacted" stakeholders are the hydropower plants themselves.Segmenting the rivers by the locations of these hydropower plants and reservoirs will help in the identification of upstream sources (impacting countries / municipalities).

4.2.5 Environmental and Economic Impacts

The majority of floating debris(both marine and transported by rivers) consists of synthetic materials such as plastic, metal, glass and rubber.

Internationally 84.1% of the total marine litter found within the coastal area (in 76 countries) could be separated into ten key items including smoking materials, food and beverage containers and other various types of packaging, which by material mainly consist of plastic (Ocean Conservancy, 2008). Other sources (Fanshawe&Everard, 2002; Sheavly& Register, 2007; Cheshire et al., 2009; MCS, 2009; Galgani et al., 2010) distinguish the following categories: plastics;glass; rubber; metal; timber; paper & cardboard; and textiles.

The transboundary impacts deriving from the floating waste in the pilot regions can be environmental and economic. This Method should help in quantifying, where possible in economic terms, the impacts of marine litter / floating debris on the interests of pilot countries and municipalities. Placing a monetary value on the effects of litter may be possible for some sectors (for example, costs for beach cleaning, damage to tourist trade, loss of energy production due to turbine breakdowns, etc.), but is more difficult for some other sectors (notably environmental impacts). The stakeholders in the pilot regions will beinstrumental in collecting information necessary to quantify the respective impacts.

The assessment of the impactssignificance is put in the perspective of the sources ("impacting" countries / municipalities), pathways and endpoints / sinks ("impacted" countries / municipalities). Hence, the country / municipality with high population numbers, low waste collection rate and consequently high quantities of waste ending up at unregulated sites (either non-compliant landfills or illegal dumps) which are located nearby pathways that are able to carry the litter at greater distances, will cause high impact to the environment and "impacted" communities. Another issue to consider when assessing the significance of the impact is whether the endpoint country / municipality is solely "impacted" or it also contributes to the problem. Those endpoint countries / municipalities which are not part of or are not considerably contributing to the problem are "impacted" significantly.

4.2.5.1 Environmental Impacts

Floating waste poses a considerable threat to the health and productivity of marine, lake and riverine ecosystems.

Box 3. Impact of marine litter on biodiversity

The entanglement by and ingestion ofmarine litter by organisms, are the most noticeable short-term impacts (Gregory, 2009; Thompson et al., 2009). It is estimated that 267 species are affected by marine litter globally of which 86% of all sea turtle species, 44% of seabird species, 43% of marine mammal species are affected (Laist, 1997; U.S. Commission on Ocean Policy, 2004; Allsopp et al., 2006).

Plastic litter in particular is estimated to lead to the mortality either directly or indirectly of one million seabirds, 100,000 marine mammals (including 30,000 seals) and 100,000 turtles globally every year, through entanglement or ingestion (Wallace, 1985; Laist, 1997; Moore, 2008).

Entanglement by items such as fishing nets and line, lures, light sticks, crab/lobster/fish traps, plastic bags, strapping bands and four/six pack yokes pose a significant risk to marine organisms (MCS, 2009; Ten Brink, 2009). These items are responsible for an estimated 62% of all entanglements and can reduce movement, cause injury and in some cases death from starvation, drowning or suffocation (MCS, 2009; Ocean Conservancy, 2009)

In order to assess the environmental impacts a comprehensive research should be conducted to measure the extent to which the impact occurs or affects species at the population level. In order to derive credible data, number of affected animals (either by ingestion or entanglement) hauled out, roosted or stranded at beaches, as well as animals that survive long enough to swim ashore or that become entangled close to shore, should be determined for a given period. Given the limitations of the project resources and duration, such a research cannot be conducted.

Instead, it is proposed to collect information from stakeholders in respective pilot countries on casualties of marine, lake and riverine wildlife as a result of floating waste ingestion or entanglement. Such specific knowledge may be unavailableamong the project stakeholders and therefore any quantitative assessment may not be possible.

A provisional list of responsible institutions to be involved in the process of identification and assessment of environmental impacts is provided in Table 10 below.

Table 10 List of responsible institutions for environment and fisheries

Albania	BiH	Croatia	Montenegro	Macedonia	Serbia	Kosovo*[13]
Ministry of Environment, Forestry and Water Administration; Fishery Directorate (FD) in the Ministry of Agriculture and Food (MoAF)	Ministry of Spatial Planning, Civil Engineering and Environment of the Republic of Srpska; Ministry of Environment and Tourism, Federation of BiH; Ministries of agriculture, water economy and forestry of the Republic of Srpska and Federation of BiH	Ministry of Environment and Nature; Ministry of Agriculture; Directorate of Fisheries;	Ministry of Sustainable Development and Tourism; Ministry of Agriculture and Rural Development; "MorskoDobro";[14]	Ministry of Environment and Physical Planning; Ministry of Agriculture. Forestry and Water Economy;	Ministry of Agriculture and Environment;	Ministry of Environment and Spatial Planning; Environmental Protection Agency; Ministry of Agriculture, Forestry and Rural Development.

The floating waste can have adverse impacts for the protected areas (PAs) in the pilot regions. A tentative list of PAs in the pilot regions is provided in the Table below.

Table 11 Tentative List of Protected Areas in the Pilot Regions

Sharra Region	Drina – Sava Region	Drina – Tara Region	Adriatic Sea Region
National Park Sharra		Drina – Tara Biosphere Reserve; Tara National Park	River Buna - Velipoje, Kune Vain, Patoku (Important Bird Areas); Shkoder Lake (Ramsar Site); Bojana Delta; Mljet (National Park)

The initial process of the assessment of the environmental impacts should be focused on engaging the stakeholders in the discussions; collecting baseline information on the types and significance of impact to the aquatic wildlife should be considered a follow up activity, subject to available funding.

4.2.5.2 Economic Impacts

Marine Litter / Floating Debris can cause serious economic losses to various sectors and authorities. Among the most seriously affected are coastal communities (increased expenditure on beach cleaning, public health and waste disposal), tourism (loss of income, bad publicity), fishing (reduced and lost catch, damaged nets and other fishing gear, fouled propellers, contamination) and shipping (costs associated with fouled propellers, damaged engines, litter removal and waste management in harbours). Economic costs are lost benefits to society (welfare effects).

Box 4. Costs for removing beach litter

Removing beach litter costs municipalities in the Netherlands and Belgium approximately €10.4 million per year. For most municipalities, the potential economic impact of marine litter on tourism provides the principal motivation for removing beach litter. In this respect, regularly removing beach litter costs less than the potential reduction in revenue that could result from taking no action. The potential economic impact of marine litter also provides a more powerful incentive for removing beach litter than current legislation, particularly in the UK.

*This designation is without prejudice to positions on status, and is in line with UNSCR 1244/1999 and the ICJ Opinion on the Kosovo declaration of independence

[14]"Morsko Dobro" or"Sea Wealth" is Public Enterprises responsible for managing the sea waters in Montenegro.

The Method gives theway to quantifying the monetary impact of litter to the following sectors:

- Removal of marine litter / floating debris;
- Clean-up of illegal dumps – sources of floating waste (prevention activities);
- Lost revenues from tourism due to aesthetic disturbance caused by litter, floating and stranded waste;
- Lost revenues of Hydropower Plants due to reduced power generation.

The estimation of monetary value of the marine litter / floating debris impacts may be difficult to estimate in the absence of suitable records. An organised approach for monitoring will have to be deployedin the futureat the regional scale, subject to available funding.

4.2.5.2.1 Removal of Marine Litter / Floating Debris

Removal of marine litter at the endpoints – sea coasts (beaches, bays, etc.) takes place most commonly before and after the tourist season, to minimise the bad perceptions of tourists related to beach cleanliness.

Clean up of floating debris at thereservoirs Potpec, Visegrad, BajinaBasta, Zvornik and Fierze by respective Hydropower Plants is necessary to prevent damage of power plants.

Costs for cleaning depend on the frequency (seasonal), human power (number of people involved), auxiliary equipment (i.e. bags, machinery), protective clothing / equipment used (i.e. gloves, masks, etc.), transport (vessels, fuel) and disposal (disposal fees paid at the recipient landfill).

With this Method it is proposed toestimate the costs of clean-up activities by multiplying the unit costs (EUR/m) and the length of the cleaned area.

To estimate the unit costs interviews with waste management operators, NGOs and other stakeholders involved in cleaning activities in the past will be conducted. Available literature will also be consulted. These unit costs may differ among the pilot countries in respect to the market conditions and purchase power of the households which will be taken into account. Then, the information on the length of beaches (of both the sea and reservoirs) will be collected from available literature and/or stakeholders.

4.2.5.2.2. Clean-up of Illegal Dumps

Costs for cleaning illegal dumps comprise the same pattern as those associated with the removal of marine litter/ floating debris: first the unit costs per a ton of waste and then the quantity of irregularly deposited waste will be calculated. The irregularly deposited waste is obtained from the difference between the total waste generation and the collected waste (the collected waste is either measured at the landfill gate, or is estimated by multiplying the total volume of refuse trucks with the number of routes in a given period). Afterwards, the unit costs and the total quantity of irregularly deposited waste will be multiplied to derive the clean-up costs in respective municipalities, countries and pilot regions as a whole.

Interviews are proposed to derive the unit costs and crosscheck the overall cost estimations.

4.2.5.2.3 Lost Revenues from Tourism

Floating and accumulated / stranded debris can act as a deterrent to tourists. In this way, floating debris can reduce tourism revenue and consequently weaken economies, especially of the coastal areas.

Box 5. Example of list tourist revenue estimation in South Africa

Examples of how marine litter affects tourist revenue are thus relatively scarce but a South African study found that a drop in beach cleanliness standards could reduce tourism revenue by up to 52% in the area studied. This project also investigated the densities of litter that exerted a deterrent effect on tourists and found that 85% of beach users would not visit a beach with 2 or larger debris items per meter with 97% stating they would not visit a beach with 10 or more large items of debris per meter. Interestingly, however, only 44% of people surveyed classified the beach they were on as “clean” suggesting that there may be considerable differences between people’s priorities and their actions in practice (Ballance et al 2000).

Lost expenditure can be expressed as the product of decreased visitors and average visitor expenditure. When analyzing the trends in tourism overnights in the “Adriatic Sea” Pilot Region, these show positive results, meaning that the tourist visits and overnight stays are on the rise in the period 2011-2014.

There is some decline of tourism visits in Serbia in 2012 and 2014 compared to 2007/2008 (the highest tourism turnover). In Tara there was around 20% decline in tourist visits / overstay nights in 2014 compared to 2013; in Koviljaca Spa there is a decline of 12% in 2014 compared to 2013. However, it is not possible to link the landscape disturbance due to litter and the tourism decline.

Another method will be to understand the perceptions of tourists regarding the cleanliness of the coast / river / lakes. It is proposed to contact responsible institutions dealing with tourism and ask whether they conduct surveys on the satisfaction / dissatisfaction of tourists with the cleanliness of the beaches / riverbeds and lakes.

There is a tourist info center in Montenegro which, among others, receives complaints on the beach cleanliness. It would be possible to estimate the share of tourists complaining compared to the total number of tourists calling the tourist info center. Assuming these tourists would not return, it would be possible to calculate the revenues lost by multiplying the total number of tourists, percent of dissatisfied tourists, the average stay and potential revenue.

4.2.5.2.4 Lost Revenues of Hydropower Plants due to Reduced Power Generation

The floating debris can induce power generation losses as a result of the damages of power generation machinery. Additional losses occur due to the reduced flow.

Significant amount of floating debris accumulates over girders;it causes a decrease of the water inflow and hinders the production of electricity. An additional problem is formations of shell colonies onto the girders due to the increased concentration of organic matteroriginating from the municipal waste. The invasion of shell colonies also clogs the girders: it reducesthewater inflow and the electricity production. Hence, the floating debris disrupts the work of motors and machines of the HPPs, causing significant costs for repairs and cleaning.

Box 6. Breakdown of BajinaBasta Hydropower Plant in 2010

The level of the BajinaBasta reservoir was lowered in the period July-August 2010to allow for a rehabilitation of the girder, which was damaged by the floating waste. The electricity production stopped for two months. During the remount, various debris was cleaned from the bottom of the reservoir; even a sunk boat was taken out[15].

The information on lost revenues of electricity generation due to floating debris problems should be available to the hydropower plants` authorities. It is proposed to conductinterviews and/or obtain existing reports from these authorities. The estimated amount of reduced energy generation (and associated loss of revenues) can be deduced from the number of non – operating hours, the hourly production of electricity and price of a kWh of electricity. Otherwise, the existing data, if available, will be presented in the Environmental and Economic Impact Assessment Report to be developed for the “Sharra” and “Tara – Drina – Sava” Pilot regions.

5. Conclusions

The problem of marine litter / floating debris has obvious international dimensions. It affects the marine and riverine environment outside the jurisdiction of pilot municipalities, countries and regions. Sources of marine litter / floating debris are spread across the territory of the pilot municipalities; under the influence of various factors (wind, flood, tide, sea current, etc.) the litter enters the river or sea and by way of some pathways it is transported over long distances.

Box 7. Life cycle of marine debris / floating debris

The complicated nature of the distribution of marine debris / floating debris in the environment calls for a clear and defined approach to characterizing and assessing the problem. Marine debris / floating debris enters the sea / river / reservoir through many pathways, and the patchiness in the distribution of debris, and spatial and temporal variability in the drivers add to its complex life cycle (Ryan et al., 2009, Cole et al., 2011, Doyle et al., 2011).

The full cycle approach proposed under the Method is intended to track the marine litter / floating debris from the source, through the pathway to the endpoint / sink.However, finding usable data on impacts and quantities of marine litter remains a challenge. Systematic scientific research on marine litter in the pilot regions is relatively scarce. This makes quantifying the impacts very hard. Nevertheless, even the characterization of impacts based on assumptions can be a step forward in understanding the marine litter / floating debris problems.

Some municipalities, which are most plagued by litter, have no control over the production or disposal of that litter at the place of source. Furthermore, in the absence of a coordinated approach, efforts of some municipalities to reduce the intake of or remove the plagued debris may be undermined by the lack of action of the others. Therefore, an open, constructive and forward-looking dialogue on controversial topics is needed to identify joint visions and opportunities on solutions to marine litter / floating debris.

[15]http://www.pecat.co.rs/2010/07/drina-ko-truje-srpsku-zilu-kucavicu/

ASSESSMENT REPORT

on the cross boarder adverse environmental and economic impact in Tara-Drina-Sava region

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Executive Summary

The floating debris is a serious pollution problem in the Tara - Drina - Sava region, particularly in Montenegro, Bosnia and Herzegovina and Serbia. Major transboundary environmental and economic impacts caused by floating debris in the Tara - Drina - Sava Pilot Region are identified during the development of the Environmental and Economic Impact Assessment Report as follows:

- Water pollution;
- Threats to the riverine wildlife (Drina River and its right tributaries Cehotina, Lim, Uvac, Rzav and Jadar, the left tributaries Sutjeska, Praca and Dranjaca;
- Destruction of protected areas: Durmitor National Park in Montenegro, Sutjeska National Park in Bosnia and Herzegovina and the Tara National Park in Serbia;
- Endangered riverine ecosystems: Salmonidae family with Danube salmon (*Hucho hucho*) and Brown trout (*Salmo trutta*) by the floating waste and wood filings (which are thrown from sawmills located in the catchment) entering the gills of fish;
- Human health problems in terms of potential injuries of people by sharp objects at the beaches and settled at the bottom of the reservoirs Potpec, Visegrad, Bajina Basta and Zvornik;
- Economic impacts on local communities (increased expenditure on cleaning floating debris at the reservoirs Potpec, Visegrad, Bajina Basta and Zvornik and illegal dumpsites located near riverbanks), tourism in the areas such as Zlatibor (Cajetina), Banja Koviljaca (Loznica), Tara, Mokra Gora, Pljevlja, Bjelo Polje, etc. and the protected areas (loss of income, bad publicity), fishing (reduced and lost catch) and lost revenues from electricity generation at the Potpec, Visegrad, Bajina Basta and Zvornik Hydropower Plant due to blockages of turbines in the powerhouse.

Considering the richness of biodiversity and the presence of globally threatened species, on one hand, and the significant threat of the litter on these populations, on the other, waste dumping related prevention measures are a matter of urgency.

Albeit the environmental impacts could not be quantified due to lack of information, some effort has been made to assess the economic impacts related to floating debris and illegal dumps cleaning in the pilot area. It was estimated that each year ***4,968,150 EUR*** are spent on cleaning up illegal dumps; for cleaning of the floating debris at the reservoir an amount of ***400,000 EUR*** per annum is spent and ***1,700,000 EUR*** a year is lost due to reduced electricity generation at the Potpec, Visegrad, Bajina Basta and Zvornik Hydropower Plants (HPPs).

Pilot municipalities contribute to the environmental impacts proportionally to the quantities of released floating debris. Some municipalities are responsible for the generation of floating waste and / or pollution, by inadequate waste management practices and particularly illegal dumping in flood / tide - prone areas. These are considered to be impacting municipalities. Other municipalities that are receiving the (unwanted) floating waste and / or pollution and need to bear (non-recoverable) costs for their clean-up and disposal, are impacted municipalities.

The Drina River catchment is being segmented by the locations of reservoirs Potpec (Lim River), Visegrad, Bajina Basta and Zvornik (Drina River). The municipalities that contribute to the floating debris generation in the reservoirs are shown in the following figures.

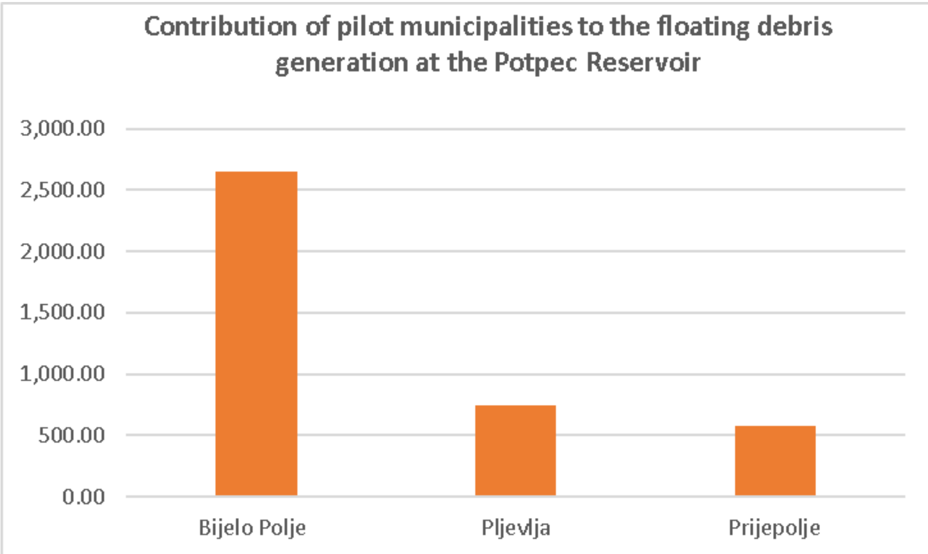

Figure 1 Contribution of pilot municipalities to the floating waste generation in the Potpec Reservoir

It can be seen that Bijelo Polje Municipality is generating more floating waste than the Municipalities of Pljevlja and Prijepolje.

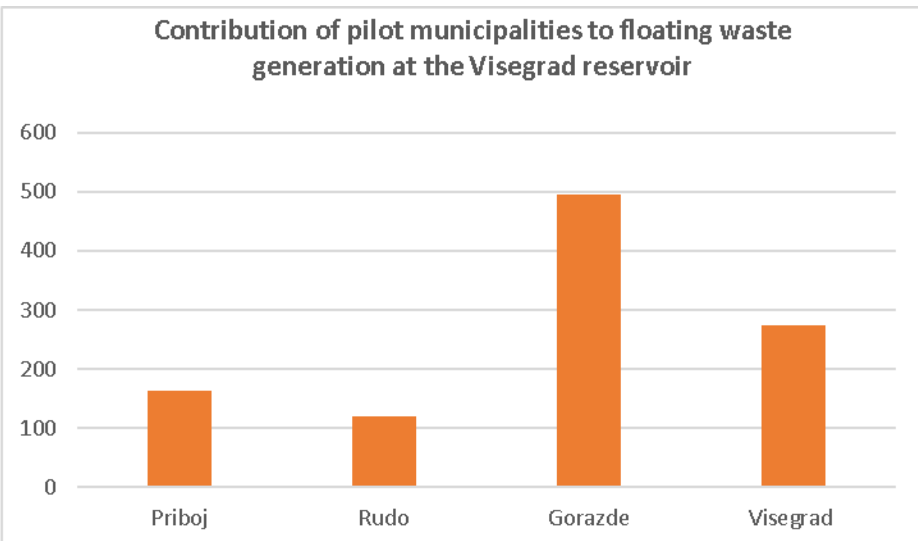

Figure 2 Contribution of pilot municipalities to the floating waste generation in the Visegrad Reservoir

Floating waste in the Visegrad reservoir is originating mostly from Gorazde Municipality.

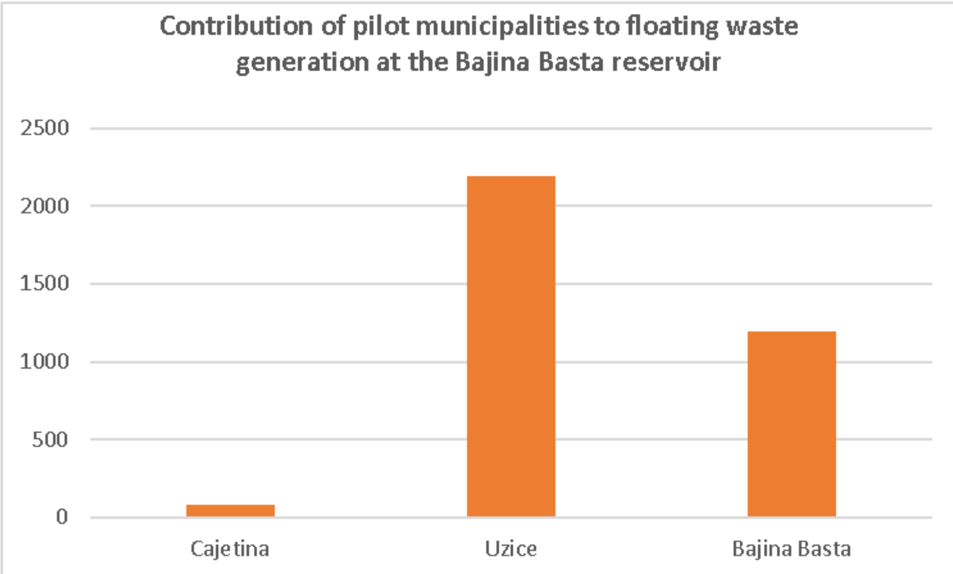

Figure 3 Contribution of pilot municipalities to the floating waste generation in the Bajina Basta Reservoir

Although Usice Municipality runs the regional sanitary landfill, there is waste in the rural communities that is not collected and which may enter the rivers in the catchment. Uzice Municipality is, however, contributing to the floating debris in the cathcment of Morava River. Therfore, the greatest contributor to the generation of floating debris at the Bajina Basta reservoir is the Municipality of Bajina Basta.

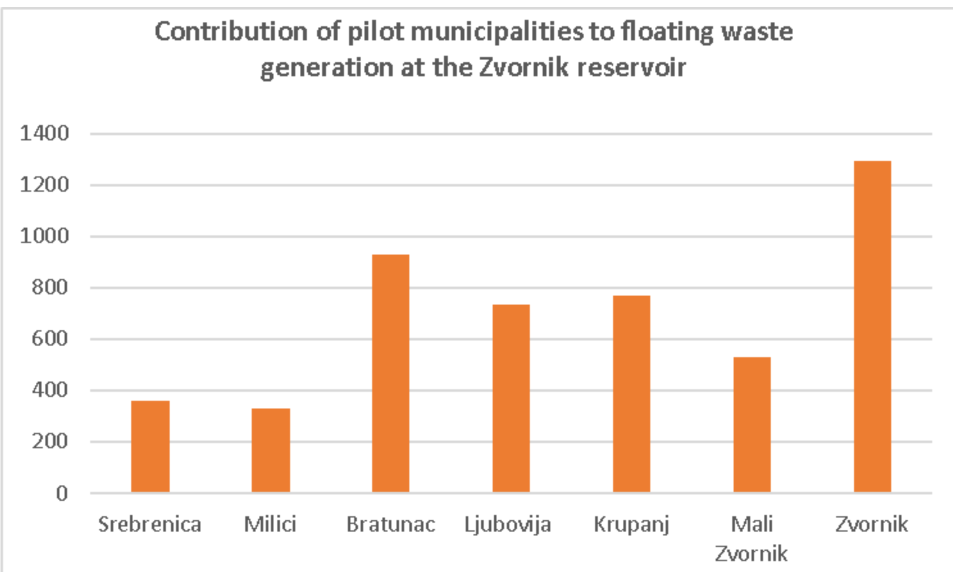

Figure 4 Contribution of pilot municipalities to the floating waste generation in the Zvornik Reservoir

Zvornik, but also Bratunac, Krupanj and Ljubovija, are the greatest contributors to the generation of floating debris in the Zvornik reservoir.

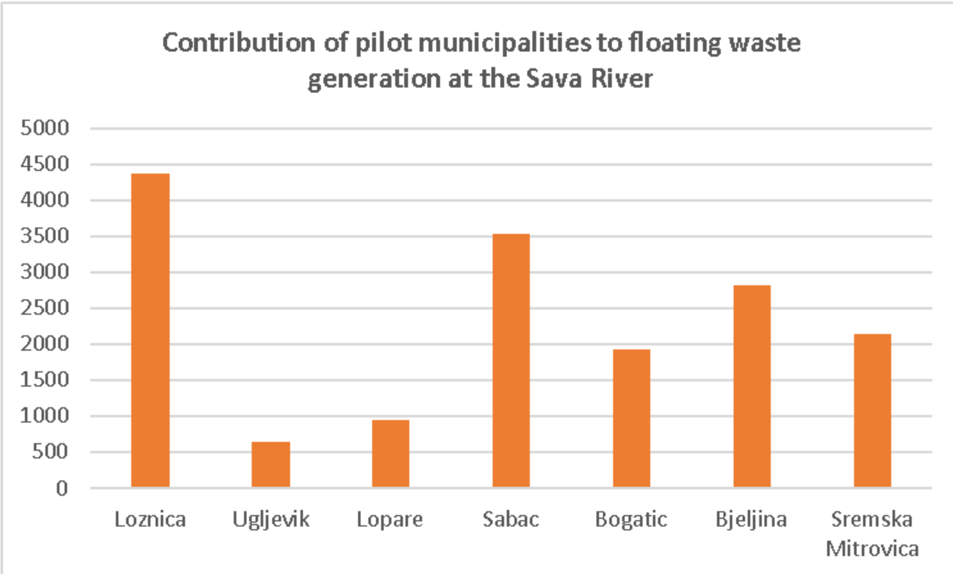

Figure 5 Contribution of pilot municipalities to the floating waste generation in the Sava River

Loznica, Sabac and Bjeljina contribute the most to the generation of floating waste in the lower secton of Drina and Sava Rivers after the confluence.

The influence of discharged waste is significant when looking at the total pollution of the Drina River, and this problem must be solved urgently taking the economic, social and cultural situations into consideration. To solve the Drina's waste problem sustainably, it is necessary to synchronize efforts at national and international levels because transboundary water resources and their preservation, protection and sustainable uses are of great importance for all countries.

1. Background

The Regional Rural Development Standing Working Group (SWG) and the Network of Associations of Local Authorities of South-East Europe (NALAS) are implementing a regional sub-project “Solid Waste Management in cross-border rural and coastal areas of South Eastern Europe” supported by the German Federal Ministry for Economic Cooperation and Development (BMZ) through the GIZ Open Regional Fund for South East Europe – Modernisation of Municipal Services (ORF MMS) and the Government of Switzerland.

The SWG is engaged in improving rural livelihoods in the SEE countries. To this end, it promotes innovative and sustainable agriculture and rural development through regional cooperation of respective Ministries of Agriculture and other stakeholders. It supports the EU integration in the SEE, by:

- fostering rural development policies,
- improving implementing structures and systems for agriculture and rural development,
- improving the understanding and use of implementation tools for agriculture and rural development,
- identifying and sharing information and application of good practice in agriculture and rural development to broaden the rural agenda.

NALAS brings together 16 Associations which represent roughly 9000 local authorities, directly elected by more than 80 million citizens of this Region. NALAS helps the associations to represent viably the local authorities vis-à-vis central governments. NALAS provides services to local governments and aspires to develop itself as the Knowledge Center for the local government development in the SEE. It promotes:

- processes of decentralization, considering the local self-government as a key issue in the transition process in the SEE;
- partnerships in order to contribute to the EU integration as well as the reconciliation and stabilization process.

1 Goals and Objectives

The overall aim of the sub-project is to “improve the conceptual and organisational framework conditions concerning Integrated Solid Waste Management (ISWM) in cross-border rural and coastal areas in SEE”.

The specific goal of the assignment is to “assess and develop schemes (models) for integrated management of solid waste that are environmentally effective and economically affordable in order to reduce adverse environmental and economic impacts of solid waste mismanagement and support the ecological and socio-economic development of the cross-border rural and coastal areas in the SEE countries”.

In order to define models for integrated management of solid waste in SEE countries (pilot rural and coastal regions), it is envisaged to carry out an assessment of the transboundary environmental and economic impacts from currently applied (insufficient) practices.

2 The Tara - Drina - Sava Pilot Region

The sub - project covers three pilot rural and coastal areas which share natural resources – a mountain range (Sharra Mountain), transboundary river catchments (Tara – Drina and Drina - Sava) and a sea coast (Adriatic Sea) area.

This Assessment Report on the Cross Border Adverse Environmental and Economic Impact is focused on the Tara – Drina - Sava pilot region. It encompasses Serbia (Figure 6 - Municipalities of Ljubovija, Bajina Basta, Prijepolje, Priboj, Cajetina, Uzice, Loznica, Sremska Mitrovica, Sabac, Krupanj, Mali Zvornik and Bogatic), Montenegro (Figure 7 - Bijelo Polje and Pljevlja), BiH (Figure 8 - Municipalities of Visegrad, Rudo, Gorazde, Srebrenica, Bratunac, Milici, Brcko, Bjelina, Zvornik and Ugljevik).

The pilot municipalities have been selected by the SWG, in collaboration with the Regional Expert.

Figure 6 Serbia- pilot municipalities Ljubovija, Bajina Basta, Prijepolje, Priboj, Cajetina, Uzice, Loznica, Sremska Mitrovica, Sabac, Krupanj, Mali Zvornik and Bogatic

Figure 7 Montenegro- pilot municipalities Bijelo Polje and Pljevlja

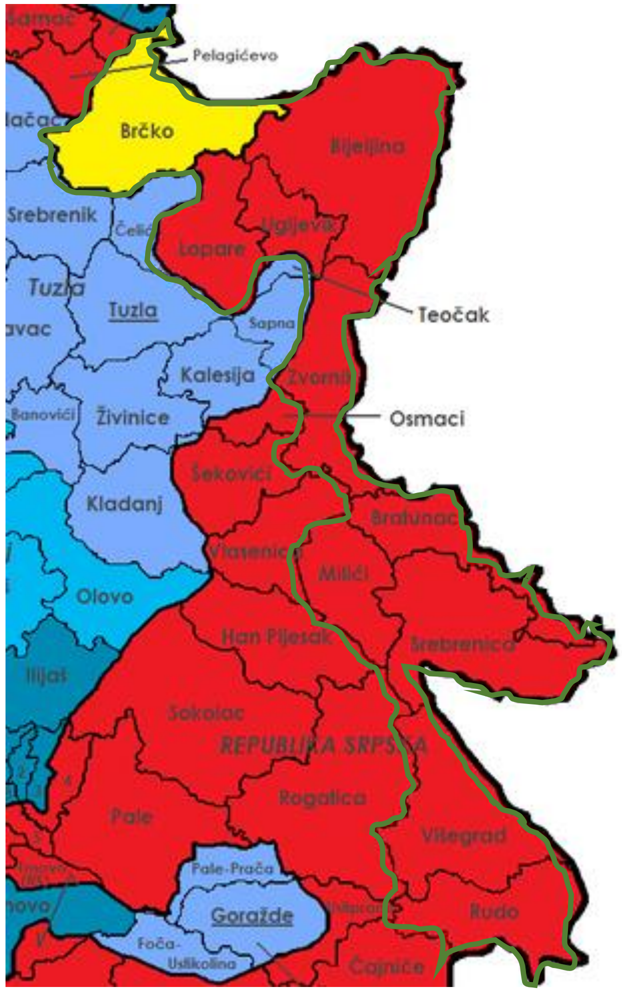

Figure 8 Bosnia and Herzegovina-pilot municipalities Visegrad, Rudo, Gorazde, Srebrenica, Bratunac, Milici, Brcko, Bjelina, Zvornik and Ugljevik

The provisional geographical position of the pilot municipalities in respect to the Tara – Drina – Sava region is shown in a schematic way in Figure 9 below.

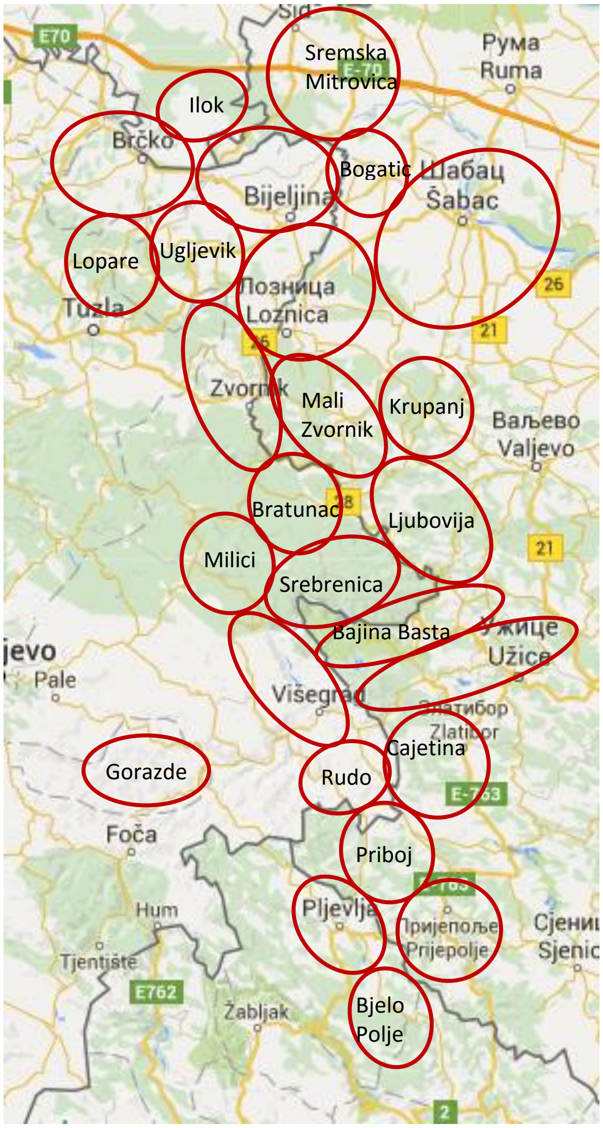

Figure 9 Geographical position of pilot municipalities along the Tara – Drina –Sava Region

The area and population of pilot municipalities is presented in Table 1 below.

Table 1 Area and population of the pilot municipalities and of the total pilot region

Pilot Municipality	Area (km^2)	Population
	Serbia	
Ljubovija	356	14,469
Bajina Basta	673	26,022
Prijepolje	827	41,188
Priboj	552	30,377
Cajetina	647	14,754
Uzice	667	82,921
Loznica	612	78,788
Sremska Mitrovica	762	85,000
Sabac	795	115,347
Krupanj	342	17,398
Mali Zvornik	184	12,496

Pilot Municipality	Area (km^2)	Population
Bogatic	384	28,883
Total	**6,801**	**547,643**
Montenegro		
Bijelo Polje	923	43,460
Pljevlja	1,346	29,054
Total	**2,269**	**72,514**
Bosnia and Herzegovina		
Visegrad	448	11,774
Rudo	344	8,840
Gorazde	252	30,017
Srebrenica	527	9,117
Bratunac	293	22,133
Milici	285	9,849
Brcko	402	93,028
Bjelina	132	109,167
Zvornik	387	64,551
Ugljevik	165	16,358
Lopare	298	17,101
Total	**3,533**	**391,935**
Croatia		
Ilok		
Total		
Total Pilot Region	**12,603**	**1,012,092**

Respective shares of areas and population for each country within the pilot region are highlighted in Figures 10 and 11 below.

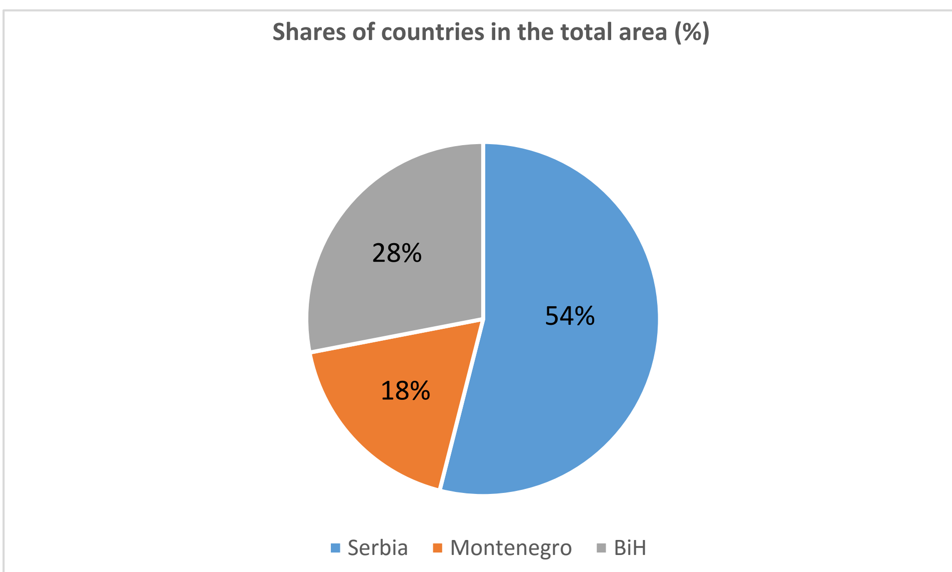

Figure 10 Respective shares of the area size of the countries in the pilot region

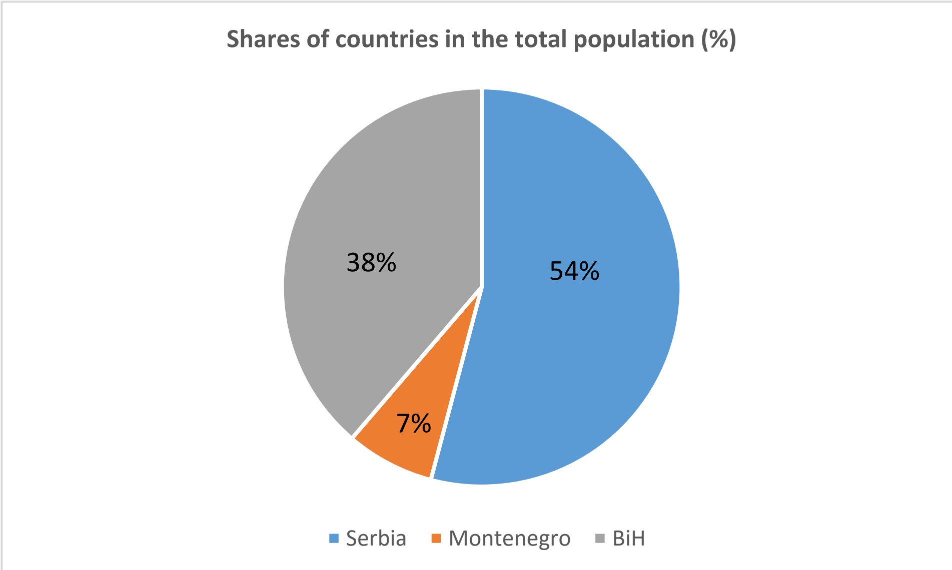

Figure 11 Shares of countries in the total population

It is obvious that Serbia with its pilot municipalities has the biggest share in the pilot region in terms of both population and area size; the share of BiH is also relatively high, while the participation of Montenegro is negligible.

Provided that further analysis yields evidence of deficiencies in their waste management practices, Serbia and BiH would be the countries with the highest relative contribution to transboundary impact generation in the pilot region.

3 Environmental and Economic Impact Assessment of Floating Debris in the Tara – Drina - Sava Pilot Region

3.1 Floating Debris in the Drina River Catchment

Floating debris is found in almost every river catchment - in streams, rivers and lakes (reservoirs). It is composed of a variety of materials from plastic bottles to sage brush, including also wood in some shape or form--from whole trees to lawn furniture. Biodegradable waste degrades naturally in conjunction with biological agents. Non-biodegradable debris does not really decompose. Examples of non-biodegradable floating debris include municipal waste, cans, bottles, Styrofoam, etc. The material may be floating on the surface, or it may be a water-soaked or suspended at some depth beneath the surface. Also, it can strand along the riverbanks and reservoirs.

Surface water runoff is an important mechanism of bringing debris into the water bodies. Runoff can move some debris directly, but primarily it increases the stream velocities and water levels so that debris along the banks is swept into the stream. As water levels increase, the width of the affected land increases, and more debris can be carried. The intensity of water flow under some flood conditions is such that the direction and width of streams (rivers) are changed, and dumped waste - buried in sandbars - can be washed loose (Cummins et al. 1983). Streambank erosion is the primary cause of wastes entering the watercourse (McFadden and Stallion 1976). The rapidly moving material is also a danger to many man-made structures such as hydropower plants (Klingman 1973, Rowe 1974). Submerged debris can build up in front of trash racks of hydropower plants` turbines. High flows will also remove structures that are normally on land, as well as the loose debris that people dispose of in the watercourse.

The floating debris is mainly transported by the Drina River. Drina is 346 km long; it is the biggest tributary of Sava River, which is the biggest tributary of Danube River. Drina River catchment area is 19,680km^2, laying across three states: Bosnia and Herzegovina, Montenegro and Serbia (Figure 12).

Figure 12 Drina River Catchment Area

Tara – Drina – Sava Pilot Region encompasses part of the catchment area of Drina River and the analyses are limited to the area described above. Nevertheless, the Impact Assessment Method applied herein is applicable to the entire catchment, and the catchment of Sava River.

Investigations of the properties of the floating debris[1] showed that:

- Floating debris consists of dead branches, leaves, plastic bottles and bags. Its thickness on the surface of the calm sections of rivers and reservoirs is 0.5-0.7m.
- Suspended debris consists of smaller branches, plastic bottles and plastic bags. Debris is entangled with organic materials (i.e. mud).
- Settled debris is 4.5 to 5m thick. It consists of tires, plastic packages, entangled with plastic bags.

There were / are initiatives / projects aiming to address the root problem – the municipal waste management operations and waste fly tipping in the Drina River catchment:

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1 https://www.researchgate.net/publication/266571770_Floating_Debris_in_the_Storage_Reservoirs_of_Bajina_Basta_and_Potpec_Hidropower_Plant

- The Regional Environmental Centre implemented a study “Pollution in the Drina River Basin - an inventory of potential sources”[2] in 2011, in order to systematically identify and record all risk sites in the catchment, using the methodology of the International Commission for the Protection of the Danube River (ICPDR) which was adapted to local conditions and needs. Apart from industrial and communal polluters, municipal landfills and illegal dumps have been identified.
- The Italian civil society organization OXFAM implemented a project “Toward the good status of Drina river water” supported Civil Society Organizations’ actions to promote private - public partnerships for a better river management”[3] in the period 2010 – 2012, including a grant programme for the municipalities to purchase waste bins / containers.
- The Regional Environmental Centre implemented a project “Supporting the implementation of the 3R concept in the Drina River Basin”[4] in 2014/2015. The aim of the study was to assess the status of waste management in the Drina River Basin, and on the basis of this analysis to provide recommendations for measures and actions integrating the concept of “3R” into waste management practices. The study provides the theoretical context for integrated solid waste management and the concept of 3Rs.
- A current project “Technical Assistance for the Preparation of the GEF SCCF West Balkans Drina River Basin Management Project”[5] is intended to develop a Study for analyses of Floating Waste in the Drina River Basin. It would provide a long-term reduction of floating waste in the River Drina Basin and sustainable water resources management and environmental protection by establishing cooperation between local communities on performing the solid waste management activities. This way an integrated solid waste management in the basin of the river Drina will be provided. ***Close cooperation with this project should be established to exploit synergies.***

Considering the fact that the majority of floating debris items originate from the land based sources, the impact assessment is focused on:

1 Root Problem: current waste management practices
2 Locations of the land-based sources of floating debris (non-compliant landfills and illegal dumps)
3 Pathways of the litter from the origin to the sea and the shorelines where it strands.
4 Effect (floating debris) and the deriving environmental and economic impacts

Thus, this Assessment Report sheds light on the matter of how and why the pilot municipalities contribute to, or are affected by floating debris in the Tara – Drina – Sava Pilot Region. Once the questions of "how" and "why" are answered, the emergence of a regional model for the tackling of the issue of floating debris can become possible.

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[2] http://documents.rec.org/publications/DrinaRiver_July2011.pdf

[3] http://www.oxfamitalia.org/scopri/oxfam-italia-in-see/toward-the-good-status-of-drina-river-water#sthash.uFN80c20.dpuf

[4] http://documents.rec.org/greenhorizon/Supporting%20the%20implementation%20of%20the%203R%20concept%20in%20the%20Drina%20river%20basin_en.pdf

[5] file:///C:/Users/Rec/Documents/GIZ%20Waste%20Application/Background/World%20Bank%20Floating%20Debris%20Drina%20GEF.pdf

3.2 Environmental and Economic Impact Assessment Method

Floating debris is mobile, and it may be found relatively far from its original source. This movement is influenced by winds, erosion and flood patterns (Figure 13).

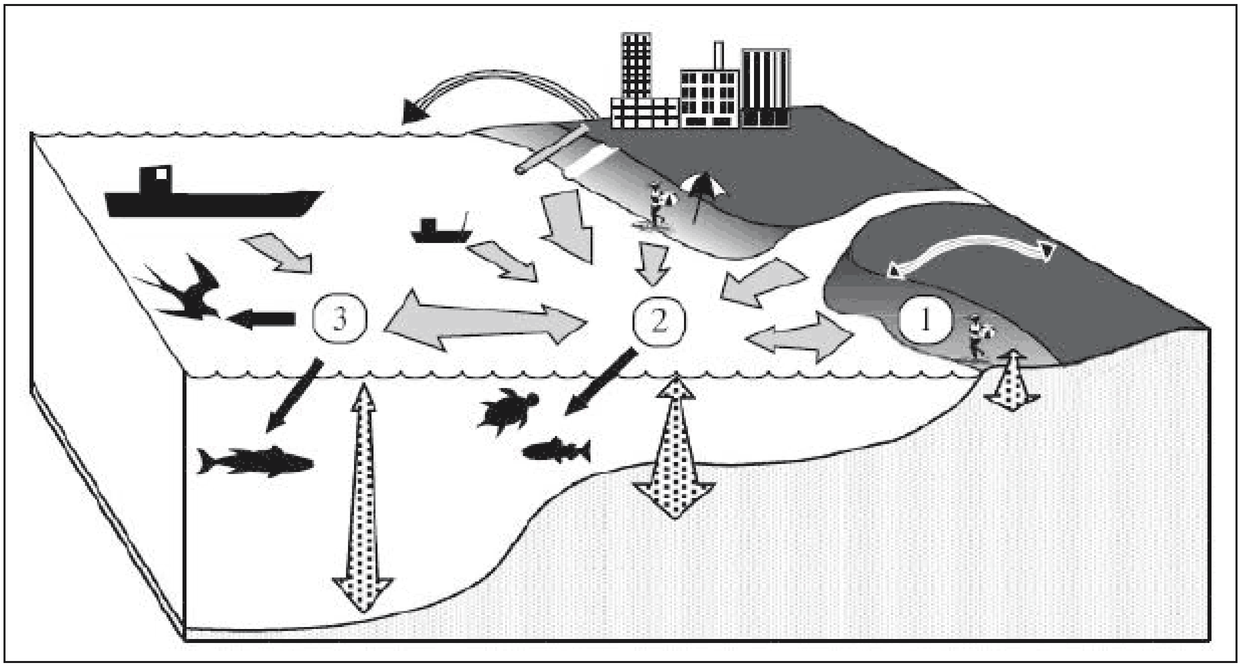

Figure 13 Origins, pathways and sinks of floating debris[6]

- *Origins* include land - based sources (landfills / dumps / recreational areas)
- *Pathways* are presented as wind-blown litter (curved arrows) and washed away litter transported by the rivers (grey arrows)
- *Sinks* into the riverbed (stippled arrows): 1) near the riverbank; 2) bottom of the rivers and reservoirs
- Impacted wildlife (black arrows)

The Method for Environmental and Economic Impacts deriving from the current solid waste management (SWM) practices in the pilot countries / municipalities in the Tara - Drina - Sava Pilot Region, in response to the mobility character of floating debris is intended to:

- Identify the origins and pathways of the land-based sources of the floating debris in each pilot municipality by analysing the:
    - Waste generation and composition
    - Waste collection
        - Capacity of the operator
        - Waste collection rate (service coverage)
        - Waste not collected
    - Waste disposal practice and locations of “hotspots”
        - Non-compliant municipal landfills

[6] http://www.gov.scot/Publications/2013/07/9297/5

        - Illegal dumps

    - Pathways of floating waste: rivers
    - Recycling operations and recycling rate

- Assessment of the types and significance of transboundary environmental and economic impacts:

    - Environmental Impacts
        - Riverine ecosystems
        - Protected areas

    - Economic Impacts
        - Clean-up costs
        - Lost revenue from tourism

- Assessment of the contribution to the environmental and economic impacts of the floating debris of each pilot country / municipality (impacting and impacted municipalities)

A snapshot of the method for identification of origins is presented in Figure 14 below:

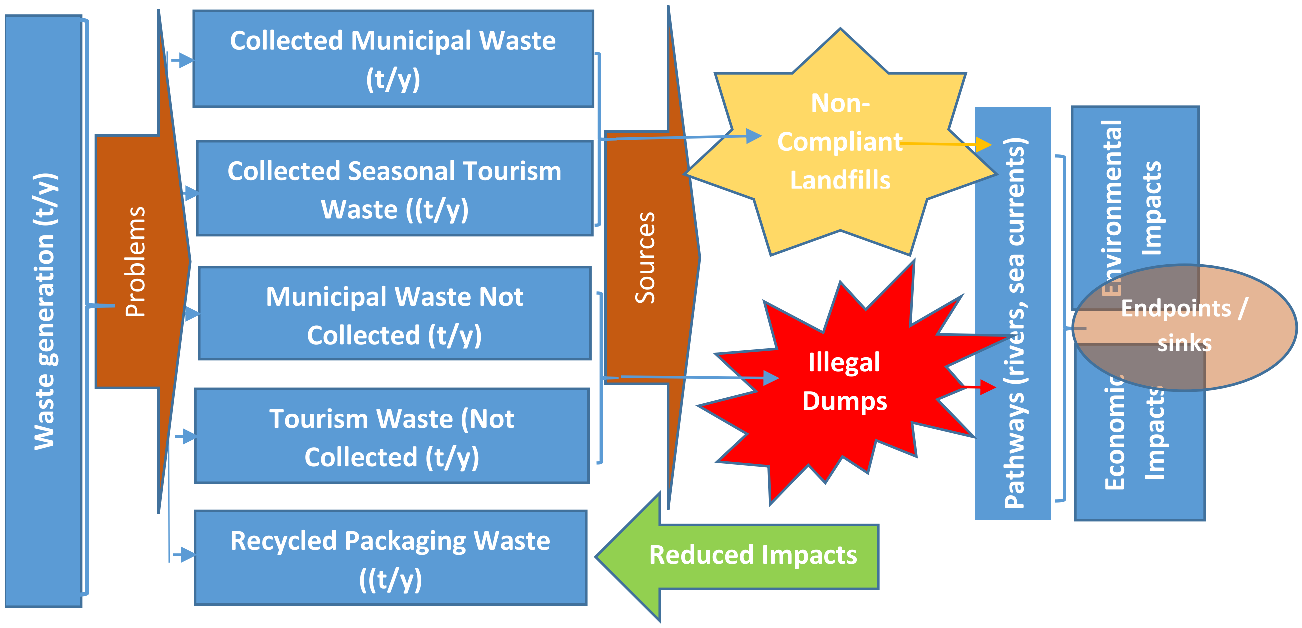

Figure 14 Method for Environmental and Economic Impact Assessment

3.3 Process of Environmental and Economic Impact Assessment

After the formulation of the Environmental and Economic Impact Assessment Method, two separate streams of data collection have been established:

1. ***Desk research***:
    a. Two types of questionnaires have been developed which are available in Annex 1. The following data was collected:
        i. Policy and legislation; waste generation; financing of municipal waste management; sources of marine litter (so called “hotspots”);
        ii. Operational and technical capacity of waste management operators, more specifically: service coverage; frequency of waste collection; available collection vessels and refuse vehicle fleet; requirements for additional collection vessels and trucks; status of primary waste segregation, if any;
2. ***Participatory process for data collection and validation***, gathering relevant stakeholders, such as national and municipal authorities, waste management operators (including the regional sanitary landfills), private companies dealing with recycling, NGOs, etc.:
    a. National Workshops in pilot countries[7]
    b. 1st Dialogue Platform[8].

[7] National Assessment Workshops were conducted in October 2015 in Bajina Basta. Representatives of municipal administration, PCEs, regional sanitary landfills “Duboko”, “Eko Dep”, NGOs and the private companies involved in recycling were present.
[8] The 1st Dialogue Platform was held in November 2015 in Zlatibor. Next to the stakeholders represented at the National Assessment Workshops, also the representatives of the HPP in Bajina Basta took part.

Separate communication streams have been established with relevant institutions to complement the outstanding information as well.

The sources of floating debris in the Tara – Drina - Tara pilot region are identified in the following sections.

3.4 Sources of floating debris in the pilot municipalities in the Tara - Drina - Sava Pilot Region

Data on waste generation, waste collection service coverage, recycling and disposal (including illegal dumping) has been collected using a pre-defined questionnaire which was filled in by the assigned Regional Expert. Data validation was performed by the local self-government representatives and contact points of the Public Communal Enterprises (PCEs), the operators of the regional sanitary landfills Duboko (located in the Uzice Municipality), Eko Dep (located in the Bjeljina Municipality), Srem - Macva (located in the Municipality of Sremska Mitrovica), the recycling operator "Green Idea" and other stakeholders. Some municipalities, however, did not respond to the inquiries and gaps in the present analyses may persist until the missing data will be collected.

Stakeholders stated that the customer base often lags behind in providing an accurate number of total served households, and it is also difficult to determine service coverage. Incoming waste is measured at the gates of regional landfills, however it remains unclear exactly what proportion of the collected waste is actually delivered for measuring. Irregular reporting by the recycling companies[9] precludes determining the rate of recycling with any accuracy. All of the above makes presenting the waste flows into a challenging endeavour, however, the data provided herein is an attempt at deriving some preliminary quantities of floating debris originating from the territory of the pilot municipalities.

3.4.1 Waste generation

Waste generation figures for each pilot municipality were obtained as a product of the multiplication of population numbers in each pilot municipality and indicators of waste generated per capita and day. The waste generation indicators are adopted from the stakeholders` experience, waste samplings, if any, and whenever the stakeholders were not responsive to the requests of the Regional Expert for clarifications, respective National Waste Strategies and Plans were consulted. For the majority of pilot municipalities, it was agreed to use the indicator of 0.90 or 0.70 kg/capita/day, respectively; the representatives of the Municipality of Prijepolje stated that on their territory larger waste quantities are generated and therefore the indicator 1.3kg/capita/day was utilised.

In the Tara - Drina - Sava Pilot Region, waste generated by tourists does not add up significantly to the overall waste figures and the waste generation indicators do encompass the tourism waste.

Table 2 Waste generation in the pilot municipalities of the Tara-Drina-Sava pilot region

Pilot Municipality	Population	Waste generation indicator (kg/cap/day)	Total waste generation (tons/year)
Serbia			

[9] The licensed operators do report the types and quantities of collected / treated recyclables, however, there are small companies involved in recycling which do not possess any license. Also, the informal recycling is present at the municipal landfills for which no records exist.

Pilot Municipality	Population	Waste generation indicator (kg/cap/day)	Total waste generation (tons/year)
Ljubovija	14,469	0.9	4,753
Bajina Basta	26,022	0.9	8,548
Prijepolje	41,188	0.59	11,000
Priboj	30,377	1.3	14,413
Cajetina	14,754	0.9	4,846
Uzice	82,921	0.9	27,239
Loznica	78,788	0.9	25,882
Sremska Mitrovica	85,000	0.9	27,923
Sabac	115,347	0.9	37,891
Krupanj	17,398	0.9	5,715
Mali Zvornik	12,496	0.9	4,104
Bogatic	28,883	0.9	9,488
Total	**547,643**		**193,305**
Montenegro			
Bijelo Polje	43,460	0.9	15,127
Pljevlja	29,054	0.9	10,113
Total	**72,514**		**25,240**
Bosnia and Herzegovina			
Visegrad	11,774	0.9	3,867
Rudo	8,840	0.9	2,903
Gorazde	30,017	0.9	7,253
Srebrenica	9,117	0.7	2,329
Bratunac	22,133	0.7	5,654
Milici	9,849	0.9	3,235
Brcko	93,028	0.59	20,001
Bjelina	109,167	0.9	37667
Zvornik	64,551	0.7	16,492
Ugljevik	16,358	0.7	4.179
Lopare	17,101	0.7	4369.31
Total	**391,935**		**103,774**
Total Pilot Region	**1,012,092**		**322,319**

The biggest contribution to the total waste generation is made by the Municipalities of Uzice[10], Loznica, Sabac, Bjaljina and Sremska Mitrovica (Figure 15).

[10] Uzice Municipality is not part of the Drina River Catchment Area. It has been included as a pilot municipality as the regional sanitary landfill “Duboko” is being located on its territory.

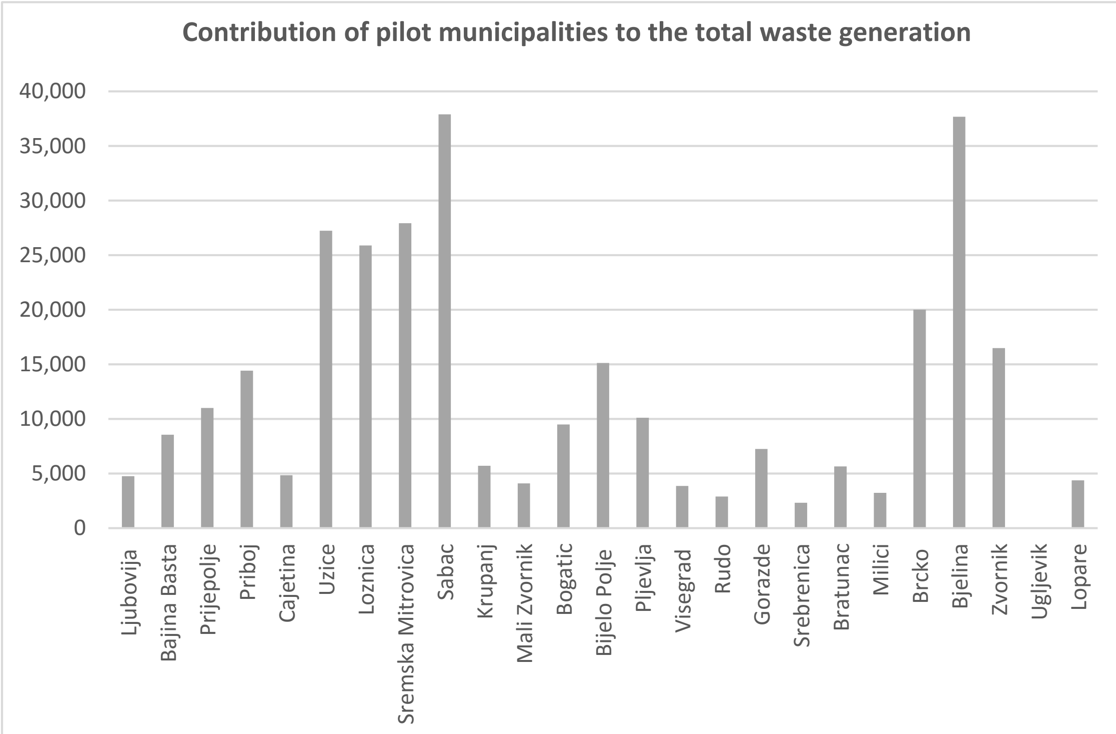

Figure 15 Contribution of the pilot municipalities in the total waste generation tons/year

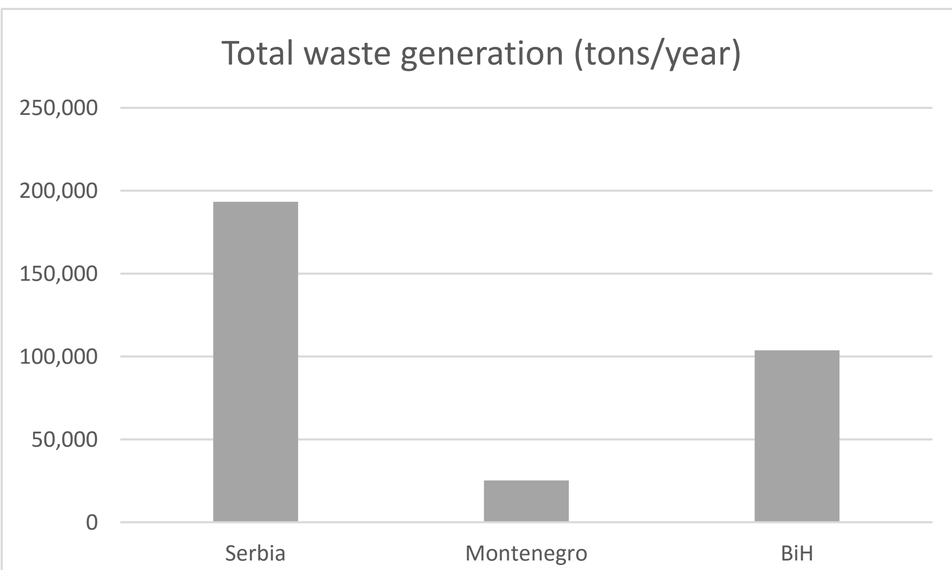

Figure 16 Contribution of pilot countries to the total waste generation (tons/year)

The relative contribution of each pilot municipality / country to the overall waste generation figures is linked to the population numbers. Differences between used waste generation indicators are also influential. As stated elsewhere, the data on waste generation is indicative and further analyses are needed to establish accurate information.

3.4.2 Waste collection

Waste collection is mainly performed by the PCEs owned by the municipalities. There are also exceptions: in Bratunac and Ugljevik, the waste management is performed by joint stock companies; in Bjeljina, there are 4 licensed operators which collect the waste from urban areas and bring the waste to the regional landfill Eko Dep, while in the rural areas of the Municipality the local communities (so called “Mesne zajednice”) take care of waste collection. In the Municipality of Cajetina, there was an international waste operator - .A.S.A. ECO d.o.o., which shared the responsibility for waste collection with the PCE Zlatibor; recently the contract was terminated.

All the PCEs perform other duties apart from waste management. The operations are mainly financed by the user charges paid by the served population; the tariffs are set by the municipalities based on the purchase power of the population and not on the full cost recovery. The fee collection efficiency varies largely across the pilot region: 60% of service users pay regularly their fees in Ljubovija, Bratunac and Milici, while the collection rate is over 80% in Uzice, Sremska Mitrovica and Sabac. Higher fee collection rates in Serbia, according to the stakeholders, are owed to the system of integrated payment which comprises issuing one bill for different public services. In the municipalities in BiH, the highest fee collection rate is achieved in Zvornik, Brcko, Gorazde and Rudo. Fee collection is performed by bill collectors in the majority of municipalities; in Montenegro, the law on postal services obliges the PCEs to deliver the bill via regular mail. Experience shows that the fee collection efficiency is linked mostly to the quality of service and regular interaction between the service provider and the users. In spite of insufficient fee collection rates, the operations of all PCEs are still viable as a result of cross subsidising from various services and collecting outstanding receivables throughout a year.

Typically, the waste in urban areas is collected in 1.1m^3 containers while in the rural areas located in plains kerbside („door-to-door“) collection is applied using 80l, 90l and 120l bins. Non-standardised containers are also used in rural areas. In some municipalities (i.e. Uzice) special bins are given to the househols for the collection of ashes left from burning of fuelwood in winter.

Skip containers (usualy 5m^3 volume) are placed at crossroads of regional and local roads (i.e. „bring“ systems). The population, unwilling to bring their waste to the collection vessels located over 300 meters away from their dwellings, takes the path of least resistance and fly tiping.

Most often, rural settlements located at higher elevations are not included in the regular waste collection services. Kerbside collection is also not performed in dispersed rural settlements at flat terrains, due to high costs involved and/or the refusal of rural population fo receive / pay for the service.

The PCEs are not capable of covering the entire territory by an organised waste collection due to the lack of suitable refuse trucks and containers. Even though the PCEs stated that their operations are viable, their capacity to invest into necessary equipment is limited.

Waste collection rate (service coverage) varies among the pilot municipalities and spans from 100% in the Municipality of Brcko to less than 50% in Srebrenica, Bratunac, Milici, Zvornik, Bogatic and Ugljevik. Low waste collection rate renders significant amounts of waste not collected and potentially dumped along the rivers in the Tara-Drina-Sava pilot region (Table 3).

Table 3 Waste collection rate and amounts of waste not collected in the pilot municipalities

Pilot Municipality	Waste Collection Rate (%)	Waste not collected (tons/year)
Serbia		
Ljubovija	50	2,448
Bajina Basta	78	3,990
Prijepolje	85	1,912
Priboj	70	547
Cajetina	80	257
Uzice	80	7,301
Loznica	55	14,235
Sremska Mitrovica	90	7,122
Sabac	68	11,788
Krupanj	69	2,565
Mali Zvornik	68	1,764
Bogatic	23	6,438
Total		**60,704**
Montenegro		
Bijelo Polje	86	8,827
Pljevlja	63	2,468
Total		**11,295**
Bosnia and Herzegovina		
Visegrad	80	913
Rudo	80	403
Gorazde	74	1,653
Srebrenica	43	1,190
Bratunac	40	3,099
Milici	37	1,095
Brcko	100	0
Bjelina	75	9,398
Zvornik	41	4,315
Ugljevik	40	2,129
Lopare	60.	3,169
Total		**27,364**
Croatia		
Ilok		
Total Pilot Region		**99,363**

Considering high population numbers and relatively low waste collection service coverage, it is assumed that Serbia contributes the most to the floating waste generation in the pilot region (61%); it is followed by BiH (28%), while the Montenegrin pilot municipalities' share in the total waste not collected is only 11% (Figure 17).

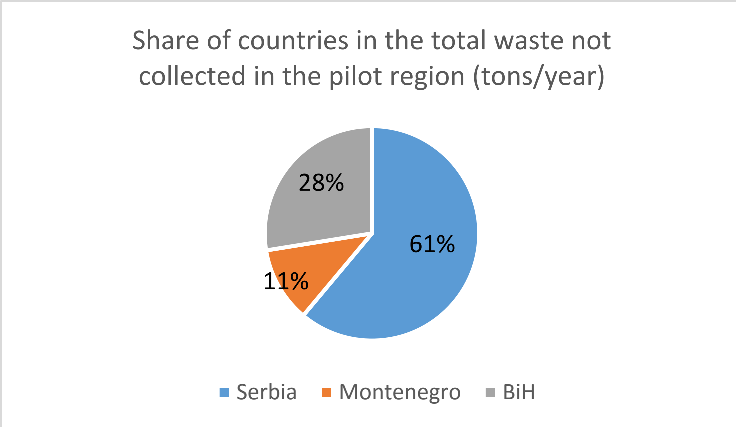

Figure 17 Share of countries in the total waste not collected in the pilot region

Municipalities which contribute the highest share in the total waste not collected in the pilot region are: Loznica (15%), Sabac (12%), Bjeljina (9.5%), Bijelo Polje (9%) Uzice and Sremska Mitrovica (7%), Bogatic (6.5%) and Zvornik (4%) (Figure 18).

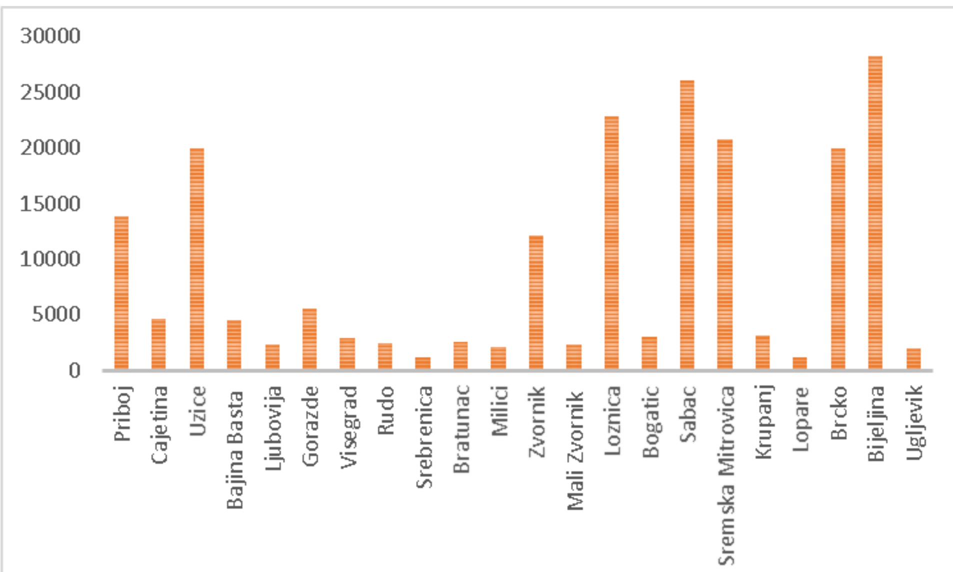

Figure 18 Shares of municipalities in the total waste not collected in the pilot region

The waste quantities potentially dumped in each pilot municipality is an important baseline information necessary to assess the significance of environmental and economic impacts of the present mismanagement of municipal solid waste in the Tara - Drina - Sava Pilot Region.

Further input to the assessment relates to the identification of non-compliant landfills and illegal dumpsites ("hotspots") located nearby rivers – Drina and its tributaries.

3.4.3 Waste disposal and "hotspots"

The collected waste is disposed at either regional sanitary landfills or non-compliant municipal landfills. In some cases, the disposal sites are far away from the collection areas which may encourage illegal dumping to avoid excessive transportation (and gate fee) costs by the operators.

An overview of the destinations of the collected waste (municipal or regional landfills) and distances from the collection areas for each pilot municipality is provided in Table 4 below.

Table 4 Destinations of collected waste in the pilot municipalities and transport distances from the collection area

Pilot Municipality	**Destination of collected waste**	**Distance from the collection area (km)**
	Serbia	
Ljubovija	Non-compliant landfill “Trbusnica” in Loznica; Originally waste was dumped at the non-compliant landfill “Vagan” which is abandoned but not remediated. Planned regional sanitary landfill for the Municipalities of Ljubovija, Mali Zvornik, Krupanj, and Loznica. Realisation pending due to the complaints of the population residing nearby the location of the planned regional landfill in Loznica.	40
Bajina Basta	Regional Sanitary Landfill “Duboko” (Uzice)	35
Prijepolje	Non-compliant landfill „Stanjevine“, located in-between the regional road and the Lim River. Planned regional sanitary landfill “Banjica” for the Municipalities of Sjenica, Priboj, Prijepolje and Nova Varos.	15
Priboj	Non-compliant landfill Druglići “Duboki Do” Planned regional sanitary landfill “Banjica” for the Municipalities of Sjenica, Priboj, Prijepolje and Nova Varos.	15
Cajetina	Regional Sanitary Landfill “Duboko” (Uzice) Planned transfer station at Susica (Cadastre Municipality Branesci)	30
Uzice	Regional Sanitary Landfill “Duboko” (Uzice)	20
Loznica	Non-compliant landfill “Trbusnica” Planned regional sanitary landfill for the Municipalities of Ljubovija, Mali Zvornik, Krupanj and Loznica.	20
Sremska Mitrovica	Regional Sanitary Landfill “Srem-Macva”	15
Sabac	Regional Sanitary Landfill “Srem-Macva” Former non-compliant landfill in Varna closed but not remediated.	25
Krupanj	Non-compliant landfill “Kosevine” Planned regional sanitary landfill for the Municipalities of Ljubovija, Mali Zvornik, Krupanj and Loznica.	30
Mali Zvornik	Non-compliant landfill “Trbusnica” Planned regional sanitary landfill for the Municipalities of Ljubovija, Mali Zvornik, Krupanj and Loznica.	30
Bogatic	Non-compliant landfill "Nišno Polje" Planned to join the “Srem - Macva” regional landfill.	10
	Montenegro	
Bijelo Polje	Non-compliant landfill “Bijekovac Kumanica”	15

Pilot Municipality	Destination of collected waste	Distance from the collection area (km)
Pljevlja	Non-compliant landfill “Jagnjilo” Planned regional sanitary landfill in “Jelin potok” for the Municipalities of Pljevlja and Zabljak.	15
Bosnia and Herzegovina		
Visegrad	Non-compliant landfill “Nezuk”	15
Rudo	Non-compliant landfill “Dolovi”	10
Gorazde	Non-compliant landfill „Šišeta“ Planned regional sanitary landfill in “Tresnjica”	25
Srebrenica	Non-compliant local landfill Planned regional sanitary landfill for the Municipalities of *Zvornik*, *Bratunac, Srebrenica*, Vlasenica and *Milići.*	15
Bratunac	Non-compliant landfill „Repovac“ Planned regional sanitary landfill for the Municipalities of *Zvornik*, *Bratunac, Srebrenica*, Vlasenica and *Milići.* Planned transfer station in Konjevic Polje	15
Milici	Borrow pit of the mine “Bracan” Planned regional sanitary landfill for the Municipalities of *Zvornik*, *Bratunac, Srebrenica*, Vlasenica and *Milići.*	15
Brcko	Non-compliant landfill located nearby the road to Bijeljina	15
Bjeljina	Regional Sanitary Landfill “Eko Dep” Former non-compliant landfill “Brijesnica” in use for slaughter waste and sludge from septic tanks	15
Zvornik	Non-compliant landfill „ Tilić Ada“- Karakaj; Planned regional sanitary landfill for the Municipalities of *Zvornik*, *Bratunac, Srebrenica*, Vlasenica and *Milići.*	15
Ugljevik	Regional Sanitary Landfill “Eko Dep”	25
Lopare	Regional Sanitary Landfill “Eko Dep”	30
Croatia		
Ilok		

It can be seen that the majority municipalities dispose their collected waste at non-compliant landfills, with the exception of the Municipalities of Bajina Basta, Cajetina, Uzice, Bjeljina, Ugljevik, Lopare, Sremska Mitrovica and Sabac.

The non-compliant landfills located nearby the Lim and Drina Rivers which may be sources of floating debris are: “Stanjevine” (Prijepolje), “Drugljici” (Priboj), “Kumanica” (Bijelo Polje), “Nezuk” (Visegrad), “Tilić Ada“-Karakaj (Zvornik), abandoned landfill “Siseta” (Gorazde), the local landfill in Srebrenica, “Repovac” (Bratunac), “Trbusnica” (Loznica) and “Kosevine” (Krupanj). Amongh those listed, the stakeholders “nominated” the landfills in Prijepolje, Bjelo Polje and Zvornik as the biggest “hotspots” (Figure 19).

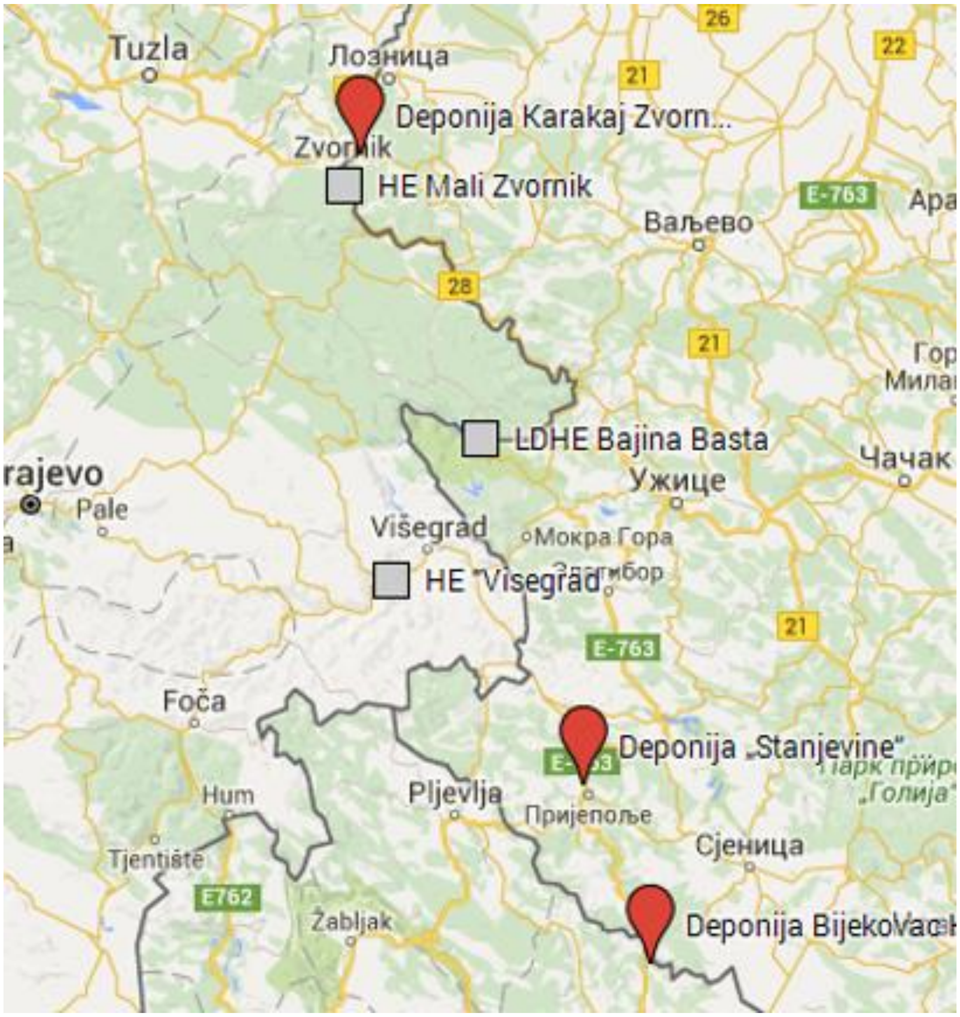

Figure 19 "Hotspot "non-compliant landfills in the Drina catchment

Various sources[11] indicate that waste transportation routes exceeding 25 km are not economically viable, especially if the waste is carried in small size refuse trucks (less than 10 tons). It implies that the operators in Ljubovija, Cajetina, Bajina Basta, Sabac, Krupanj, Mal Zvornik, Gorazde, Ugljevik and Lopare should look for solutions to reduce the transportation costs, i.e. installation of waste transfers and possibly secondary waste segregation at these transfer points.

The waste not collected ends up at illegal dumps which proliferate along the roads and riverbeds. The construction and demolition waste mainly ends up at the kerbsides of the roads and these spoiled areas are also magnet for dumping of household waste. Considering the habits of local population, it is assumed that they fly tip their wastes predominantly near water streams. A study of ICPDR[12] operates with an assumption that approximately 30% of the fly-tipped waste becomes floating debris.

[11] http://www.unep.org/ietc/Portals/136/SWM-Vol1-Part1-Chapters4.pdf
[12] (ref: http://www.icpdr.org/main/publications/drina-rivers-floating-problem), 2008

The Regional Environmental Centre in the study “Pollution in the Drina River Basin - an inventory of potential sources”[13] developed maps of non-compliant and illegal dumps in the countries covering the entire catchment area of the Drina River in order to assess the risk spots / activities contributing to the water pollution.

Figure 20 Waste deposition sites in Montenegro

Figure 21 Waste deposition sites in BiH

Figure 22 Waste deposition sites in Serbia

Waste deposition sites highlighted in Figures 20, 21 and 22 above have been mapped out in 2011; they are presented for illustration only as they cover municipalities outside the pilot region and include industrial and mining activities which are not in the scope of this assessment report being limited to the municipal solid waste management. Further analyses are needed in the future to update the information specific to the municipal waste management and the pilot region`s territory.

There are inventories of illegal dumps presented in the municipal waste management plans collected and analysed during the impact assessment report development. These inventories comprise either of settlements` lists near which the illegal dumps are created, the provisional locations are indicated on a map, or both settlements list and map are developed.

The settlements lists with illegal dumps identified in the municipal waste management plans of several pilot municipalities are highlighted in Table 5 below.

Table 5 Inventories of illegal dumps deriving from municipal waste management plans of some pilot municipalities

Pilot municipality	Illegal dumps	Comments
Sabac	• Prnjavor	110 dumps created along the rivers at

[13] http://documents.rec.org/publications/DrinaRiver_July2011.pdf

Pilot municipality	Illegal dumps	Comments
	• Ribari • Petlovaca • Slepcevic • Lipolist • Stitar • Drenovac • Varna	the locations of borrow pits for gravel. In the mentioned settlements the biggest illegal dumps exist.
Bajina Basta	• 17 illegal dumps identified along the Drina River and the reservoir	Local population dumps waste illegally within the reservoir itself.
Cajetina	• Alin Potok 20 m^3 • Branesci 20 m^3 • Golovo 70 m^3 • Gostilje 80 m^3 • Dobroselica 50 m^3 • Jablanica 150 m^3 • Kriva Reka 50 m^3 • Ljubis 150 m^3 • Mackat 80 m^3 • Musvete 30 m^3 • Rozansko 200 m^3 • Rudine 200 m^3 • Tripkova 250 m^3 • Trnava 100 m^3 • Sljivovica 450 m^3 • Segmenjivo 60 m^3	Dumps created in local communities (Mesne Zajednice).
Uzice	• Sevojno-Rujevac 110m^3 • Gorjani-Sibalica stream 40 m^3 • Krvavci-Bukovicki bridge 5 m^3 • Krvavci-stream Badanj 20 m^3 • Lunovo village-Kamenica 10 m^3 • Ribasevina-Jazovik 5 m^3 • Trnava-Markovici 40 m^3 • Trnava-Lazici 15 m^3 • Trnava-Radivojevici 16 m^3 • Voljac-Stitari 30 m^3 • Volujac-Bus station 15 m^3 • Volujac-road to Ponikva 40 m^3 • Stapari-Tupaje 10 m^3 • Stapari-Postenje 10 m^3 • Stapari-Studeni Do 20 m^3	Clean-up can be difficult due to accessibility problems for the following dumps: Sevojno-Rujevac; Ribasevina-Jazovik; Trnava-Markovici; Trnava - Lazici; Trnava - Radivojevici; Voljac - Stitari; Volujac - Bus station; Volujac - road to Ponikva; Stapari-Studeni Do.
Gorazde	• Settlements Mravinjac and Haldis	Located near Drina`s riverbed, in a beautiful landscape – tourism potential; cleaned up occasionally by the local population.
Loznica	• 42 illegal dumps identified on the territory	After the organized action “Clean up Serbia / Ocistimo Srbiju” initiated by the competent ministry, their number has been considerably decreased (20 of them have been cleaned up). Also, the coverage with organized waste collection has been extended to prevent recurrent emerging of illegal

Pilot municipality	Illegal dumps	Comments
		dumps.
Priboj	Illegal dumpsites exist in rural areas of Priboj, but considering the fact that those areas are sparsely populated those dumpsites are very small.	Some bigger dumpsites in the Municipality have been cleaned up through public works.

The figures below show the provisional locations of major illegal dumps in the Tara – Drina - Sava Pilot Region. These are also taken from the available municipal waste management plans.

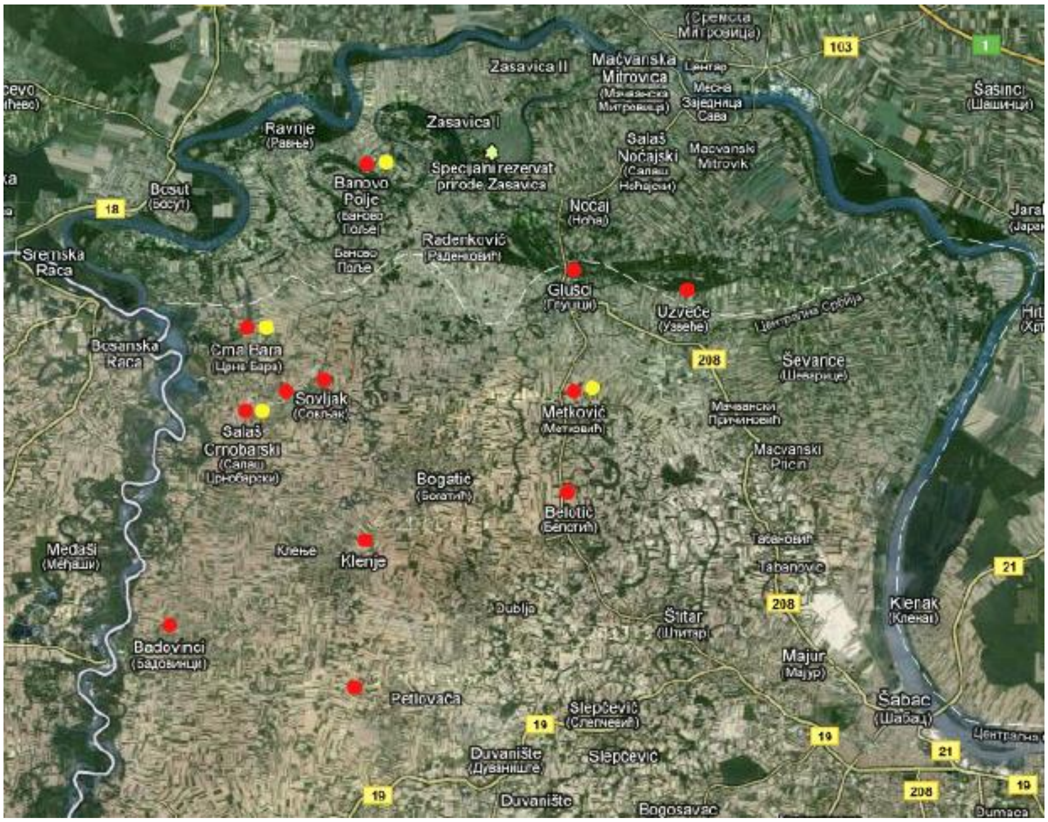

Figure 23 Illegal dumps in the municipality Bogatic

Figure 24 Illegal dumps in the municipality Bratunac

Figure 25 Illegal dumps in the City Sremska Mitrovica

Figure 26 Illegal dump in the settlement Lezimir

Figure 27 Illegal dump in the settlement Grgurevci

Figure 28 Illegal dump in the settlement Suljam

Figure 29 Illegal dump in the settlement Besenovo

Figure 30 Illegal dump in the settlement Mandjelos

For some municipalities the locations of illegal dumps are not known either because there is not any inventory in the municipal waste management plans, they did not submit any municipal waste management plan to the Regional Expert, or they did not show up at the 1st DP.

Even though the inventories of most pilot municipalities are not available, it is obvious that illegal dumps appear in the suburbs and villages in every pilot municipality without any organised waste collection. However, illegal dumps are also present in the areas where there is some sort of waste collection (i.e. “bring” systems).

Notwithstanding the incompleteness and insufficient accuracy of the locations of “hotspots”, the initial information on land based sources of floating debris provides solid background for the dialogue on designating suitable prevention and/or cleaning actions in the future. An inventory of illegal dumps (“hotspots”) to derive exact locations of the floating debris sources will have to be compiled in order to organise for a sound monitoring as part of joint activities at regional scale.

3.4.4 Recycling

Recycling operations in the Tara – Drina - Sava Pilot Region are in infancy, although primary recycling has been initiated in urban centres of Bajina Basta, Uzice, Prijepolje, Sremska Mitrovica and Bjeljina and secondary recycling is performed at the regional sanitary landfills “Eko-Dep”, “Duboko” and “Srem-Macva”.

Primary waste segregation of household and commercial waste[14] exists in the following municipalities:

Table 6 Primary recycling and active operators in the pilot municipalities

Pilot Municipality	Recyclables segregated	Recycling spots / operators
	Serbia	
Bajina Basta	PET, other plastics	***Recycling spots*** placed in downtown. Collected PET is delivered to “Duboko” Sanitary Landfill
Priboj	PET, paper	There are no organised recycling spots, however, PET and paper are segregated at the bigger generators and recyclables are taken by the operator “Kiko Prom” for further treatment and marketing.
Prijepolje	PET	***30 containers for PET*** segregation placed in downtown.

[14] Bigger generators of paper / cardboard and PET / plastics– supermarkets, shops, hotels, restaurants, enterprises etc. conclude contracts with licensed operators who collect segregated recyclables for further treatment and marketing either by the same operators or by third parties in the country or abroad.

Pilot Municipality	Recyclables segregated	Recycling spots / operators
		PP NOVAK and PCE “Lim Prijepolje” also collect recyclables from 6 big generators and sell the commodities to third parties
Cajetina	PET	***Recycling spots*** placed in downtown. Collected PET is delivered to “Duboko” Santary Landfill
Uzice	PET, paper	***10 recycling spots*** installed in the city area (30% of the households in the urban area covered). PCE “Bioktos” sells the segregated recyclables to “Duboko” regional landfill. Bigger generators have concluded contracts with operators “Paper Service” and FHB
Loznica	PET, plastics and paper	There are no organised recycling spots, however, PET and paper are segregated at the bigger generators and recyclables are taken by the operator “Green Idea” for further treatment and marketing
Sremska Mitrovica	PET	***Recycling spots*** placed in downtown. The PCE “Komunalije” collects segregated PET and sells to the operator Pro-Plast
Sabac	Paper and PET	There are no organised recycling spots, however, PET and paper are segregated at the bigger generators and recyclables are taken by the operators „INOS Napredak“, .„Hemiko“„Djoleks“ Ltd, “Denex”,“Paper Service FHB” and “Salveco” for further treatment and marketing
Mali Zvornik	PET, plastics and paper	There are no organised recycling spots, however, PET and paper are segregated at the bigger generators and recyclables are taken by the operator “Green Idea” for further treatment and marketing
Bijelo Polje	No segregated collection of recyclables.	The PCE “Lim” has concluded a contract with the operator “R – MARKOVIĆ CO” from Podgorica for marketing of recyclables, but the activities are put on hold
BiH		
Gorazde	PET and paper	There are no organised recycling spots, however, PET and paper are segregated at the bigger generators and recyclables are taken by the operator “Janjina” Ltd for further treatment and marketing
Srebrenica	PET and paper	There are no organised recycling spots, however, PET and paper is segregated at the bigger generators and recyclables are taken by the operator s.p. SARA, Zvornik for further treatment and marketing
Bratunac	PET and paper	There are no organised recycling spots, however, PET and paper are segregated at the bigger generators and recyclables are taken by the operator s.p. SARA, Zvornik for further treatment and marketing
Brcko	PET and paper	There are no organized recycling spots, however, PET and paper is segregated at the bigger generators and recyclables are taken by the operator “Promal A.B” for further treatment and marketing
Bjeljina	PET and paper	***30 recycling spots*** in Bjeljina and ***8 recycling spots*** in Janja; Joint Stock Company “Komunalac” collects recyclables and sells them to third parties.
Zvornik	PET, paper	Baskets for PET placed in downtown; PET and paper are segregated at the bigger generators and recyclables are taken by the operator s.p. SARA, Zvornik for further treatment and marketing

The primary segregation of household waste is confined to the densely populated areas. No waste segregation exists in rural settlements. In Table 6 above, the active licensed companies involved in the recycling business are listed for each pilot municipality. There are potentially other companies that have not been identified during the development of this Impact Assessment Report due to time constraints. A comprehensive inventory of all active recycling companies will have to be generated and the quantities of the collected / treated recyclables will have to be monitored in the future.

The secondary waste segregation takes place at the “Duboko”, Eko Dep” and “Srem-Macva” regional sanitary landfills. While the “Eko Dep” regional landfill did not share the information on secondary waste segregation, the Regional Expert obtained information that there is a sub-contractor (“Eko Radex”), engaged since January 2015 for segregating PET and other recyclables who collects approximately 30 tons of PET a month. According to the contract, the Regional Landfill`s authorities are paid a monthly fee (lump sum) regardless of the turnover of the sub-contractor.

The “Duboko” authorities reported that 5% of the total waste delivered at the landfill has been segregated and “Srem-Macva” representatives stated that in the period January-October 2015 they separated approximately 10 tons of PET. Compared to the results of the sub-contractor of “Eko-Dep”, it is rather negligible. It is obvious that the private sector is more interested in marketing the recyclables than the PCEs.

The involvement of the informal sector (mostly Roma people) in the recycling business, according to the stakeholders, is significant. Information on the actual collection of recyclables by the informal sector from the containers or at the landfills is not available.

There is plenty of room for improvement of the present recycling activities in all pilot municipalities. Suitable measures targeting the prevention of floating debris in the Tara – Drina - Sava Pilot Region will be designed as part of the ISWM model.

3.2.1 Pathways of floating debris

The floating debris originating from the territory of pilot countries is transported by the rivers in the catchment area - Drina River and its right tributaries Cehotina, Lim, Uvac, Rzav and Jadar, the left tributaries Sutjeska, Praca and Dranjaca.

The inflow into the rivers, the quantity of floating debris and its transportation downstream the source is related to the following variables:

- river catchment area and number of settlements / population residing in the catchment / sub-catchment,
- discharge and streamflow (short-term) variations, including periodic flooding,
- dynamics (turbulence, current velocity, cross-section profile stability).

The bigger the waste quantities of the land based sources and the discharge of the river, the greater will be the floating debris` flow and accumulation at calm river`s sections and reservoirs.

Drina River springs are located in Montenegro in an uphill terrain (2.500 m.a.s.) of the mountains Maglic and Pivska, which have the highest specific discharge in Europe (up to 50 $l/s/km^2$). The largest part of the Drina River catchment area (35%) is in Bosnia and Herzegovina, 34% in Montenegro, 30% on Serbian territory. Drina emerges by the confluence of the rivers Tara (sub-catchment area 2,006 km²), Piva (sub-catchment 1,784 km²) and Lim (sub-catchment 5,968 km²). Tara and Piva merge at the Scepan Plain along the border between BiH and Montenegro (combined mean flow of 154m³/s), while Lim`s estuary is at the reservoir Visegrad (mean flow of 113 m³/s). Drina flows into Sava River in the Panonija Plain (78 m.a.s.). Mean annual flow of Drina is 400 m³/s, which is an equivalent of the volume of 12.6 billion m³. Drina has very torrential character in its upper catchment; the erosion and flood risks are controlled by 771 km of dikes. Clogging of these dikes by floating debris increases the flood risk. Floating debris is a threat for Drina River quality and consequently for the security of potable and industrial water supply and irrigation.

Figure 31 Drina River before Bajina Basta Reservoir

Lim River is the most important river in Montenegro and the largest tributary of Drina. Lim is 193 km long and it has a catchment area of 5,967.7 km², including territory of four countries –Albania, Bosnia and Herzegovina, Montenegro and Serbia. From its source to its mouth, Lim passes through gorges and ravines within the Polimlje area, and flows through the Plav Lake. Its outlet from the Plav is at 999 m. above sea level, and it flows northwest through a valley towards the Sutjeska gorge. Before the town of Andrijevica, and in the vicinity of Berane and Bijelo Polje, Lim receives water from several tributaries. Similarly, the floating waste is impacting adversely the functioning of the HPP Potpec (Figure 33) in the Lim River catchment.

Figure 32 Lim River through Prijepolje

Figure 33 Potpec Reservoir near the road Prijepolje-Priboj

Cehotina River rises in northeast Montenegro, and its watershed area is shared with Serbia and Bosnia and Herzegovina. It is Drina's second largest tributary after Lim and its catchment area is 1,237 km^2. It originates from two streams, the Koraci and Brezovska. Its major tributaries are Koricka, Maocnica, Vezosnjica and Voloder. Its upper flow reaches through a narrow canyon up to 300 m deep, near Pljevlja. The thermal power plant in Pljevlja is the biggest polluter in this area in terms of the quantity and quality of wastewater discharged into the river Vezisnjica. As a result, Vezisnjica and Cehotina are the most polluted rivers in Montenegro.

Figure 34 Cehotina River

Floating debris transported by Drina and its tributaries is a threat for the power generation at the Hydropower Plants installed onto the river (for more details please see section 3.3.4.3 Costs for Cleaning Floating Debris at Reservoirs Lost and Revenues from Power Generation below). It is also a problem for tourism development as the tourists are disinclined to visit the region due to the degraded landscape by illegal dumping and the floating debris in the reservoirs.

3.5 Environmental and Economic Impact Assessment

The transboundary impacts deriving from the floating waste in the pilot regions can be environmental and economic. The significance can be high, moderate and low. It is linked to the quantity and property of waste potentially released from each pilot municipality (please see the section 3.4 Sources of floating debris in the pilot municipalities in the Tara - Drina - Sava Pilot Region above).

The *environmental impacts* encompass water pollution, threats to the riverine wildlife and protected areas, as well as human health problems in terms of potential injuries of people by sharp objects settled at the bottom of the rivers or reservoirs.

The *economic impacts* comprise costly clean-up activities (either in the reservoirs or at the river banks), declining fisheries, loss of power generation and related revenues, loss from non-returning tourists due to landscape disturbance, etc.

3.4.1 Environmental Impacts

Floating waste poses considerable threat to the health and productivity of lake and riverine ecosystems.

The illegal waste dumping can threaten the biodiversity and protected areas in the Tara – Drina – Sava Pilot Region. Drina crosses three national parks: Durmitor National Park in Montenegro, Sutjeska National Park in Bosnia and Tara National Park in Serbia (Figure 26). The biodiversity of the Drina Catchment Area is becoming increasingly recognized, as it hosts numerous endemic species, and provides the space and sustenance of large important habitats (some in protected nature parks), that in turn support tourism and “green agriculture” economies.

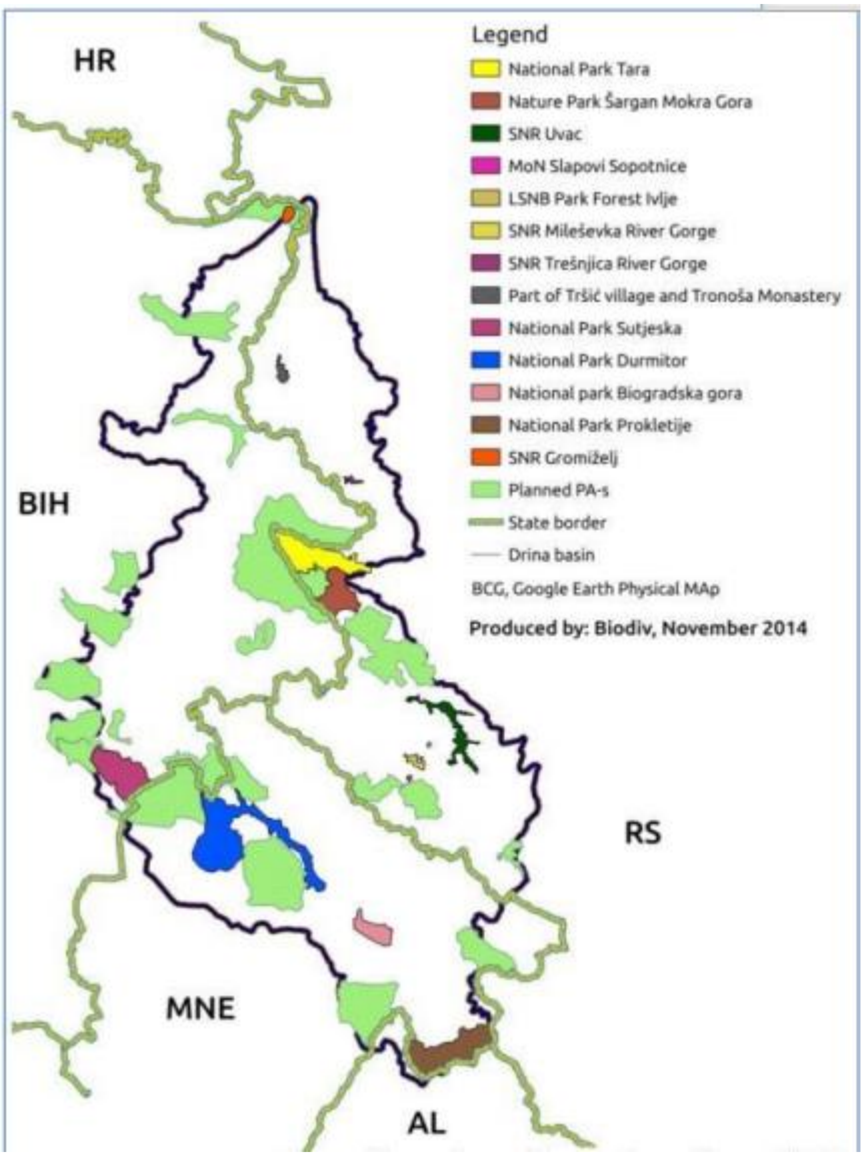

Figure 35 Protected Areas and proposed Protected Areas in the Drina River Catchment

A Feasibility study on establishing transboundary cooperation in the potential transboundary protected area: Tara-Drina National Park (2011), has been prepared within the project "Sustaining Rural Communities and their Traditional Landscapes through Strengthened Environmental Governance in Transboundary Protected Areas of the Dinaric Arc"[15]. In the study the need for establishing transboundary collaboration is emphasized as a mechanism for effectively managing the transboundary (to be protected) area and its functional units at the scale of the regional landscape. It highlights multiple benefits to local communities from protecting jointly important habitats and ecosystems that are divided by the state border or are in close proximity to the border: habitats and ecosystems of Pancic spruce (Picea omorica)

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[15] The project was funded by the Ministry for Foreign Affairs of Finland and implemented by IUCN (International Union for Conservation of Nature) - IUCN Regional Office for Pan-Europe and IUCN Programme Office for South-Eastern Europe, in partnership with the World Wide Fund for Nature–Mediterranean Programme Office and SNV–Netherlands Development Organization.

ecosystems of Austrian pine forests (Pinus nigra), preserved forest ecosystems of mixed forests of coniferous and deciduous tree species, freshwater habitats and ecosystems of Lake Perucac and Drina River, and mountain meadows with rare plant species. These benefits are linked to maintaining the natural and cultural landscape as a basis for tourism development and other economic activities (collection of mushrooms, berries, medicinal plants, etc.). While assessing the natural values, the feasibility Study also identifies *"pollution problems due to mis-management of solid waste in Drina Valley and accumulation of floating waste on Lake Bajina Basta; due to the general lack of* environmental awareness and the collection of waste which is not well organized in some parts of the region (remote villages, new tourism settlements) waste disposal, sometimes illegal, creates a problem and poses a threat to water and land quality". Joint management of the transboundary protected area (to be established) should, therefore, address the floating waste in order to prevent deterioration of Drina River dependent ecosystems. Unfortunately, the proposal to establish a transboundary protected area has not been materialized yet.

The riverine ecosystems are affected by the floating debris. In Drina, the most important species due to the genetically pure populations are the Salmonidae family with Danube salmon (*Hucho hucho*) and Brown trout (*Salmo trutta*). Danube salmon is an endemic species of the Danube watershed and an endangered fish species in many countries. Fish in general, but also the endemic species in Drina River, is endangered by the floating waste and wood filings, (which are thrown from sawmills located in the catchment), entering the gills of fish.

Fisheries developed at the HPP reservoirs are also threatened by the floating debris. 600 t of fish a year is produced in the Bajina Basta fish ponds, but their productivity may have been even greater, in the absence of the floating waste.

3.3.4 Economic Impacts

Floating debris can cause serious economic losses to various sectors and authorities. HPPs in the Drina River catchment are among the most seriously affected. Economic costs are lost benefits to society (welfare effects).

The following economic impacts are analysed:

- Costs for cleaning illegal dumps – origins of floating waste (prevention activities);
- Costs for cleaning floating debris from the reservoirs of HPPs and lost revenue from power generation.

These costs may be difficult to estimate in the absence of suitable records. The assessment of these costs will have to deploy an organised approach for monitoring at regional scale in the future.

3.3.4.1 Costs for Cleaning Illegal Dumps

The inventory of illegal dumps in the Tara – Drina – Sava Pilot Region is not complete at present, however, the estimations made for the purpose of this Impact Assessment Report show that approximately 99,363 tons of waste are not collected and may end up at illegal dumps. Assuming a unit price of 50 EUR/ton for collection, transportation and disposal at the regional sanitary landfills, the annual costs for cleaning the illegal dumps are estimated at around 5 million EUR.

Table 7 Costs for clean-up of illegal dumpsites

Waste Not Collected (tons/annum)	Unit Price for Clean Up (EURO/ton)	Total Clean Up Costs (EUR/annum)
99,363	50	4,968,150

3.3.4.3 Costs for Cleaning Floating Debris at Reservoirs Lost and Revenues from Power Generation

Drina River has an important potential for hydro-energy generation: there are 4 hydropower plants (HPPs): Potpec (Lim River), Visegrad, Bajina Basta and Zvornik (Drina River) in the pilot region (Figure 36).

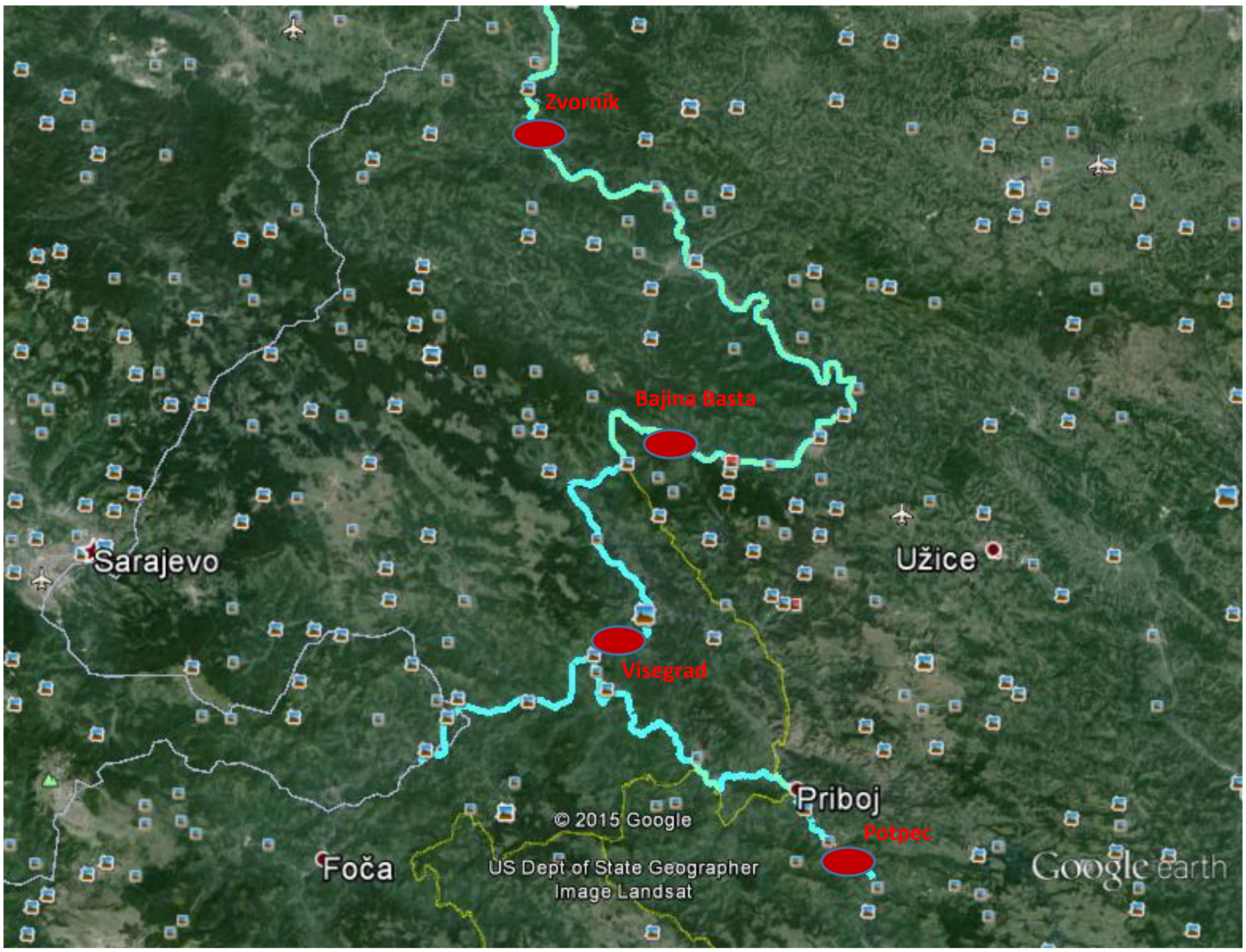

Figure 36 Locations of the HPPs at Lim and Drina Rivers

The floating debris is washed away from municipal non-compliant landfills and illegal dumps and transported by the river flow to the reservoirs where it is accumulated in significant quantities. Previous studies[16] indicate that more than 100,000 m^3 of organic and PVC waste ends up in the Lim River every year, which is approximately 30% of the waste originating from the land based sources. Other sources[17] state that, at the Visegrad HPP, by Drina River and its tributaries,

[16] ICPDR (ref: http://www.icpdr.org/main/publications/drina-rivers-floating-problem), 2008.
[17] http://www.zelenaneretva.ba/ecology/article/?id=9

ends up approximately 60.000 m^3 of waste a year. Over 70 % of the floating debris at the Visegrad HPP has originated from the Lim River in 2010 after the flood.

Significant amount of floating debris accumulates over girders; it causes a decrease of the water inflow and hinders the production of electricity. Formations of shell colonies onto the girders due to the increased concentration of organic matter originating from the municipal waste constitute additional problem. The invasion of shell colonies also clogs the girders: divers who cleaned the girders manually, observed that up to 80% of the girders were covered. It reduces the water inflow and the electricity production. Hence, the floating debris disrupts the work of motors and machines of the HPPs, causing significant costs for repairs and cleaning.

For example, in the period July-August 2010 the level of the Bajina Basta reservoir was lowered to allow for a rehabilitation of the girder, which was damaged by the floating waste. The electricity production stopped for two months. During the remount, various debris was cleaned from the bottom of the reservoir; even a sunk boat was taken out[18].

Figure 37 The boat pooled from the bottom of the Bajina Basta Reservoir during the remount of the dam`s aggregates

During the remount of the HPP Potpec in 2011, big quantities of floating debris entered the Visegrad reservoir during the tourist season; the tourists complained about the disturbed landscape and bathing water purity of the Visegrad reservoir. The Tourist organization of Visegrad, under a cross-border cooperation project, procured two boats (30.000 EUR) for cleaning the debris from the reservoir. These are not in use as the HPP Visegrad failed to conclude an appropriate contract with the Tourist organization. For the removal of the floating debris the HPP Visegrad spends 200,000 EUR. Fishermen, led by the Association "Drinska jezera", organize themselves and clean the dumps along the riverbank.

Visegrad HPP authorities set a debris skimmer / beam in the Lim catchment (Setihovo) in 2014 to prevent the inflow of floating debris in the reservoir. There was an attempt to install similar debris skimmer at another location to prevent the inflow of debris from Piva River (Gorazde), but the local population in Novo Gorazde opposed and the idea was discarded. The HPP Bajina Basta authorities report[19] that after the installation of debris skimmers at Visegrad HPP, millions

[18] http://www.pecat.co.rs/2010/07/drina-ko-truje-srpsku-zilu-kucavicu/
[19] https://www.youtube.com/watch?v=5kKuk_s6qvY

of Serbian Dinars have been saved as a result of avoided cleaning of floating debris originating from the upstream Visegrad Reservoir.

In addition to skimmers` installation, the HPP authorities invested into building portal cranes with grabbers and special boats supplied with grabbers (Figures 33-41).

Figure 38 Equipment installed for seizing of floating waste at Potpec reservoir (Lim River)


Figure 39 Portal crane


Figure 40 Grabber

Figure 41 Cleaning of floating debris at Bajina Basta reservoir

Figure 42 Boat for cleaning the debris

Figure 43 floating debris next to the dam

Figure 44 Debris cleaning installation at Zvornik reservoir

Figure 45 Skimmer

Figure 46 Grabber

The investment costs for the cleaning equipment have not been disclosed so far. It is obvious, however, that the Power generation authorities have spent significant financial resources to deal with the floating waste problems: continuous cleaning of floating debris, as well as reduced power generation due to clogging of girders and reduced water flow through turbines.

Cleaning of the floating debris at the reservoir is performed every day by a boat and two persons; in addition, the grabbers pool the debris out in front of the dams. Annual costs at all 4 HPPs (Potpec, Visegrad, Bajina Basta and Zvornik) are in the range of 400,000 EUR. These encompass the salaries of the people involved in cleaning, the electricity and maintenance of the grubbers and the crane and fuel for the boat operating at the Bajina Basta reservoir.

Figure 47 Cleaning of floating debris

In 2014, the Public Enterprise “Power Economy of Serbia” (Elektroprivreda Srbije – EPS) hired “Tekon-Techno-Consulting” Ltd and “Dekonta” Ltd from Belgrade to develop a “Techno-economic analyses of the floating waste management in the Drina-Lim Hydropower Plants”. The study is aimed to assess the financial losses caused by the floating debris, as well as investment and operating costs of an improved system for cleaning of floating debris.

The method used in the study to estimate power generation losses operates with the assumption that 0.25-1.5% of the annual power generation or 1-3,5% of the installed power is wasted as a result of the damages of power generation machinery. Due to the reduced flow, additional losses occur. Analyses are conducted for the HPP Zvornik (Table 8),

Table 8 Financial losses of the HPP Zvornik associated with reduced power generation due to floating waste

Power generation in 2013 (kWh)	**Estimated loss coefficient**					
	0.25%	**0.50%**	**0.75%**	**1.00%**	**1.25%**	**1.50%**
523.000.000	1.307.500	2.615.000	3.922.500	5.230.000	6.537.500	7.845.000
Electricity price (EUR /kWh)	0.0442	0.0442	0.0442	0.0442	0.0442	0.0442
Financial loss (EUR)	57,974	115,948	173,922	231,898	286,872	347,846

Additional 18,000 EUR are lost as a result of the reduced flow so the total loss at the Zvornik HPP is in the range of 366,000 EUR a year.

Table 9 Financial losses of the HPP Bajina Basta associated with reduced power generation due to floating waste

Power generation in 2013 (kWh)	**Estimated loss coefficient**					
	0.25%	**0.50%**	**0.01**	**1.00%**	**0.01**	**1.50%**
1,685,000,000	4,212,500	8,425,000	12,637,500	16,850,000	21,062,500	25,275,000
Electricity price (EUR /kWh)	0.0442	0.0442	0.0442	0.0442	0.0442	0.0442
Financial loss (EUR)	186,782	373,564	560,346	747,128	933,910	1,120,692

At the Bajina Basta HPP, the losses are even greater: assuming 1.5% loss of the electricity generation, the financial loss is estimated at 1,120,700 EUR a year. Adding the loss caused by the reduced flow of 39,358 EUR, the total loss is in the range of 1,160,000 EUR annually.

At the Potpec HPP, the reservoir has been lowered in 1980, 1988, 1992 and 1999 to allow for repairs of the girders damaged by floating waste. These actions rendered maintaining the minimum biological flow of the river after the dam difficult which resulted in reduced fish populations in the downstream sections. After the installation of the portal crane and grabber the reservoir was not lowered, but losses still occur.

Table 10 Financial losses of the HPP Potpec associated with reduced power generation due to floating waste

Power generation in 2013 (kWh)	**Estimated loss coefficient**					
	0.25%	**0.50%**	**0.01**	**1.00%**	**0.01**	**1.50%**
241,000,000	602,500	1,205,000	1,807,500	2,410,000	3,012,500	3,615,000
Electricity price (EUR /kWh)	0.0442	0.0442	0.0442	0.0442	0.0442	0.0442
Financial loss (EUR)	26,714	53,430	80,144	106,860	133,574	160,290

Losses as a result of reduced flow are estimated at 9,558 EUR and thus the total maximum annual loss is estimated at 170,000 EUR a year.

Hence, the total annual financial loss incurred to the HPPs in the pilot region as a result of reduced power generation and water flow in the turbine is approximately 1,700,000 EUR; adding up the amount spent for cleaning of 400,000 EUR, we come up at the total annual loss of 2,100,000 EUR.

3.3.4.5 Lost Revenues due to non-returning tourists

The economy of the pilot region is primarily based on the wealth of natural resources. Natural resources and their diversity have influenced the development of collection of medicinal plants, tourism, and hunting in the renowned Susica (Municipality of Srebrenica) hunting ground. Tourism is significantly better developed in Serbia while in BiH, tourism has great though unrealized potential. Transit tourism is important for the pilot municipalities in Montenegro. According to the Master Tourism Plan for Tara, resources (preserved mountain area, freshwater resources, etc.) in this area could be used for the development of several types of tourism:

winter and summer holidays, rural tourism, business tourism, short holidays, health and wellness tourism, touring.

Important tourism facilities on Tara are the Tara military complex, and the children's camp complex on Mitrovac. The region is also a host to some of the famous ethno villages such as Terzića Avlija in Zlakusa, Lazarevi Konaci in Kačer, Vrhpolje in Ljubovija, Stari Brod in Višegrad, Kalušići in Pljevlja, etc. A specific complex is the ethno village of Mećavnik/Drvengrad (Timber Town) with the Šargan Eight Rail in Mokra Gora, etc.

Built with the similar idea as Drvengrad, the Drina -Tara region hosts Andrićgrad (Stone Town, located in the town of Visegrad) dedicated to a famous writer and Nobel Prize winner, Ivo Andrić. This town is a unique open-air museum with the active institutions such as theatre, institute, or cinema.

There is also a significant health-related tourism offer in the region, with spas and rehabilitation centres (Rehabilitation Centre Čigota, Zlatibor, Priboj Spa, Višegrad Spa, Guber Spa, etc). Koviljaca Spa (Banja Koviljaca) is a popular tourist location situated in the Loznica Municipality by the Drina River.

Tourism and natural resources form the base of the economy of the Municipality of Cajetina. The Municipality has a famous tourism centre at Zlatibor Mountain with 12 hotels, 29 restaurants, 4 tourist agencies and other tourist facilities (according to the Zlatibor Tourist Board).

The Drina Regatta is a central tourist and recreational event on Drina River. It is organised in honour of the Drina rafters. Regatta is the most visited event in Western Serbia and the central water summer event in the region. Day one features a swimming competition and fish soup preparation competition near the small river of Vrelo in Perućac. The following day includes the Competition Regatta from Perućac to Bajina Bašta. The third day is reserved for a major event and fun - recreational downstream, which involves hundreds of vessels and crews with the trumpets, floating bars, music rafts, barbecue and other curiosities of local inhabitants[20].

Illegal dumps and floating waste can be detrimental for the tourism development if suitable measures would not be carried out. During the field investigations, the developers of the "Techno-economic analyses of the floating waste management in the Drina-Lim Hydropower Plants" interviewed 10 tourists (5 Englishmen and 5 Italians) who were travelling in Drina region: they stated that the nature and landscape is fantastic, but the floating waste is spoiling it and deterring them from coming back. It is interesting to observe that 10 out of 10 interviewed persons responded similarly showing discontent with the present waste management practice and illegal dumping.

Data on tourism (arrivals and overnight stays) for Koviljaca Spa, Zlatibor and Tara (Serbia), as well as Bjelo Polje and Pljevlja shows the following information:

[20] http://seerural.org/wp-content/uploads/2014/11/1.-General-brochure_Drina-Tara.pdf

Table 11 Arrivals and overnight stays in some tourist locations in the pilot region (November 2014-November 2015)[21]

Pilot municipality	Tourist Location	Arrivals 2014		Overnight 2014	
		Domestic	International	Domestic	International
Loznica	Koviljaca Spa	10,706	3,500	77,542	18,142
Bajina Basta	Tara	51,821	4,748	200,260	11,658
Cajetina	Zlatibor	106,039	31,594	427,577	94,531
Bijelo Polje[22]	/	1,824	2,369	2,751	4,918
Pljevlja[23]	/	1,854	2,094	7,818	5,136

The average stay of domestic tourists in Koviljaca Spa for the analyzed period was 7, and for the international tourists 5 days; the average stays of both domestic and international tourists in Tara and Zlatibor in the same period was in the range of 2.5 to 4 days. Assuming that one average tourist spends 100 EUR a day, the revenue from international tourists in these pilot municipalities for the analyzed period was 12,433,100 EUR.

The average stay of domestic tourists in Bjelo Polje for the analyzed period was 1.5 for domestic and for the international tourists 2 days; assuming that one average tourist spends 100 EUR a day, the revenue from international tourists in Bjelo Polje was 491,800 EUR.

The average stay of domestic tourists in Pljevlja for the analyzed period was 4.2 and for the domestic and 2.5 days for the international tourists; assuming that one average tourist spends 100 EUR a day, the revenue from international tourists in Pljevlja was 513,600 EUR.

We cannot establish the percentage of non-returning tourists in the absence of a more comprehensive survey. In order to derive the loss of income from tourism, 2.5% non-returning tourists was set based on a survey conducted in Montenegro. Namely, the tourist information bureau collects complaints from tourists and 2.5% of total received calls in 2014 related to beach cleanliness and illegal dumping. The resulting figures are as follows:

Table 12 Loss of revenues from tourism

Pilot municipality	Tourist Location	Overnight Stays (2014)		Tourist Expenditures (EUR/2014)	Loss non-returning tourists (2.5%) (EUR)
		Domestic	International		
Loznica	Koviljaca Spa	77,542	18,142	6,697,880	167,447
Bajina Basta	Tara	200,260	11,658	14,834,260	370,857
Cajetina	Zlatibor	427,577	94,531	36,547,560	913,689
Bjelo Polje	/	2,751	4,918	536,830	13,421
Pljevlja	/	7,818	5,136	906,780	22,670
Total Overnight Stays		**715,948**	**134,385**	**59,523,310**	**1,488,083**

21 http://webrzs.stat.gov.rs/WebSite/Public/PageView.aspx?pKey=180

22 http://www.monstat.org/userfiles/file/turizam/dolasci%20i%20nocenja%202014/godisnja/Turizam%20u%20Crnoj%20Gori%20-%202014.pdf

23 http://www.monstat.org/userfiles/file/turizam/dolasci%20i%20nocenja%202014/godisnja/Turizam%20u%20Crnoj%20Gori%20-%202014.pdf

The negative perceptions of interviewed international tourist visitors which may relate to the floating debris may be a reason for losing over one million of euros annually.

3.6 Impacting and Impacted Municipalities

Considering the origins, significance and pathways of the waste or pollution moving across the borders, there is a need to highlight the relationships between the impacting and impacted countries / municipalities.

Impacting municipalities are responsible for the generation of floating waste and / or pollution, by inadequate waste management practices and particularly illegal dumping in flood prone areas.

Impacted municipalities are receiving the (unwanted) floating waste and / or pollution. They are to bear additional costs for their clean-up and disposal, which they cannot recover from the service users and thus they face significant financial loss.

Due to the specific character of the pilot region, the major impacted receivers of the floating debris are the HPPs Potpec, Visegrad, Bajina Basta and Zvornik. There are no impacted municipalities as the floating debris is accumulated at the respective reservoirs.

Therefore, a segmentation of the pilot region as per the locations of the reservoirs – Potpec (Lim River), Visegrad, Bajina Basta and Zvornik (Drina River) should be carried out as the reservoirs play a role of barrier and split the catchment into sub-catchments. Hence, the floating debris washed away from the illegal dumps and non-compliant landfills in the municipalities located upstream respective reservoirs is impacting adversely the power generation and causing high clean-up costs for its removal. In this regard, the most impacted sector is the power generation.

After the last reservoir – Zvornik, the floating waste continues to be transported to Sava River and eventually in Danube.

Table 10 below presents the segmentation of Drina River catchment and the potential contribution of the upstream municipalities to the accumulation of the floating debris in the reservoirs and the transportation of the debris from the last reservoir to the wider catchment of Sava River. It is assumed that 30% of total waste quantities not collected may enter the rivers as floating waste.

Table 13 Potential contribution of upstream pilot municipalities to the accumulation of floating debris in the reservoirs Potpec, Visegrad, Bajina Basta and Zvornik, as well as to the transport of floating debris to the Sava River`s wider catchment

Pilot Municipality	Waste not collected (tons/year)	Floating waste (30% of the waste not collected)
Bijelo Polje	8,827	2,648.1
Pljevlja	2,468	740.4
Prijepolje	1,912	573.6
Potpec Reservoir	**11,295**	**3,388.5**
Priboj	547	164.1
Rudo	403	120.9

Pilot Municipality	Waste not collected (tons/year)	Floating waste (30% of the waste not collected)
Gorazde	1,653	495.9
Visegrad	913	273.9
Visegrad Reservoir	**3,516**	**1,054.8**
Cajetina	257	77.1
Uzice[24]	7,301	2,190.3
Bajina Basta	3,990	1197
Bajina Basta Reservoir	**11,548**	**3,464.4**
Srebrenica	1,190	357
Milici	1,095	328.5
Bratunac	3,099	929.7
Ljubovija	2,448	734.4
Krupanj	2,565	769.5
Mali Zvornik	1,764	529.2
Zvornik	4,315	1,294.5
Zvornik Reservoir	**16,476**	**4.942.8**
Loznica	14,572	4,271
Ugljevik	2,129	638.7
Lopare	3,169	950.7
Sabac	11,788	3,536.4
Bogatic	6,438	1,931.4
Bjeljina	9,398	2,819.4
Sremska Mitrovica	7,122	2,136.6
Sava River	**54,616**	**16,384.8**

Table 10 above does not include all municipalities in the Tara – Drina – Sava catchment area which are also contributing to the generation of floating waste. Nonetheless, the figures below show the relative contribution of pilot municipalities to the accumulation of floating debris in each reservoir in the analysed catchment.

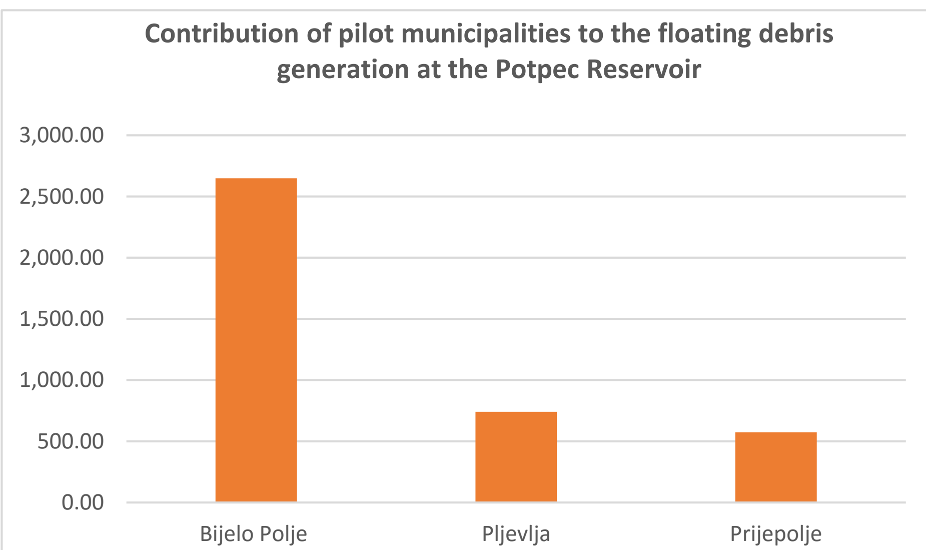

Figure 48 Contribution of pilot municipalities to the floating waste generation in the Potpec Reservoir

[24] Municipalities Cajetina and Uzice are not contributing to the floating debris at the Baijna Basta reservoir as they belong to the Morava River catchment.

It can be seen that Bijelo Polje Municipality is generating more floating waste than the Municipalities of Pljevlja and Prijepolje.

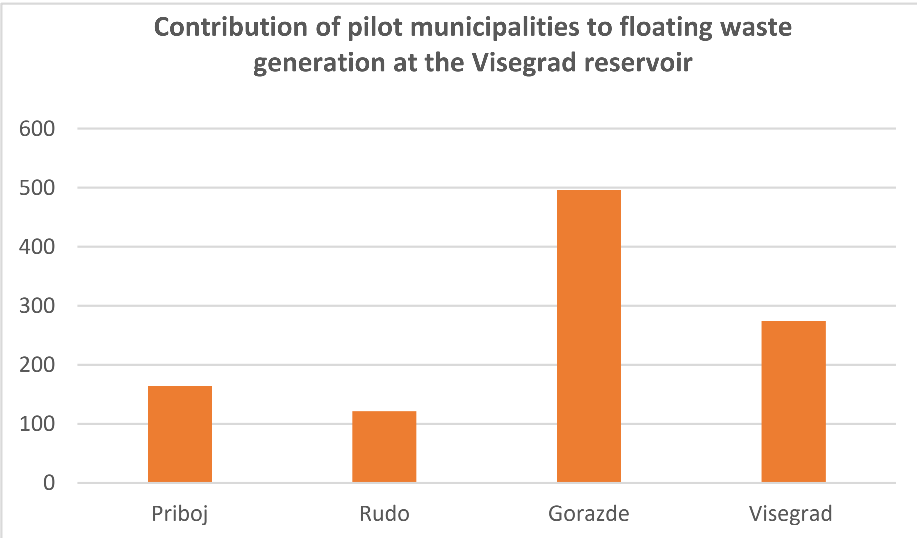

Figure 49 Contribution of pilot municipalities to the floating waste generation in the Visegrad Reservoir

Floating waste in the Visegrad reservoir is originating mostly from Gorazde Municipality.

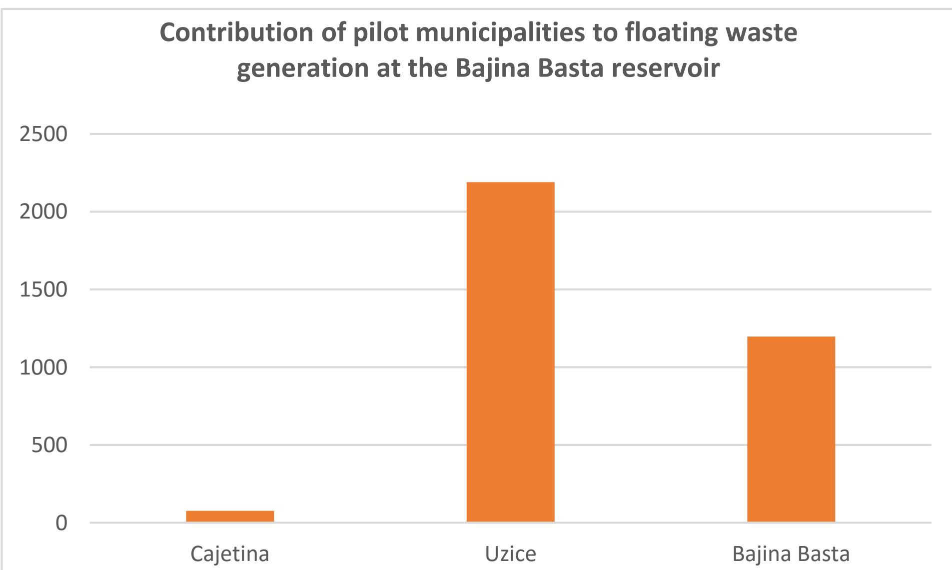

Figure 50 Contribution of pilot municipalities to the floating waste generation in the Bajina Basta Reservoir

Although Usice Municipality runs the regional sanitary landfill, there is waste in rural communities that is not collected and which may enter the rivers in the catchment. Uzice Municipality is, however, contributing to the floating debris in the cathcment of Morava River. Therfore, the greatest contributor to the generation of floating debris in the Bajina Basta reservoir is the Municipality of Bajina Basta.

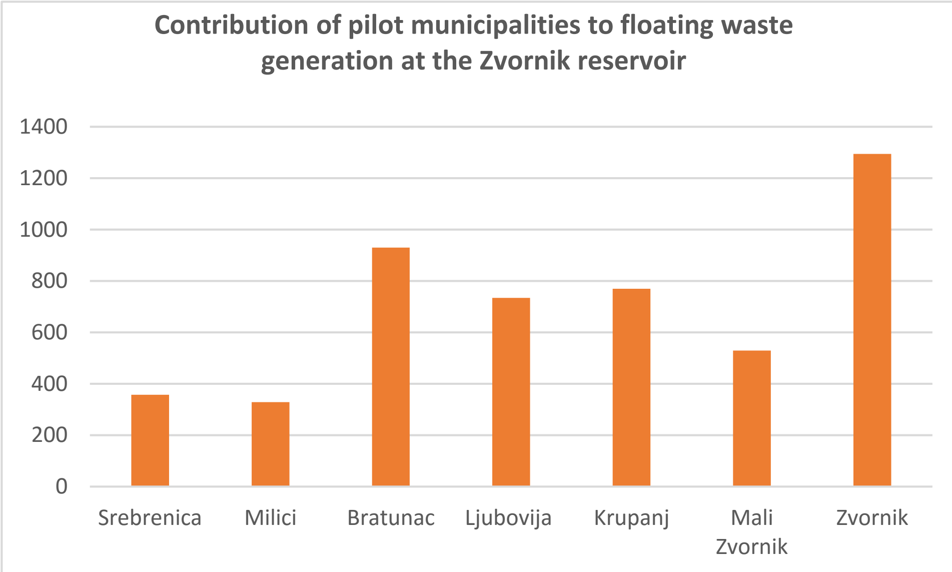

Figure 51 Contribution of pilot municipalities to the floating waste generation in the Zvornik Reservoir

Zvornik, but also Bratunac, Krupanj and Ljubovija, are the greatest contributors to the generation of floating debris in the Zvornik reservoir.

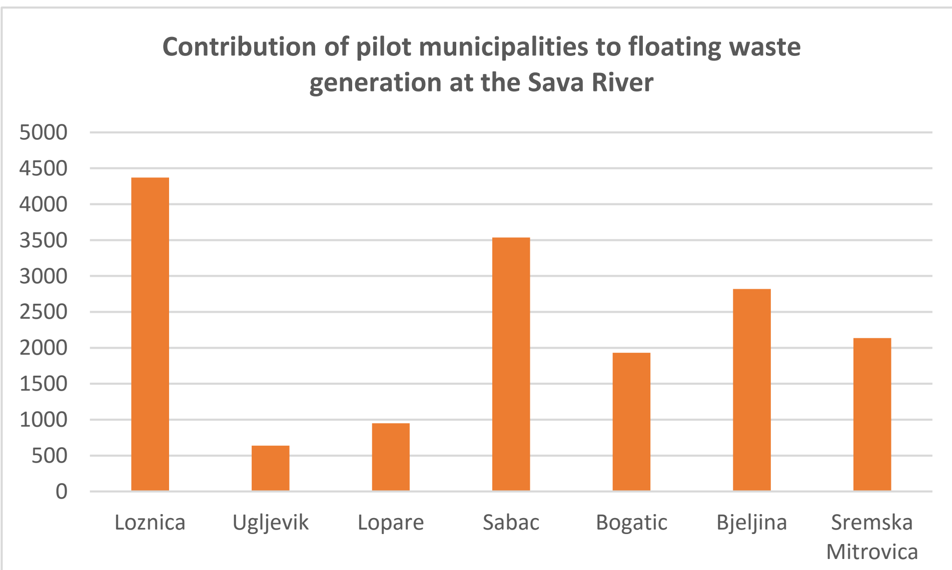

Figure 52 Contribution of pilot municipalities to the floating waste generation in Sava River

Loznica, Sabac and Bjeljina contribute the most to the generation of floating waste in the lower secton of Drina and Sava River after the confluence.

The influence of discharged waste is significant when looking at the total pollution of Drina River, and this problem must be solved urgently taking the economic, social and cultural situations into consideration. To solve the Drina's waste problem sustainably, it is necessary to synchronise efforts at national and international level because transboundary water resources and their preservation, protection and sustainable uses are of great importance for all countries.

4 Conclusions

The problem of marine litter / floating debris has obvious international dimensions. It affects the marine and riverine environment outside the jurisdiction of pilot municipalities, countries and regions. Sources of marine litter / floating debris are spread across the territory of the pilot municipalities; under the influence of various factors (wind, flood, tide, sea current, etc.), the litter enters the river or sea and by way of some pathways it is transported over long distances.

Box 1. Life cycle of marine debris / floating debris

The complicated nature of the distribution of marine debris / floating debris in the environment calls for a clear and defined approach to characterizing and assessing the problem. Marine debris / floating debris enters the sea / river / reservoir through many pathways, and the patchiness in the distribution of debris, and spatial and temporal variability in the drivers add to its complex life cycle (Ryan et al., 2009, Cole et al., 2011, Doyle et al., 2011).

The full cycle approach implemented herein is intended to track the marine litter / floating debris from the source, through the pathway to the endpoint / sink. However, finding usable data on impacts and quantities of marine litter remains a challenge. Systematic scientific research on marine litter in the pilot regions is relatively scarce. This makes quantifying the impacts very hard. Nevertheless, we attempted to characterize and whenever possible quantify the impacts based on stakeholders` input and literature, which is considered to be a step forward in understanding the marine litter / floating debris problems.

Some municipalities, which are most plagued by litter, have no control over the production or disposal of that litter at the place of source. Furthermore, in the absence of a coordinated approach, efforts of some municipalities to reduce the intake of or remove the plagued debris may be undermined by the lack of action of the others. Therefore, an open, constructive and forward-looking dialogue on controversial topics is needed to identify joint visions and opportunities on solutions to marine litter / floating debris.

Annex 1

Template Questionnaires used for data collection

Questionnaire 1

Country				
What documents are in place to guide waste management in the country?	**Document Title / Content etc.**	**Date Published**	**Date Due for Revision**	**Comments**
What are the key pieces of waste legislation?	**Waste Management**	**Special Waste Streams**	**Waste Treatment and Disposal**	**Others**
What are the main institutions involved in the governance of waste management - describe roles and responsibilities?	**National Government**	**Regional Authorities**	**Local Authorities**	**Waste Utilities (public or private)**
Recycling Targets	**Packaging Waste**		**Organic Waste**	
Are there additional revenues for the local authorities for managing waste?				**Yes / No**
Is there producers` responsibility for special waste streams?				**Yes / No**
Is there any landfill tax?				**Yes / No**
Local Regulations (e.g. Decision on Communal Order, Ordinance on Public Hygiene, etc.)				**Yes / No**

Municipality	
Population	
Economic activities	
Waste generation per capita (per day and year)	
Waste Composition (%)	
Organic	
Paper	
Plastic	
Glass	
Metal	
Other	

Public Utility (name)	
Do the population pay waste management charges?	
Charging Method: – **flat rate;** – **based on frequency of service;** – **based on waste volume (container);**	
Payment efficiency (%)	
Cost Recovery	**Yes / No**
Is there any private waste management operator?	**Yes / No**
Waste Collection Rate (Service Coverage) (%)	
Municipality	

Name of non-compliant landfill(s), illegal dump(s)	
Area (m^2)	
Waste origin (settlements, industry, healthcare establishments, etc.)	
Typical landfill operations (e.g. compaction, daily coverage)	
Typical technical measures applied (e.g. bottom sealing, leachate drainage, landfill gas extraction and flaring, etc.)	
Likelihood for transboundary impacts (high, medium, low)	

Municipality	
Pathways (rivers, cannels, drains, gullies, reservoirs, aquifers, sea currents, atmosphere etc.)	
Migration Drivers (wind, precipitation / flood, erosion)	

Questionnaire 2

QUESTIONNAIRE FOR THE PUBLIC UTILITY ______

IN THE MUNICIPALITY OF _____________ ________________

1. Which settlements you collect waste from?

2. Which settlements you do not collect waste from?

3. How often you collect waste in most of the settlements?
   a. Once a week
   b. Twice a week
   c. Every day
   d. Other, specify

4. Is the collection frequency sufficient?
   a. Yes
   b. No

5. Which containers are used for the collection of waste?

Volume of Container	Number
90l	
120l	
240l	
1100l	
5,7, 9m^3	
Others	

6. Do you need additional containers?
   a. Yes
   b. No

7. Which trucks you use for the waste collection?

Type of truck	Number / volume
Tractor & trailer	

Type of truck	Number / volume
Compaction refuse trucks	
Roto- press refuse trucks	
Skip trucks	
Others (small truck Piaggo for pedestrian areas)	

8. Do you need additional trucks?
    a. Yes
    b. No

9. Do you segregate the waste at source?
    a. Yes
    b. No

10. Which recyclables you collect?
    a. Plastic
    b. Paper
    c. Aluminum cans
    d. Others

11. Do you sell the collected recyclables:
    a. To private companies in the country?
    b. To private companies abroad?

12. Where the waste is disposed of? What is the transport distance from the collection area to the disposal site?

13. What is the composition of the disposed waste (e.g. household, industrial, construction and demolition, healthcare, etc.)?

14. Is there any possibility that some hazardous waste is mixed with non-hazardous waste?

Yes, household hazardous waste in small quantities.

15. Is the landfill fenced?
    a. Yes
    b. No

16. Is the landfill located nearby a river, canal or gully?
    a. Yes

b. No

17. Do you implement waste compaction and daily coverage?
    a. Yes
    b. No

18. Is there any leachate drainage and landfill gas collection & flaring at the landfill site?
    a. Yes
    b. No

ASSESSMENT REPORT

on the cross boarder adverse environmental and economic impact in Sharra region

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Executive summary

The floating debris is a serious pollution problem in the Sharra region, particularly in Albania, Kosovo* and Macedonia. Major transboundary environmental and economic impacts caused by floating debris in the Sharra Pilot Region are identified during the development of the Environmental and Economic Impact Assessment Report as follows:

- Threats to the riverine wildlife (Drini E Bardhe and Lepenec);
- Destruction of protected areas: Lumi i Gashit in Tropoja; Lugina e Valbones in Tropoja; Tej Drini i Bardhe in Has; Korab-Koritnik; threatening the Sharr National Park`s high-mountain endemism (200 endemic taxa) comprising endemic-relict, endemic and steno-endemic species;
- Human health problems in terms of potential injuries of people by sharp objects settled at the bottom of the rivers Drini E Bardhe and Lepenec as well as Fierzi Lake;
- Economic impacts on local communities (increased expenditure on cleaning floating debris and the Fierze reservoir and illegal dumpsites located near riverbanks), tourism in areas such as Valibona, Sistavec, Lake Fierzi and the protected area Korab-Koritnik (loss of income, bad publicity), fishing (reduced and lost catch) and lost revenues from electricity generation at the Fierzi Hydropower Plant due to blockages of turbines in the powerhouse.

Considering the richness of biodiversity and the presence of globally threatened species, on one hand, and the significant threat of the litter on these populations, on the other, waste dumping related prevention measures are a matter of urgency.

Albeit the environmental impacts could not be quantified due to lack of information, some effort has been made to assess the economic impacts related to floating debris and illegal dumps cleaning in the pilot area. It was estimated that each year 529,000 EUR are spent on cleaning up illegal dumps and 73,886 EUR a year is lost due to reduced electricity generation at the Fierzi Hydropower Plant (HPP).

Pilot municipalities contribute to the environmental impacts proportionally to the quantities of released floating debris. Some municipalities are responsible for the generation of floating waste and / or pollution, by inadequate waste management practices and particularly illegal dumping in flood / tide - prone areas. These are considered to be impacting municipalities. Other municipalities that are receiving the (unwanted) floating waste and / or pollution and need to bear (non-recoverable) costs for their clean-up and disposal, are impacted municipalities.

Due to the specific character of the pilot region, the major impacted receiver of the floating debris is the HPP Fierzi, where the waste generated from the upstream communities – Dragas and Prizren. Impacted municipalities downstream the Lepenec River which carries floating debris from the territory of Prizren and Strpce Municipalities can impact the Municipalities of Cucer-Sandevo, Gjorce Petrov and Karpos (Macedonia). Lepenec River has a torrential character and it floods the lowlands at its confluence. Floating waste can, therefore, strand onto the fertile agricultural land. Tearce and Jegunovce Municipalities also contribute to the floating debris generation in Vardar River.

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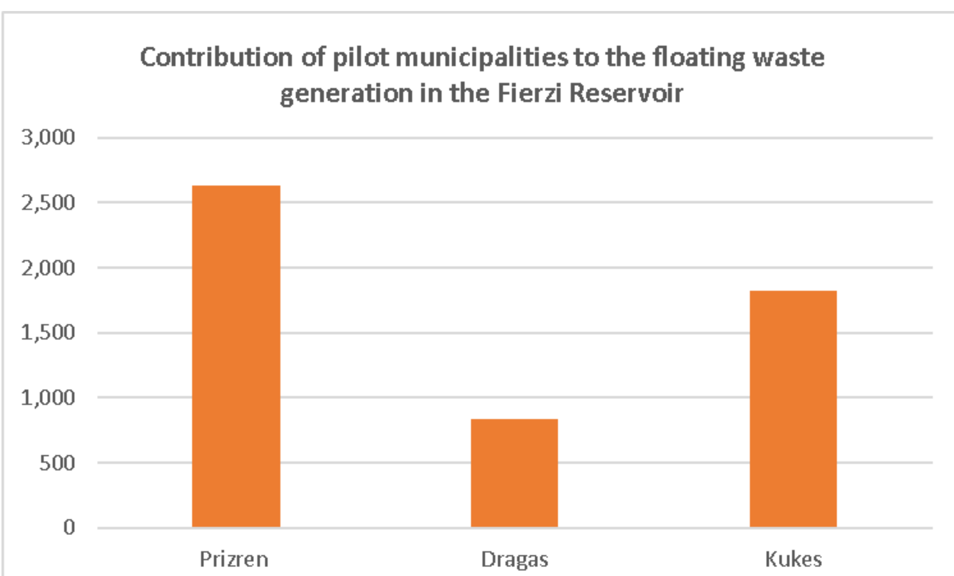
Table 3 below presents the situation of impacting and impacted municipalities and the potential contribution of the upstream municipalities to the accumulation of the floating debris in the Fierzi reservoir and the transportation of the debris from Lepenec River to the catchment of Vardar River. It is assumed that 30% of total waste quantities not collected may enter the rivers as a floating waste.

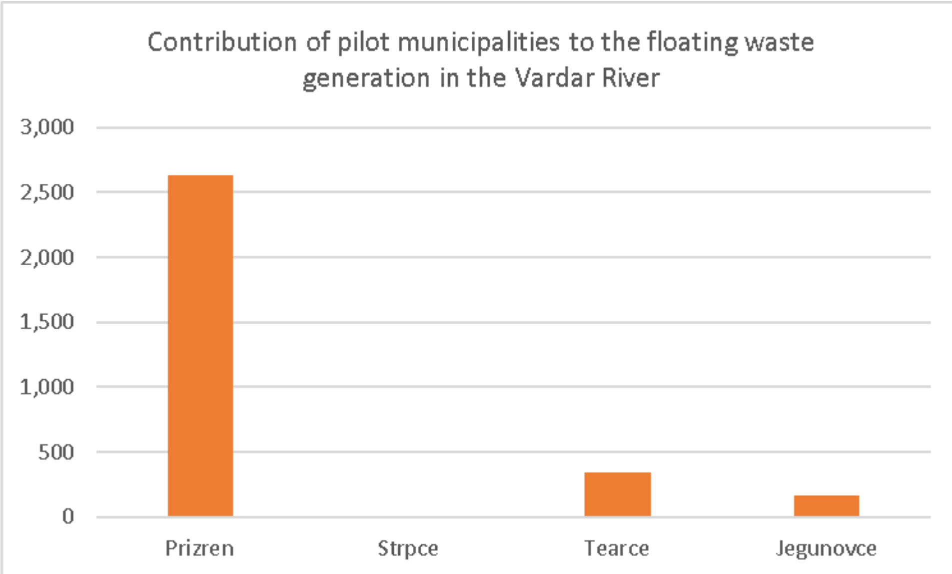
Table. Potential contribution of upstream pilot municipalities to the accumulation of floating debris in the reservoir Fierzi, , as well as to the transport of floating debris to the Vardar River`s wider catchment

Pilot Municipality	Waste not collected (tons/year)	Floating waste (30% of the waste not collected)
Prizren	0	0
Dragas	2,780	834
Kukes	6,070	1,821
Fierzi Reservoir	8,850	2655
Prizren	0	0
Strpce	20	6
Tearce	1,147	344.1
Jegunovce	551	165.3
Vardar River	1,718	515.4

Even though the Municipality of Prizren recently covered the whole territory with an organised waste collection service, local authorities reported that 15% of the population still dumps their waste in the countryside. Considering that the Municipality of Prizren is the biggest in terms of population and waste generation, it still contributes significantly to the floating debris streams in Drin River (Drini E Bardhe) and Lepenec. Table 3 above does not include the municipalities in the Black Drin catchment area which are also contributing to the generation of floating waste at the Fierzi Lake. Also, it does not include the Municipality Hani Elezi which lays into Lepenec River catchment. Nonetheless, the figures below show the relative contribution of pilot municipalities to the accumulation of floating debris in the reservoir Fierzi and the Vardar River.



It can be seen that Prizren and Kukes Municipalities are generating more floating waste than the Municipality of Dragas.



Floating waste in Vardar River is originating mostly from Tearce and Jegunovce Municipalities.

The influence of discharged waste is significant when looking at the total pollution of Drin and Lepenec Rivers, and this problem must be solved urgently taking the economic, social and cultural situations into consideration. To solve the floating debris problem sustainably, it is necessary to synchronise efforts at national and international level because transboundary water resources and their preservation, protection and sustainable uses as well as the tourism development are of great importance for all countries.

1. Background

The Regional Rural Development Standing Working Group (SWG) and the Network of Associations of Local Authorities of South-East Europe (NALAS) are implementing a regional sub-project "Solid Waste Management in cross-border rural and coastal areas of South Eastern Europe" supported by the German Federal Ministry for Economic Cooperation and Development (BMZ) through the GIZ Open Regional Fund for South East Europe – Modernisation of Municipal Services (ORF MMS) and the Government of Switzerland.

The SWG is engaged in improving rural livelihoods in the SEE countries. To this end, it promotes innovative and sustainable agriculture and rural development through regional cooperation of respective Ministries of Agriculture and other stakeholders. It supports the EU integration in the SEE, by:

- fostering rural development policies,
- improving implementing structures and systems for agriculture and rural development,
- improving the understanding and use of implementation tools for agriculture and rural development, and
- identifying and sharing information and application of good practice in agriculture and rural development to broaden the rural agenda.

NALAS brings together 16 Associations which represent roughly 9000 local authorities, directly elected by more than 80 million citizens of this Region. NALAS helps the associations to represent viably the local authorities vis-à-vis central governments. NALAS provides services to local governments and aspires to develop itself as the Knowledge Center for the local government development in the SEE. It promotes the:

- processes of decentralization, considering the local self-government as a key issue in the transition process in the SEE; and
- partnerships in order to contribute to the EU integration as well as the reconciliation and stabilization process.

1 Goals and Objectives

The overall aim of the sub-project is to "improve the conceptual and organisational framework conditions concerning Integrated Solid Waste Management (ISWM) in cross-border rural and coastal areas in SEE".

The specific goal of the assignment is to "assess and develop schemes (models) for integrated management of solid waste that are environmentally effective and economically affordable in order to reduce adverse environmental and economic impacts of solid waste mismanagement and support the ecological and socio-economic development of the cross-border rural and coastal areas in the SEE countries".

In order to define models for integrated management of solid waste in SEE countries (pilot rural and coastal regions), it is envisaged to carry out an assessment of the transboundary environmental and economic impacts from currently applied (insufficient) practices.

2 Shrra Pilot Region

The sub - project covers three pilot rural and coastal areas which share natural resources – a mountain range (Sharra Mountain), transboundary river catchments (Tara – Drina and Drina - Sava) and a sea coast (Adriatic Sea) area.

This Assessment Report on the Cross Border Adverse Environmental and Economic Impact is focused on the Sharra pilot region. It encompasses Albania (Figure 1 - Municipality of Kukes), Kosovo* (Figure 2 – Municipalities of Dragas, Priren and Strpce) and Macedonia (Figure 3 - Municipalities of Tearce and Jegunovce).

The pilot municipalities have been selected by the SWG.

Figure 1 Albania - pilot municipality Kukes

Figure 2 Kosovo – pilot municipalities Dragas, Prizren and Strpce*

Figure 3 Macedonia – pilot municipalities Tearce and Jegunovce

The provisional geographical position of the pilot municipalities in respect to the Sharra pilot region is shown in a schematic way in Figure 4 below.

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*This designation is without prejudice to positions on status, and is in line with UNSCR 1244/1999 and the ICJ Opinion on the Kosovo declaration of independence

Figure 4 Geographical position of pilot municipalities along the Sharra Region

The area and population of pilot municipalities are presented in Table 1 below.

Table 1 Area and population of the pilot municipalities and of the total pilot region

Pilot Municipality	Area (km^2)	Population
Albania		
Kukes	938	59,393
Total	938	59,393
Kosovo*		
Dragas	430	33,997
Prizren	640	178,112
Strpce	247	6,948
Total	**1317**	**219,057**
Macedonia		
Tearce	137	22,454
Jegunovce	174	10,790
Total	**311**	**33,244**
Total Pilot Region	**2,566**	**311,694**

Respective shares of areas and population for each country within the pilot region are highlighted in Figures 5 and 6 below.

*This designation is without prejudice to positions on status, and is in line with UNSCR 1244/1999 and the ICJ Opinion on the Kosovo declaration of independence

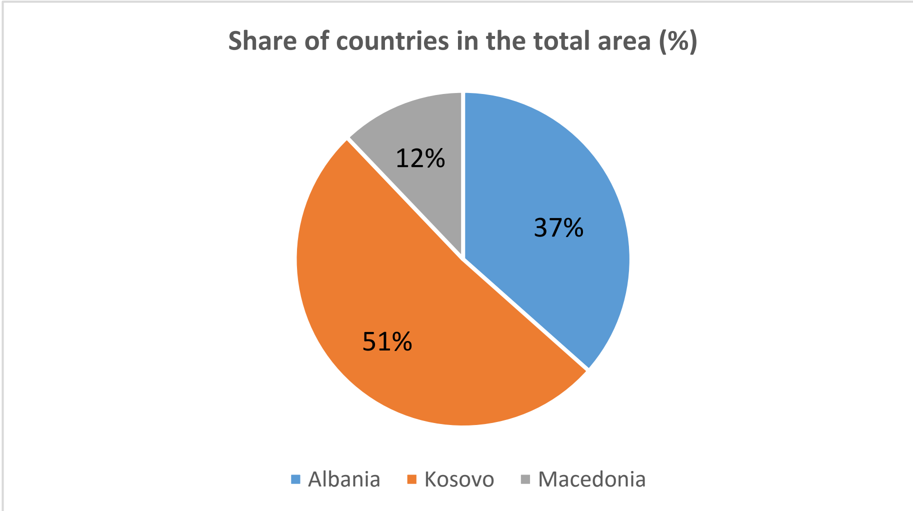

Figure 5 Respective shares of the area size of the countries in the pilot region

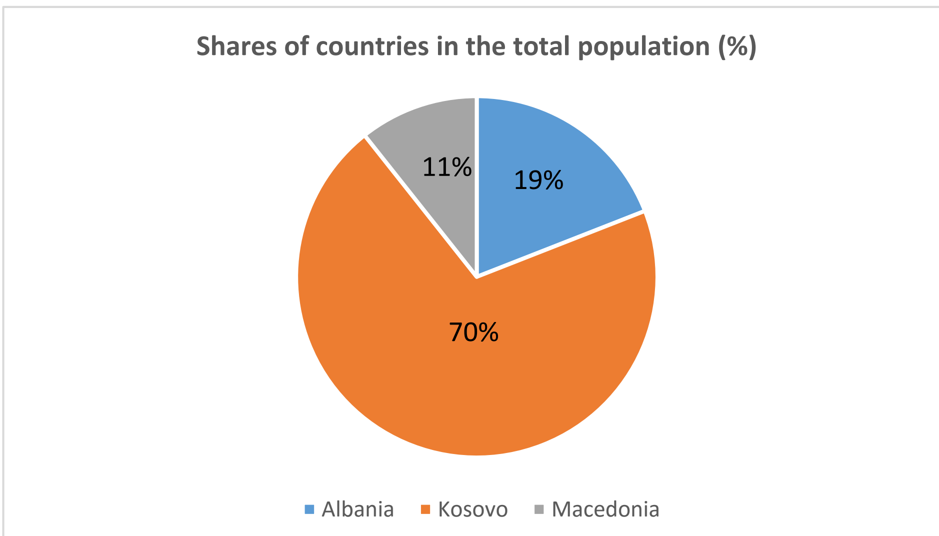

Figure 6 Respective shares of the population of the countries in the pilot region

It is obvious that Kosovo* with its pilot municipalities has the biggest share in the pilot region in terms of both population and area size; the shares of area / population of Albania is moderate, while Macedonia participates with a low share of population and area.

Provided that further analysis yields evidence of deficiencies in their waste management practices, Kosovo* would be the country with the highest relative contribution to transboundary impact generation in the pilot region.

3 Environmental and Economic Impact Assessment of Floating Debris in the Sharra Pilot Region

*This designation is without prejudice to positions on status, and is in line with UNSCR 1244/1999 and the ICJ Opinion on the Kosovo declaration of independence

3.1 Floating Debris in the Catchments of Transboundary Rivers in the Pilot Region

The major transboundary impact deriving from the municipal waste mismanagement in the pilot region is the floating debris carried by the rivers in the transboundary area. Namely, light pieces of plastic - part of the dumped packaging material, floats around on the surface and is carried by the river stream for long periods across great distances. Some part of the floating waste is washed onto the riverbanks. Another part ends up in reservoirs created by dams which are built onto the transboundary rivers. The remaining plastic materials, having a density greater than that of water, sink to the bottom of rivers or reservoirs.

Investigations carried out in Drina River catchment on the properties of the floating debris[5] showed that:

- Floating debris consists of dead branches, leaves, plastic bottles and bags. Its thickness on the surface of the calm sections of rivers and reservoirs is 0.5-0.7m.
- Suspended debris consists of smaller branches, plastic bottles, and plastic bags. Debris is entangled with organic materials (i.e. mud).
- Settled debris is 4.5 to 5m thick. It consists of tires, plastic packages, entangled with plastic bags.

So far, no research has been conducted on the situation of the floating debris in the Sharra pilot region – the origins, quantities, pathways, accumulation and stranding. It is likely, however, that the floating debris is a direct result of waste fly tipping.

While the origins are certainly the numerous illegal dumps in each of the pilot municipalities, the pathways are mostly two transboundary rivers: White Drin – running through Kosovo* and Albania and Lepenec – flowing through Kosovo* and Macedonia.

Floating debris brought by White (Kosovo*) and Black Drin River (Macedonia) is accumulated in the Fierzi reservoir. It is the first Hydropower Plant (HPP) of the cascade built on Drin River, followed by Koman and Vau I Dejes HPPs. The floating debris generated upstream the Fierzi reservoir is accumulated in the lake which serves as barrier for the further transportation of the debris. Sharra pilot region does not include all countries / municipalities that contribute to the accumulation of the floating debris in the Fierzi reservoir; hence, this Report does not provide an insight into the whole catchment.

Floating debris carried by Lepenec River from Kosovo* enters Macedonia and flows into Vardar River after their confluence; part of the floating debris may be transported towards the Aegean Sea. Floating waste from Kosovo* carried away by the Lepenec River, does not influence the Macedonian pilot municipalities Tearce and Jegunovce. Floating waste generated on their territory also enters Vardar River.

Considering the fact that the majority of floating debris items originate from the land based sources, the impact assessment is focused on:

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5 https://www.researchgate.net/publication/266571770_Floating_Debris_in_the_Storage_Reservoirs_of_Bajina_Basta_and_Potpec_Hidropower_Plant

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1 Root Problem: current waste management practices
2 Locations of the land-based sources of floating debris (non-compliant landfills and illegal dumps)
3 Pathways of the litter from the origin to the sea and the shorelines where it strands
4 Effect (floating debris) and the deriving environmental and economic impacts

Thus, this Assessment Report sheds light on the matter of how and why the pilot municipalities contribute to, or are affected by floating debris in the Sharra Pilot Region. Once the questions of "how" and "why" are answered, the emergence of a regional model for tackling of the issue of floating debris can become possible.

3.2 Environmental and Economic Impact Assessment Method

Floating debris is mobile, and it may be found relatively far from its original source. This movement is influenced by winds, erosion and flood patterns (Figure 7).

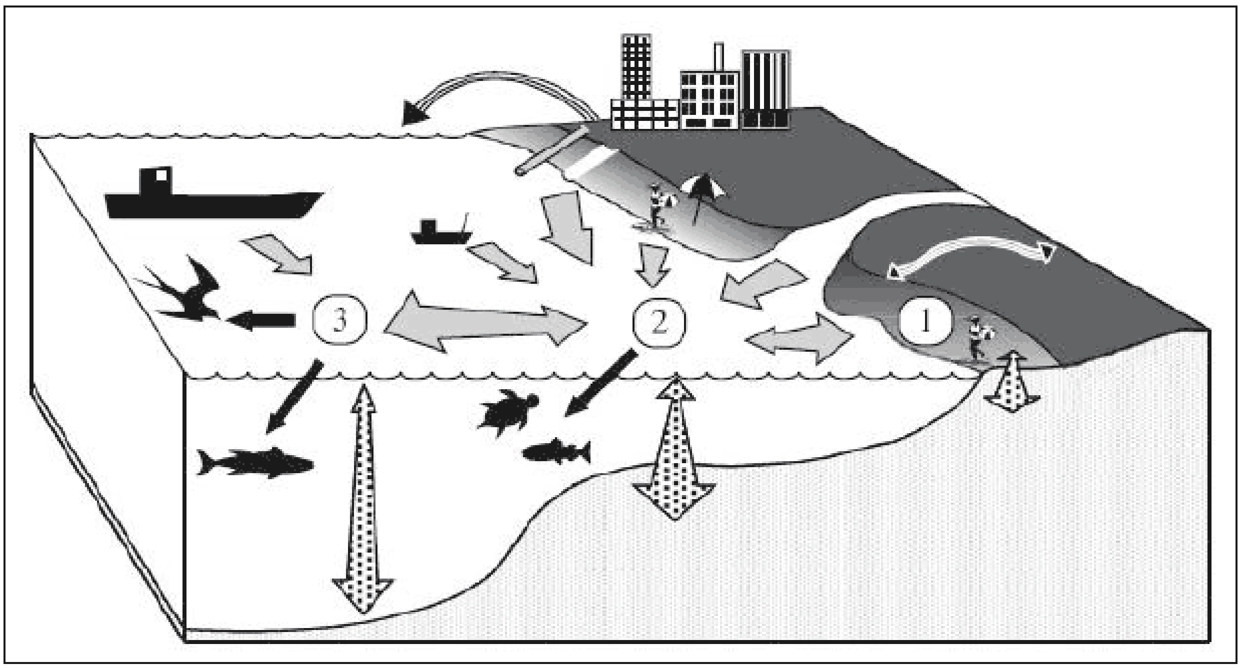


Figure 7 Origins, pathways and sinks of floating debris[7]

- *Origins* include land - based sources (landfills / dumps / recreational areas)
- *Pathways* are presented as wind-blown litter (curved arrows) and washed away litter transported by the rivers (grey arrows);
- *Sinks* into the riverbed (stippled arrows): 1) near the riverbank and reservoirs coastlines; 2) bottom of the rivers and reservoirs;
- Impacted wildlife (black arrows).

The Method for Environmental and Economic Impacts deriving from the current solid waste management (SWM) practices in the pilot countries / municipalities in the Sharra Pilot Region, in response to the mobility character of floating debris is intended to:

[7] http://www.gov.scot/Publications/2013/07/9297/5

- Identify the origins and pathways of the land-based sources of the floating debris in each pilot municipality by analysing:

    - Waste generation and composition
    - Waste collection
        - Capacity of the operator
        - Waste collection rate (service coverage)
        - Waste not collected

    - Waste disposal practice and sources of floating debris (so called “hotspots”)
        - Non-compliant municipal landfills
        - Illegal dumps

    - Pathways of floating waste: rivers
    - Recycling operations and recycling rate

- Assessment of types and significance of transboundary environmental and economic impacts:

    - Environmental Impacts
        - Riverine ecosystems
        - Protected areas

    - Economic Impacts
        - Clean-up costs
        - Lost revenue from tourism

- Assessment of the contribution to the environmental and economic impacts of the floating debris of each pilot country / municipality (impacting and impacted municipalities)

A snapshot of the method for identification of origins is presented in Figure 8 below:

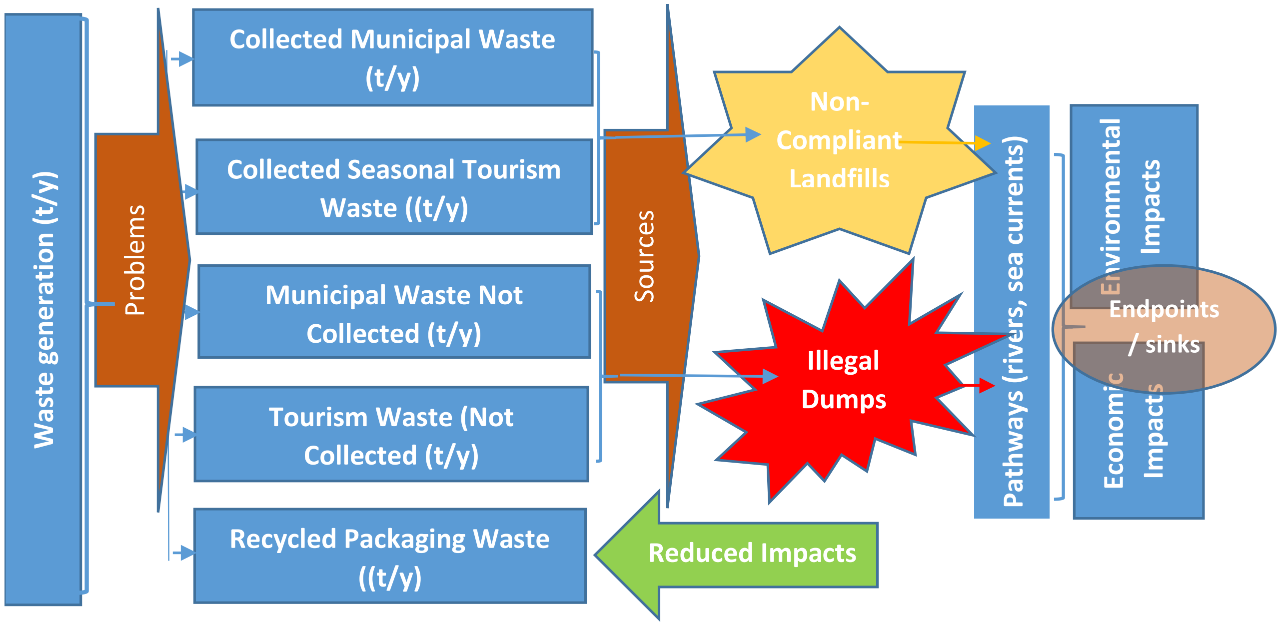
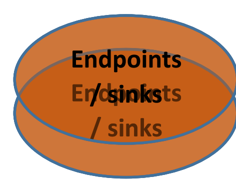


Figure 8 Method for Environmental and Economic Impact Assessment



3.3 Process of Environmental and Economic Impact Assessment

After the formulation of the Environmental and Economic Impact Assessment Method, two separate streams of data collection have been established:

1. ***Desk research***:
    a. Two types of questionnaires have been developed which are available in Annex 1. The following data was collected:
        i. Policy and legislation; waste generation; financing of municipal waste management; sources of marine litter (so called "hotspots");
        ii. Operational and technical capacity of waste management operators, more specifically: service coverage; frequency of waste collection; available collection vessels and refuse vehicle fleet; requirements for additional collection vessels and trucks; status of primary waste segregation, if any;
2. ***Participatory process for data collection and validation***, gathering relevant stakeholders, such as national and municipal authorities, waste management operators (including the regional sanitary landfills), private companies dealing with recycling, NGOs, etc.:
    a. National Workshops in pilot countries[8]
    b. 1st Dialogue Platform[9]

Separate communication streams have been established with relevant institutions to complement the outstanding information as well.

The outcomes of the identification of sources of floating debris in the selected municipalities participating in the Sharra pilot region are presented in the following sections.

3.4 Sources of floating debris in the pilot municipalities in the Sharra Pilot Region

Data on waste generation, waste collection service coverage, recycling and disposal (including illegal dumping) was collected using the pre-defined questionnaires which were filled in by the SWG staff and assigned Regional Expert. Data validation was performed by the local self-government representatives, Public Communal Enterprises (PCEs) and the private operators.

During the data collection process and based on the relevant stakeholders` experience, it was proved that the customer base often lags behind in providing an accurate number of total served households, and therefore it is difficult to determine service coverage. Albanian municipalities are undergoing a territorial reform which renders even impossible determining the population number and service coverage. Also, there is a number of operators providing waste collection service in the Kukes Municipality which do not report on their performance to the local authorities. Private waste management operator serving the costumers in Tearce and Jegunovce Municipalities does not inform the local authorities on the waste collected and disposed. All of the above makes presenting the waste flows into a challenging endeavour. Hence, the data provided herein is an attempt to derive the quantities of not collected waste based on the estimated waste generation figures and the provisional service coverage rate;

National Assessment workshop was conducted in October 2015 in Strpce.

[9] The 1st Dialogue Platform was held in December 2015 in Prevalac – Municipality of Prizren.

certain percentage of not collected waste (15-30%)[10] potentially enters the transboundary water courses and joins the stream of the floating debris from the territory of the pilot municipalities.

3.4.1 Waste generation

Waste generation figures for each pilot municipality were obtained as a product of the multiplication of population numbers in each pilot municipality and indicators on waste generated per capita and day. The waste generation indicators are adopted from the stakeholders` experience, waste samplings, if any, and respective National Waste Strategies and Plans. For the majority of pilot municipalities, it was agreed to use the indicator of 0.70 kg/capita/day. The only exceptions are the Municipality of Prizren (used the indicator of 0.90 kg/capita /day) and Strpce (adopted the indicator of 0.40 kg/capita /day).

In the Sharra Pilot Region, waste generated by tourists does not add up significantly to the overall waste figures and the waste generation indicators do encompass the tourism waste.

Table 2 Waste generation in the pilot municipalities of the Sharra pilot region

Pilot Municipality	Population	Waste generation indicator (kg/cap/day)	Total waste generation (tons/year)
Albania			
Kukes	59,393	0.70	15,175
Total	59,393		15,175
Kosovo*			
Dragas	33,997	0.70	8,686
Prizren	178,112	0.90	58,510
Strpce	6,948	0.40	1,014
Total	**219,057**		**68,210**
Macedonia			
Tearce	22,454	0.70	5,737
Jegunovce	10,790	0.70	2,757
Total	**33,244**		**8,494**
Total Pilot Region	**311,694**		**91,879**

The biggest contribution to the total waste generation in the pilot region is made by the Municipalities of Prizren[11] and Kukes (Figure 9). Among the pilot countries Kosovo* has the biggest share in the overall waste generation; although Albania participates with only one municipality, its share is bigger than the one of the two pilot municipalities from Macedonia (Figure 10).

[10] https://www.icpdr.org/main/publications/drina-rivers-floating-problem

[11] Prizren Municipality may contribute to the floating waste generation in Kukes Municipality as the White Drin passes through its territory.

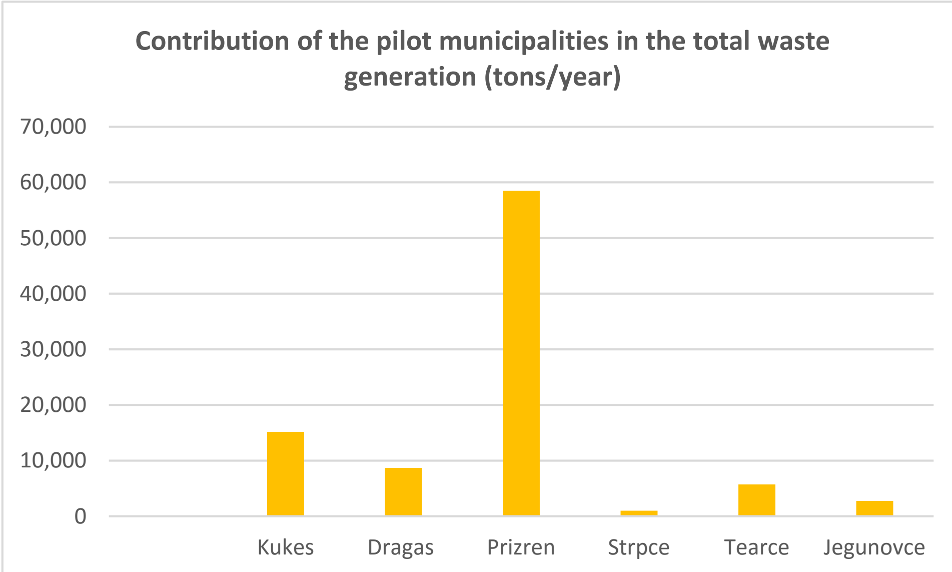


Figure 9 Contribution of the pilot municipalities in the total waste generation tons/year

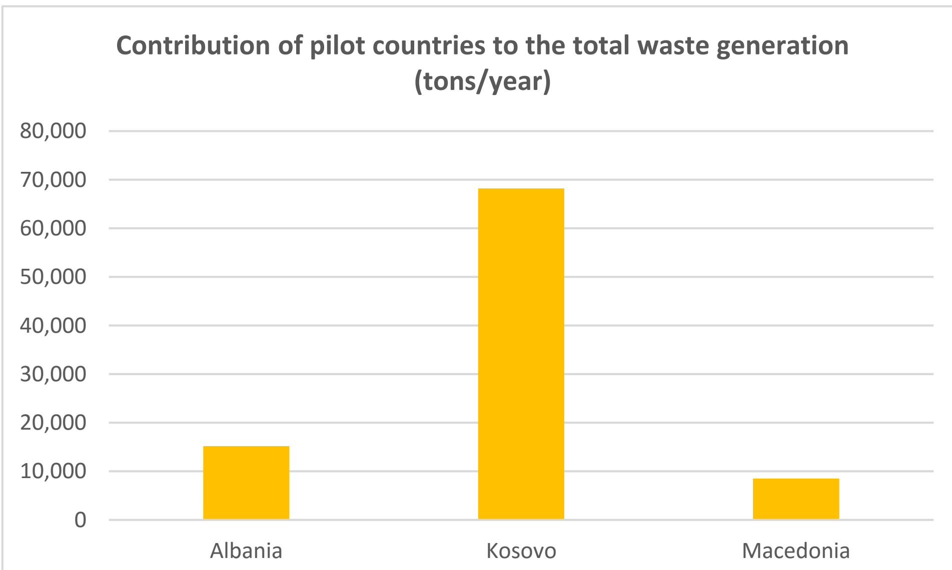


Figure 10 Contribution of pilot countries to the total waste generation (tons/year)

The relative contribution of each pilot municipality / country to the overall waste generation figures is linked to the population numbers. Differences between used waste generation indicators are also influential. As stated elsewhere, the data on waste generation is indicative and further analyses are needed to establish accurate information.

3.4.2 Waste collection

Waste collection is performed by PCEs owned by the municipalities and private operators. An overview of the waste collection companies in the pilot municipalities is provided in Table 3 below.

Table 3 Waste Management Operators

Pilot Municipality	Waste Management Operators
Albania	
Kukes	Public enterprise that operates within the Department of Public Services of the Kukes Municipality collects the waste from the municipal centre; local companies hired by the communes collect the waste in rural areas.
Kosovo*	
Dragas	Regional Waste Company "Eco Regjioni"; sub-contractors of local communities in the Gora area.
Prizren	Regional Waste Company "Eco Regjioni" and two private operators
Strpce	Public Communal Enterprise
Macedonia	
Tearce	Private Operator "Ekoflor"
Jegunovce	Private Operator "Ekoflor"

Only the PCE in Strpce performs other duties apart from waste management while the others are involved in waste management only. The operations are mainly financed by the user charges paid by the served population. Experience shows that the fee collection efficiency is linked mostly to the quality of service and regular interaction between the service provider and the users. Monthly fees charged to households vary among the pilot municipalities (Table 5).

Table 4 User Charges in the Pilot Municipalities

Pilot Municipality	User Charges (EUR/household/month)
Albania	
Kukes[12]	0.75
Kosovo*[13]	
Dragas	4.5
Prizren	4.5
Strpce	3
Macedonia	
Tearce	2.17
Jegunovce	3.3

Payment efficiency is not satisfactory in all countries / municipalities. Only in Prizren the fee collection rate is continuously improving which is, most likely, a result of the public awareness campaignes carried out concurently with the extension of the service coverage enabled by the grant aid of JIC. In Dragas including the Gora community in the collection system is challenging because the local population in the so called „Gora“ area is disinclined to give up their present activities: they have their own collection system performed by sub-contractors (local residents in every village) who pick the waste up from the households by tractors and dump it nearby the villages. Local community leaders reject any offers to use the services of „Eko Regjioni“ due to the relatively high price. In Strpce, there is room to improve the fee collection efficiency by improving the communication with the service users. In the Macedonian municipalities, the fee collection is performed by the private operator „Ekoflor“; the willingness of households to pay their bills to a private operator, according to the stakeholders, is higher than if they would need

[12] The user charge should be adjusted as additional communes were submerged with the former Kukes District after the territorial reform. In any case, the tariffs in Kukes are very low and the revenues are not sufficient to recover the operations, let alone to extend the service coverage.

*This designation is without prejudice to positions on status, and is in line with UNSCR 1244/1999 and the ICJ Opinion on the Kosovo declaration of independence

to pay to a PCE. In Kukes the payment efficiency is rather low and the local authorities should look for measures to improve the situation. The capacity of the operators to invest in waste collection equipment is limited.

Typically, the waste in urban areas is collected in 1.1m^3 containers while in the rural areas located in plains kerbside („door-to-door") collection is applied using 120l and non-standardised bins.

Most often, rural settlements located at higher elevations are not included in the regular waste collection services. Kerbside collection is also not performed in dispersed rural settlements at flat terrains, due to high costs involved and/or the refusal of rural population fo receive / pay for the service.

The waste management operators (either public or private) are not capable of covering the entire territory by an organised waste collection due to the lack of suitable refuse trucks and containers. The only exception is the Municipality of Prizren which received a grant from JICA for the supply of 25 new refuse collection vehicles. JICA consultants developed a waste collection plan involving re-routing of existing and routing of new collection vehicles to improve the efficiency of collection. In this way, 100% collection of the waste generated by the population in Prizren Municipality was achieved in 3 years time. Consultants also proposed introducing a "bell collection system" which is intended to notify by a sound signal the residents on the time of the waste collection service[14].

Waste collection rate (service coverage) varies among the pilot municipalities and spans from 100% in the Municipality of Prizren to 50% in Kukes. Low waste collection rate renders significant amounts of waste not collected and potentially dumped along the rivers in the Sharra pilot region (Table 6).

Table 5 Waste collection rate and amounts of waste not collected in the pilot municipalities

Pilot Municipality	**Waste Collection Rate (%)**	**Waste not collected (tons/year)**
Albania		
Kukes	50	6,070
Total		**6,070**
Kosovo*[15]		
Dragas	68	2,780
Prizren	85[16]	8,777
Strpce	98	20
Total		**2,980**
Macedonia		
Tearce	80	1,147
Jegunovce	80	551
Total		**1,699**

[14] https://kk.rks-gov.net/prizren/getattachment/Projects/Menaxhimi-i-mbeturinave/Buletini/Newsletter-04_En.pdf.aspx

*This designation is without prejudice to positions on status, and is in line with UNSCR 1244/1999 and the ICJ Opinion on the Kosovo declaration of independence

[16] In Prizren, the waste collection coverage is up to 100%. As the service waste has been recently introduced in rural areas, some 15% of the population still dump their waste in the countryside. Therefore, in the further analyses it is anticipated that 15% of the total generated waste ends up at illegal dumpsites where it may join the floating debris stream via various pathways.

Pilot Municipality	Waste Collection Rate (%)	Waste not collected (tons/year)
Total Pilot Region		**10,569**

Considering high population numbers and relatively low waste collection service coverage, it is assumed that Kosovo* contributes the most to the floating waste generation in the pilot region; it is followed by Albania, while the Macedonian pilot municipalities share in the total waste not collected is the lowest (Figure 11).

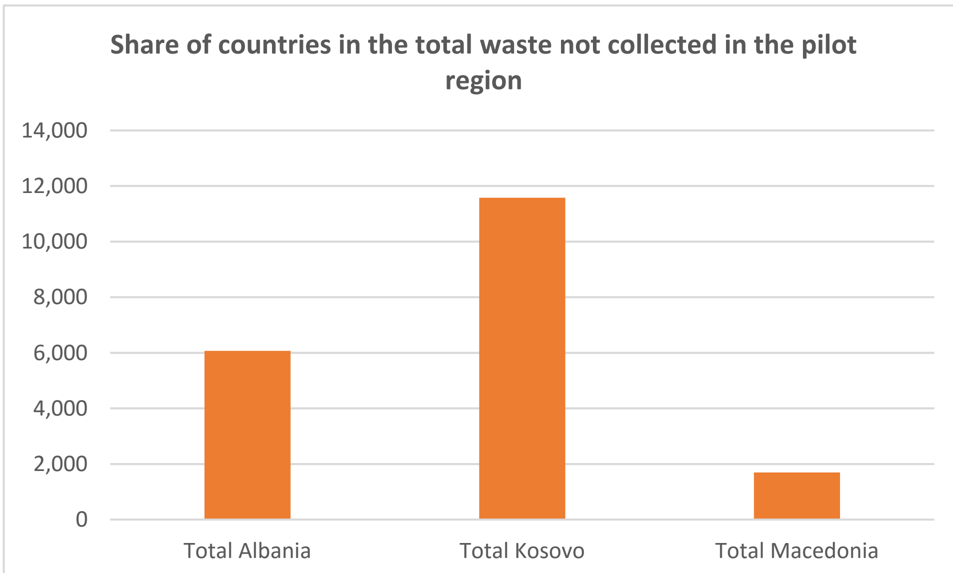


Figure 11 Share of countries in the total waste not collected in the pilot region

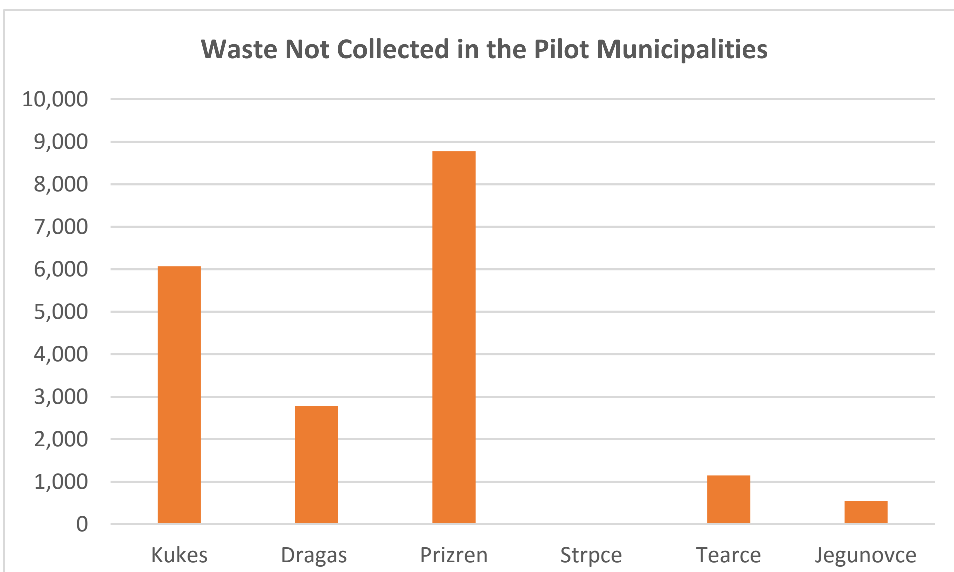


Figure 12 Shares of municipalities in the total waste not collected in the pilot region

*This designation is without prejudice to positions on status, and is in line with UNSCR 1244/1999 and the ICJ Opinion on the Kosovo declaration of independence

Municipalities which contribute the highest share in the total waste not collected in the pilot region are: Prizren, Kukes and Dragas; Tearce and Jegunovce are contributing with least quantities of not collected waste.

The waste quantities potentially dumped in each pilot municipality is an important baseline information necessary to assess the significance of environmental and economic impacts of the present mismanagement of municipal solid waste in the Sharra Pilot Region.

Further input to the assessment relates to the identification of non-compliant landfills and illegal dumpsites (“hotspots”) located nearby rivers – White Drin and Lepenec.

3.4.3 Waste disposal and “hotspots”

The collected waste is disposed at either regional sanitary landfills (Prizren and Gjilan) or non-compliant municipal landfills. In some cases, the disposal sites are far away from the collection areas which may encourage illegal dumping to avoid excessive transportation (and gate fee) costs by the operators.

Municipalities in Kosovo* dispose their collected waste at engineered (Dragas) or sanitary landfills (Prizren and Strpce).

<u>Dragas Municipality:</u> The only official landfill site in Dragas Municipality is near Brezne village, 12 km from Dragas on the way to Prizren, in a place called “Trokon”. The dimensions of the dumpsite are 247m X 40m or approximately 1.2ha, while its total capacity is 50,000m^3. The monthly capacity of this landfill site is 20 tons. Although the dumpsite has been constructed according to EU standards with funds from the European Commission, it still does not conform to minimum standards as half of the landfill is not covered by soil layers (due to financial limitations) and waste water does not undergo any treatment.

<u>Prizren Municipality:</u> Prizren regional landfill is located close to the town of Prizren and it serves a catchment of approximately 317,000 inhabitants in the Municipalities of Prizren, Rahovec, Malisheve and Suhareke. It was constructed under an EAR grant of € 2.6 million. Prizren Sanitary Landfill began operation (the receipt of waste) in the middle of 2004. The landfill covers a surface area of 24 ha. The active area is lined with a clay and HDPE liner in order to meet sanitary landfill standards. Some small sections of the HDPE liner have been cut away and removed. Leachate is collected and conveyed by gravity to a leachate lagoon (3,000 m^3).

<u>Strpce Municipality:</u> it transports their collected waste to the sanitary landfill in Gjilan. It is outside the pilot region. This regional landfill is located in a small valley just south of Gjilan and it serves a catchment of approximately 245,000 inhabitants within the Municipalities of Gjilani, Kamenice, Viti, Novoberde, Kacanik, Shtime, Ferizaj and Strpce. It was constructed under anEAR grant of €2.6 million. The Landfill has a total capacity of 1,200,000 m^3 and a monthly intake capacity of 5,000 tons. Gjilani landfill began operation in June 2003. The active part of the landfill (i.e. the southern part of the site), covers an area of approximately 6 ha within an overall area of 24 ha; its area is lined with a clay liner in order to meet engineered landfill standards. The design includes a leachate collection lagoon (4,000 m^3), in two parts, each of

*This designation is without prejudice to positions on status, and is in line with UNSCR 1244/1999 and the ICJ Opinion on the Kosovo declaration of independence

which is lined with plastic (i.e. HDPE) liner, from where the leachate is to be re-circulated onto the landfill by means of a pumping system. As part of the initial construction, some landfill gas control measures were installed. Occasionally the landfill has operation problems which are faced by the served municipalities, including Strpce. In addition, the waste from Strpce is transported to long distance which hampers the sustainability of operations of the PCE.

Kukes Municipality: the void space of the sanitary landfill built with the support of the KfW (1997) at the locality was exhausted; currently the waste is being dumped at the non-compliant landfills in Qaf Barak, Suka e Mamzit and Bajram Curri. None of these non-compliant landfills is located along a river.

Figure 13 Locations of municipal non-compliant landfills in Kukes and Dragas and the sanitary landfill in Prizren

Tearce and Jegunovce Municipalities: the waste collected in the Municipalities of Tearce and Jegunovce is disposed at the non-compliant landfill "Rusino" which is located nearby the City of Gostivar (outside the pilot region. Rusino non-compliant landfill is used for the disposal of collected waste from all the municipalities in the Polog[19] region, with the exception of the Municipality of Gostivar. The landfill is formed in a former clay pit and has an area of 13.5 ha as well as available volume: 2.5 mill m^3.

Various sources[20] indicate that waste transportation routes exceeding 20 km (more than 30 minutes of travel from the terminal point of the collection route to the disposal site are not economically viable, especially if the waste is carried in small size refuse trucks (less than 10 tons). It implies that the operator in Strpce, Tearce and Jegunovce should look for solutions to reduce the transportation costs, i.e. installation of waste transfers and possibly secondary waste segregation at these transfer points. Such solution will be sought in the future.

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[19] Polog region comprises the Municipalities of Brvenica, Bogovinje, Gostivar, Jegunovce, Mavrovo and Rostuse, Tearce, Zelino, Tetovo and Vrapciste.
[20] http://www.unep.org/ietc/Portals/136/SWM-Vol1-Part1-Chapters4.pdf

The waste not collected ends up at illegal dumps which proliferate along the roads and riverbeds. The construction and demolition waste mainly ends up at the kerbsides of the roads and these spoiled areas are also magnet for household waste dumping . Considering the habits of local population, it is assumed that they fly tip their wastes predominantly near water streams. A study of ICPDR[21] operates with an assumption that approximately 30% of the fly-tipped waste becomes floating debris.

There are inventories of illegal dumps for Albania[22] and Kosovo*[23] which have been analysed during the impact assessment report development. These inventories comprise provisional locations indicated on a map without any reference to the area, quantity and property of dumped waste (Figures 14 and 15).

[21] (ref: http://www.icpdr.org/main/publications/drina-rivers-floating-problem), 2008
[22] http://mbetjet.zhvillimiurban.gov.al/
[23] http://www.ammk-rks.net/repository/docs/Raport_Waste_and_Chemicals_2014.pdf
*This designation is without prejudice to positions on status, and is in line with UNSCR 1244/1999 and the ICJ Opinion on the Kosovo declaration of independence

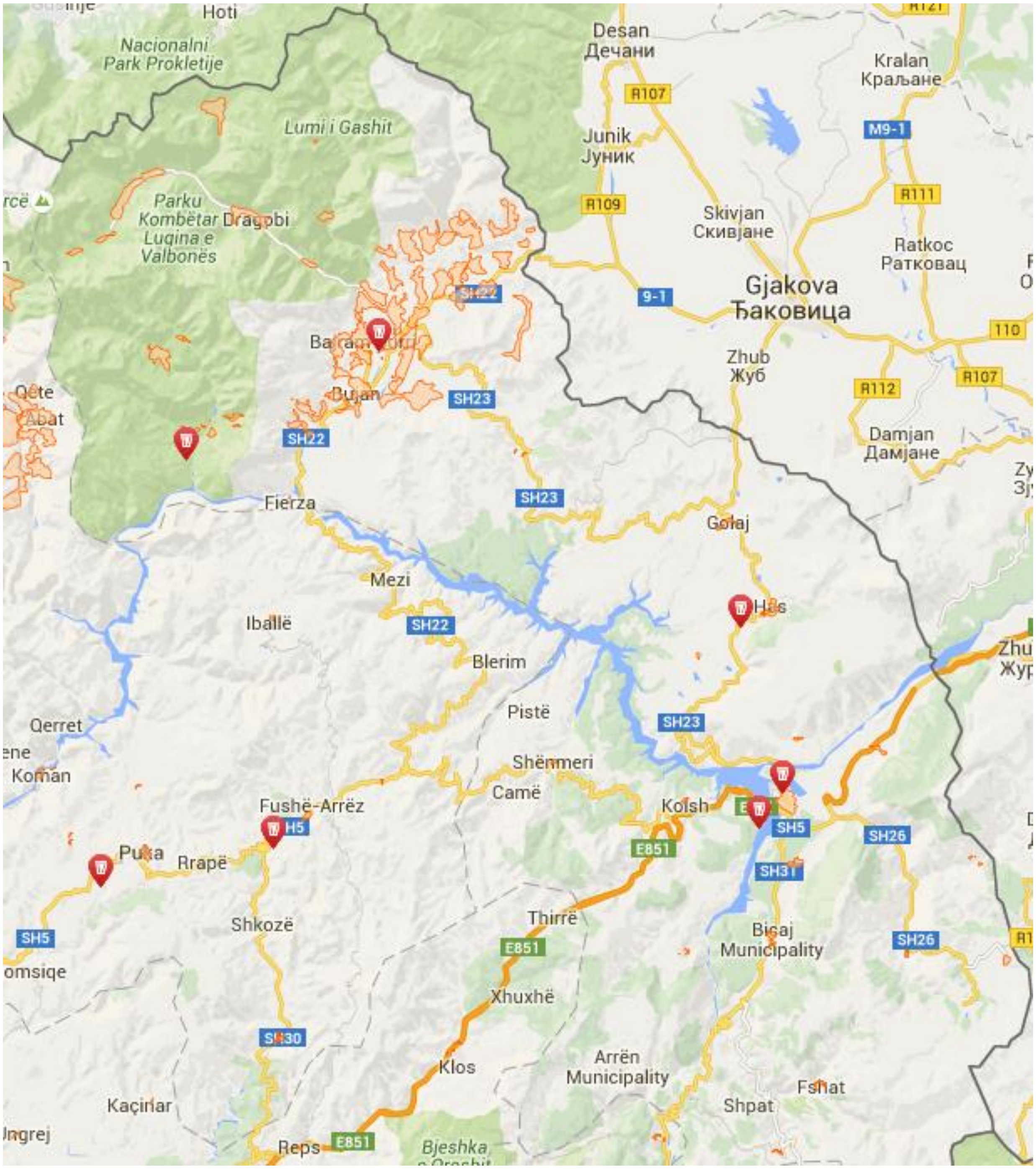

Figure 14 Map of illegal landfills in the Kukes Municipality developed by the Ministry of Urban Development in Albania

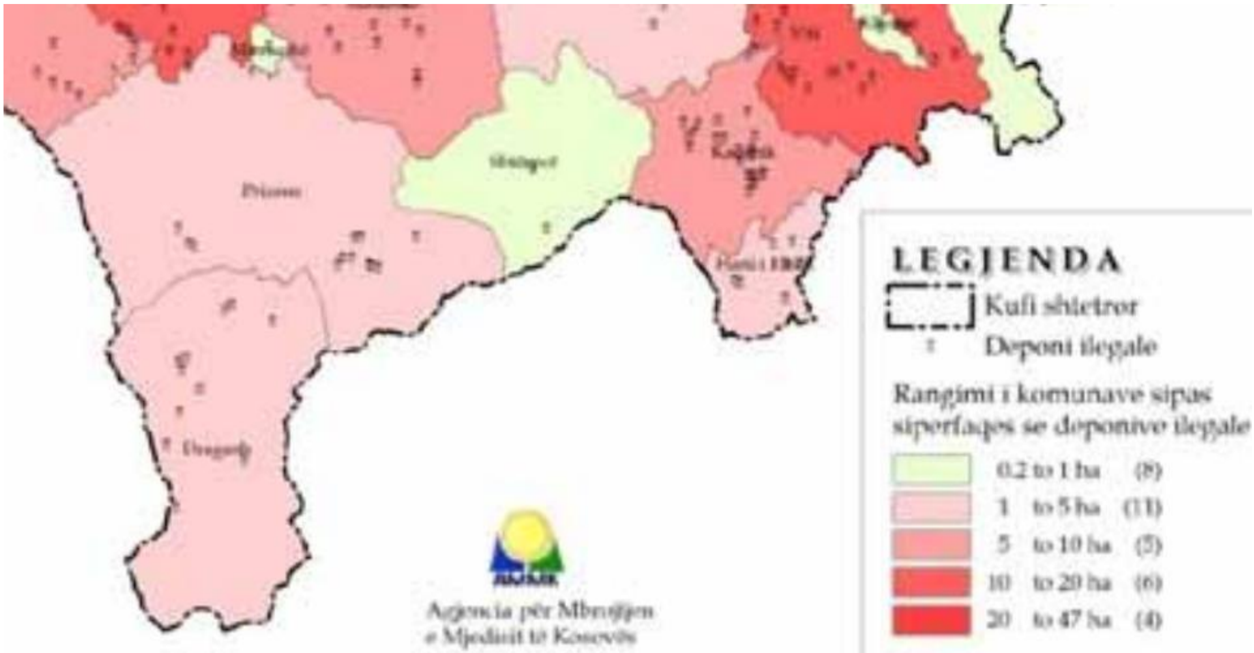

Figure 15 Map of illegal landfills in the Municipalities of Dragas, Ptizren and Strpce

The illegal landfills inventories have been complemented by information provided by the stakeholders during the 1st Dialogue Platform. In addition, the SWG staff engaged in a survey of illegal dumps in January 2016.

The figures below show the provisional locations of the major illegal dumps in the Sharra Pilot Region.

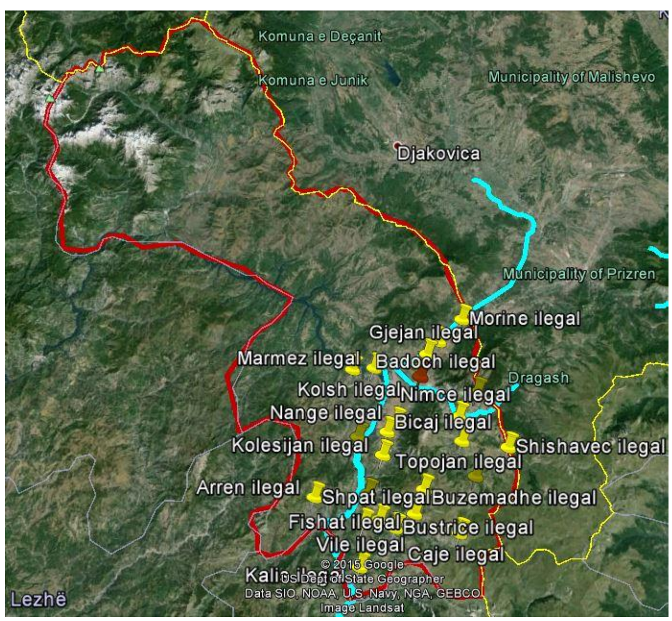

Figure 16 Illegal dumps in the Municipality of Kukes

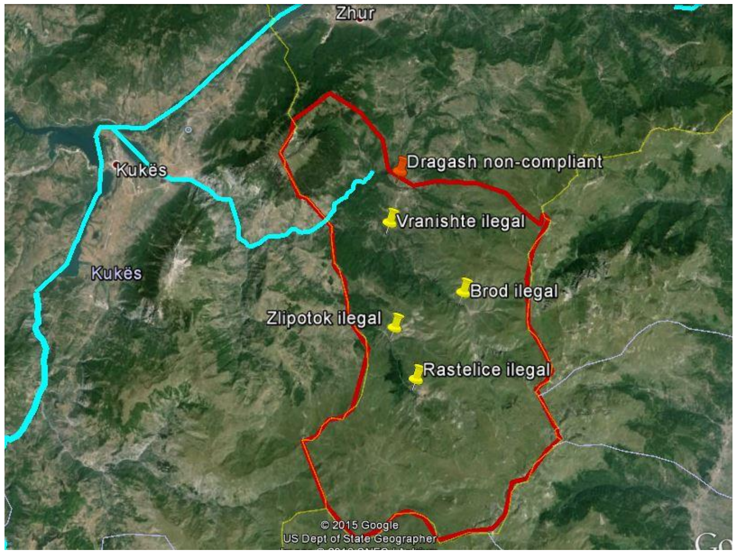

Figure 17 Illegal dumps in the Municipality of Dragas

Figure 18 Illegal dumps in Prizren Municipality

Figure 19 Illegal dumps in the Municipality of Strpce

Figure 20 Illegal dumps in the Municipality of Tearce

Figure 21 Illegal dump in the Municipality of Jegunovce

Even though the detailed inventories of most pilot municipalities are not available, it is obvious that illegal dumps appear in the suburbs and villages in every pilot municipality without an organised waste collection. However, illegal dumps are also present in the areas where there is some sort of waste collection (i.e. “bring” systems).

Notwithstanding the incompleteness and insufficient accuracy of the locations of “hotspots”, the initial information on land based sources of floating debris provides solid background for the dialogue on designating suitable prevention and/or cleaning actions in the future. An inventory of illegal dumps ("hotspots") to derive exact locations of the floating debris sources will have to be created in order to organise for a sound monitoring as part of joint activities at regional scale.

3.4.4 Recycling

Recycling operations in the Sharra Pilot Region are underdeveloped.

Macedonia: Some plastic recycling is performed in Tearce Municipality (EMC Company, based in Slatino). The company owner informed the stakeholders at the 1st Dialogue Platform that he mainly collected HDPE and PET; they collected 20 tons of HDPE for 6 months in 2015 and also cleaned the rivers from plastic bottles. He cooperates with Roma informal collectors and other suppliers of recyclables. He is interested in cooperating with the Municipality of Tearce, but considering the fact that the waste collection is performed by a private operator (Ekoflor) that is not incentivised in the contract to carry out a primary waste segregation, it is unlikely that this initiative will materialise.

Kosovo*: Even in Prizren, where the waste collection is organised in the most efficient manner compared to the other pilot municipalities, primary recycling does not exist. Stakeholders reported that there were companies involved in the collection of recyclables (mainly metals and rarely plastics and paper); however, they do not cooperate with the local authorities or the existing waste management operators. The only companies involved in waste collection that perform some recycling are "Pastrimi" (operating also the regional landfill for Pristina) and "Ambienti" (performing waste collection and disposal for the Municipality of Peje). There are a dozen of companies involved in recycling of plastics in Kosovo*, however, none of them is operational in the pilot municipalities. The following companies involved in recycling of plastics were identified in 2009 during the USAID supported project "Kosovo* Plastic Recycling Activity[24]: Companies in Ferizaj: 1) Çama Komerc; 2) Samira Plast; 3) Mbrojtja e Ambientit; 4) Tiki-Niti; 5) Metal Elektro; 6) CADI COMMERCE; 7) Tefik Canga; 8) PAJA; companies in Rahovec: 9) Pista Ekoplast; 10) Kroni; companies in Lipjan: 11) ALCOM; 12) Lulebora; companies in Pristina: 13) Plas-Kos; 14) Euro Plastika; companies in Gjilan: 15) Y Rival; 16) Rrezi-Com; companies in Fushë Kosovë: 17) Rec-Kos.

Albania: There are currently some private recycling companies in Albania that collect and process different types of waste, namely metal scrap, paper, plastic, textiles and used tires. There are about 12,000 individual collectors (informal sector) and about 60 different recyclable waste collection companies. However, there is a lack of waste separation at the source. Individual collectors and companies face difficulties in finding clean and separated waste. Most of the recyclable waste comes from urban waste and partly from the industrial sector. Some sorting of glass bottles, paper and cardboard and metal scrap takes place in Albania. Glass bottles are collected, sterilized and reused by beverage companies. Paper and cardboard are sorted only in small quantities at a paper recycling plant in Tirana. Aluminium cans are usually exported to neighbouring countries for reprocessing, and a very small proportion of them goes to a small private Albanian smelter (UNECE, 2012). The recycling industry in Albania is obliged to import plastic waste due to the large processing capacity of this industry and the inefficient system of plastic waste collection and separation. Several municipalities in the country, in cooperation with recycling companies and various associations, have tried implementing such systems that can enable the separation of waste at source and their collection in the respective categories. However, these initiatives have either failed or are in the early stages, in which the

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[24] http://pdf.usaid.gov/pdf_docs/PA00HQS8.pdf

amount of waste separated at source is negligible[25]. In Kukes Municipality, there is no recycling activity, according to the stakeholders contacted during the data collection process.

At the sanitary landfill in Prizren, it is planned to implement secondary waste segregation. The design documentation is underway, but it is not known whether the necessary resources for the investment will be secured in the near future.

There is plenty of room for improvement of the present recycling activities in all pilot municipalities. Suitable measures targeting the prevention of floating debris in the Sharra Pilot Region will be designed as part of the ISWM model.

3.2.1 Pathways of floating debris

The floating debris originating from the territory of pilot countries is transported by the rivers in the catchment area – White Drin (passing through the Municipalities of Prizren, Dragas and Kukes) and Lepenec (running through the Municipality of Strpce). In this way the floating debris generated in the pilot region is branching off to two main destinations: 1) through White Drin it is going to the Fierzi reservoir (Municipality of Kukes; 2) through Lepenec River it continues from Kosovo* to Macedonia to the mouth with the Vardar River.

While the Albanian and Kosovo* pilot municipalities are connected by the major pathways of the floating debris, the Macedonian pilot municipalities are isolated as they do not belong to either the White Drin or Lepenec catchment area. They still contribute to the Vardar River pollution, adding up floating debris generated on their territory. They do not generate significant transboundary impacts as it is unlikely that the floating debris generated on their territory and transported by Vardar River will reach Greece.

The inflow into the rivers, the quantity of floating debris and its transportation downstream the source is related to the following variables:

- river catchment area and number of settlements / population residing in the catchment / sub-catchment,
- discharge and streamflow (short-term) variations, including periodic flooding,
- dynamics (turbulence, current velocity, cross-section profile stability).

The bigger the waste quantities of the land based sources and the discharge of the river, the greater will be the floating debris flow and accumulation at calm river`s sections and reservoirs.

The ***Drin River*** Basin is located in the Western Balkans and it is shared between Albania, Greece, Kosovo*, Macedonia and Montenegro. The basin represents a very complex water system where rivers, lakes, wetlands, groundwater interact with each other and create a very rich ecosystem in terms of natural resources.

[25] file:///C:/Users/Rec/Downloads/JIARM%20paper21262.pdf

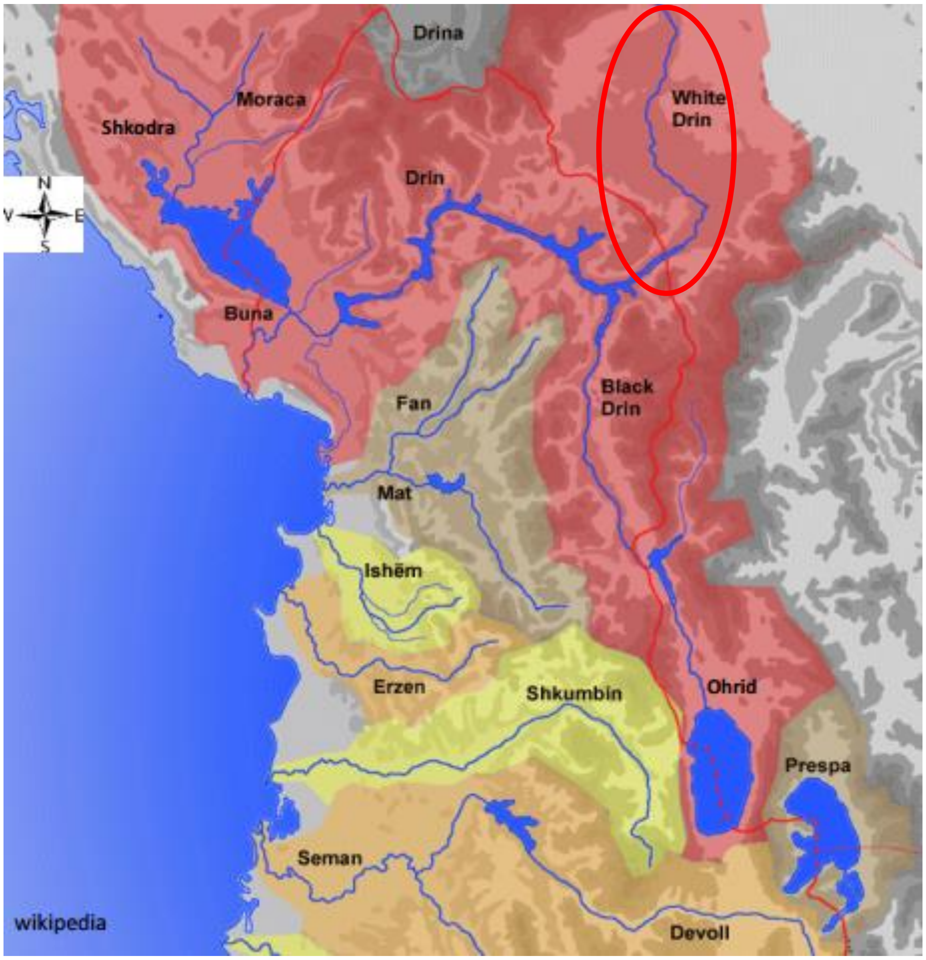

Figure 22 Drin River Catchment

Along its length of about 136 km, the ***White Drin*** drains a karstic region of nearly 4,964 km^2 within Albania and 4,360 km^2 in Kosovo* at a mean elevation 862 m. Municipal and industrial pollution is coming from various towns like Peje, *Prizren*, Gjakova, and Rahovec.

Floating debris transported by White Drin and its tributaries is a threat for the power generation at the Hydropower Plant at Fierzi. It is also a problem for tourism development as the tourists are disinclined to visit the region due to the degraded landscape by illegal dumping and the floating debris in the reservoir.

The ***Lepenec River*** Basin in Kosovo* flows through the territory of the Municipalities of Strpce, Ferizaj, Kaçanik and Hani e Elezit. The Lepenci/Lepenec springs out on the Oshlak Mountains east of the City of Prizren, at an altitude of 2212 m a.s.l. The Lepenec River shapes the border between Kosovo* and Macedonia in a length of 5 km; after its course of 60 km it leaves Kosovo*. Lepenci/Lepenec River Basin lies in the northern part of Macedonia and flows through the territory of the Municipalities of Cucer Sandovo, Gjorce Petrov and Karpos.

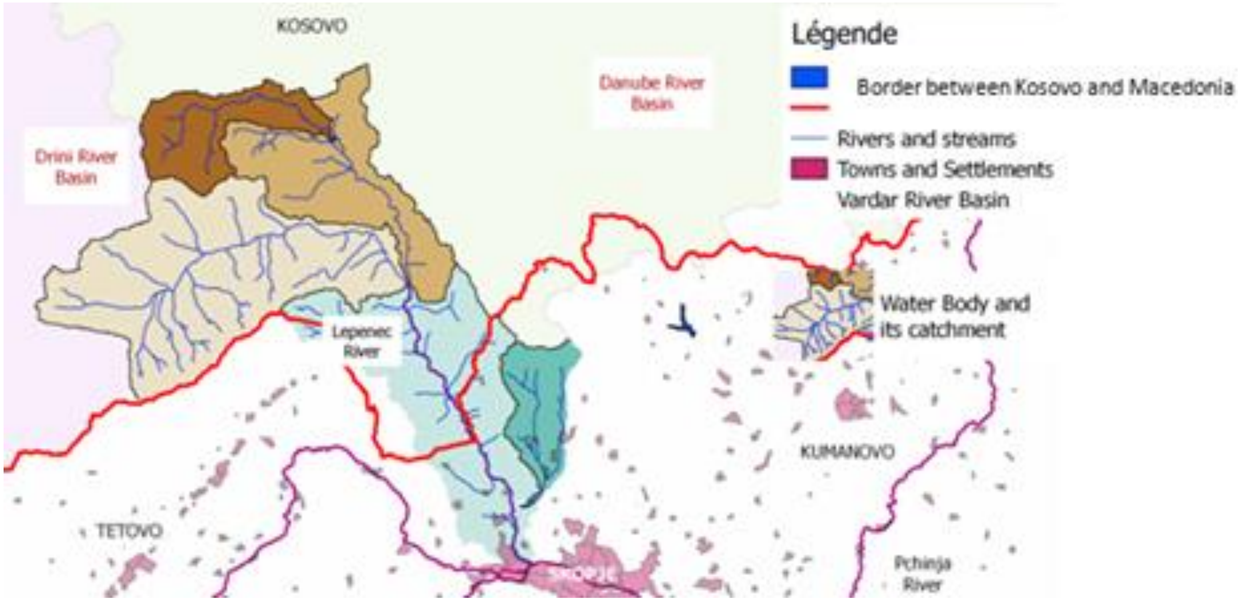

Figure 23 Catchment area of Lepenec River in Kosovo and Macedonia*

On the territory of the Macedonian municipalities the pathways of floating waste towards the Vardar River are: Tearska River (Jegunovce, Tearce) Slatinska (Lesocka) River (Tearce), Beloviska anf Raduska River (Jegunovce). These are relatively small rivers with torrential character, especially in spring when the snow is melting in the Sharra Mountain.

3.5 Environmental and Economic Impact Assessment

The transboundary impacts deriving from the floating waste in the pilot regions can be environmental and economic. The significance can be high, moderate and low. It is linked to the quantity and property of waste potentially released from each pilot municipality (please see the section 3.2 Origins and land-based sources of floating debris in the pilot municipalities in the Sharra Pilot Region above).

The *environmental impacts* encompass water pollution, threats to the riverine wildlife and protected areas, as well as human health problems in terms of potential injuries of people by sharp objects settled at the bottom of the rivers or reservoirs.

The *economic impacts* comprise costly clean-up activities (either in the reservoirs or at the river banks), declining fisheries, loss of power generation and related revenues, loss from non-returning tourists due to landscape disturbance, etc.

3.4.1 Environmental Impacts

Floating waste poses a considerable threat to the health and productivity of lake and riverine ecosystems.

The illegal waste dumping can threaten the biodiversity and protected areas in the Sharra Region.

Kukes region despite its backward economic situation is endowed with unique natural resources and a culture heritage of its own. The Region has several attractive natural and environmental resources including Fierzi lake with a coast length of 80 km within the region, the unique landscape of the Albanian Alps, the well-known Valbona valley, which is increasingly becoming a destination for wild nature tourism, the canyons of Gryka e Gashit and Shishtavec, the skiing station of Shishtaves, which has lost presently part of its fame, the tower houses of Arren and several other tourist sites including characteristic houses, natural landscapes, rare species, and sites of historical and cultural interest. In addition, three national protected areas have been identified in Kukes Region including: Lumi i Gashit in Tropoja with a surface of 3,000 ha; Lugina e Valbones in Tropoja with a surface of 8,000 ha; and Tej Drini i Bardhe in Has with a surface of 30 ha.

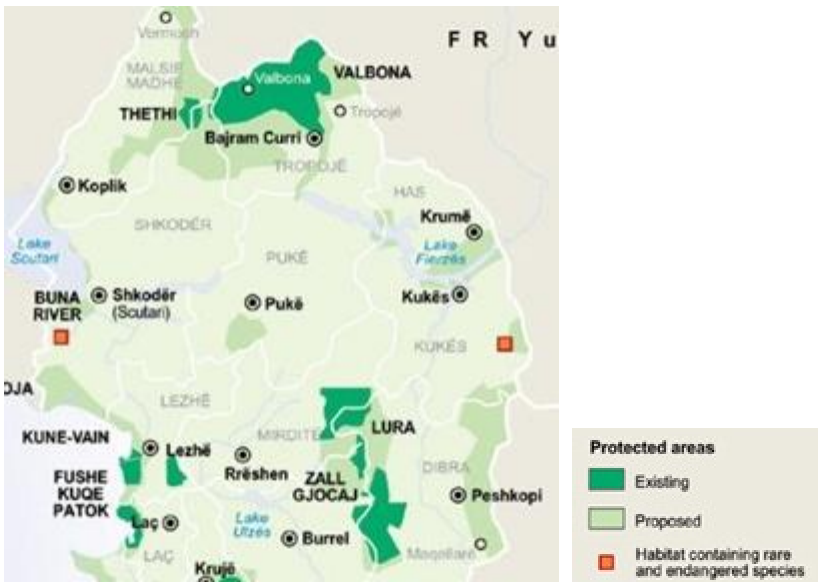

Figure 24 Protected Areas and proposed Protected Areas in Kukes municipality

Floating debris impacts adversely the tourist areas Valbona, Sistavec, Lake Fierzi and the protected area Korab-Koritnik.

The Sharr Mountain National Park has been recorded with the international list, and pertains to the second category (National Parks) of protected areas by IUCN[26]. The National Park territory covers an area of around 23,000 ha, and falls part of territories of four municipalities: 1) Prizren, around 41 % (or around 9,200 ha), 2) Shtërpce, 47 % (or around 10,700 ha), 3) Suhareka with 10 % (or 2300 ha) and 4) Kaçanik with 2 % (or 400 ha).

[26] 1990 – IUCN United Nations List of National Parks and Protected Areas.

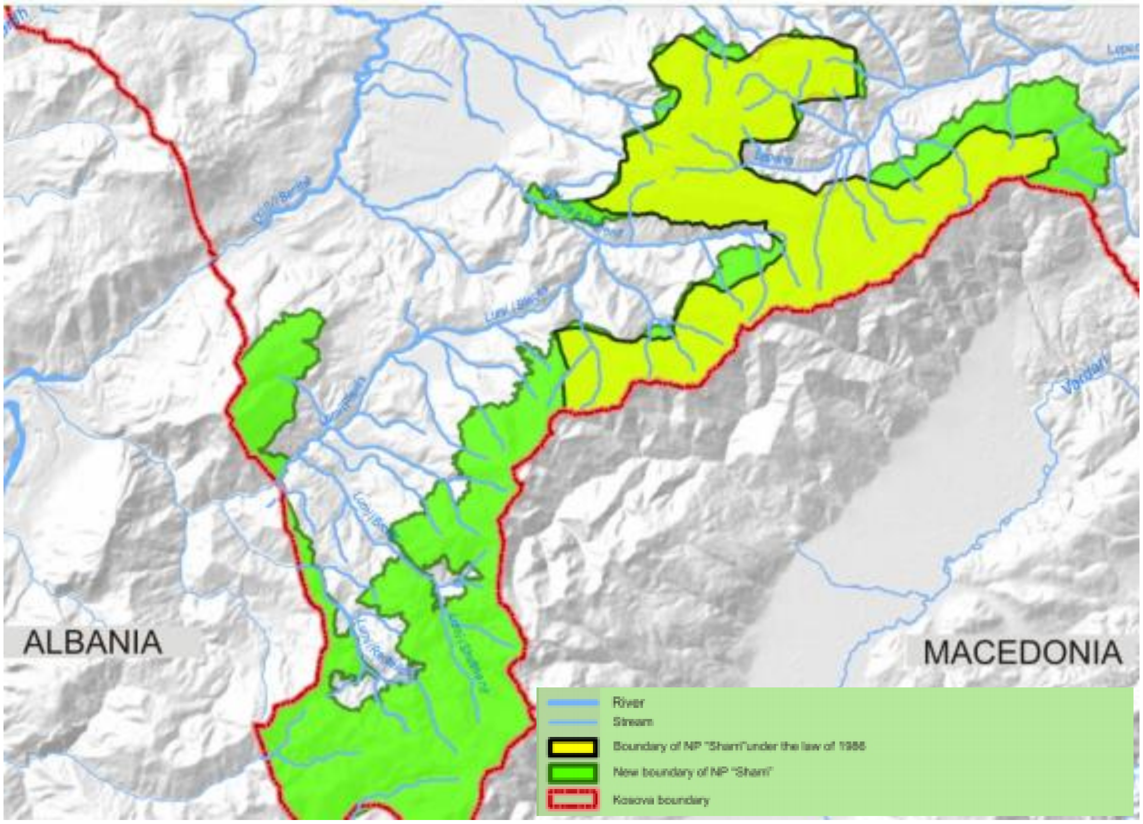

*Figure 25 Sharr National Park in Kosovo**

The stakeholders informed of an illegal landfill located in the area of the ski centre within the boundaries of the Sharr National Park on the territory of the Municipality of Strpce.

On the Macedonian territory, Sharra Mountain has been proposed for protection under the status of National Park long ago, but due to political reasons the proclamation of the protected area has been delayed. Sharra Mountain is among the most important centres of high-mountain endemism comprising of endemic-relict, endemic and steno-endemic species. 200 endemic taxa are found on the Sharra Mountain.

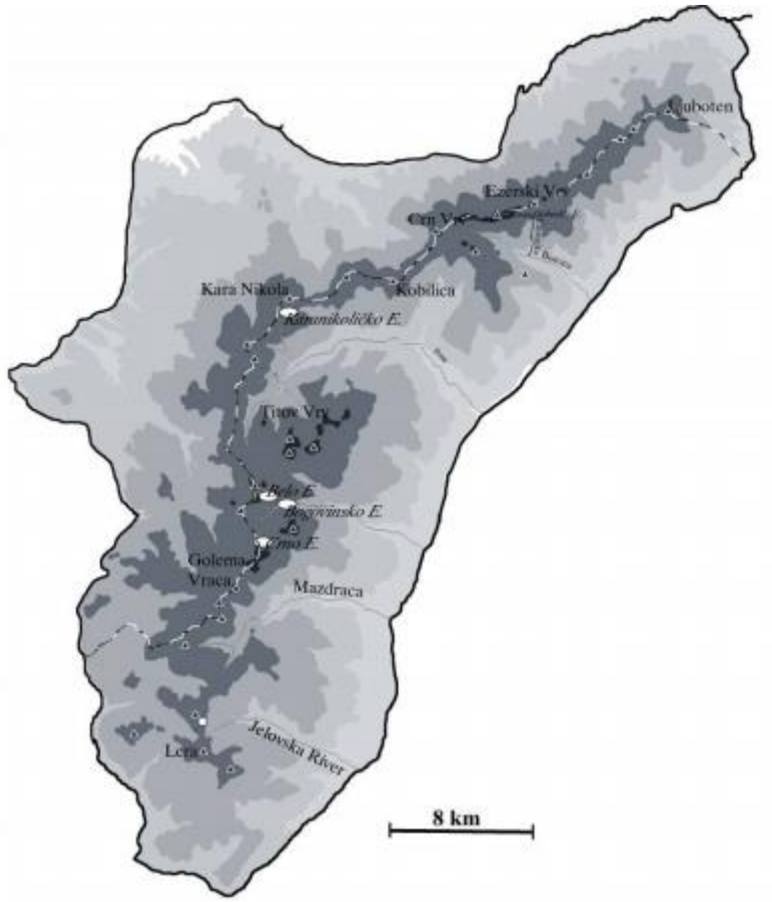

Figure 26 Proposed boundaries of the Sharra Mountain National Park in Macedonia

There has been a study evaluating the market value of the natural wealth of Sharra Mountain[27] in Macedonia based on a survey of the local population. The interviewees ranked the significance of threats for the biodiversity and natural wealth and the illegal dumping was assessed highly on the list of problems associated with unsustainable use of natural resources. The market value of natural wealth was defined based on the declared willingness of interviewees to pay monthly fees for utilising forests, pastures, medicinal plants, mushrooms, etc. The total market value of the Sharra Mountain ecosystems deriving from the survey was 3.3 million EUR. Compared to other regions in the world where similar surveys have been executed, the estimated market value of Sharra Mountain is rather low. It reflects the low awareness of the population on the real value of ecosystems on Sharra Mountain and the risks for their wellbeing originating from unsustainable use including illegal dumping. Unless the awareness of the population raises, it is to expect that the illegal dumping will prevail in the future.

Illegal dumping can cause threats for fish and fisheries. Fishing is a very important potential for the economic development of the Fierzi Lake, which constitutes a great opportunity for the cultivation of fishing with about 5000 ha of water. Since the formation, the structure of fishery was alienated with lake fish species, coupled with the departure of running water species that formerly inhabited the river Drin, as trout, eel and found suitable environment for breeding and feeding on different kind of fish species. Today, about 13 species of fish grow in Fierzi including small shellfish of freshwaters. It is noteworthy that Otters are mentioned among the important

[27] http://www.moepp.gov.mk/wp-content/uploads/2015/01/Studija-za-SAR-PLANINA.pdf

biological aquatic mammals that live in the waters of Fierzi, a type of mammal included in the Red List of Albanian Fauna, also globally threatened. Up to 5 thousand tons of fish a year has been taken from the Lake, but production has declined in recent decades due to no more breeding, but also due to uncontrolled fishing, often by means of extermination and also because of lake pollution. The biggest existing problem is that the lake is highly polluted by urban waste where most of the pollution comes from the White Drin and the Black Drin rivers, which adversely affect water quality, fauna, surrounding environment, as well as the use of the terrain for sunbathing and water activities.

3.3.4 Economic Impacts

Floating debris can cause serious economic losses to various sectors and authorities. Among the most seriously affected is the HPP Fierzi in the Drin River catchment (Kukes Municipality). Economic costs are lost benefits to society (negative welfare effects).

The following economic impacts are analysed:

- Costs for cleaning illegal dumps – origins of floating waste (prevention activities);
- Costs for cleaning floating debris from the Fierzi reservoir and lost revenue from power generation.

These costs may be difficult to estimate in the absence of suitable records. The assessment of these costs will have to deploy an organised approach for monitoring at the regional scale in the future.

3.3.4.1 Costs for Cleaning Illegal Dumps

The inventory of illegal dumps in the Sharra Pilot Region is not complete at present, however, the estimations made for the purpose of this Impact Assessment Report show that approximately 10,569 tons of waste are not collected and may end up at illegal dumps. Assuming a unit price of 50 EUR/ton for collection, transportation and disposal at the regional sanitary landfills, the annual costs for cleaning the illegal dumps are estimated at around 529,000 EUR. This amount does not include the costs for cleaning the illegal dumps in Prizren.

The financial resources needed to purchase equipment to collect the waste from settlements which are currently not covered by the organised service concern 1,700 dust bins (120l volume, once a week collection frequency, 150 EUR per bin) and 41 new refuse trucks (5 tons collection capacity, once a week collection frequency, 60,000 EUR per truck). The investment costs for the purchase of the necessary equipment is 255,000 EUR for the bins and 2,460,000 EUR for the refuse trucks, or 2,715,000 EUR for the total investment. This provisional calculation shows that investing in the equipment needed to extend the waste collection area and prevent the emerging of illegal dumps is more sustainable than cleaning them every year as the investment would pay off in 5 years. Anyway, after the purchase of trucks and bins, a cleaning campaign will have to be organised to rehabilitate all the locations.

3.3.4.2 Costs for Cleaning Floating Debris at Reservoirs Lost and Revenues from Power Generation

Drin River has an important potential for hydro-energy generation: there is a hydropower plant (HPP) located near the settlement Fierzi in the Municipality of Kukes. (Figure 27).

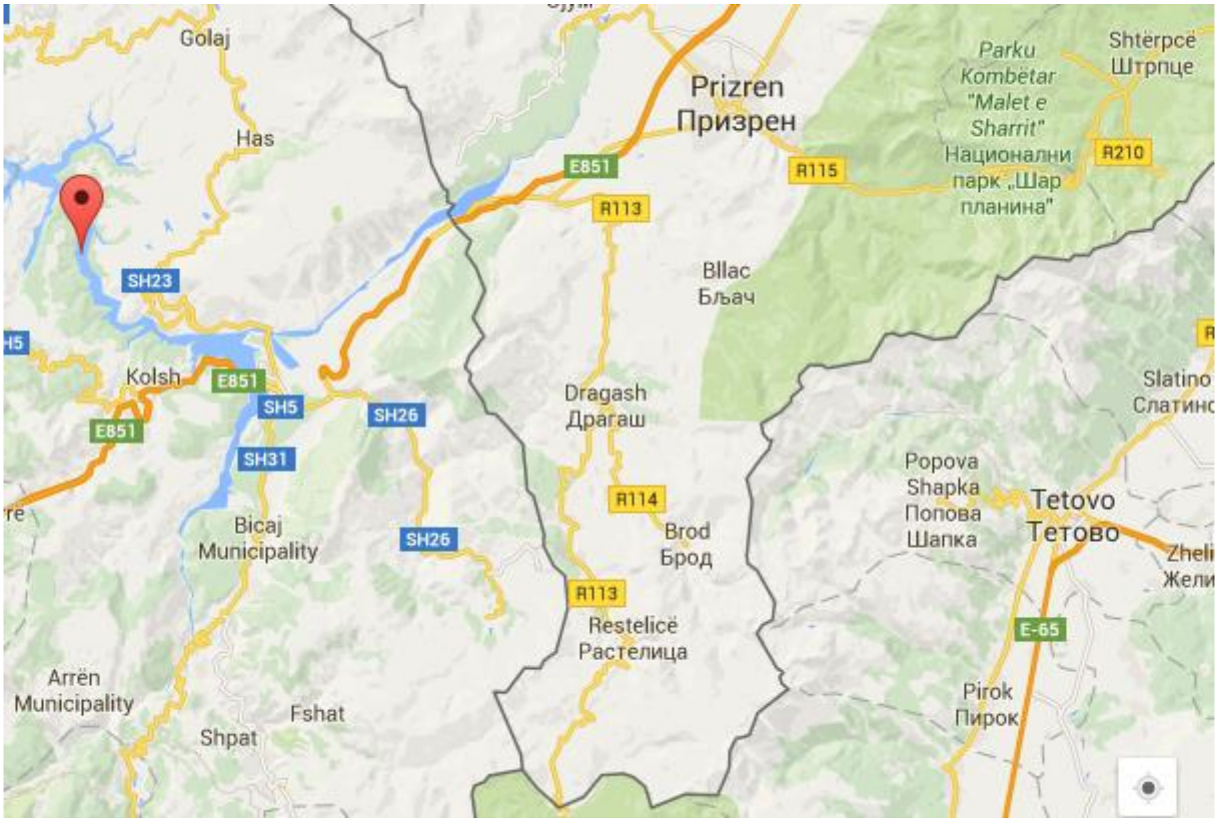

Figure 27 Locations of the Fierzi HPP at Drin River

The floating debris is washed away from municipal non-compliant landfills and illegal dumps and transported by the river flow to the reservoir where it is accumulated in significant quantities. Stakeholders reported during the 1st Dialogue Platform that 38 tons of plastics coming from Macedonia and Kosovo* have been cleaned recently in the Fierzi Lake.

Significant amount of floating debris accumulates over girders; it causes a decrease of the water inflow and hinders the production of electricity. Formations of shell colonies onto the girders due to the increased concentration of organic matter originating from the municipal waste constitute an additional problem. It reduces the water inflow and the electricity production. Hence, the floating debris disrupts the work of motors and machines of the Fierzi HPP, causing significant costs for repairs and cleaning. Occasionally, the power generation is interrupted to allow for cleaning the girders and shell colonies.

In the absence of more detailed investigations and records, an attempt was made to estimate the loss of power generation due to floating debris problems indicated above based on a “Techno-economic analyses of the floating waste management in the Drina-Lim Hydropower Plants” developed by “Tekon-Techno-Consulting” Ltd and “Dekonta” Ltd from Belgrade. The method used in the study to estimate power generation losses operates with the assumption that 0.25-1.5% of the annual power generation or 1-3.5% of the installed power is wasted as a result of the damages of power generation machinery (Table 6).

Table 6 Financial losses of the HPP Fierzi associated with reduced power generation due to floating waste

Power generation in (kWh)	**Estimated loss coefficient**					
	0,25%	**0,50%**	**0,75%**	**1,00%**	**1,25%**	**1,50%**
523.000.000[28]	1,307,500	2,615,000	3,922,500	5,230,000	6,537,500	7,845,000
Price (EUR/KWh)	0.00718757[29]	0.00718757	0.00718757	0.00718757	0.00718757	0.00718757
Financial loss (EUR)	9,398	18,795	28,193	37,591	46,989	56,386

Additional 17,500 EUR are lost as a result of the reduced flow so the total loss at the Fierzi HPP is in the range of 73,886 EUR a year.

3.3.4.5 Lost Revenues due to non-returning tourists

The economy of the pilot region is primarily based on the wealth of natural resources. Natural resources and their diversity have influenced the development tourism and fisheries in the Fierzi reservoir.

The beautiful and picturesque landscape of the Sharra Mountains, the City of Prizren (also known as a cultural capital of Kosovo*), the surrounding area of Shtrpce Municipally, Pollog Valley in Jegunovce and Tearce, Fierzi Lake and Sistavec area are the places and sites most visited by domestic and foreign tourists. Tourists are also impressed with the opportunities for skiing, swimming or taking some other activity in the wonderful natural surroundings.

The statistics of tourist arrivals and average stays in the pilot municipalities is not available; there is only information on tourism statistics for Prizren[30] according to which in 2013 there have been 8,109 tourist arrivals and 10,360 overnight stays (average 1.2 days duration of a tourist visit). Due to the cultural infrastructure that works on protection, development and presentation of values of legacy in material and spiritual ways, the Prizren City plans its opportunities counting on the development of tourism as a profitable economic activity. Prizren has an enviable potential of cultural values inherited from different historical epochs becoming thus one of the most attended touristic centres with 24 identified archaeological locations, 39 idols from Christian religion as well as 46 idols from Islam religion and up to 74 other objects with evident characteristics of ethnical architecture[31].

There is a significant potential for the development of rural tourism in Dragas and Prizren. Surveys[32] show, however, that despite ever developing demand for rural tourism in Kosovo*, this sector of the tourism industry does not grow well and even originality and authenticity of the most of rural attractions has not been effective in convincing rural tourists to choose those municipalities as an ecotourism destination. One of the reasons, apart from the lack of suitable tourism infrastructure, may be the disturbed landscape due to numerous illegal landfills and polluted rivers.

Numerous domestic and international studies point out to the fact that the Municipality of Strpce has huge natural potentials and resources for development of winter and summer tourism.

[28] http://aea-al.org/wp-content/uploads/2012/04/HYDRO-ENERGY-ALBANIA.pdf
[29] http://serbia-energy.eu/albania-electricity-prices-for-households-price-trends/
[30] file:///C:/Users/Rec/Downloads/Hotel%20Statistics%20Q2-2014.pdf
[31] file:///C:/Users/Rec/Downloads/24-91-1-PB.pdf
[32] https://ckprizreneu.wordpress.com/2015/01/20/study-on-turism-potential-for-prizren-dragash/

Among the natural wealth, Sharr Mountain stands out, with its very rich water resources (rivers and mountain lakes), agricultural land, pastures, woods, flora and fauna. National Park "Sharr Mountain", ski-resort "Brezovica" with its FIS ski tracks over 3,000m long, 5 ski lifts, preserved environment, medieval cultural and historic heritage with unique orthodox sites from XVI Century, are just some of attractions that represent international wealth and huge touristic potentials. Unfortunately, these potentials are not sufficiently utilized, since presently, for tourism purposes, only 0.12% of municipal territory is used. In the future, touristic capacities could be increased more than ten folds without any obstacles or risks for other industries[33]. According to the Master Plan for the development of the Brezovica Tourist Centre, the total capacity would be 10,000 beds. Assuming the 80% utilisation during 30 days high ski season, there could be 240,000 overnight stays and revenues of 12,000,000 EUR can be realised. It is planned to privatise the tourist assets, but so far the investment has not been materialised. Considering the fact that within the National Park territory illegal dumpsites exist, one can assume that potential private operators of the tourist assets would be concerned with the landscape disturbance and hence the attractiveness of the area and they would not be willing to invest. In addition, stakeholders pointed out that the Lumbardhi / Bistrica River is significantly polluted by floating debris and illegal dumps created at the riverbanks in the recreational areas.

The traditional and very attractive event symbolizing the opening of the regular fishing season in Fierzi Lake is held every year on June 13th. Organized ferry tours on the lake and tasting fish dishes especially prepared for this occasion make this event a genuine attraction both for fishermen and for tourists[34]. International tourists, however, left comments on the Trip advisor[35] site that floating debris at the lake is very distracting.

We cannot establish the percentage of non-returning tourists in the absence of a more comprehensive survey. However, considering the obvious impacts on the landscape related to the floating debris, one can assume that millions of euros are lost due to the under exploitation of the tourist potential of the region, part of this owed to the landscape disturbance caused by the floating debris.

3.6 Impacting and Impacted Municipalities

Considering the origins, significance and pathways of the waste or pollution moving across the borders, there is a need to highlight the relationships between the impacting and impacted countries / municipalities.

Impacting municipalities are responsible for the generation of floating waste and / or pollution, by inadequate waste management practices and particularly illegal dumping in flood prone areas.

Impacted municipalities are receiving the (unwanted) floating waste and / or pollution. They are to bear additional costs for their clean-up and disposal, which they cannot recover from the service users and thus they face significant financial loss.

Due to the specific character of the pilot region, the major impacted receiver of the floating debris is the HPP Fierzi, where the waste generated from the upstream communities – Dragas

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[33] http://invest-ks.org/repository/docs/Invest_in_Shterpce_646170.pdf

[34] http://seerural.org/wp-content/uploads/2014/11/1.-General-brochure_Sharra.pdf

[35] https://www.tripadvisor.co.nz/ShowUserReviews-g2284133-d4943591-r224772045-Komani_Lake-Koman_Shkoder_County.html

and Prizren. The Municipality of Prizren is equipped with sufficient vessels and refuse trucks capacity but approximately 15% of citizens did not join the system. Therefore, the waste dumped at the illegal sites in the past, but also in present time, can be washed away and transported by the White Drin River. Impacted municipalities downstream the Lepenec River which carries floating debris from the territory of Prizren and Strpce Municipalities can impact the Municipalities of Cucer-Sandevo, Gjorce Petrov and Karpos (Macedonia). The Lepenec River has a torrential character and it floods the lowlands at its confluence. Floating waste can, therefore, strand onto the fertile agricultural land. Tearce and Jegunovce Municipalities also contribute to the floating debris generation in the Vardar River.

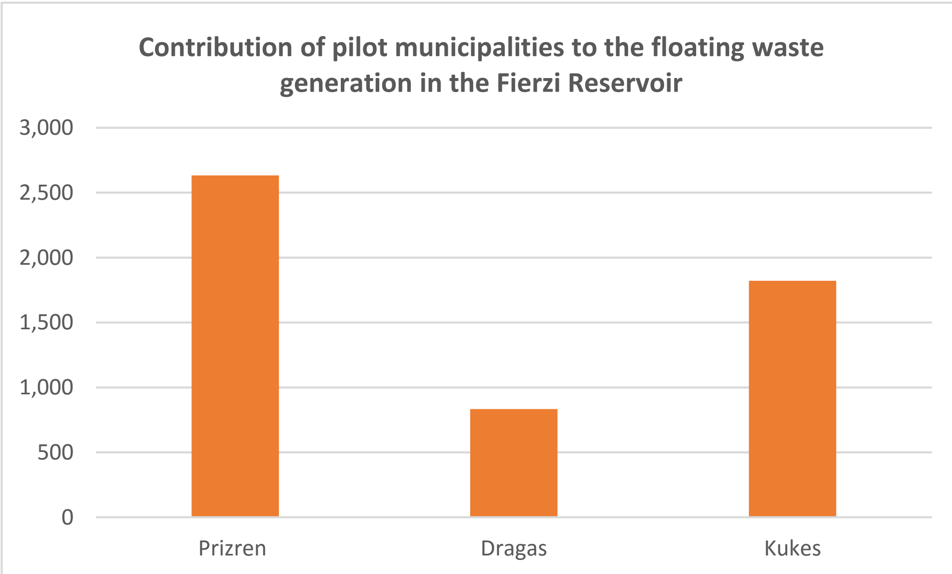
Table 7 below presents the situation of impacting and impacted municipalities and the potential contribution of the upstream municipalities to the accumulation of the floating debris in the Fierzi reservoir and the transportation of the debris from the Lepenec River to the catchment of Vardar River. It is assumed that 30% of total waste quantities not collected may enter the rivers as a floating waste.

Table 7 Potential contribution of upstream pilot municipalities to the accumulation of floating debris in the reservoir Fierzi, , as well as to the transport of floating debris to the Vardar River`s wider catchment

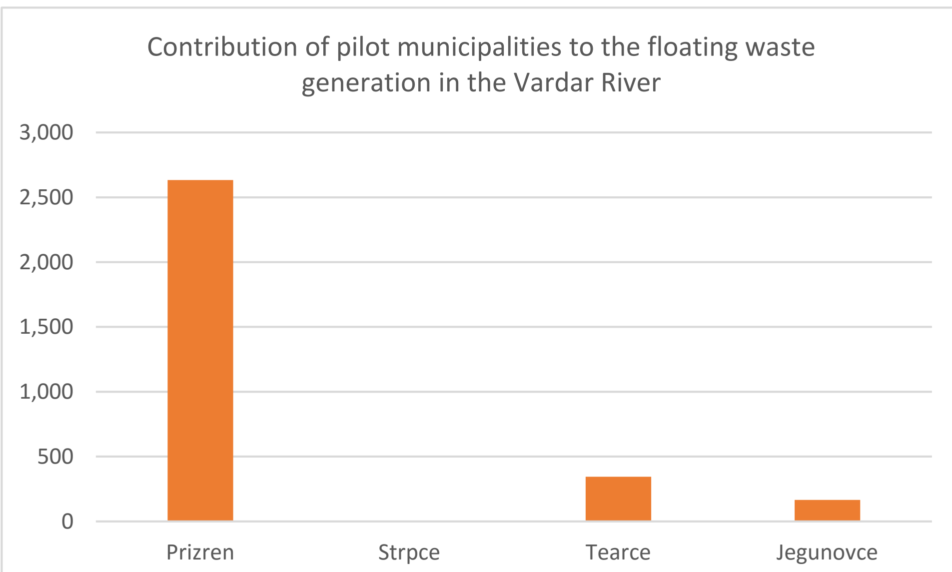
Pilot Municipality	**Waste not collected (tons/year)**	**Floating waste (30% of the waste not collected)**
Prizren	8,777	2,633
Dragas	2,780	834
Kukes	6,070	1,821
Fierzi Reservoir	17,627	5,288
Prizren	8,777[36]	2,633
Strpce	20	6
Tearce	1,147	344.1
Jegunovce	551	165.3
Vardar River	10,495	3,148

Table 7 above does not include the municipalities in the Black Drin catchment area which are also contributing to the generation of floating waste at the Fierzi Lake. Also, it does not include the Municipality of Hani Elezi which lays into the Lepenec River catchment. Nonetheless, the figures below show the relative contribution of pilot municipalities to the accumulation of floating debris in the reservoir Fierzi and Vardar River.

[36] The figure of not collected waste relates to an illegal dumping activity of population which, although the service is being offered, refuse to join the regular waste collection system.



It can be seen that Kukes Municipality is generating more floating waste than the Municipality of Dragas.



Floating waste in Vardar River is originating mostly from Municipalities of Prizren, Tearce and Jegunovce.

The influence of discharged waste is significant when looking at the total pollution of the Drin and Lepenec Rivers, and this problem must be solved urgently taking the economic, social and cultural situations into consideration. To solve the floating debris problem sustainably, it is necessary to synchronise efforts at national and international levels because transboundary water resources and their preservation, protection and sustainable uses as well as the tourism development are of great importance for all countries.

4 Conclusions

The problem of marine litter / floating debris has obvious international dimensions. It affects the marine and riverine environment outside the jurisdiction of pilot municipalities, countries and regions. Sources of marine litter / floating debris are spread across the territory of the pilot municipalities; under the influence of various factors (wind, flood, tide, sea current, etc.) the litter enters the river or sea and by way of some pathways it is transported over long distances.

Box 1. Life cycle of marine debris / floating debris

> The complicated nature of the distribution of marine debris / floating debris in the environment calls for a clear and defined approach to characterizing and assessing the problem. Marine debris / floating debris enters the sea / river / reservoir through many pathways, and the patchiness in the distribution of debris, and spatial and temporal variability in the drivers add to its complex life cycle (Ryan et al., 2009, Cole et al., 2011, Doyle et al., 2011).

The full cycle approach implemented herein is intended to track the marine litter / floating debris from the source, through the pathway to the endpoint / sink. However, finding usable data on impacts and quantities of marine litter remains a challenge. Systematic scientific research on marine litter in the pilot regions is relatively scarce. This makes quantifying the impacts very hard. Nevertheless, we attempted to characterize and whenever possible quantify the impacts based on stakeholders` input and literature, which is considered to be a step forward in understanding the marine litter / floating debris problems.

Some municipalities, which are most plagued by litter, have no control over the production or disposal of that litter at the place of source. Furthermore, in the absence of a coordinated approach, efforts of some municipalities to reduce the intake of or remove the plagued debris may be undermined by the lack of action of the others. Therefore, an open, constructive and forward-looking dialogue on controversial topics is needed to identify joint visions and opportunities on solutions to marine litter / floating debris.

Annex 1

Template Questionnaires used for data collection

Questionnaire 1

Country				
What documents are in place to guide waste management in the country?	**Document Title / Content etc.**	**Date Published**	**Date Due for Revision**	**Comments**
What are the key pieces of waste legislation?	**Waste Management**	**Special Waste Streams**	**Waste Treatment and Disposal**	**Others**
What are the main institutions involved in the governance of waste management - describe roles and responsibilities?	**National Government**	**Regional Authorities**	**Local Authorities**	**Waste Utilities (public or private)**
Recycling Targets	**Packaging Waste**		**Organic Waste**	
Are there additional revenues for the local authorities for managing waste?				**Yes / No**
Is there producers` responsibility for special waste streams?				**Yes / No**
Is there any landfill tax?				**Yes / No**
Local Regulations (e.g. Decision on Communal Order, Ordinance on Public Hygiene etc.)				**Yes / No**

Municipality	
Population	
Economic activities	
Waste generation per capita (per day and year)	
Waste Composition (%)	
Organic	
Paper	
Plastic	
Glass	
Metal	
Other	

Public Utility (name)	
Do the population pay waste management charges?	
Charging Method: – **flat rate;** – **based on frequency of service;** – **based on waste volume (container);**	
Payment efficiency (%)	
Cost Recovery	**Yes / No**
Is there any private waste management operator?	**Yes / No**
Waste Collection Rate (Service Coverage) (%)	
Municipality	

Name of non-compliant landfill(s), illegal dump(s)	
Area (m2)	
Waste origin (settlements, industry, healthcare establishments, etc.)	
Typical landfill operations (e.g. compaction, daily coverage)	
Typical technical measures applied (e.g. bottom sealing, leachate drainage, landfill gas extraction and flaring etc.)	
Likelihood for transboundary impacts (high, medium, low)	

Municipality	
Pathways (rivers, cannels, drains, gullies, reservoirs, aquifers, sea currents, atmosphere etc.)	
Migration Drivers (wind, precipitation / flood, erosion)	

Questionnaire 2

QUESTIONNAIRE FOR THE PUBLIC UTILITY ______

IN THE MUNICIPALITY OF ____________ _______________

1. Which settlements you collect waste from?

2. Which settlements you do not collect waste from?

3. How often you collect waste in most of the settlements?
   a. Once a week
   b. Twice a week
   c. Every day
   d. Other, specify

4. Is the collection frequency sufficient?
   a. Yes
   b. No

5. Which containers are used for the collection of waste?

Volume of Container	Number
90l	
120l	
240l	
1100l	
5,7, 9m^3	
Others	

6. Do you need additional containers?
   a. Yes
   b. No

7. Which trucks you use for the waste collection?

Type of truck	Number / volume
Tractor & trailer	

Type of truck	Number / volume
Compaction refuse trucks	
Roto- press refuse trucks	
Skip trucks	
Others (small truck Piaggo for pedestrian areas)	

8. Do you need additional trucks?
    a. Yes
    b. No

9. Do you segregate the waste at source?
    a. Yes
    b. No

10. Which recyclables you collect?
    a. Plastic
    b. Paper
    c. Aluminum cans
    d. Others

11. Do you sell the collected recyclables:
    a. To private companies in the country?
    b. To private companies abroad?

12. Where the waste is disposed of? What is the transport distance from the collection area to the disposal site?

13. What is the composition of the disposed waste (e.g. household, industrial, construction and demolition, healthcare etc.)?

14. Is there any possibility that some hazardous waste is mixed with non-hazardous waste?

Yes, household hazardous waste is small quantities.

15. Is the landfill fenced?
    a. Yes
    b. No

16. Is the landfill located nearby a river, canal or gully?
    a. Yes

b. No

17. Do you implement waste compaction and daily coverage?
    a. Yes
    b. No

18. Is there any leachate drainage and landfill gas collection & flaring at the landfill site?
    a. Yes
    b. No

INTEGRATED SOLID WASTE MANAGEMENT MODEL

in Tara-Drina-Sava region

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Executive Summary

The floating debris is a serious pollution problem in the Tara - Drina - Sava region, particularly in Montenegro, Bosnia and Herzegovina and Serbia. This Integrated Waste Management Model comprises actions to monitor the floating debris in the environment as well as prevent and/or reduce its generation at the source. In a nutshell, it is a response to the root problems of the floating debris generation:

Problem	Solution
Scarce information on the amounts, composition and spatial distribution[1] of floating, settled (at the river and reservoir`s floor) and stranded floating debris at the riverbanks and reservoirs` coastline (mainly bays and beaches).	Regional monitoring system of stranded floating debris at the riverbanks and reservoirs` coastlines, based on the Marine Litter Watch[2] protocol (developed for the needs of the European Environment Agency - EEA) for collecting sank litter (at the riverbanks and reservoirs` coastline) data.
Incomprehensive municipal and hence national statistics on waste generation, composition and management (the latter including, as a minimum, collection rate from service users, recycling / recovery rate, the amounts of disposed waste, the inventory of sources of floating debris – non-compliant municipal landfills, illegal dumps, etc.).	• Develop and implement regionally harmonised method for waste sampling analyses building upon the existing methods applied in the region and strengthening statistical analyses of waste generation with the stratification methods elaborated in the Methodological Tool to Enhance the Precision & Comparability of Solid Waste Analysis Data, 5th Framework Program, EU[3]; • Develop and implement a regionally harmonised methodology for determination of the waste collection service coverage, taking into account: ○ existing versus the required available volume of collection vessels, ○ existing density and respective locations of containers versus the population density & waste arising and locations of properties, ○ existing versus the required vehicle routing and collection frequency; • Create inventories of illegal dumpsites upon the clean-up campaigns by tracking the locations of dumpsites, volume and

[1] Spatial distribution of floating debris is linked to river / reservoir currents, tides and river information indications about the physical source, i.e. the litter input zone and its pathway.
[2] http://www.eea.europa.eu/themes/coast_river / reservoir/marine-litterwatch
[3] https://www.wien.gv.at/meu/fdb/pdf/swa-tool-759-ma48.pdf

Problem	Solution
	provisional composition of fly tipped waste using the mobile application "Trash Out"[4] and joining the initiative "Let`s Do It World"[5]; • Exploit clean-up campaigns as a formidable tool to raise public awareness; • Strengthen enforcement against illegal waste dumping following the clean-up events; • Set a mechanism for regional cooperation towards harmonising and synchronising the implementation of methodologies for waste statistics, waste collection service coverage and inventories of illegal dumpsites;

Insufficient waste management practices in the majority of pilot municipalities, constituting the root cause for the generation of floating debris: lack of organisational and financial capacity of operators to cover remote rural areas with an organised waste collection service; littering habits of population (and tourists) due to the low awareness on deriving adverse environmental and economic impacts; lack of responsiveness to newly introduced waste segregation practice in some municipalities; insufficient enforcement.	• Carefully plan the rural waste collection system by:
	  ○ setting convenient collection routes,
	  ○ establishing suitable collection points for mobile or fixed transfer of waste delivered by the citizens or local community elected waste collection agents,
	  ○ planning the collection schedule (travel time per a route and frequency of collection),
	  ○ planning the required resources (containers, refuse vehicles, staff, fuel);
	• Establish "door-to-door" waste collection system in rural areas not covered by the service; initiate primary waste segregation upon the start-up of operations;
	• Implement public awareness campaigns to foster the acceptance of the new service, including the primary waste segregation;
	• Invite the private sector to take over segregated recyclables from the collection points.

[4] https://www.trashout.ngo/
[5] https://www.letsdoitworld.org/about/overview/

1. Background

The Regional Rural Development Standing Working Group (SWG) and the Network of Associations of Local Authorities of South-East Europe (NALAS) are implementing a regional sub-project “Solid Waste Management in cross-border rural and riverbanks and reservoirs` coastline of South Eastern Europe” supported by the German Federal Ministry for Economic Cooperation and Development (BMZ) through the GIZ Open Regional Fund for South East Europe – Modernisation of Municipal Services (ORF MMS) and the Government of Switzerland.

The SWG is engaged in improving rural livelihoods in the SEE countries. To this end, it promotes innovative and sustainable agriculture and rural development through regional cooperation of respective Ministries of Agriculture and other stakeholders. It supports the EU integration in the SEE, by:

- fostering rural development policies,
- improving implementing structures and systems for agriculture and rural development,
- improving the understanding and use of implementation tools for agriculture and rural development, and
- identifying and sharing information and application of good practice in agriculture and rural development to broaden the rural agenda.

NALAS brings together 16 Associations which represent roughly 9000 local authorities, directly elected by more than 80 million citizens of this Region. NALAS helps the associations to represent viably the local authorities vis-à-vis central governments. NALAS provides services to local governments and aspires to develop itself as the Knowledge Center for the local government development in the SEE. It promotes the:

- processes of decentralization, considering the local self-government as a key issue in the transition process in the SEE; and
- partnerships in order to contribute to the EU integration as well as the reconciliation and stabilization process.

1.1 Goals and Objectives

The overall aim of the sub-project is to “improve the conceptual and organisational framework conditions concerning Integrated Solid Waste Management (ISWM) in cross-border rural and riverbanks and reservoirs` coastline in SEE”.

The specific goal of the sub-project is to “assess and develop schemes (models) for integrated management of solid waste that are environmentally effective and economically affordable in order to reduce adverse environmental and economic impacts of solid waste mismanagement and support the ecological and socio-economic development of the cross-border rural and riverbanks and reservoirs` coastline in the SEE countries”.

The sub-project applies a regional approach, which is oriented towards the needs and perspectives of the countries contributing to the impacts of solid waste mismanagement (so called “impacting”) and the countries suffering from the adverse effects (so called “impacted”). Furthermore, three pilot regions are analysed: “Shara”, “Tara – Drina – Sava” and “Adriatic Coast” Region.

The sub-project is implemented in several stages as follows:

1. Developing a Method for Environmental and Economic Impact Assessment.
2. Developing Environmental and Economic Impact Assessment Reports for each pilot region using the Environmental and Economic Impact Assessment Method. These reports help enhancing the knowledge of relevant stakeholders on floating debris impacts and associated costs.
3. Drafting Integrated Solid Waste Management (ISWM) Models based on the lifecycle analyses of the floating debris / floating debris and available Best Practices on preventing the deriving environmental and economic impacts.
4. Proposing Policy Recommendations, in order to create an enabling environment for the implementation of ISWM models.
5. Generating project proposals (i.e. fiches), deriving from the ISWM models, to support the relevant stakeholders in fundraising of follow-up activities.

This Integrated Waste Management Model has been developed for the Tara - Drina - Sava pilot region. It comprises actions to monitor the floating debris in the environment as well as prevent and/or reduce its generation at the source. The geographical scope and information on area/population per municipality / country is explained in more details in chapter 2 below.

1.2 The Tara - Drina – Sava Pilot Region

The “Tara-Drina-Sava” pilot region is divided into two sub-catchments: “Drina-Tara” and “Drina-Sava”.

The “Drina-Tara” region encompasses 14 municipalities from three countries: Bosnia and Herzegovina, Montenegro and Serbia (Table 1).

Table 1"Drina - Tara” River (Bosnia and Herzegovina-Serbia-Montenegro)

Countries		
BiH	**Serbia**	**Montenegro**
Pilot Municipalities		
Visegrad	Ljubovija	Bjelo Polje
Rudo	Bajina Basta	Pljevija
Gorazde	Prijepolje	
Srebrenica	Priboj	
Bratunac	Cajetina	
Milici	Uzice	

The “Drina - Sava” Pilot Region encompasses 11 municipalities from two countries: Bosnia and Herzegovina and Serbia (Table 2). Originally the participation of two municipalities from Croatia was foreseen (Ilok and Lovas), but it was decided to exclude them due to objective reasons.

Table 2 “Drina - Sava" Pilot Region

Countries		
BiH	**Serbia**	**Croatia**
Pilot Municipalities		
Brcko	Loznica	/

Countries		
BiH	**Serbia**	**Croatia**
Pilot Municipalities		
Bjelina	Sremska Mitrovica	
Zvornik	Sabac	
Ugljevik	Krupanj	
Lopare	Mali Zvornik	
	Bogatic	

The pilot municipalities have been selected by the SWG in collaboration with the regional experts engaged during the project implementation.

The administrative boundaries of the pilot municipalities for each participating country are highlighted: (Figure 1 - Municipalities of Ljubovija, Bajina Basta, Prijepolje, Priboj, Cajetina, Uzice, Loznica, Sremska Mitrovica, Sabac, Krupanj, Mali Zvornik and Bogatic), Montenegro (Figure 2 - Bijelo Polje and Pljevlja), BiH Figure 3 - Municipalities of Visegrad, Rudo, Gorazde, Srebrenica, Bratunac, Milici, Brcko, Bjelina, Zvornik and Ugljevik).

Figure 1 Serbia- pilot Municipalities Ljubovija, Bajina Basta, Prijepolje, Priboj, Cajetina, Uzice, Loznica, Sremska Mitrovica, Sabac, Krupanj, Mali Zvornik and Bogatic

Figure 2 Montenegro- pilot Municipalities Bijelo Polje and Pljevlja

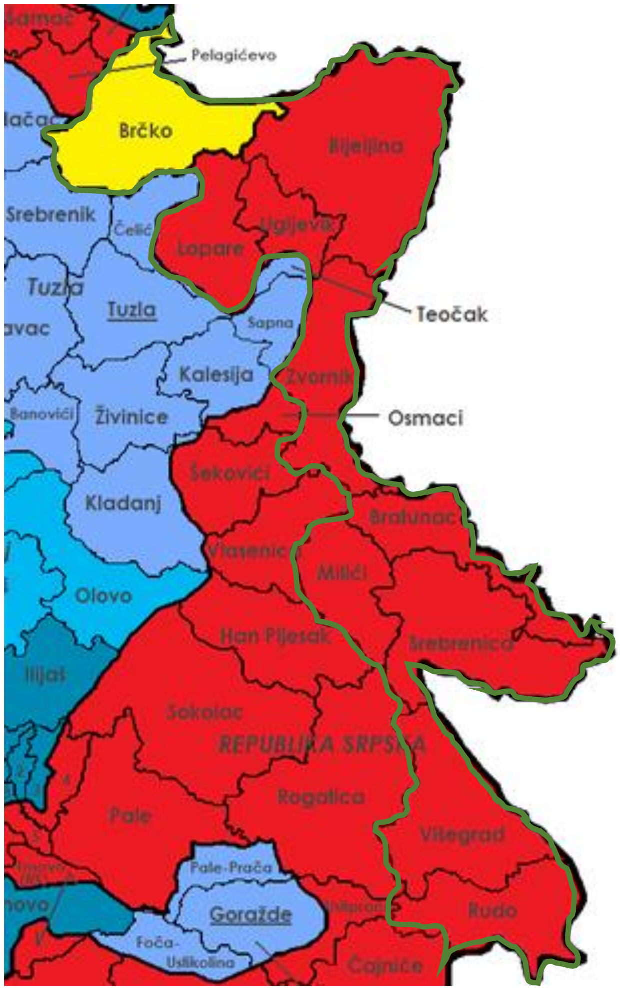


Figure 3 Bosnia and Herzegovina-pilot municipalities Visegrad, Rudo, Gorazde, Srebrenica, Bratunac, Milici, Brcko, Bjelina, Zvornik and Ugljevik

The provisional territorial distribution of the pilot municipalities in the “Tara - Drina - Sava” region is highlighted in Figure 4 below.

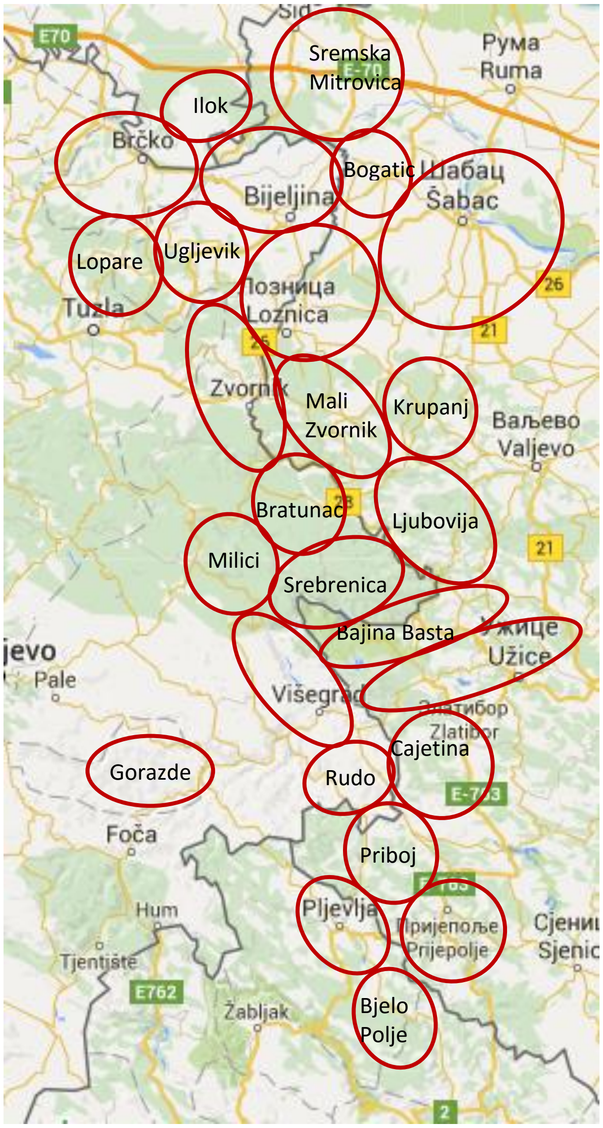


Figure 4 Geographical position of pilot municipalities along the Tara – Drina –Sava Region

The area and population of pilot municipalities are presented in Table 3 below.

Table 3 Area and population of the pilot municipalities and of the total pilot region

Pilot Municipality	Area (km^2)	Population
Serbia		
Ljubovija	356	14,469
Bajina Basta	673	26,022
Prijepolje	827	41,188
Priboj	552	30,377
Cajetina	647	14,754
Uzice	667	82,921
Loznica	612	78,788
Sremska Mitrovica	762	85,000
Sabac	795	115,347
Krupanj	342	17,398
Mali Zvornik	184	12,496

Pilot Municipality	Area (km^2)	Population
Bogatic	384	28,883
Total	**6,801**	**547,643**
Montenegro		
Bijelo Polje	923	43,460
Pljevlja	1,346	29,054
Total	**2,269**	**72,514**
Bosnia and Herzegovina		
Visegrad	448	11,774
Rudo	344	8,840
Gorazde	252	30,017
Srebrenica	527	9,117
Bratunac	293	22,133
Milici	285	9,849
Brcko	402	93,028
Bjelina	132	109,167
Zvornik	387	64,551
Ugljevik	165	16,358
Lopare	298	17,101
Total	**3,533**	**391,935**
Croatia		
Ilok		
Total		
Total Pilot Region	**12,603**	**1,012,092**

Respective shares of areas and population for each country within the pilot region are highlighted in figures 5 and 6 below.

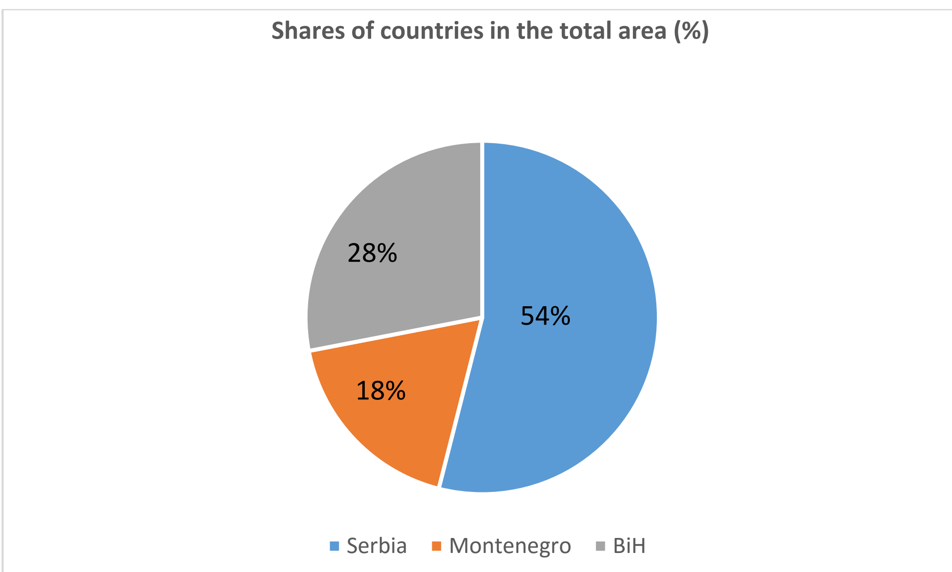


Figure 5 Respective shares of the area size of the countries in the pilot region

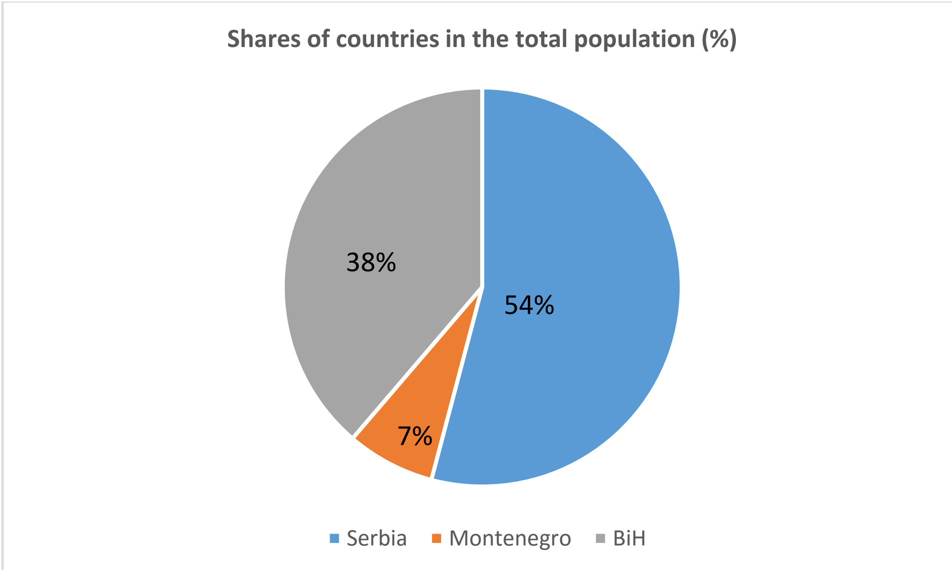


Figure 6 Shares of countries in the total population

2. Assumptions of the Integrated Solid Waste Management Model

The floating debris is a serious pollution problem in the Tara - Drina - Sava Region, particularly in Montenegro, Bosnia and Herzegovina and Serbia. Major transboundary environmental and economic impacts caused by floating debris in the Tara - Drina - Sava Pilot Region have been identified during the development of the Environmental and Economic Impact Assessment Report as follows:

- Water pollution;
- Threats to the riverine wildlife (Drina River and its right tributaries Cehotina, Lim, Uvac, Rzav and Jadar, the left tributaries Sutjeska, Praca and Dranjaca;
- Destruction of protected areas: Durmitor National Park in Montenegro, Sutjeska National Park in Bosnia and Herzegovina and Tara National Park in Serbia;
- Endangered riverine ecosystems: Salmonidae family with Danube salmon (*Hucho hucho*) and Brown trout (*Salmo trutta*) by floating waste and wood filings, (which are thrown from sawmills located in the catchment), entering the gills of fish;
- Human health problems in terms of potential injuries of people by sharp objects at beaches and settled at the bottom of the reservoirs Potpec, Visegrad, Bajina Basta and Zvornik; and
- Economic impacts on local communities (increased expenditure on cleaning floating debris at the reservoirs Potpec, Visegrad, Bajina Basta and Zvornik and illegal dumpsites located near riverbanks), tourism in areas such as Zlatibor (Cajetina), Banja Koviljaca (Loznica), Tara, Mokra Gora, Pljevlja, Bjelo Polje etc., and protected areas (loss of income, bad publicity), fishing (reduced and lost catch) and lost revenues from electricity generation at the Potpec, Visegrad, Bajina Basta and Zvornik Hydropower Plant due to blockages of turbines in the powerhouse.

Considering the richness of biodiversity and the presence of globally threatened species, on one hand, and the significant threat of the litter on these populations, on the other, waste dumping related prevention measures are a matter of urgency.

Albeit the environmental impacts could not be quantified due to lack of information, some effort has been made to assess the economic impacts related to floating debris and illegal dumps cleaning in the pilot area. It was estimated that each year 4,968,150 EUR are spent on cleaning up illegal dumps; for cleaning of the floating debris at the reservoir, an amount of 400,000 EUR per annum is spent and 1,700,000 EUR a year is lost due to reduced electricity generation at the Potpec, Visegrad, Bajina Basta and Zvornik Hydropower Plant (HPP).

Pilot municipalities contribute to the environmental impacts proportionally to the quantities of released floating debris. Some municipalities are responsible for the generation of floating waste and / or pollution, by inadequate waste management practices and particularly illegal dumping in flood / tide - prone areas. These are considered to be impacting municipalities. Other municipalities that are receiving the (unwanted) floating waste and / or pollution and need to bear (non-recoverable) costs for their clean-up and disposal are impacted municipalities.

Table 4 below presents the segmentation of Drina River catchment and the potential contribution of the upstream municipalities to the accumulation of the floating debris in the reservoirs and the transportation of the debris from the last reservoir to the wider catchment of Sava River. It is assumed that 30% of total waste quantities not collected may enter the rivers as a floating waste.

Table 4 Potential contribution of upstream pilot municipalities to the accumulation of floating debris in the reservoirs Potpec, Visegrad, Bajina Basta and Zvornik, as well as to the transport of floating debris to the Sava River`s wider catchment

Pilot Municipality	Waste not collected (tons/year)	Floating waste (30% of the waste not collected)
Bijelo Polje	8,827	2,648.1
Pljevlja	2,468	740.4
Prijepolje	1,912	573.6
Potpec Reservoir	**11,295**	**3,388.5**
Priboj	547	164.1
Rudo	403	120.9
Gorazde	1,653	495.9
Visegrad	913	273.9
Visegrad Reservoir	**3,516**	**1,054.8**
Cajetina	257	77.1
Uzice[6]	7,301	2,190.3
Bajina Basta	3,990	1197
Bajina Basta Reservoir	**11,548**	**3,464.4**
Srebrenica	1,190	357
Milici	1,095	328.5
Bratunac	3,099	929.7
Ljubovija	2,448	734.4
Krupanj	2,565	769.5
Mali Zvornik	1,764	529.2
Zvornik	4,315	1,294.5
Zvornik Reservoir	**16,476**	**4.942.8**
Loznica	14,572	4,271
Ugljevik	2,129	638.7
Lopare	3,169	950.7
Sabac	11,788	3,536.4

[6] Municipalities of Cajetina and Uzice are not contributing to the floating debris at the Baijna Basta reservoir as it belongs to the Morava River catchment.

Pilot Municipality	Waste not collected (tons/year)	Floating waste (30% of the waste not collected)
Bogatic	6,438	1,931.4
Bjeljina	9,398	2,819.4
Sremska Mitrovica	7,122	2,136.6
Sava River	**54,616**	**16,384.8**

Table 4 above does not include all municipalities in the Tara – Drina – Sava catchment area which are also contributing to the generation of floating waste. Nevertheless, the figures below show the relative contribution of pilot municipalities to the accumulation of floating debris in each reservoir in the analysed catchment.

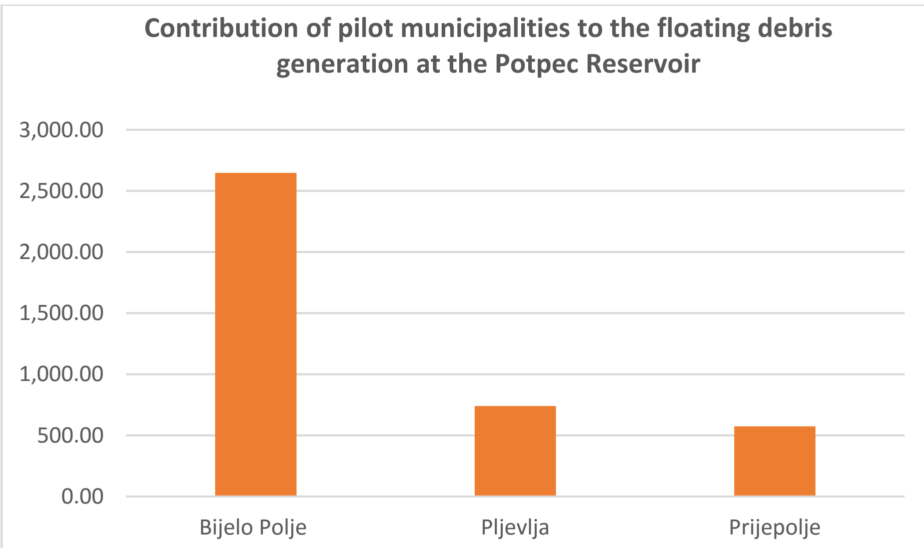


Figure 7 Contribution of pilot municipalities to the floating waste generation in the Potpec Reservoir

It can be seen that Bijelo Polje Municipality is generating more floating waste than the Municipalities of Pljevlja and Prijepolje.

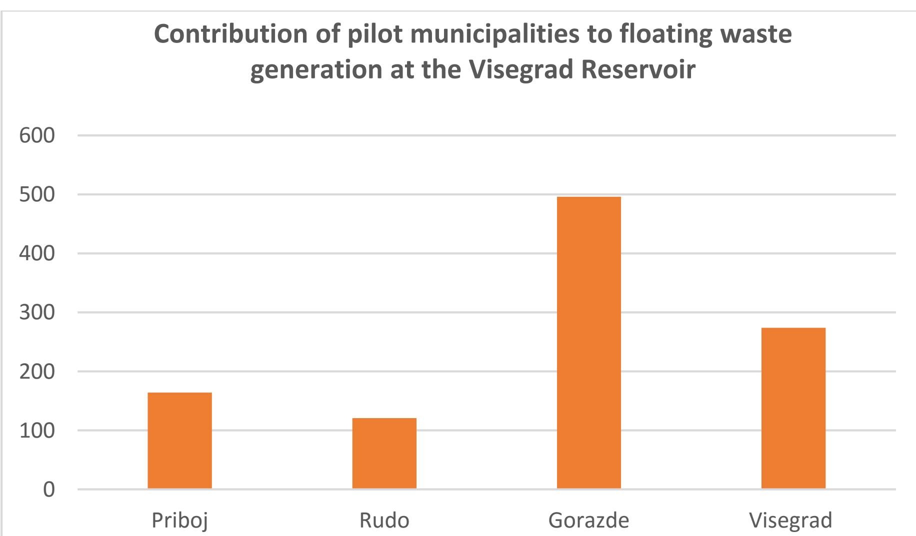


Figure 8 Contribution of pilot municipalities to the floating waste generation in the Visegrad Reservoir

Floating waste in the Visegrad reservoir is originating mostly from Gorazde Municipality.

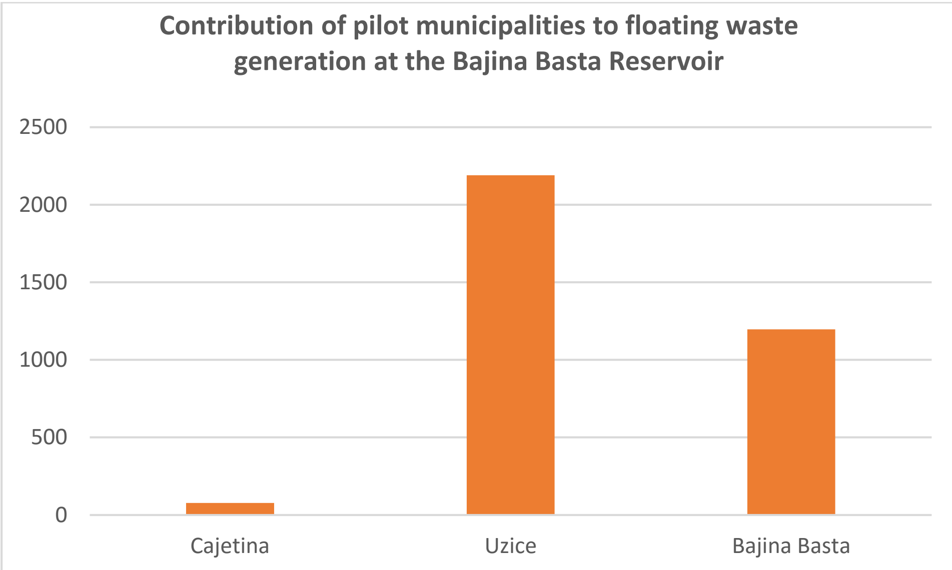


Figure 9 Contribution of pilot municipalities to the floating waste generation in the Bajina Basta Reservoir (

Although Usice Municipality runs the regional sanitary landfill, there is waste in the rural communities that is not collected and which may enter the rivers in the catchment. Uzice Municipality is, however, contributing to the floating debris in the cathcment of Morava River. Therfore, the greatest contributor to the generation of floating debris at the Bajina Basta Reservoir is the Municipality of Bajina Basta.

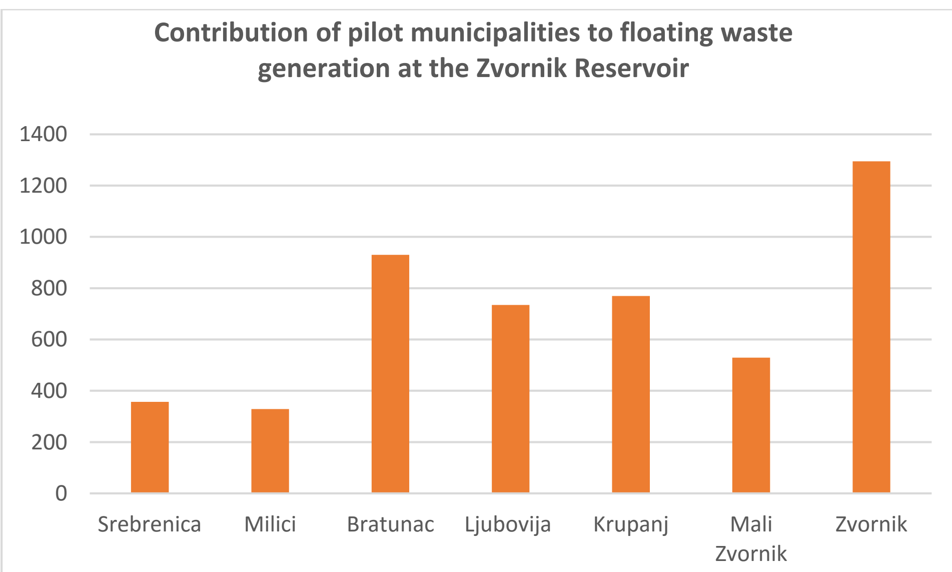


Figure 10 Contribution of pilot municipalities to the floating waste generation in the Zvornik Reservoir

Zvornik, but also Bratunac, Krupanj and Ljubovija, are the greatest contributors to the generation of floating debris in the Zvornik Reservoir.

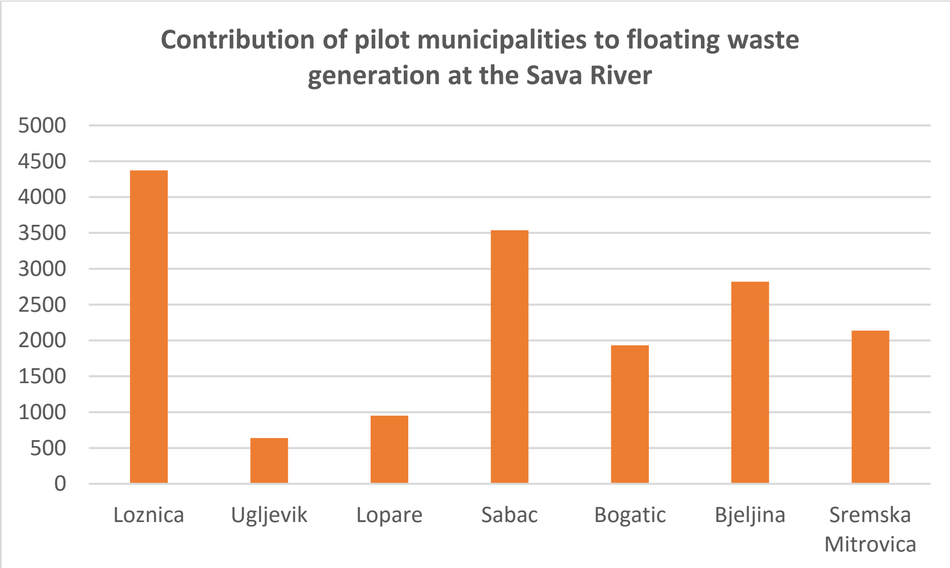


Figure 11 Contribution of pilot municipalities to the floating waste generation in the Fierzi Reservoir (Municipality of Kukes)

Loznica, Sabac and Bjeljina contribute the most to the generation of floating waste in the lower secton of Drina and Sava Rivers after the confluence.

The influence of discharged waste is significant when looking at the total pollution of Drina River, and this problem must be solved urgently taking the economic, social and cultural situations into consideration. To solve the Drina's waste problem sustainably, it is necessary to synchronize efforts at national and international level because transboundary water resources and their preservation, protection and sustainable uses are of great importance for all countries.

Considering the above, the Integrated Solid Waste Management (ISWM) Model has been developed with the aim to minimise the environmental and economic impacts by synchronised efforts at national and transboundary level.

The main areas where improvements are needed to prevent/ reduce floating debris generation are:

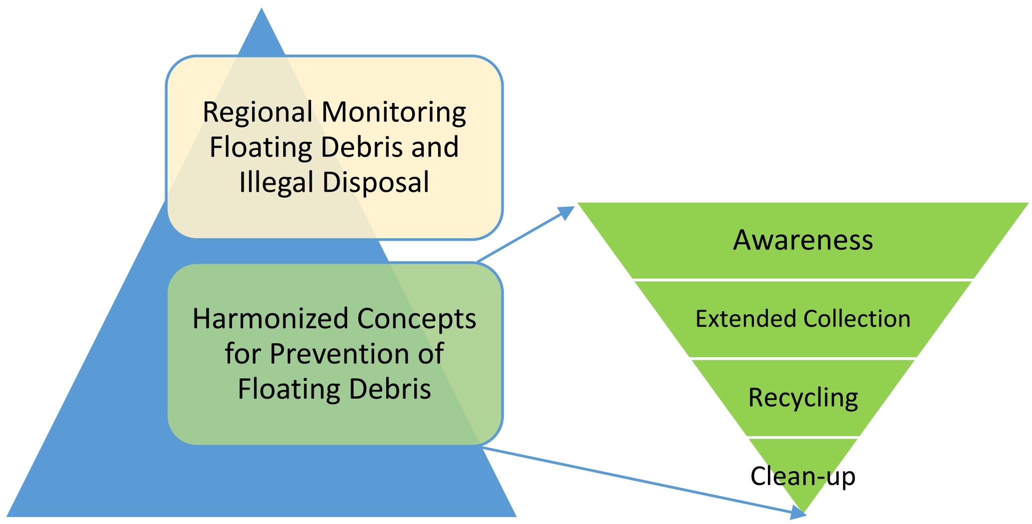
- Scarce information on the amounts, composition and spatial distribution[7] of floating, settled (at the river / reservoir floor) and stranded floating debris at the riverbanks and reservoirs` coastline.
- Incomprehensive municipal and hence national statistics on waste generation, composition and management (the latter including, as a minimum, collection rate from service users, recycling / recovery rate, the amounts of disposed waste, the inventory of sources of floating debris – non-compliant municipal landfills, illegal dumps, etc.).
- Insufficient waste management practices in the majority of pilot municipalities, constituting the root cause for the generation of floating debris: lack of organisational and financial capacity of operators to cover remote rural areas with an organised waste collection service; littering habits of population (and tourists) due to the low awareness of deriving adverse environmental and economic impacts; lack of responsiveness to newly introduced waste segregation practice in some municipalities; insufficient enforcement.

[7] Spatial distribution of floating debris is linked to river / reservoir currents, tides and river information indications about the physical source, i.e. the litter input zone and its pathway.

3. The Scope of ISWM

The ISWM Model stems from the stakeholder inputs obtained at the 1st Dialogue Platform held in Bajina Basta (Serbia*) in December 2015. It proposes concepts and tools to improve the situation in three main areas:

1. Regional monitoring system of floating debris and illegal disposal;
2. Mechanism for improved and shared waste management information / statistics; and
3. Harmonised concepts for prevention of floating debris.



The approach of the ISWM Model has been discussed and agreed throughout the process involving various stakeholders of the pilot region (municipalities, waste management operators, NGOs, private recycling companies, etc.). The process comprised two subsequent Dialogue Platforms (DP): during the 1st DP, the challenges for regional cooperation were discussed and the scope of the ISWM Model was analysed and established at the 2nd DP.

The necessary improvements that are to be carried out via regional cooperation or on a national level are laid out below separated by subject area.

3.1 Regional Monitoring of Floating Debris and Illegal Disposal

Floating debris is found in almost every river catchment - in streams, rivers and lakes (reservoirs). It is composed of a variety of materials, ranging from plastic bottles to sage brush, including also wood in some shape or form--from whole trees to lawn furniture. Biodegradable waste degrades naturally in conjunction with biological agents. Non-biodegradable debris does not really decompose. Examples of non-biodegradable floating debris include municipal waste, cans, bottles, Styrofoam, etc. The material may be floating on the surface, or it may be a water-soaked or suspended at some depth beneath the surface. It can also strand along the riverbanks and reservoirs.

Surface water runoff is an important mechanism of bringing debris into the water bodies. Runoff can move some debris directly, but primarily it increases the stream velocities and water levels so that debris along the banks is swept into the stream. As water levels increase, the width of the affected land increases and more debris can be carried on. The intensity of water flow under some flood conditions is such that the direction and width of streams (rivers) are changed, and dumped waste- buried in sandbars - can be washed loose (Cummins et al. 1983). Streambank erosion is the primary cause of wastes entering the watercourse (McFadden and Stallion 1976). The rapidly moving material is also a danger to many man-made structures such as hydropower plants (Klingman 1973, Rowe 1974). Submerged debris can build up in front of trash racks of hydropower plants turbines. High flows will also remove structures that are normally on land, as well as the loose debris that people dispose of in the watercourse.

Some monitoring[8] of the amount and type of floating debris, found in three reservoirs of hydropower plants, and assessment of the amount of floating debris which entered the Drina River in the period 2009-2011 has been performed. While the data is available at the "Jaroslav Cerni" Institute, the used monitoring methodology and results were not published.

Considering the character and behaviour of the floating debris, this ISWM Model analyses existing monitoring methodologies for ***stranded litter at riverbanks and shorelines of reservoirs*** as well as for ***illegal disposal***.

3.1.1 Best Practice of Floating Debris and Illegal Disposal Monitoring Methodologies

Systematic efforts to collect data on the amounts, distribution and composition of floating debris along the riverbanks and coastlines of the Potpec, Visegrad, Bajina Basta and Zvornik reservoirs in the Tara - Drina – Sava pilot region do not exist.

There are a number of best practice methodologies for monitoring of marine litter that are discussed herein, that can be applied in the Tara - Drina - Sava pilot region. Even though the floating debris[9] may be different from the marine litter by its composition and sources[10], it eventually reaches the sea[11]; therefore the marine litter monitoring methodologies, in the absence of tailored ones for the riverine environments, are considered to be relevant. By applying these methodologies, the contribution to the marine litter of the Drina River to the Black Sea can be established.

The most recent marine litter monitoring methodology has been developed under the DeFishGear Project[12], constituting three Guidelines:

- Methodology for Monitoring Floating debris on Beaches[13]
- Methodology for Monitoring Floating debris on the River / reservoir surface[14]
- Methodology for Monitoring Floating debris on the River / reservoir floor[15]

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[8] FLOATING DEBRIS AS A NEW PARAMETER OF THE SURFACE WATER POLLUTION, Water Management Institute „Jaroslav Cerni", Belgrade, Serbia, 2012.

[9]The term "floating debris" is used for the debris found in the riverine environments.

[10]Sources of marine litter are sea and land based, while the sources of floating debris in the Tara - Drina - Sava pilot region are exclusively land based, as the rivers are not navigable.

[11]The Drin River (Drini E Bardhe) enters the Adriatic Sea and Lepenec River inflows the Aegean Sea.

[12]http://www.defishgear.net/project/background

[13]http://mio-ecsde.org/wp-content/uploads/2014/12/Beach-litter_monitoring-methodology_complete.pdf

[14]http://mio-ecsde.org/wp-content/uploads/2014/12/Floating-litter_monitoring-methodology_complete.pdf

[15]http://mio-ecsde.org/wp-content/uploads/2014/12/River / reservoirfloor-litter_monitoring-methodology_complete.pdf

The methodology for monitoring floating debris on beaches is pertinent to the stranded floating debris at the riverbanks and coastline of the Potpec, Visegrad, Bajina Basta and Zvornik reservoirs.

Other relevant methodologies for monitoring floating debris include, but are not limited to:

- UNEP/MAP MEDPOL Monitoring Guidance Document on Ecological Objective 10:Floating debris (2014)[16]
- The NOAA Marine Debris Program (MDP)[17]
- National Marine Debris Monitoring Program (UNEP and Ocean Conservancy, September 2007)[18]
- UNEP/IOC Guidelines on Survey and Monitoring of Floating debris[19]
- Guidance on Monitoring of Floating debris in European River / reservoirs (JRC, 2013)[20]

All above methodologies focus on abundance, types, and concentration rather than analysing by potential source, as in many cases it is very difficult to connect a debris item to a specific debris-generating country or activity. Many published studies have attempted to attribute sank litter (at the riverbanks and reservoirs coastline) to a broad source, but this has often been based on local knowledge, assumptions and seemingly an absence of a rigorous methodology. For example, Willoughby (1986), found that rubbish slicks on islands surrounding the city of Jakarta, Indonesia, contained large quantities of freshwater hyacinth, a plant which does not grow on the islands, thus linking the source of the litter to rivers of the mainland. Such local knowledge and anecdotal evidence can be extremely useful. However, there are very few published studies that have set out to determine the precise source of sank litter (at the riverbanks and reservoirs` coastline) using a specific methodology; a repeatable and transferable method is desirable to allow comparison and use as a management tool. At present there is no accepted methodology that enables researchers to link litter items to their source.

Nevertheless, a number of techniques has been developed to assist in the identification of sources on the basis of litter items recorded in the marine environment e.g. the Matrix Scoring Technique to Determine Litter Sources at a Bristol Channel Beach (Tudor & Williams 2004)[21].The aim of this study was to create a method of assigning a source to litter found on beaches of the Bristol Channel but which could equally be used on any beach. The method adapts the elements from the Percentage Allocation (Method 5 - Earll et al. 1999) and Cross Tabulation Probability Scoring (Method 6 – Whiting 1998 Adaptations and different scoring schemes were tried to produce a refined 'Matrix Scoring Technique'. ***The method can be applicable to the riverine environment and reservoirs either.*** The process consists of several steps:

- generation of lists of floating debris found at the beach (riverbank or coastline of the reservoir);

[16]http://rac-spa.org/nfp12/documents/working/wg.408_06_eng.pdf
[17]http://marinedebris.noaa.gov/sites/default/files/Lippiatt%20et%20al%202013.pdf
[18]http://www.unep.org/regionalriver /reservoirs/marinelitter/publications/docs/NMDMP_REPORT_Ocean_Conservancy__2_.pdf
[19]http://www.unep.org/regionalriver /reservoirs/marinelitter/publications/docs/Marine_Litter_Survey_and_Monitoring_Guidelines.pdf
[20]https://ec.europa.eu/jrc/sites/default/files/lb-na-26113-en-n.pdf
[21]http://databases.eucc-d.de/files/documents/00000611_C10.119-127.pdf

- elimination using various degrees of likelihoods of a litter item to descend from a number of sources (Table 5); and
- percentage allocation of each litter item to specific source.

Table 5 Litter items and the likelihood of source. Key to probability phraseology: Very unlikely (UU); Unlikely (U); Possible (P); Likely (L); Very likely (LL)

Litter Category	**Sources of Floating debris**			
	Tourism (reservoir and riverbank beach)	**SRD[22]**	**Fly tipping- land**	**Land (run off)**
Sweet wrapper	LL	UU	UU	U
Food container	L	UU	UU	U
Plastic drinks bottle < 500 ml	LL	UU	UU	U
Take away food container	LL	UU	UU	U
Lollipop stick	LL	UU	UU	U
Straw	LL	UU	UU	U
Fishing line	UU	UU	UU	UU
Unidentifiable plastic fragment	P	UU	UU	U
Polystyrene piece	P	UU	UU	U
Cigarette stubs	LL	UU	UU	U
Cigarette box	LL	UU	UU	UU
Children's toy	LL	UU	UU	UU

This Matrix scoring system gives a new alternative and offers a transparent and usable method of establishing sources of floating debris stranded at the riverbanks and reservoirs coastlines.

Considering the fact that the Environmental and Economic Impact Assessment Report identified illegal dumps as sources of floating debris, it is proposed to include the inventories of these sites in the regional monitoring as well.

There are various methodologies to monitor illegal disposal but no standardised and broadly recognised method exists. These span from using remote sensing tools to physical surveys which can be regular or incidental; combinations of these methods can also be found.

3.1.1.1. Floating Debris Monitoring

The Marine Strategy Framework Directive (MSFD –2008/56/EC) requires the EU Member States to establish monitoring programmes of marine litter by 15 July 2014.The monitoring programmes have to be "coordinated", "compatible", "coherent", "consistent" and "comparable".

The pilot countries are accession countries (Albania, Kosovo* and Macedonia) and therefore the floating debris methodology should comply with the MSFD. Other applicable conventions to adhere to include: OSPAR Convention, Barcelona Convention, Helsinki Convention (HELCOM) and Bucharest Convention. A full Floating Debris Monitoring Programme should cover the following categories and stakeholders:

- Monitoring of litter on river / reservoir floor: divers` associations should be involved.

[22]SRD – sewerage related debris

*This designation is without prejudice to positions on status, and is in line with UNSCR 1244/1999 and the ICJ Opinion on the Kosovo declaration of independence

- Monitoring of litter on the water surface of the reservoir: visual observations from boats are needed.
- Monitoring of stranded waste at riverbanks and coastlines of reservoirs: trained volunteers can implement this type of monitoring instead of professional surveyors.
- Monitoring of litter in biota. Involvement of scientific institutions and specialists on fauna, birds are required.

It is also possible to monitor the sediment in the reservoir changing under the influence of the sank litter, as part of the standard monitoring of the sediment movement in the dams. Unfortunately, a globally recognised methodology does not exist and therefore we cannot propose a best practice on this.

The pilot municipalities can independently undertake monitoring of ***sank litter*** (at the riverbanks and reservoirs coastlines) only. Monitoring of floating, river / reservoir floor litter and litter in biota would require involvement of specialised institutions and experts which will absorb significant resources. Therefore, the best practice methods for monitoring of sank litter at the riverbanks and reservoirs coastlines are detailed in this ISWM Model.

A (best practice) regional monitoring of ***sank litter*** (at the riverbanks and reservoirs coastline) in the Tara - Drina - Sava Pilot Region should therefore set a harmonised approach in the following compartments:

- Spatial distribution of monitoring: site selection strategy;
- Survey method: setting sampling units, monitoring frequency and surveyed litter categories;
- Identification and making available necessary resources;
- Data handling & reporting;

The site selection strategy has fundamental consequences for the monitoring analysis, as has the selection of the survey method. Monitoring programmes are not compatible or comparable if they use the same survey methods, but different site selection strategies (e.g. special site selection on the basis of litter pollution levels, or a randomised selection of sites). It is proposed to use a combination which is sometimes referred to as, “stratified randomised sampling strategy” (e.g. OSPAR beach litter protocol).

The proposed criteria[24] should take into account the following locations:

- Riverbanks and river mouths;
- Reservoirs coastlines;
- Tourists` destinations;

Additional criteria for the selected monitoring sites are to:

- have a minimum length of 100m[25];
- be characterized by a low to moderate slope (~1.5-4.5 º), which precludes very shallow tidal mudflat areas that might be kilometres long;
- have clear access such that floating debris is not screened by anthropogenic structures;
- be accessible to survey teams throughout the year;

[24] These criteria have been taken over from the DeGishGear Methodology for Beach Monitoring
[25] The National Marine Debris Monitoring Program (UNEP and Ocean Conservancy, September 2007) sets a minimum length of 500 meters.

- be known when the most recent cleaning activities have taken place[26] in order to determine the trends of floating debris over time;
- be posing no threat to endangered or protected species, such as birds, marine mammals or sensitive vegetation.

A best practice Floating debris monitoring method comprises:

- setting sampling units,
- frequency,
- methods for identification of litter, and
- surveyed categories.

A sampling unit is defined as a fixed section of a monitoring site. A 100-metres stretch from the strandline to 10 meters back will be considered a sampling unit. Two sampling units on the same monitoring site should be monitored. The same sites should be monitored for all surveys. In order to identify the start and end points of each sampling unit permanent reference points can be used and coordinates obtained by GPS.

The monitoring frequency, as proposed in analysed methodologies, spans from every 28 days to 4 times a year.

The DeFishGear project proposes to undertake monitoring upon the following seasons:

1. Autumn: mid-September-mid October
2. Winter: mid-December-mid January
3. Spring: April
4. Summer: mid-June-mid July

Before any sampling begins, shoreline characterization should be completed for each 100m site. The GPS coordinates of all four corners of the sampling unit should be recorded. A site ID name should be created and used for the duration of the study. The site's special features, including characterization of the type of substrate (sand, pebbles, etc.), topography, land use, distances from urban settlements and river mouths, etc. should be recorded using a special "Monitoring Site Identity Sheet'. Digital photographs should be taken to document the physical characteristics of the monitoring site.

All items found on the sampling unit should be entered in the sank litter Monitoring Sheet. On the sheet, each type of item is given a unique identification number. Data should be entered in the sheet while picking up the litter item. The number of litter categories and sub-categories varies among different methodologies. There are, however, globally recognised 9 categories (Table 6) and 77 sub-categories (Annex 1) of sank litter (at the riverbanks and reservoirs coastline).

Table 6 Floating debris Categories

Class	Material Composition	Litter Code	Litter Form (and Examples)

[26] According to the National Marine Debris Monitoring Program (UNEP and Ocean Conservancy, September 2007), the monitoring should be undertaken every 28 days throughout a year; The monitoring will therefore start 28 days after the first clean up activity to avoid any skewing of the results by historical pollution not attributable to floating debris.

Class	Material Composition	Litter Code	Litter Form (and Examples)
1	Plastic	PL01	Bottle caps & lids
2	Foamed Plastic	FP01	Foam sponge
3	Cloth	CL01	Clothing, shoes, hats & towels
4	Glass & ceramic	GC01	Construction material (brick, cement, pipes)
5	Metal	ME01	Tableware (plates, cups & cutlery)
6	Paper & cardboard	PC01	Paper (including newspapers & magazines)
7	Rubber	RB01	Balloons, balls & toys
8	Wood	WD01	Corks
9	Other	OT01	Paraffin or wax

The identification and correct categorization of litter items should be facilitated by a Photo Guide[27].

Unrecognisable pieces of plastic smaller than 2,5 cm: number 117 on the survey form

Piece of plastic bag recognisable as a shopping bag: number 2 on the survey form

Piece of plastic bag recognisable as a small plastic bag: number 3 on the survey form

Figure 12 Photo Guide Developed under the OSPAR Methodology

Unknown litter or items that are not in the survey sheet should be noted in the appropriate "other item box". A short description of the item should then be included in the survey sheet. If possible, digital photos should be taken of unknown items so that they can be identified later and, if necessary, be added to the survey sheet.

The unit in which litter will be assessed on the coastline will be number of items and it will be expressed as counts of litter items per square meter (m^2). In addition, the main category types of litter items should be weighed. The results shall be statistically processed and reported in an agreed format.

By applying best practice monitoring programmes the abundance, types, and concentration, and possibly links between the potential source and specific debris-generating countries or activities can be analysed in the Tara - Drina - Sava pilot region. However, such comprehensive monitoring programmes can be costly and resource demanding in terms of qualified and skilled labour. Therefore, this ISWM Model proposes a simplified approach which is described in detail in section 3.1.2.1 below.

3.1.1.2. Illegal Disposal Monitoring

Best practice in monitoring of ***illegal disposal sites*** comprises two distinct methodologies: visual observation using remote sensing and field surveys. It does not preclude a combination of

[27] http://www.ospar.org/ospar-data/10-02e_beachlitter%20guideline_english%20only.pdf

these methods from being useful for illegal domestic waste disposal sites monitoring and mapping.

Remote sensing comprises the following steps:

1. Selecting high, moderate or medium spatial resolution remote sensors to be applied for mapping illegal municipal waste disposal sites;
2. Conduct visual identification of illegal municipal waste disposal sites observing visible indirect temporal land changes associated with illegal waste disposal such as thermal anomalies and/or vegetation: land degraded by the presence of illegal waste is usually noticeable for its spectral signature stability over time in comparison to other features such as urban areas, river / reservoir, salt evaporation pools, cultivation systems, etc.

Limited studies[28] have been conducted into techniques to analyse remote sensing data[29] towards illegal waste disposal sites monitoring and mapping. However, existing studies do provide some insight into the future opportunities likely afforded by different remote sensors and methods.

Silvestri and Omri[30] developed a method to map illegal dumps based on the spectral signature of stressed vegetation associated with the presence of (illegal) waste. Using this method, a spectral library with accompanying statistics that define the spectral characteristics of seven illegal waste disposal sites[31] was created. The resultant map was then validated; approximately 12% of the identified sites were actually illegal dumps. Maximum likelihood classification was achieved by analysing both digital orthophotos and very high-resolution IKONOS imagery to map illegal waste dumpsites.

The visual data observation using remote sensing requires utilisation of highly specialised staff. Data transformation alongside ISODATA[32] unsupervised classification can be useful for monitoring and mapping illegal domestic waste disposal and it does not require specially trained staff.

Various methodologies[33] for designing ***field surveys to locate, qualify and quantify illegal dumps*** exist. The method would vary depending on the survey objective: creating inventories of illegal dumps[34] and preparing for clean-up, or planning their closure and remediation. If closure and remediation are foreseen, the qualification and quantification of an illegal dump is followed

[28] Yonezawa, C. Possibility of monitoring of waste disposal site using satellite imagery. J. Integr. Field Sci. 2009
[29] Remote sensing data are acquired through satellites such as LANDSAT, ALOS AVNIR-2, ALOS PALSAR, and FORMOSAT-2 (moderate resolution) and ALOS PRISM, IKONOS (high resolution).
[30] Silvestri, S.; Omri, M. A method for the remote sensing identification of uncontrolled landfills: Formulation and validation. Int. J. Remote Sens. 2007
[31] Biotto, G.; Silvestri, S.; Gobbo, L.; Furlan, E.; Valenti, S.; Rosselli, R. GIS, multi-criteria and multi-factor spatial analysis for the probability assessment of the existence of illegal landfills. Int. J. Geogr. Inf. Sci. 2009
[32] ISODATA is a method of unsupervised classification using Algorithm splits and merged clusters; computer runs algorithm through many iterations until threshold is reached: http://web.pdx.edu/~jduh/courses/Archive/geog481w07/Students/Vassilaros_ISODATA.pdf
[33] chrome-extension://klbibkeccnjlkjkiokjodocebajanakg/suspended.html#uri=http://www.litter.vic.gov.au/litter-prevention-tooklits/local-litter-measurement-toolkit; https://webcache.googleusercontent.com/river / reservoirrch?q=cache:0mzUsW9hslgJ:https://www.ru.ac.za/media/rhodesuniversity/content/environmentalscience/Group%25202.docx+&cd=1&hl=mk&ct=clnk
[34] Inventories of illegal dumps may be useful for assessing the climate change impact of landfill gas emissions.

by a Risk Assessment. A profound Risk Assessment may require additional investigations, including biological, geological / hydrogeological monitoring and groundwater sampling.

The staged approach for the implementation of field investigations is summarised as follows:

1. Undertaking a stakeholder survey to focus the field investigations into the areas which are the most prone to emerging of illegal dumping;
2. Compare the results of the stakeholder survey and previous inventories of illegal dumpsites;
3. Establish a grid on a map with sufficient scale, covering the country territory into zones / polygons; classify these zones by the likelihood of illegal dumpsites emerging – high, moderate and low, based on the stakeholders` input and previous inventories. The zones may have an area of $1km^2$ or more. For countries with high density of illegal dumpsites the grid will be more condensed;
4. Develop visual observation sheets to record the locations, size, composition of dumped waste, distance from pathways (rivers, gullies, river / reservoir coast, reservoirs, etc.);
5. Plan and execute the field investigations: the resources needed encompass manpower (volunteers, staff of the waste management operators, civil society organisations, etc.), GPS devices, Clipboard for each surveyor; Recording sheets; pencils;
6. Design clean-up and prevention programmes.

To design successfully an illegal dumps inventory, a survey of public should be undertaken. An example of a survey questionnaire is provided in Annex 2. The survey should answer which areas are most likely prone to illegal dumping emerging, i.e. gullies, riverbanks, roads, etc. Stakeholders should also help in the identification of the potential locations and size of dumpsites, as well as composition of dumped waste and distance from a pathway potentially leading to the river / reservoir. The information collected from stakeholders should be crosschecked with available information on illegal dumps inventories collected in the past.

Additional preparations are required for closing and remediating the illegal dumpsites, including:

- The identified illegal dumpsites should be classified (based on the observations and records) as per the following attributes:

    - Sites below and above $500m^2$ of area;
    - Sites where there is high probability for dumping of hazardous waste;
    - Sites located within and outside a corridor of 20 meters along a pathway;

- Risk Assessment should be undertaken (including biological, geological / hydrogeological investigations and water sampling of the nearby river) for illegal dumps which have an area above $500m^2$, there is some hazardous waste dumped and which are located at a distance of 20m from a pathway.

Then, preparation of field observation and identification can start: the country area should be divided into sufficient number of zones (polygons) by the identification of horizontal and vertical “divide“ lines on a map. The zones are purely to make the data collection process more efficient and to allow for no part of the country to be left out. Each zone should be classified by the likelihood for illegal dumps emerging. Once the zones are set, the planning of resources and the data collection method will take place.

Inventories of illegal disposal should be used for designing of suitable ***clean-up*** and especially for ***prevention programmes*** to eliminate or reduce illegal dumping practices. The key to successfully using this practice is increasing public awareness of the problem and its implications. Illegal dumping clean-up and prevention programmes use a combination of:

1. Clean up efforts
2. Community outreach and involvement
3. Targeted enforcement
4. Tracking and Evaluation

In the Illegal Dumping Preventing Guidebook[35] of the US Environment Protection Agency (EPA), a tool is developed for preventing illegal dumping focusing on the four programmatic areas outlined above (Box 1.).

Box 1. Four Programmatic Areas for Preventing Illegal Dumping (US EPA, 1998)

Cleanup Efforts
Cleanup projects will require a coordinated planning effort to ensure that adequate resources and funding are available. Once a site has been cleaned, signs, lighting or barriers may be required to discourage future dumping. Signs should indicate the fines and penalties for illegal dumping, and a phone number for reporting incidents. Landscaping and beautification efforts may also discourage future dumping, as well as provide open space and increase property values.

Community Outreach and Involvement
This may be the most important tool in ensuring that this practice is effective. The organization of special cleanup events where communities are provided with the resources to properly dispose of illegally dumped materials increases the understanding among residents of illegal dumping impacts and supplies opportunities to correctly dispose of materials which may otherwise be illegally dumped. Integration of illegal dumping prevention into community policing programs or use of programs such as Crime Stoppers may also be an effective way to increase enforcement opportunities without the additional cost of hiring new staff. Producing simple messages relating the cost of illegal dumping on local taxes and proper disposal sites will aid in eliminating the problem. Having a hotline where citizens can report illegal activities and educating the public on the connection between the illegal dumping and floating debris will decrease illegal waste dumping.

Targeted Enforcement
This tool involves the use of ordinances to regulate waste management and eliminate illegal dumping through methods such as fines, cost recovery penalties for cleanup, and permit requirements for waste management activities, to name a few. These fines and penalties can be used to help fund the prevention program or to provide rewards to citizens who report illegal

[35] http://nepis.epa.gov/Exe/ZyNET.exe/2000CNVU.txt?ZyActionD=ZyDocument&Client=EPA&Index=1995%20Thru%201999&Docs=&Query=&Time=&EndTime=&River /reservoirrchMethod=1&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&UseQField=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A%5CZYFILES%5CINDEX%20DATA%5C95THRU99%5CTXT%5C00000009%5C2000CNVU.txt&User=ANONYMOUS&Password=anonymous&SortMethod=h%7C-&MaximumDocuments=1&FuzzyDegree=0&ImageQuality=r75g8/r75g8/x150y150g16/i425&Display=p%7Cf&DefSeekPage=x&River /reservoirrchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1

dumping activities. Other recommendations for this tool include training of staff from all municipal departments in recognizing and reporting illegal dumping incidents, and dedicating staff who have the authority to conduct surveillance and inspections, and write citations for those caught illegally dumping.

Tracking and Evaluation
This tool measures the impact of prevention efforts and determines if goals are being met. Using mapping techniques and computer databases allows officials to identify areas where dumping most often occurs, record patterns in dumping occurrence (time of day, day of week, etc.), and calculate the number of citations issued and the responsible parties. This allows for better allocation of resources and more specific targeting of outreach and education efforts for offenders.

The above tool highlights the most important issues which need to be examined when creating a clean-up and prevention programme. These include:

- The locations of persistent illegal dumping activity.
- The types of waste that are dumped and the profile of dumpers.
- Possible driving forces behind illegal dumping such as excessive user fees, restrictive curbside trash pickup, or ineffective recycling programmes.
- Previous education and cleanup efforts that have been used.
- Current prevention programmes and local laws or ordinances that address the problem.
- Existing sources of funding and additional resources that may be required.

Hence, the best practice methods for monitoring of illegal dumping require careful planning involving desk research and targeted surveys; the execution itself is a matter of good coordination of previously trained staff, while the reporting and record keeping should be designed in such a way that the dumpsites` inventories can be used for various purposes: to design clean – up programmes, closure and remediation of landfills posing higher environmental risk and setting enforcement programmes against illegal dumping. The most important outcome of monitoring activities executed concurrently with clean-up activities is the raising of public awareness.

Having in mind the limited resources of pilot municipalities, a simple monitoring programme for illegal disposal is outlined in section 3.1.2.2 below.

3.1.2 Proposed Monitoring Methods for Floating Debris and Illegal Disposal

The proposed approaches will simultaneously allow for coordinating and comparing the results on a regional scale and maintaining comparability to the results achieved by using harmonised monitoring methodologies across the pilot region. Another added value of the implementation of the monitoring of sank litter (at the riverbanks and reservoirs coastline) and illegal disposal will be the raising of public awareness.

Key to the success of any regional monitoring programme will be the community involvement and more specifically adaptive co-management. Adaptive co-management relies on the involvement of multiple level actors and promotes building relationships between these levels in order to attain a functional and reliable management system (Cundill and Fabricius, 2008).

In the pilot municipalities, municipal administration, councillors and Public Communal Enterprises (PCEs) will play a crucial role in managing floating debris and illegal disposal monitoring programmes. Community leaders need to be elected and start involving citizens in decision making and action. In this way, a community-mentality is gained whereby people act towards bettering their own area for the greater good of the whole community. If communities were more educated on the impacts of floating debris and illegal dumping and identified this as a social deviation, this could potentially begin to change their habits (McKinlay and Starkey, 1998).

3.1.2.1 Floating Debris Monitoring

The Guidance on Monitoring of Marine Litter in European Seas[36] recognises that the full scope is demanding in terms of organisation and resources; therefore, it suggests integration of monitoring with measures such as clean-up campaigns. ***Consequently, the first step to introducing a comprehensive floating debris monitoring in the Tara - Drina - Sava Pilot Region would be to undertake sank litter (at the riverbanks and reservoirs coastline) monitoring.***

The Guidance on Monitoring of Floating Debris in European Seas recommends using the citizen-science based Marine Litter Watch[37]protocol (developed for the needs of the European Environment Agency - EEA). As stated elsewhere, even though this protocol has originally been designed for marine litter, it can also be useful for collecting sank litter (at the riverbanks and reservoirs coastline) data. It is based on a simple counting mobile application, which enables volunteers to count litter on beaches and submit the data on a central public data base that is hosted by the EEA. The process of floating debris monitoring and the interface of the mobile application are presented in the following Figure 13:

Figure 13Sank litter (at the riverbanks and reservoirs` coastline) Monitoring-Overall Approach (left) and Interface of the Mobile Application Marine Litter Watch

Guidance[38]on implementing the beach cleaning and monitoring protocol using the Marine LiiterWatch mobile application describes:

- How to join or create a community;

[36]https://ec.europa.eu/jrc/sites/default/files/lb-na-26113-en-n.pdf
[37]http://www.eea.europa.eu/themes/coast_river / reservoir/marine-litterwatch
[38]http://www.eea.europa.eu/themes/coast_river / reservoir/marine-litterwatch/get-started/how

- How can communities help monitoring floating debris;
- How to monitor and report litter found on beaches;
- How to generate data to support floating debris management and raise awareness;

As stated elsewhere, coordination at a regional/national level is required for the regular implementation of the monitoring system for sank litter (at the riverbanks and reservoirs coastline).The possible regional process of floating debris monitoring is illustrated in Figure 14.

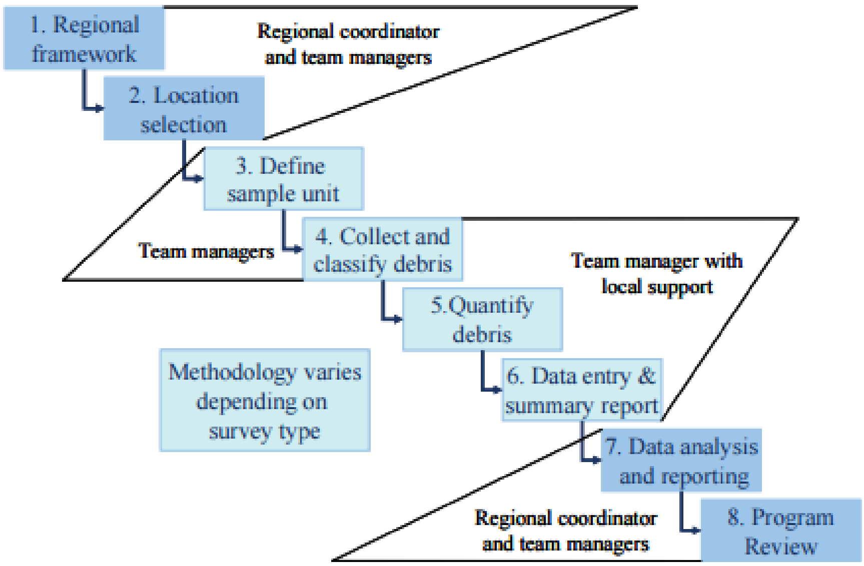

Figure 14 Regional Sank litter (at the riverbanks and reservoirs' coastline) Monitoring Process

At the 2nd Dialogue Platform[39], stakeholders proposed the following institutional setup of the monitoring activities to be performed in spring 2016 session:

- Regional Coordinator: SWG Secretariat
- National Coordinators: SWG Offices
- Local Coordinators: Public Communal Enterprises (PCEs) and volunteers

Tasks of the regional coordinator are:

- identification and setting up of survey sites
- contact with the organizations/institutions carrying out the surveys
- development & maintenance of the survey system
- training of surveyors
- entering the data into the database/QA of data
- maintaining the database
- data analysis
- reporting
- (further) development of methodology
- participation in national and international workshops, working groups, etc.

For the overall coordination of four survey sites ca. 330 hours will be necessary in order to set up the monitoring system and about 250 hours/year will be required to maintain the system[40].

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[39]The 2nd Dialogue Platform Session has been held in March 2016 in Prizren.

Any long term floating debris assessment programme will require a specific and focussed effort to recruit and train field staff and volunteers. Consistent, high quality training is essential to ensure data quality and needs to explicitly include the development of operational (field based) skills. Staff education programmes should incorporate specific information on the results and outcomes from the work so that staff and volunteers can understand the context of the floating debris assessment programme. In summary, there are a number of key issues that need to be considered when engaging volunteers in floating debris assessments and these include (adapted from Sheavly 2007):

- Volunteers need to be properly trained with hands-on training exercises and supportive training materials and programme manuals that detail responsibilities and procedures;
- Local coordination and management is needed to ensure that volunteers are available when needed and monitoring schedules are followed;
- Effective and frequent communication is a key element in keeping volunteers engaged and up-to-date with the programme activities, including how their monitoring activities are supporting resource and conservation management efforts;
- Succession plans are needed to ensure that as some volunteers retire or leave the programme, new volunteers are trained to provide replacements;
- Regular recognition efforts of the volunteers and their efforts can be effective in maintaining their involvement in the monitoring programme (e.g. media coverage, presentations by monitoring group members and/or management groups at local civic meetings, thank you notes, various memorabilia including t-shirts, hats, etc.);
- The monitoring programme needs to be realistic in terms of the expectations of labour and the length of time needed to conduct this type of study;
- Regional coordinator needs to make regular visits to sites to ensure that training is relevant and appropriate to the needs of the survey. Ideally follow-up visits should be scheduled to coincide with re-training efforts and other activities;
- Where appropriate, typically where local people are limited by financial or other resources, monetary support may be required to cover transportation expenses related to their efforts.

While the very nature of a volunteer is not to expect anything in return for his/her efforts, people do like to know that their efforts are meaningful and appreciated. In more general terms the following issues are also relevant when managing volunteer programmes (adapted from the "Model Code of Practice for Organisations Involving Volunteer Staff"; Volunteering Australia 2007)[41]:

- Interview and employ volunteer staff in accordance with anti-discrimination and equal opportunity legislation;
- Provide volunteer staff with a healthy and safe workplace;
- Provide appropriate and adequate insurance coverage for volunteer staff;
- Define volunteer roles and develop clear job descriptions;
- Differentiate between paid and unpaid roles;
- Provide all staff with information on grievance and disciplinary policies and procedures;
- Reimburse volunteer staff for out of pocket expenses incurred on behalf of the organization;
- Treat volunteer staff as valuable team members, and advise them of the opportunities to participate in agency decisions; and
- Acknowledge the contributions of volunteer staff.

[40] https://ec.europa.eu/jrc/sites/default/files/lb-na-26113-en-n.pdf
[41] http://volunteeringaustralia.org/wp-content/uploads/VA-Model-Code-June-2005.pdf

3.1.2.2 Illegal Disposal Monitoring

The pilot municipalities do not have an efficient monitoring system for illegal dumpsites and do not know who needs to be fined for dumping or where all the illegal dumpsites are actually located. Therefore, a simple approach, applicable on regional scale is proposed.

The monitoring of illegal sites and creation of their regional inventory will not require site selection. Ideally all illegal dumps should be monitored. However, as a first step, only those located along the rivers, river / reservoir coast and lakes / reservoirs will be monitored.

Similarly to the Floating Debris Monitoring approach, the first step in reducing the impacts will be to create inventories of illegal dumpsites upon the clean-up campaigns. Therefore, the most suitable method to track the locations of dumpsites, volume and provisional composition of fly tipped waste will be the one developed by the initiative "Let`s Do It World"[42] - a civic-led mass movement that began in Estonia in 2008 when 50,000 people united together to clean up the entire country in just five hours.

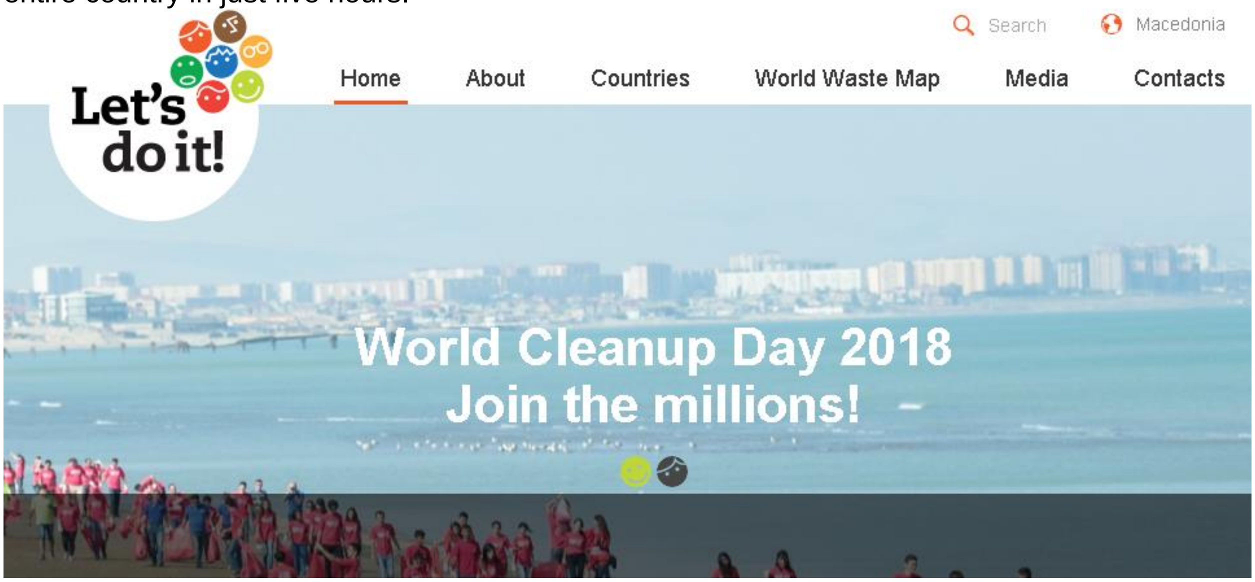

Figure 15 "Let`s Do It World" Platform

To date, 112 countries and 13,8 million people have joined this platform to clean up illegal waste. All the pilot countries joined the initiative; however, the driving forces behind the implementation of clean-up activities are non-governmental organisations and not the municipalities. The significance of organising clean-up campaigns for generating the inventories of illegal dumpsites and planning prevention / enforcement programmes is yet to be recognised by a broad range of stakeholders in the Tara - Drina - Sava pilot region. Illegal dumping is an extremely complex issue and therefore implementing monitoring and clean-up programmes requires all stakeholders, including the government, local municipality, counsellors and community members, to participate if this problem is to be eradicated.

The method applied by the "Let`s Do It World" takes the following steps:

- Recruiting ambitious leaders to run the nationwide cleanups;
- Mobilizing various organizations, experts and volunteers;

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[42] https://www.letsdoitworld.org/about/overview/

- Training the participants in the campaign;
- Conducting the cleanup campaign by using technology (a mobile application “Trash Out”[43], shown on Figure 16), to map the illegal dumpsites:
    - Taking a photo documentation on site;
    - Locating the site using GPS on a global satellite map;
    - Estimating the quantity and composition of dumped waste.

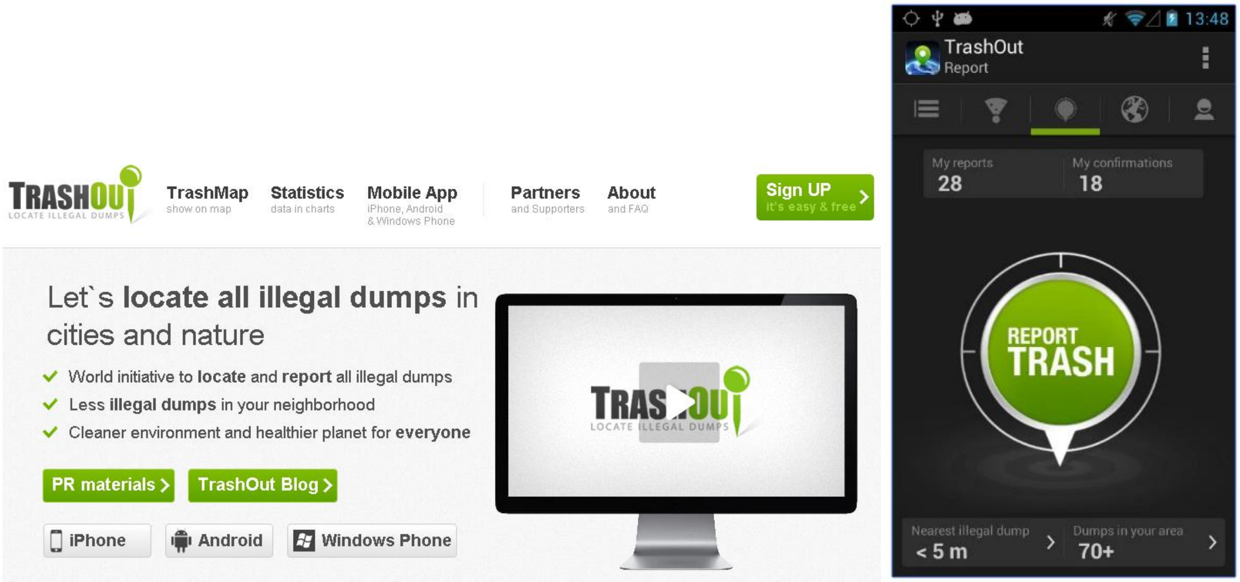

Figure 16 Trash Out Mobile Application

Ideally, the pilot municipalities should organize regionally coordinated cleanup campaigns at least twice a year. The same setup should be implemented as for the sank litter cleaning events. Preferably, the cleanup actions for both monitoring of sank litter (at the riverbanks and reservoirs coastline) and illegal disposal should be coordinated by regional coordinators and should take place in the same periods.

Information obtained from those cleanup campaigns should be used to design prevention programmes.

4. Improved and Regionally Harmonized Waste Statistics

In the Environmental and Economic Impact Assessment Report for the Tara - Drina - Sava pilot region, an attempt was made to quantify the relative contribution to the floating debris generation by each municipality. Comparative analysis looked first at waste generation rates and quantities of waste collected versus waste not collected. Waste not collected was estimated by multiplying the per-capita waste generation figures and the population not covered by a regular waste collection service. It was assumed that the waste not-collected was dumped illegally at various locations, from where, taking the closest pathways (water courses and river / reservoir currents) it joined the stream of floating debris. Analyses showed that both the figures of waste generation and the percent of service coverage were based on estimations. Furthermore, these estimations were based on different methods. Therefore, it is of utmost importance for setting and monitoring suitable floating debris prevention programmes, to

[43] https://www.trashout.ngo/

establish waste statistics` related (benchmark) indicators and design regionally harmonized methodologies for these indicators generating.

Benchmark indicators are required to deliver a well-functioning ISWM system. The key waste statistics related indicators are set in the Commission Regulation (EU) No 849/2010 of 27 September 2010 amending Regulation (EC) No 2150/2002 of the European Parliament and of the Council on waste statistics[44].

For the comparisons on the regional scale, the following indicators are proposed:

- Waste generation (kilograms per capita and year)
- Waste Composition
- Waste collection rate (tonnage of waste not collected and/or percentage of generated waste)
- Waste recycling rate (tonnage of waste separately collected by or voluntary drop off centers and/or percentage of generated waste)

This ISWM Model proposes regionally harmonized methodologies for collecting and evaluation data on waste generation & composition and waste collection rate (service coverage).

4.1 Methodology for Determining Waste Generation and Composition

Reliable data on waste generation and composition can be obtained only from waste sampling analyses. Waste sampling analyses are indispensable instruments to obtain waste generation rates and compositional data and enable waste management measures to be planned, monitored and optimized. Currently, the pilot regions have no systematic approach or standardised methodology for the analysis of solid waste.

The waste sampling methodology legally set in Serbia and developed with the involvement of the Faculty of Technical Sciences, Department of Environmental Engineering and Safety and Health from Novi Sad, for collecting data on waste generation and composition was discussed at the 2nd Dialogue Platform (DP) in Banja Koviljaca. For the most DP attendants, the presented methodology was acceptable. The Municipalities of Bjelo Polje and Prijepolje have already implemented the methodology upon waste sampling analyses and they were able to share hints on the selection of collection vessels intended for screening for the composition related analyses. They have been supported by consultants using grant funds. Others, however, raised their concern that even though the methodology was not resource demanding, its implementation would require training and other support.

These concerns should reach higher decision making levels in order to make the necessary resources available. It is of utmost importance as any planning of actions intended for reducing the floating debris must be grounded in reliable waste generation (and composition) statistics. In addition, waste sampling analyses must apply a regionally harmonised methodology.

[44] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:253:0002:0041:EN:PDF

Such a regionally accepted and reliable sampling method[45] should take into account the following steps:

1. Pre-Investigation
2. Analysis Design and Planning
3. Execution of Waste Analysis
4. Evaluation of Waste Analysis

4.1.1 Pre-Investigation

The pre-investigation stage is concerned with the provision of necessary background information for the pilot municipality intending to undertake a waste analysis.

The following background information to a waste analysis is suggested:

1. General Description of the Area under Investigation:
   a. Identification of the area or portion of the area to be assessed, its location and surface area;
   b. Identification of the various relevant districts.

2. General Population Information and Waste Management Information: The following data could be important to collect:

   a. General Population Information;
   b. Number of inhabitants;
   c. Number of households;
   d. Types and proportions of residential structures.

3. General description of the organisation of the waste management system (actors, responsibilities, etc.);
4. Type of waste streams produced and collected;
5. Description of waste container systems in use such as household bins, communal bins and bin storage capacities;
6. Average numbers of households and/or persons using bins;
7. Total bin volume; spatial distribution of bins; collection intervals;
8. Method of waste collection such as open truck or refuse collection vehicles compactor and types of waste collected;
9. Description of collection rounds;
10. Disposal methods such as landfill.

Waste management stratification is important to derive statistically accurate information. Generally, stratification is not compulsory for a waste analysis programme, but may have advantages for both accuracies of results and additional waste management information (e.g. tourism). In practical terms it will be useful to set up a stratification matrix at the initial planning stage. This matrix will show if the necessary data and information for stratification are available. If the municipality would choose to perform stratification, it should consider the following criteria:

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[45] The elements of the waste sampling methodology have been extracted from the SWA-Tool, Development of a Methodological Tool to Enhance the Precision & Comparability of Solid Waste Analysis Data, 5th Framework Program, EU, https://www.wien.gv.at/meu/fdb/pdf/swa-tool-759-ma48.pdf

1. Seasonality: Generally, a seasonal waste analysis should be done based on a minimum of three and ideally four season sorting campaigns. Since waste analysis results tend to be similar for spring and autumn, one of these two seasons may be left out;
2. Residential Structure: The following types of residential structures and locations have been demonstrated to act as significant stratification criteria:

    a. Rural areas
    b. Suburban areas
    c. Inner city areas
    d. Multiple dwellings
    e. Multi storey buildings
    f. Tourist accommodation (if it can be separated by area)

3. Bin Size: Generally, waste analysis stratification according to the following bin sizes can be recommended:

    a. Bins up to 240 litres volume
    b. Bins above 240 litres volume

4. Collection System: it is important to delineate those areas with and without separate collection of recyclables;
5. Source of Waste: stratification according to the source of waste as either household waste or commercial waste is recommended where possible; tourism waste can be added as well;
6. Collection Day: whenever a significant difference between waste composition/generation is evidenced for different days of the week, it is recommended these days be used as stratification criteria.

4.1.2 Analyses Design and Planning

The design and planning are comprised of the following elements:

1. Type of sampling: This may encompass the whole area of a municipality or a defined part of a municipality although the former will generally be the case in order to obtain waste analysis results, which are representative of the whole area under investigation;
2. Number and type of strata: the decision concerning the number and type of strata to use in a waste analysis depends on several factors including the waste management information needs of the municipality, the availability of adequate waste planning data and sufficient resources;
3. Level of sampling: There are three principal levels at which sampling may take place, namely:

    a. Inside the household/business such as from an internal waste bin
    b. Outside the household/business such as from an external waste bin/container such as used in kerbside collection
    c. A refuse collection vehicle (RCV)

4. Type of sampling unit: There are three main sampling units that could be used to obtain the necessary waste samples for analysis, namely:

    a. A specific waste bin volume such as 240 litres (l) or 1100 l

b. A specific weight of household/commercial waste such as 100 kilograms (kg)
c. A specific number of persons who generate relevant waste such as 30 persons

5. Calculation of the Number of Sampling Units and Sample Size: depends on 2 main criteria:

    a. The variation (heterogeneity) of the waste, expressed by the natural variation coefficient. This variation coefficient is usually unknown and has to be estimated on the basis of results from past waste analyses
    b. The desired accuracy of the results

6. Generation of Random Sample Plan: According to the analysis design it is necessary to randomly sample addresses either from the whole parent population or from the relevant sub-populations according to the designated stratification criteria (stratified random sampling);
7. Duration of an Individual Waste Analysis Campaign: it is recommended that the duration for waste sampling and sample collection covers a minimum of one week's waste. This will allow the sampling of waste to be spread over each working day (Monday to Friday) covering the full collection cycle and any potential variation due to non-collection of waste at weekends.

4.1.3 Execution of Waste Analyses

Each sample collected should be tagged with a unique identification reference code, capable of use in wet conditions. The following minimum data should be collated and recorded for each individual sample by the waste sample collection team at the time of collection:

a. Unique identification reference code
b. Sample address
c. Date of collection
d. Number and type of waste containers collected
e. Visual estimation of % filling level of waste containers collected
f. Visual estimation of % filling level of other containers at one address to get the information for calculating the waste quantity

Each sampling unit is weighed and the weight is documented. The waste generation per capita is obtained by dividing the average daily weight with the number of population in the sampling unit.

Each sampling unit has to be sorted separately. The sampling unit is sorted into the categories according to a developed Sorting Catalogue. The Sorting Catalogue contains 13 compulsory primary categories and 35 recommended secondary waste categories. Sorting is illustrated in Figure 17 below.

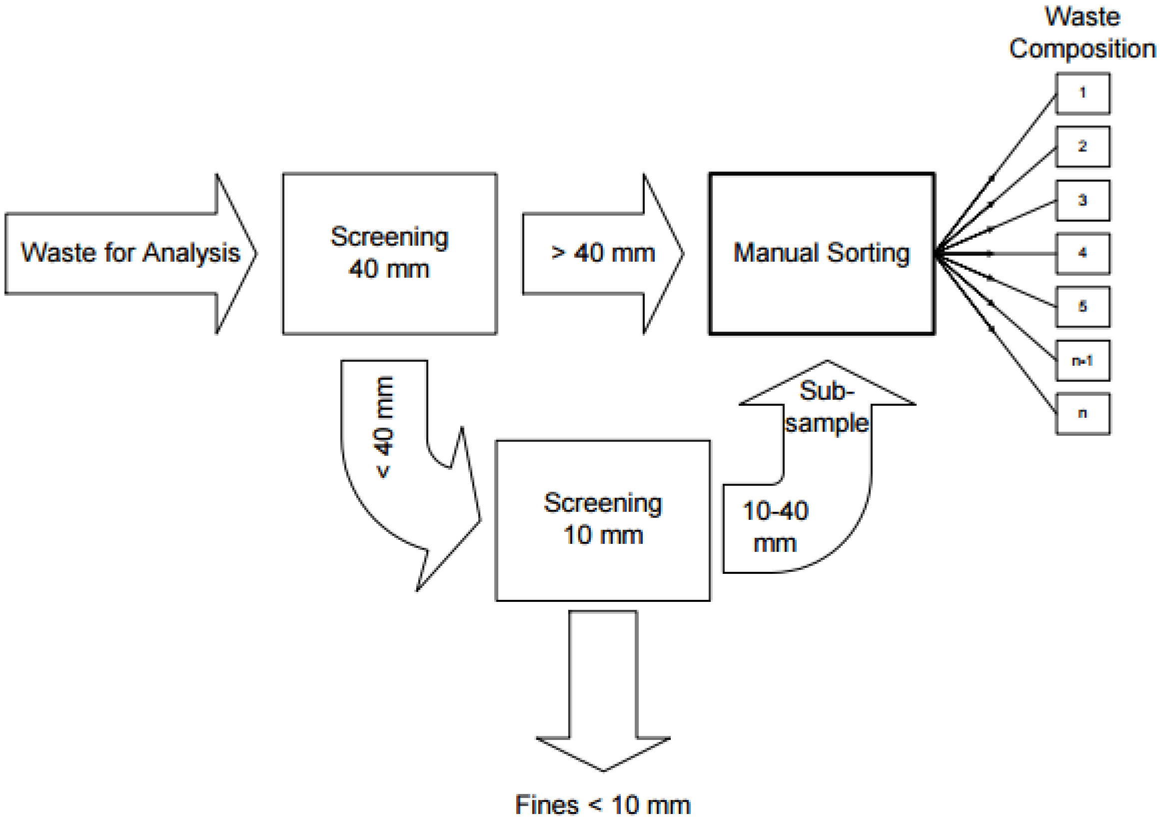

Figure 17 Waste Sorting

4.1.4 Evaluation of Waste Analyses

The basis for the evaluation are the basic weight results (kilograms per capita) and the outcomes of the sorting procedure (waste composition in kilograms) for each sampling unit. The basic weight results shall be transferred from the record sheet (paper copy) to the Excel sheet.

The following statistical values have to be calculated for each waste category, each campaign and for the total result:

- Mean
- Standard deviation
- Variation coefficient
- Relative confidence interval (%)
- Composition (%)

Extrapolation is another important element upon the waste sampling exercises. It comprises the conclusion from the obtained sample results to the total waste quantity. Two cases may be distinguished:

- Case 1: The investigated waste type of an area (e.g. daily household and commercial waste) is permanently weighed. Thus, the total waste amount is known. The total sample result (waste composition) can be apportioned to the total waste quantity, thus the extrapolation is not needed.

- Case 2: The total amount of the investigated waste type is unknown. This is the case if only household waste is subject of the waste analysis, but is not weighed separately (only the mixture of household and commercial waste is weighed). Hence, an extrapolation of the sample results to the waste of an area is necessary.

The waste quantity can be extrapolated by using the following data as a reference value:

- number of sampling units, or
- number of inhabitants, or
- number of households.

The format for the presentation of the results is an important aspect of the waste analysis methodology and will affect the comparability of waste analysis results between different waste analyses. The regionally harmonised methodology should derive standard reporting forms and procedures.

4.2 Methodology for Determination of Waste Collection Service Coverage

Currently, the pilot regions have no systematic approach or standardised methodology for the waste collection service coverage. Such a methodology should stem from comprehensive analyses of the following issues:

1. Statistical information on population, number of households and businesses (commercial and industrial establishments) in every settlement; map of spatial distribution of settlements and businesses and the road network, preferably in GIS format;
2. Overall figures of waste generation per capita for a certain period (day, week, month, year, as appropriate);
3. Calculations of the required containers sizes / numbers and number of lifts / frequency of lifts to cater the waste generated;
4. Up-to-date customer base including:

    a. Customer sector (households, businesses, institutions and industries)
    b. Actual container sizes / numbers
    c. Actual number of lifts/frequency of lifts
    d. Changes: larger businesses being replaced by smaller businesses or vice versa and seasonal variations to customer base e.g. return of immigrants, weekend houses, tourist accommodation

5. Map (in GIS format) indicating the actual placement of containers and their respective sizes in relation to the distribution of customers and waste generation;
6. Calculation of the waste quantities not collected as a percent of the total waste generated;
7. Calculation of the required container sizes / numbers and numbers of lifts to cater the waste not collected at present;
8. Update the customer base with service users not covered with a regular waste collection service;
9. Map (in GIS format) indicating where the adequate containers should be placed to be accessible by the service users in accordance with the selected collection system (kerbside or drop of, as well as waste segregation or mixed waste collection).

A detailed methodology should be developed and agreed among the pilot regions / municipalities. It would contribute to a better planning of the waste collection service extension and to reducing the floating debris.

5. Floating Debris Prevention Activities

The overall goal of the floating debris prevention activities is to improve the current waste by strengthening the organisational and financial capacity of operators to cover remote rural areas with an organised waste collection service and improve the recycling rate. Hence, the common objectives of the Tara - Drina - Sava pilot region read as follows:

1. Extension of rural waste collection (%);
2. Improved rate of plastics recycling (%);
3. Reduced illegal dumping (% of population or volume of waste);
4. Reduced floating debris (%).

This ISWM Model focuses on best practices on extending waste collection in remote rural areas and provides concepts for planning of waste collection routes, defining also the required volume of containers and refuse vehicles and monthly fuel costs for each pilot municipality.

5.1 Best Practices on Rural Waste Collection

Best practices on rural waste collection presented in this ISWM Model have been collected from the following sources:

- Municipal Waste Learning Tool, Lesson 3 – solid waste collection[46]
- Guide to Developing Community Solid Waste Facilities[47]

By using the ***Municipal Waste Learning Tool***, the pilot municipalities can understand problems and concerns associated with MSW collection, compare and contrast privately and publicly operated systems, understand the types of collection systems, identify the benefits associated with the use of transfer stations, prepare an economic analysis of transfer stations and understand the design issues associated with transfer stations.

The major benefit for the pilot municipalities from using this tool is the possibility of analyzing:

1. Total required collection time
2. Number of vehicles and containers required
3. Number of customers a truck can serve per day
4. Collection frequency
5. Monthly costs of fuel

The tool sets an equation for calculating the total required collection time as follows:

$Y=a+(bc \times N)+bkm+c(d)+e+f+g$

Table 7 Input data to calculate total collection time

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[46] http://msw.cecs.ucf.edu/collegestudents.html
[47] https://www.h-gac.com/community/solid-waste-management/documents/guide_to_developing_community_solid_waste_facilities.pdf

a+e	a - garage to route time, e- time to drive to garage at the end of the trip
N	Number of locations
Wg	Waste generation per location (kg)
Wsw	Waste specific weight (1.1m^3, or 120l)
CR	Compaction ratio of a truck (1:3)
bc	Collection time per location or pickup+put down time (min)
bkm	Time to drive between locations (min)
d	Disposal time (time at landfill 30 min)
d	In/out garage
f+g	Off route time (15% of day)
c	Number of trips per month

- a, d, and e are a function of distance and speed – usually 30km/h;
- b is a function of the number of customers, time per customer, number of loads (full or partial); b is obtained by adding bc (collection time at the location) and bkm (time to drive in-between the locations); the time is a function of the travel length (distance) and average speed, the latter being set at 30km/hour;
- c is a function of the capacity of the vehicle and its compaction ratio;

The number of vehicles and containers required is a function of the waste generation in a given area. The number of required containers will depend on the volume of the containers and waste density. The volume of containers is set based on the residential area (single houses or multi-storey buildings) and the collection method: “kerbside” (”door-to-door”) or “bring” systems. Considering that the ISWM model mainly focuses onto the rural areas, door-to-door collection is applied using bins of 120l volume. The waste density is 15kg/120l. The total number of 120l bins is then calculated by dividing the quantities (kg) of waste generated for the period coinciding with the collection frequency (i.e. weekly quantity, if the collection is performed once a week, or any other period correlated with the collection frequency) with the waste density (15kg, for 120l bins). If 1.1m^3 containers are applied, the waste density used will be 120kg/1.1m^3.

To calculate the number of costumers a truck can serve a day, the volume and waste density (which is in correlation to the compaction ratio) should be known. Considering that weight of 1m^3 waste is approximately 110 kg, the usual compaction rate of a truck is 1:3, and an average per-capita waste generation in rural areas is 0.7kg, a 12m^3 truck can serve 2,772 customers a day.

Or:

Truck volume (m^3) x 110kg (density) x 3 (compaction factor) x 0.7 (waste generation per capita) = total served costumers a day.

Collection frequency is a function of the waste quantity intended for collection, the volume of the truck, the total waste collection time and number of shifts. Usually, the optimal waste collection frequency is once a week. Such collection frequency facilitates the optimised use of the refuse vehicles fleet and their maintenance. The collection frequency is planned for the entire territory of the municipality, taking into account the waste generation, the available truck volumes and the length of the routes.

The key to planning the waste collection in rural areas is the supply of sufficient volume of containers and optimising the routes of available refuse vehicles. An obstacle to planning these routes can be the road infrastructure, i.e. accessibility of remote areas by standard vehicles. Therefore, the best practice examples suggest splitting the services in such a way that:

- the standard refuse vehicles of 12-20m^3 volume utilise the main road network;
- smaller vehicles (with a volume of 3-6m^3), possibly even tractors, serve the households and transport the collected waste to certain collection points (rural transfer stations), which are located at strategic points – at crossroads with local roads.

The ***Guide to Developing Community Solid Waste Facilities*** prepared by Dannenbaum Environmental Corporation (1999) represents a collection of best practices for rural waste collection in remote areas.

These best practises demonstrate how to estimate the total costs of the existing solid waste system, showing also how rural transfer station may lower their cost-per-capita spent on solid waste activities. The rural transfer stations can also be used to offset costs of the illegal dumpsites cleaning up.

A rural transfer station is simply a location where residents can get rid of ordinary municipal waste and hard-to-dispose items. A wide spectrum of collection center designs are possible, depending on the materials accepted, location, number of residents using the facility and funds available for construction and operation. These centers are suitable locations for recycling, too. These stations typically feature one or more movable trailer, dumpster or roll-off bin to temporarily store and then transport the collected waste to a municipal or regional landfill.

Rural transfer stations can be either fixed or mobile. A fixed station is permanently located on a parcel of land and typically has some improvements to support the collection and disposal operations, such as fencing, lighting, a driveway, and an attendant's shed. Fixed collection stations can be relatively low cost operations with waste collection bins only or they can offer more extensive services, including recycling collection, used oil collection, household hazardous waste collection and composting. However, as waste collection service options expand, so do programme costs.

Mobile collection stations are collection vehicles that stop at a designated time to accept resident's trash at a particular location, such as a section of right-of-way along a commonly travelled road. Typically, there are little or no improvements at the places where they stop to collect waste, other than a sign to designate the times for collection, acceptable materials, and to identify the location. Some mobile collection sites use all-weather surfacing so cars and trucks can make safe use of the station even in poor weather conditions. Although not as common, it is possible to offer many of the full-service options typically found at a fixed collection station at a mobile station.

The rural transfer stations should be located in close proximity to frequently travelled. The location should also consider potential nuisance problems (doors and noise) or hazard problems (traffic or floodplain issues). Lastly, the location should be affordable and suitable to the design so that capital improvement costs can be minimized.

Ideally, all fixed rural transfer stations will meet certain minimum standards to ensure user safety, convenient access, ease of use, control of litter, prevention of scavenging and adequate waste collection service opportunities. The absolute minimum requirements for a convenience collection point include:

- All-weather surfaces on the access road and on the site,
- Easy access for residents and/or community elected operators to the site and to the containers,
- A perimeter fence for security and windblown materials control,
- Convenient hours of operation, including weekends,
- Posted signs that state the hours of operation, materials accepted, and a warning that illegal dumping violators will be prosecuted.

There are many different layout options for constructing a rural transfer station (drop-off) area. Three of these options and the pros and cons associated with each are shown at Figure 18.

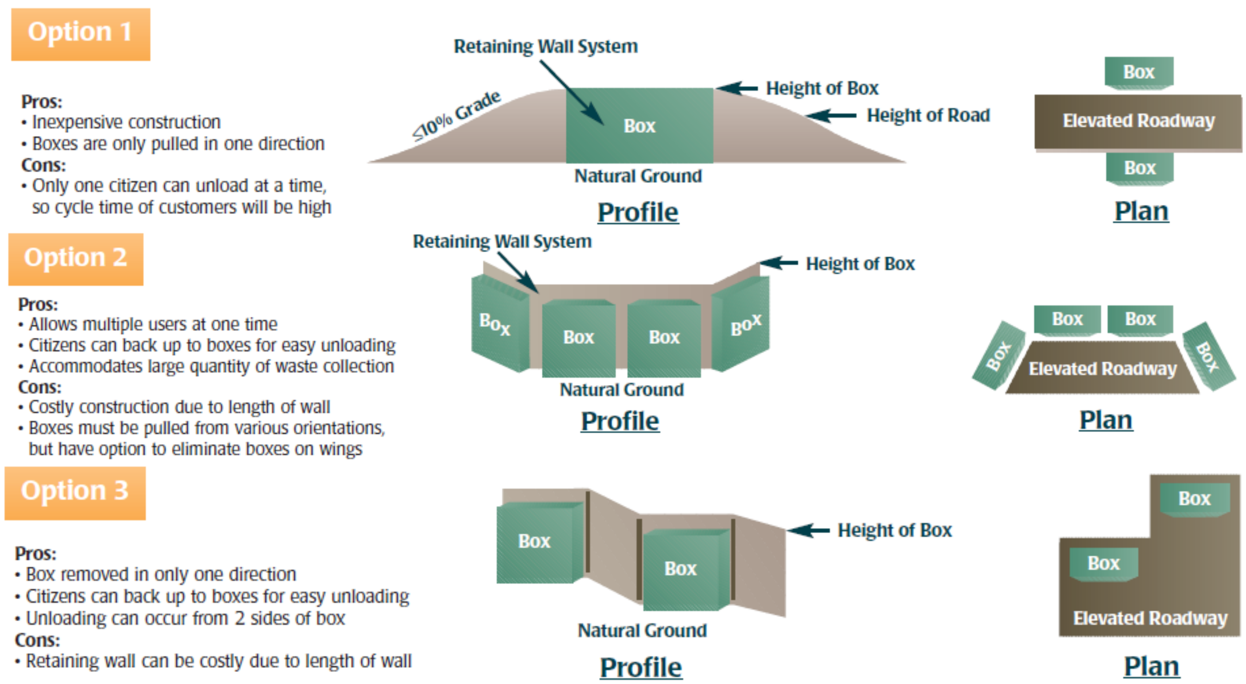

Figure 18 Layout options of a rural transfer station

Case studies provide examples for organising rural transfer stations which, in addition to providing a site for residents to dispose of bulky items, special waste and segregated household waste, can reduce the travel length (and time) of special refuse vehicles. Door-to-door collection of segregated waste is provided by an operator engaged by the local community or the population transports their wastes to the rural transfer station on their own.

Box 2. Chambers County Case Study

The population of Chambers County is approximately 25,000. The county is 5% urban and 95% rural. Approximately 87,000 tons of waste is generated annually. Chambers County believes that staffing their rural transfer stations ensures that citizens separate their waste properly, controls potential illegal dumping and controls the cleanliness of the station itself. Prior to transfer stations were manned, the county would frequently find trash laying on the ground; also, the waste segregation was not performed properly.

The county operates eight manned rural waste transfer stations which accept municipal waste, hazardous waste, used oil, used oil filters, tires, brush for grinding, white goods, and batteries. Citizens can bring their waste at the rural transfer stations on their own, or they can organize a door-to-door collection within their community. The residual municipal waste is then collected from the transfer station by the county operator while the recyclables are picked up by authorized private companies.

Figure 19Rural Transfer Station in Chamber County, Texas

Initially, rural transfer stations were in approximately twenty locations and they were only 1.1m^3 containers. It was very expensive to maintain this system. Eventually they decreased the number of rural transfer stations and increased the collection box size to 40-m^3 containers. Now, sites have compactor stations, roll-off containers, or both. The waste is trucked from rural transfer stations to the landfill by county owned roll-off vehicles and county employees.

5.2 Proposed Rural Waste Collection Concept

The best practice examples elaborated in section 5.1 have been deployed to derive concepts for rural waste collection in every pilot municipality.

The major objectives of the proposed rural waste collection are linked to reducing environmental and economic impacts of floating debris; these are:

- To prevent creation of illegal dumpsites by extending the service in areas where regular waste collection does not exist;
- To improve recycling rate of packaging (mostly plastics) and thus reduce this stream in the floating debris;

The proposed rural waste collection system is “door-to-door”, in order to prevent illegal dumping of citizens unwilling to bring their waste to distant locations / containers. Also, primary waste segregation is foreseen. The municipality can decide, however, whether the primary waste segregation will be implemented upon the start-up of rural waste collection operations or at a later stage. One should bear in mind that a “door-to-door” collection system is expensive (due to the length of the trip) and often cannot be implemented in rural areas due to accessibility issues (narrow, steep and unpaved streets where a regular refuse truck cannot drive). Therefore, it is proposed to establish two parallel collection systems:

1. Rural waste collection run on behalf of the ***municipality*** and operated either by a PCE or a contracted - out private waste management company. It is carried out by regular refuse vehicles of 10-20m^3 volume using main roads only for their routings and collecting waste from designated ***collection points***. Bigger volume vehicles (e.g. roll on / roll off

trucks) can be made available, if the road layout can permit their passage and manipulation (i.e. turning).

2. Rural waste collection run on behalf of the ***local community.*** Citizens can bring their (segregated waste) bins to the closest ***collection point*** or they can hire a local waste collection agent, elected among the community members, to do it on their behalf. The local waste collection agent can be also a sub-contractor of either the municipal operator or the rural community. The municipality can decide which institutional form will take the local community driven rural waste collection, as it is a matter of the existing regulations. The local waste collection agent should have a suitable vehicle (i.e. a tractor) which is able to access the customers` properties located along local streets (if any), which may be unpaved, steep and narrow.

The ***collection points*** are locations where two parallel systems meet: the regular waste collection operated on behalf of the municipality and the local waste collection organised by the local community (village).

These collection points are always located along the main road. In some cases, the local network of streets is adjacent to the main road, or the local road is branching off leading to the village. In both situations the local population or local waste collection agents bring their waste to these collection points. They can be either mobile or fixed (rural) transfer stations. Mobile transfer is designated at locations where the local road branching off the main road connects one or two settlements. Fixed transfer stations are placed at strategic points where a group of settlements with relatively high population numbers can conveniently dispose their waste within the period between two scheduled collections.

At the mobile transfer point, which represents a section of the main road), collection vehicles stop at a designated time to accept the collected waste. The waste is reloaded from a smaller vehicle to a standard refuse truck. Hence, the two collection systems (of the municipality and local community) need to be synchronized in terms of timing.

The fixed rural transfer stations require a parcel of land which is fenced and supplied with suitable containers. The type and volume of the containers must suit the loading system of the municipal refuse vehicles fleet. An elevated driveway (ramp) enables waste unloading from a smaller vehicle (a tractor, in most cases) to a container. The advantage of fixed transfer stations is that collection schedule of standard refuse vehicles operated by the PCE or private waste management company engaged by the municipality does not need to be adjusted to the unloading schedule of the community driven collection system. The disadvantage is that their operation is more expensive.

The collection points can be used for temporary storage of recyclables. In case of primary waste segregation, separate containers are placed for particular recyclables at the rural transfer stations. Secondary waste segregation can be organised at the rural waste transfers, too. At the mobile collection points, recyclables can also be picked up, provided that the municipality organises the collection of segregated waste. Otherwise, authorised private recycling companies can be invited for the pick-up. Thus, the municipal operators would only collect the residual waste. It would minimise the waste quantities, the required waste collection frequency and - costs.

The planning of the rural waste collection is comprised of the following steps:

1. The settlements not covered by a regular waste collection service and respective population numbers were identified for each pilot municipality based on input of PCEs; they have been located on a google earth map;
2. The waste generation was calculated for each settlement not covered by a regular waste collection service; it was discussed with the stakeholders to introduce a primary waste segregation so the residual waste would be collected by the PCEs while the recyclables would be picked up by authorised recycling companies and biodegradable waste would be composted by the customers. Some stakeholders stated at the 2nd Dialogue Platform (held in March 2016 in Banja Koviljaca) that initiating segregated collection in settlements where no service has ever been provided would be challenging. To note, at least 50% of attendants of the 2nd Dialogue Platform expressed readiness to deliver vessels for segregated collection at the beginning of operations;
3. The road infrastructure was analysed to optimise routing; routes have been indicated on a google earth map; routes have lead along main roads starting from the garage of the refuse trucks (located usually in the municipality capital) to the disposal site (either the regional sanitary landfill or the municipal non-compliant landfill) and back to the garage;
4. The number of collection points – either single settlements (mobile transfers) or rural transfer stations (fixed transfers) serving a group of settlements has been set per each route; distances in-between the collection points have been measured;
5. Rural (fixed) waste transfer stations were set at suitable locations – crossroads of the main and local roads, in the proximity of settlements with higher population numbers and hence higher waste generation;
6. The collection time per collection points and the total waste collection time has been calculated based on distance, legitimate breaks and speed;
7. The total volume of required vessels and the number of 1.1m^3 containers (which can be easily converted into 120l bins, based on the ratio 1 container of 1.1m^3 is equal to 8 x 120l bins) has been calculated; the average waste density of one 1.1m^3 container is 120kg, but due to a reserve margin of 30%, the calculations operate with an average waste density of 98 kg;
8. The required volume of required refuse trucks has been calculated based on the residual waste quantities, number of routes, total collection time of a route and collection frequency (usually once a week);
9. The fuel costs have been calculated based on the total length of travel, average consumption of 15l diesel per 100km and current diesel prices in the pilot countries.

The routings and calculations are available in Annex 3.

The example of the Municipality of Prijepolje is presented below. One should note that the ***waste to be collected from the settlements not covered by the service in Prijepolje Municipality will end up at the present non-compliant landfill which is located at the riverbank of the Lim River***. If the PCE would continue to use this landfill, the extension of the service coverage will not minimise the problem of the floating debris. On the contrary, ***adding up more waste at the landfill site serving the Prijepolje Municipality would even aggravate the problem***. Similar problem would be faced in the Municipalities of Bjelo Polje and Zvornik, as the municipal (non-compliant) landfills are located near the river. It does not mean, however, that the waste should not be collected from remote settlements by the time when these municipalities would find a solution to the waste disposal problem. ***It is recommended that these "hotspots" (landfills used by the municipalities of Bjelo Polje, Prijepolje and Zvornik) are closed and remediated in due course and the waste collected is transported to the closest regional sanitary landfill.***

The calculations of the required vehicles and containers volume are based on waste generation in the settlements in Municipality of Prijepolje not covered by a regular waste collection service. The input figures to the calculations are shown in Table 8.

Table 8 Settlements / respective population not covered by regular waste collection and waste generation in the Municipality of Prijepolje

Settlements not covered by a waste collection service	Population	Indicator (kg/ capita/ day)	waste generation (kg/ capita/day)	waste (tons / year)
Aljinovići	131	0.7	92	33
Balići	585	0.7	410	149
Bare	42	0.7	29	11
Biskupići	12	0.7	8	3
Bjelahova	75	0.7	53	19
Brajkovac	65	0.7	46	17
Brvine	157	0.7	110	40
Brodarevo	1,845	0.7	1,292	471
Bukovik	34	0.7	24	9
Vinicka	362	0.7	253	92
Vrbovo	63	0.7	44	16
Gojakovići	105	0.7	74	27
Gornje Babine	217	0.7	152	55
Gornje Goračiće	30	0.7	21	8
Gornji Stranjani	61	0.7	43	16
Gostun	64	0.7	45	16
Gračanica	168	0.7	118	43
Grobnice	232	0.7	162	59
Divci	311	0.7	218	79
Donje Babine	223	0.7	156	57
Donji Stranjani	79	0.7	55	20
Drenova	162	0.7	113	41
Dušmanići	270	0.7	189	69
Đurašići	194	0.7	136	50
Zabrdnji Toci	80	0.7	56	20
Zavinograđe	1,265	0.7	886	323
Zalug	1,205	0.7	844	308
Zastup	101	0.7	71	26
Zvijezd	76	0.7	53	19
Ivanje	1,145	0.7	802	293
Ivezići	98	0.7	69	25
Izbičanj	31	0.7	22	8
Jabuka	275	0.7	193	70
Junčevići	229	0.7	160	59
Kamena Gora	167	0.7	117	43
Karaula	37	0.7	26	9
Karoševina	163	0.7	114	42
Kaćevo	59	0.7	41	15
Kašice	71	0.7	50	18
Kovačevac	1,604	0.7	1,123	410

Settlements not covered by a waste collection service	Population	Indicator (kg/ capita/ day)	waste generation (kg/ capita/day)	waste (tons / year)
Koprivna	31	0.7	22	8
Kosatica	296	0.7	207	76
Koševine	966	0.7	676	247
Kruševo	26	0.7	18	7
Kučin	137	0.7	96	35
Lučice	156	0.7	109	40
Mataruge	130	0.7	91	33
Međani	44	0.7	31	11
Mijani	12	0.7	8	3
Mijoska	777	0.7	544	199
Milakovići	52	0.7	36	13
Mileševo	90	0.7	63	23
Milošev Do	63	0.7	44	16
Miljevići	478	0.7	335	122
Mrčkovina	16	0.7	11	4
Muškovina	19	0.7	13	5
Oraovac	254	0.7	178	65
Orašac	158	0.7	111	40
Osoje	466	0.7	326	119
Oštra Stijena	34	0.7	24	9
Potkrš	102	0.7	71	26
Potok	142	0.7	99	36
Pravoševo	48	0.7	34	12
Pranjci	326	0.7	228	83
Prijepolje	13,330	0.7	9,331	3,406
Rasno	379	0.7	265	97
Ratajska	2,032	0.7	1,422	519
Sedobro	304	0.7	213	78
Seljane	160	0.7	112	41
Seljašnica	677	0.7	474	173
Skokuće	68	0.7	48	17
Slatina	161	0.7	113	41
Sopotnica	148	0.7	104	38
Taševo	1,974	0.7	1,382	504
Hisardžik	220	0.7	154	56
Hrta	103	0.7	72	26
Crkveni Toci	46	0.7	32	12
Čadinje	303	0.7	212	77
Čauševići	149	0.7	104	38
Džurovo	89	0.7	62	23

Some containers have been placed in a number of settlements listed in Table 8 above along the main roads but they are still considered as the service is not provided because the majority of population does not have a convenient access to waste collection vessels. These settlements are shown with a different colour in the maps indicating routes and villages not covered by service.

Three main routes are established, so called “purple”, “blue” and “white”; the fourth route (“green”) may function during the tourist season. Colour coding of routes eases planning of trips and respective collection points.

The collection points along the “purple” route are:

Table 9 Collection Points along the "Purple" Route

Collection Point No.	“Purple” Route
1	Transfer St. Mileševo
	Aljinovići
	Kosatica
	Međani
	Mileševo
	Milošev Do
	Muškovina
	Pravoševo
	Sedobro
	Hisardžik
	Biskupići
	Karaula
2	Transfer St. Rasno
	Taševo
	Rasno
3	Transport to the (non-compliant) municipal landfill in Prijepolje

There are two fixed transfer stations (Milesevo and Rasno).

The “purple” route is shown in the Figure below.

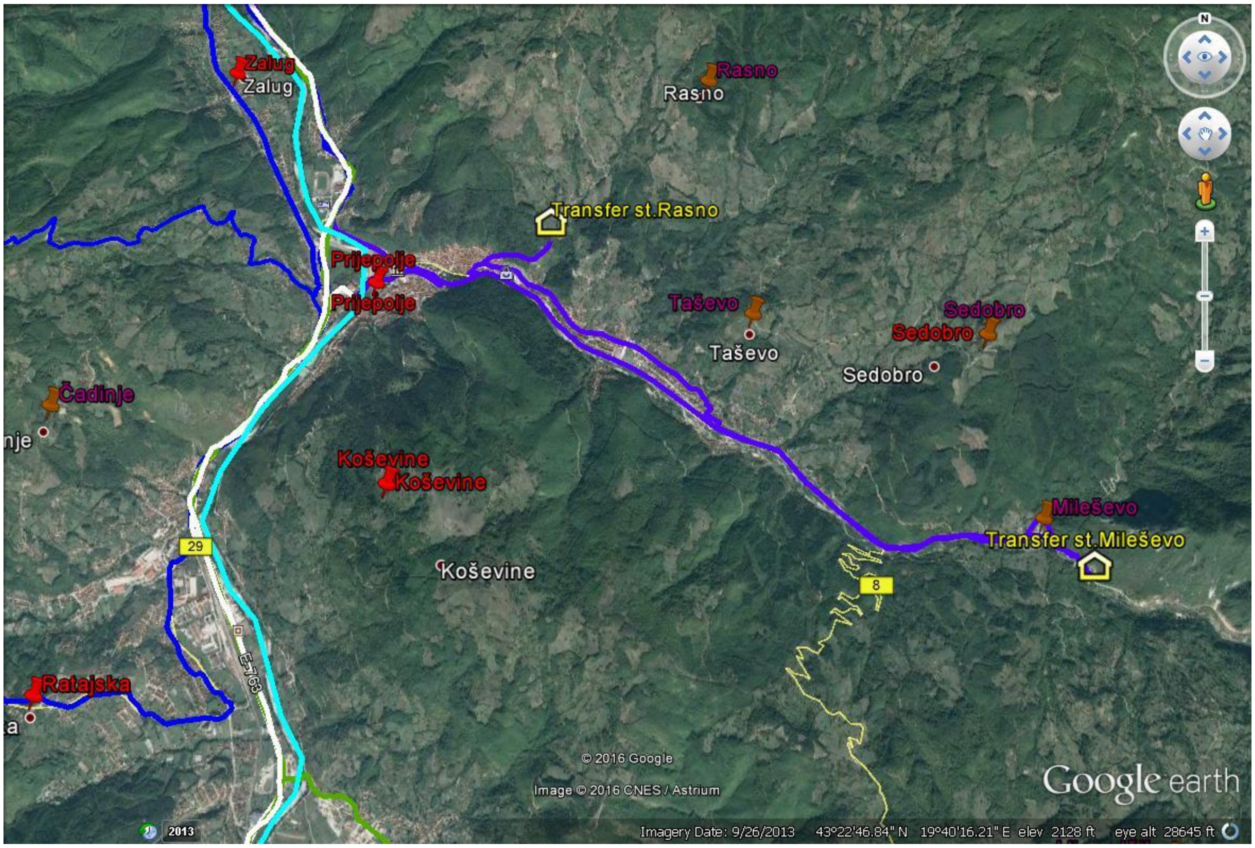

Figure 20 The "Purple" Refuse Vehicle`s Route for collecting rural waste in Prijepolje Municipality

Each route starts from the garage located in Prijepolje; a truck drives in-between the collection points (including rural transfer stations), goes to the (non-compliant) municipal landfill, unloads the waste and goes back to the garage. Therefore, the number of collection points is n+1 (3 for the “purple” route). The total waste collection time has been calculated using the formula:

Y=a+(bc x N)+bkm+c(d)+e+f+g

The travel times in-between the collection points and the total collection time for the “purple“ route are given in Table 9.

Table 10 Travel Times in-between the Collection Points along the “Purple” Route, to the (non-compliant) municipal landfill and back

		ROUTE (Purple)		
	Location No.	**1**	**2**	**3**
a+e	a - garage to route time, e- time to drive to garage at the end of the trip	15	0	0
N	Number of locations	1	1	1
Wg	Waste generation per location (kg)	6,194	11,530	0
Wsw	Waste specific weight	98	98	98
CR	Compaction ratio	3	3	3
bc	Collection time per location or pickup+put down time (min)	25	25	0
bkm	Time to drive between location (min)	20	15	15
d	Disposal time (time at landfill 30 min)	0	0	30
d	In/out garage	10	0	0

		ROUTE (Purple)		
	Location No.	**1**	**2**	**3**
f+g	Off route time (15% of day)	0	0	0
c	Number of trips per week	0.25	3	3
YLOC	**Total collection time per location**	118	354	30
Y	**Total collection time (min)**	502		

The required volume of trucks and containers located at the collection points for the "purple" route is shown in Table 10.

Table 11Number of containers and trucks needed for the "Purple" route

Collection points	Waste at location (kg / week)	No. of containers needed	Truck volume needed	Collection Frequency
Transfer St. Mileševo	6,194	63	21	Twice a week
Transfer St. Rasno	11,530	118	39	Three times a week

One should note that due to relatively big waste quantities stored at the transfer stations the collection frequency will be twice (at the Transfer Station Milesevo) or three times a week (at the transfer station Rasno).

The diesel fuel costs have been calculated for the "purple" route based on the total distance (travel length), fuel consumption of 15l/km and actual price of fuel (Table 12).

Table 12 Diesel Fuel Weekly and Monthly Costs for the "Purple" Route

Costs	Total Length of Trip (km)	Weekly Fuel Costs (EUR)	Monthly Fuel Costs (EUR)
Truck (diesel engine)	284	51	608

Hence, to extend the waste collection service in 13 settlements in the Municipality of Prijepolje, the following resources need to be made available:

- 181 containers of 1.1m^3 volume (to be placed at the collection points) and 1,447 bins of 120l (to be placed at customers` properties for the "door-to-door" collection) need to be purchased. The cost of 1.1m^3 volume containers is 63,298[48]EUR. The cost of the 120l bins is 43,404[49]EUR;
- One truck of 15m^3 volume needs to be made available for a total duration of 9 hours a week. If such a truck is not available, the investment is approximately 70,000 EUR;
- Staff of 3 persons (one driver and two loaders) will be engaged 9 hours a week;
- The monthly costs of fuel will be in the range of 608 EUR;
- If the citizens would engage a local waste collection agent, the costs of "door-to-door" collection and transportation to the collection point should be covered. One should bear in mind the number of trips of a fully loaded tractor (up to 6m^3 volume) will be more than one a week. The remuneration will be negotiated with the contracting authority, either the local community or the municipality, based on the volume of waste for collection, i.e. number of properties where the waste shall be picked up, as well as the travel length from the collection area to the collection point. A provisional amount of 400-500 EUR per a waste

[48]The unit price used for 1,1m^3 container is 350 EUR.
[49]The unit price used for 120l bins is 30 EUR.

collection agent a month seems reasonable, given the current average salaries in the region. This remuneration should also cover the fuel costs and lease of the tractor.

Apart from the planning required to optimise the rural waste collection and making resources available to make it happen, an important prerequisite to the acceptance of the new service and especially the waste segregation is the public awareness raising and enforcement.

The public awareness raising activities should not be limited to sporadic campaigns only. Citizens should be involved since the early planning stage of the rural waste collection, ideally by reaching them out via the survey discussed in section 3.1.1.2 on inventories of illegal dumpsites above. Local community leaders should use their authority to explain the importance of ceasing the illegal dumping and properly disposing their waste into the dustbins. Communication between the municipal representatives and the citizens should continue until every single household has signed a contract and obtained a dustbin for the waste storage at the property. Once the household accepts the service (and pays for it), the waste management operator should maintain the universality, through non-discrimination, sustainability, quality and efficiency, transparency, economically acceptable price and full coverage of the area of service provision.

6. Conclusions

This ISWM Model can help in implementing comprehensive measures towards reducing the floating debris and its harmful impacts.

Floating debris monitoring is the only way to get a clear idea of the sources of floating debris as well as to assess whether the actions taken to mitigate the problem are effective. The importance of monitoring is reflected in the fact that, according to the Marine Strategy Framework Directive requirements, each Member State must develop and implement floating debris monitoring protocols. It is strongly recommended that, where practices that could have an effect on floating debris are implemented, they are accompanied by a well-designed monitoring programme, which will record the amounts and types of floating debris before and after the implementation of the practice to assess any changes and thus the effectiveness of the practice. In the case of the Tara - Drina - Sava pilot region, both the monitoring and evaluation and effectiveness of the implemented policy and actions should be coordinated at a regional scale. The regional cooperation should result in consolidating existing performance monitoring tools and responsibilities and using harmonised approaches.

Once the waste management data collection and analyses of methodologies are harmonised and initial monitoring implemented, the following actions should be taken by each pilot municipality:

- ***The municipalities hosting "hotspot" non-compliant landfills – Prijepolje, Bjelo Polje and Zvornik, must close and remediate them without any delays; alternatives to the waste disposal should be explored so either another municipal non-compliant landfill, which is located outside the littoral plain of rivers in the Drina Catchment, or the closest regional sanitary landfill should be used;***
- Extend the rural waste collection and subsequently clean-up the illegal sites being previously used by the population not covered by the regular waste collection service;
- Implement instruments that apply 'the polluter pays' principle, by for example enforcing penalties for littering and other environmentally harmful behaviour;

- Organise a primary waste segregation and strengthen the collaboration with the companies active in the recycling market;
- ***Establish recycling on-the-go (i.e. reservoirs coastlines, recreational areas, roadsides, etc.) by providing an adequate number, size and type of waste bins and recycling receptacles;***
- Ensure that all public waste bins and recycling receptacles are emptied frequently and regularly.

Before any practice to reduce floating debris is implemented, one should think of the effect it is likely to have on the peoples` behaviour. For any action to be effective in the long term, it must cause a shift in behaviour that will be sustained in the long run. This is not always easy to achieve. It requires effective awareness raising in tandem to any other practice that is implemented.

In the pilot municipalities, municipal administration, councillors and waste management operators will play a crucial role in managing floating debris and illegal disposal monitoring programmes. Community leaders need to be elected and start involving citizens in decision making and action. In this way, a community mentality is gained whereby people act towards bettering their own area for the greater good of the whole community. If communities were more educated on the impacts of floating debris and illegal dumping and identified this as a social deviation, this could potentially begin to change their habits.

Annex 1

Litter classification system for all surveys where litter is collected or identified in situ

Class	Material Composition	Litter Code	Litter Form (and Examples)
1	Plastic	PL01	Bottle caps & lids
2	Plastic	PL02	Bottles < 2 L
3	Plastic	PL03	Bottles, drums, jerry cans & buckets > 2 L
4	Plastic	PL04	Knives, forks, spoons, straws, stirrers, (cutlery)
5	Plastic	PL05	Drink package rings, six-pack rings, ring carriers
6	Plastic	PL06	Food containers (fast food, cups, lunch boxes & similar)
7	Plastic	PL07	Plastic bags (opaque & clear)
8	Plastic	PL08	Toys & party poppers
9	Plastic	PL09	Gloves
10	Plastic	PL10	Cigarette lighters
11	Plastic	PL11	Cigarettes, butts & filters
12	Plastic	PL12	Syringes
13	Plastic	PL13	Baskets, crates & trays
14	Plastic	PL14	Plastic buoys
15	Plastic	PL15	Mesh bags (vegetable, oyster nets & mussel bags)
16	Plastic	PL16	Sheeting (tarpaulin or other woven plastic bags, palette wrap)
17	Plastic	PL17	Fishing gear (lures, traps & pots)
18	Plastic	PL18	Monofilament line
19	Plastic	PL19	Rope
20	Plastic	PL20	Fishing net
21	Plastic	PL21	Strapping
22	Plastic	PL22	Fibreglass fragments
23	Plastic	PL23	Resin pellets
24	Plastic	PL24	Other (specify)
25	Foamed Plastic	FP01	Foam sponge
26	Foamed Plastic	FP02	Cups & food packs
27	Foamed Plastic	FP03	Foam buoys
28	Foamed Plastic	FP04	Foam (insulation & packaging)
29	Foamed Plastic	FP05	Other (specify)
30	Cloth	CL01	Clothing, shoes, hats & towels
31	Cloth	CL02	Backpacks & bags
32	Cloth	CL03	Canvas, sailcloth & sacking (hessian)
33	Cloth	CL04	Rope & string
34	Cloth	CL05	Carpet & furnishing
35	Cloth	CL06	Other cloth (including rags)
36	Glass & ceramic	GC01	Construction material (brick, cement, pipes)
37	Glass & ceramic	GC02	Bottles & jars
38	Glass & ceramic	GC03	Tableware (plates & cups)
39	Glass & ceramic	GC04	Light globes/bulbs
40	Glass & ceramic	GC05	Fluorescent light tubes
41	Glass & ceramic	GC06	Glass buoys
42	Glass & ceramic	GC07	Glass or ceramic fragments
43	Glass & ceramic	GC08	Other (specify)
44	Metal	ME01	Tableware (plates, cups & cutlery)
45	Metal	ME02	Bottle caps, lids & pull tabs
46	Metal	ME03	Aluminium drink cans
47	Metal	ME04	Other cans (< 4 L)
48	Metal	ME05	Gas bottles, drums & buckets (> 4 L)
49	Metal	ME06	Foil wrappers
50	Metal	ME07	Fishing related (sinkers, lures, hooks, traps & pots)
51	Metal	ME08	Fragments
52	Metal	ME09	Wire, wire mesh & barbed wire
53	Metal	ME10	Other (specify), including appliances

Class	Material Composition	Litter Code	Litter Form (and Examples)
54	Paper & cardboard	PC01	Paper (including newspapers & magazines)
55	Paper & cardboard	PC02	Cardboard boxes & fragments
56	Paper & cardboard	PC03	Cups, food trays, food wrappers, cigarette packs, drink containers
57	Paper & cardboard	PC04	Tubes for fireworks
58	Paper & cardboard	PC05	Other (specify)
59	Rubber	RB01	Balloons, balls & toys
60	Rubber	RB02	Footwear (flip-flops)
61	Rubber	RB03	Gloves
62	Rubber	RB04	Tyres
63	Rubber	RB05	Inner-tubes and rubber sheet
64	Rubber	RB06	Rubber bands
65	Rubber	RB07	Condoms
66	Rubber	RB08	Other (specify)
67	Wood	WD01	Corks
68	Wood	WD02	Fishing traps and pots
69	Wood	WD03	Ice-cream sticks, chip forks, chopsticks & toothpicks
70	Wood	WD04	Processed timber and pallet crates
71	Wood	WD05	Matches & fireworks
72	Wood	WD06	Other (specify)
73	Other	OT01	Paraffin or wax
74	Other	OT02	Sanitary (nappies, cotton buds, tampon applicators, toothbrushes)
75	Other	OT03	Appliances & Electronics
76	Other	OT04	Batteries (torch type)
77	Other	OT05	Other (specify)

Annex 2

Illegal Dumping Questionnaire

Household number:

Section A: Basic Details

Street name:

1. Gender (tick)

Male	
Female	

2. Employment (tick)

   Yes ☐ No ☐

3. How long have you lived here? (tick)

Less than a year ☐ 1-3 years ☐ 4-6 years ☐ 7-10 years ☐ More than 10 years ☐

4. How many people live in your household ....

Section B: Awareness and extent of illegal dumping

5. Are you aware of the illegal dump site located in your neighbourhood? (tick)

   Yes ☐ No ☐

6. If yes, how many sites have you noticed? (tick)

0-1	2-5	More than 5

7. Do you think illegal dumping is a problem in your neighbourhood? (tick)

   Yes ☐ No ☐

8. If yes, how would you rate the severity of the problem? (circle)

   Minor Moderate Neutral Severe Highly Severe

9. How frequently does the problem occur? (tick applicable)

Daily ☐ Weekly ☐ Monthly ☐ River / reservoirs only ☐ Annually ☐

Other -- (specify)

10. How long has it been occurring? (tick)

A few weeks ☐ A few months ☐ A year ☐ 2-5 years ☐ 6-9 years ☐ >10 years ☐

11. Who do you think contributes to this illegal dumping? (tick applicable)

Construction, demolition, remodelling, roofing or landscaping contractors	
Garden services	
Vehicle repair or tyre shops	
Scrap collectors	
Waste pickers	
local residents	

Other -- (specify)

12. Why do you think people dump waste illegally? (tick applicable)

They don't know what else to do with it	
Proper disposal is costly	
They don't care/ lazy	
Missed refuse collection day	
No/unreliable waste collection services	
Unaware of the services available to them	

Other-- (specify)

Section C: Tackling illegal dumping

13. On a scale of 1 to 5, how important is it to eliminate illegal dumping? (tick)

Extremely Important	Quite Important	Don't know/Neutral	Not Very Important	Not Important
1	2	3	4	5

Explain answer?

----

14. What services can the municipality improve upon to prevent illegal dumping? (tick applicable)

Provide waste containers to specific locations	
Employ more workers	
Timely waste collection services	

Fence off area to prohibit dumping	

Other -- (specify)

15. Is the community involved in combating illegal dumping?

Yes ☐ No ☐

16. How would you be willing to combat illegal dumping in your area? (tick)

☐ Money
☐ Petition
☐ Time
☐ Nothing
☐ Other

Section D: Illegal dumping effects

17. Does having a dump site in your neighborhood affect your quality of life in any way?

Smell	
Visual	
Aesthetics	
Vagrants	
Unwanted animals (stray dogs, donkeys)	

Other (specify): ____ 18.

____ 19.

20. Has the problem affected you, your family, pets, livestock?

Yes ☐ No ☐

If yes, how ____

____

____

21. Do you think the illegal dumpsites have negative effects on the environment

Yes ☐ No ☐

22. If yes, in what way? (tick applicable)

Vegetation growth	
Soil pollution	
Water pollution	
Harmful to animals	

Other (specify): ___________________________

____

____

23. How would you rate the severity of these environmental impacts? (circle)

Minor Moderate Neutral Severe Highly Severe

Thank you for your time.

Annex 3

Rural Waste Collection calculations

INTEGRATED SOLID WASTE MANAGEMENT MODEL

in Sharra region

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Executive Summary

The floating debris is a serious pollution problem in the Sharra region, particularly in Albania, Kosovo* and Macedonia. This Integrated Waste Management Model comprises actions to monitor the floating debris in the environment as well as prevent and/or reduce its generation at the source. In a nutshell, it is a response to the root problems of the floating debris generation:

Problem	Solution
Scarce information on the amounts, composition and spatial distribution[2] of floating, settled (at the river and reservoir`s floor) and stranded floating debris at the riverbanks and reservoirs'` coastline (mainly bays and beaches).	Regional monitoring system of stranded floating debris at the riverbanks and reservoirs` coastlines, based on the Marine Litter Watch[3] protocol (developed for the needs of the European Environment Agency - EEA) for collecting sank litter (at the riverbanks and reservoirs` coastline) data.

Incomprehensive municipal and hence national statistics on waste generation, composition and management (the latter including, as a minimum, collection rate from service users, recycling / recovery rate, the amounts of disposed waste, the inventory of sources of floating debris – non-compliant municipal landfills, illegal dumps, etc.).	• Develop and implement regionally harmonised method for waste sampling analyses building upon the existing methods applied in the region and strengthening statistical analyses of waste generation with the stratification methods elaborated in the Methodological Tool to Enhance the Precision & Comparability of Solid Waste Analysis Data, 5th Framework Program, EU[4];
	• Develop and implement a regionally harmonised methodology for determination of the waste collection service coverage, taking into account:
	  ○ existing versus the required available volume of collection vessels,
	  ○ existing density and respective locations of containers versus the population density & waste arising and locations of properties,
	  ○ existing versus the required vehicle routing and collection frequency;
	• Create inventories of illegal dumpsites upon the clean-up campaigns by tracking the locations of dumpsites, volume and provisional composition of fly tipped waste using the mobile application "Trash Out"[5] and joining the initiative "Let`s Do It World"[6];

*This designation is without prejudice to positions on status, and is in line with UNSCR 1244/1999 and the ICJ Opinion on the Kosovo declaration of independence

[2] Spatial distribution of floating debris is linked to river / reservoir currents, tides and river information indications about the physical source, i.e. the litter input zone and its pathway.

[3] http://www.eea.europa.eu/themes/coast_river / reservoir/marine-litterwatch

[4] https://www.wien.gv.at/meu/fdb/pdf/swa-tool-759-ma48.pdf

[5] https://www.trashout.ngo/

[6] https://www.letsdoitworld.org/about/overview/

Problem	Solution
	• Exploit clean-up campaigns as a formidable tool to raise public awareness; • Strengthen enforcement against illegal waste dumping following the clean-up events; • Set a mechanism for regional cooperation towards harmonising and synchronising the implementation of methodologies for waste statistics, waste collection service coverage and inventories of illegal dumpsites;

Insufficient waste management practices in the majority of pilot municipalities, constituting the root cause for the generation of floating debris: lack of organisational and financial capacity of operators to cover remote rural areas with an organised waste collection service; littering habits of population (and tourists) due to the low awareness on deriving adverse environmental and economic impacts; lack of responsiveness to newly introduced waste segregation practice in some municipalities; insufficient enforcement.	• Carefully plan the rural waste collection system by:
	  ○ setting convenient collection routes,
	  ○ establishing suitable collection points for mobile or fixed transfer of waste delivered by the citizens or local community elected waste collection agents,
	  ○ planning the collection schedule (travel time per a route and frequency of collection),
	  ○ planning the required resources (containers, refuse vehicles, staff, fuel);
	• Establish “door-to-door” waste collection system in rural areas not covered by the service; initiate primary waste segregation upon the start-up of operations;
	• Implement public awareness campaigns to foster the acceptance of the new service, including the primary waste segregation;
	• Invite the private sector to take over segregated recyclables from the collection points.

1. Background

The Regional Rural Development Standing Working Group (SWG) and the Network of Associations of Local Authorities of South-East Europe (NALAS) are implementing a regional sub-project "Solid Waste Management in cross-border rural and riverbanks and reservoirs coastline of South Eastern Europe" supported by the German Federal Ministry for Economic Cooperation and Development (BMZ) through the GIZ Open Regional Fund for South East Europe – Modernisation of Municipal Services (ORF MMS) and the Government of Switzerland.

The SWG is engaged in improving rural livelihoods in the SEE countries. To this end, it promotes innovative and sustainable agriculture and rural development through regional cooperation of respective Ministries of Agriculture and other stakeholders. It supports the EU integration in the SEE, by:

- fostering rural development policies,
- improving implementing structures and systems for agriculture and rural development,
- improving the understanding and use of implementation tools for agriculture and rural development, and
- identifying and sharing information and application of good practice in agriculture and rural development to broaden the rural agenda.

NALAS brings together 16 Associations which represent roughly 9000 local authorities, directly elected by more than 80 million citizens of this Region. NALAS helps the associations to represent viably the local authorities vis-à-vis central governments. NALAS provides services to local governments and aspires to develop itself as the Knowledge Center for the local government development in the SEE. It promotes the:

- processes of decentralization, considering the local self-government as a key issue in the transition process in the SEE; and
- partnerships in order to contribute to the EU integration as well as the reconciliation and stabilization process.

1.1 Goals and Objectives

The overall aim of the sub-project is to "improve the conceptual and organisational framework conditions concerning Integrated Solid Waste Management (ISWM) in cross-border rural and riverbanks and reservoirs` coastline in SEE".

The specific goal of the sub-project is to "assess and develop schemes (models) for integrated management of solid waste that are environmentally effective and economically affordable in order to reduce adverse environmental and economic impacts of solid waste mismanagement and support the ecological and socio-economic development of the cross-border rural and riverbanks and reservoirs` coastline in the SEE countries".

The sub-project applies a regional approach, which is oriented towards the needs and perspectives of the countries contributing to the impacts of solid waste mismanagement (so called "impacting") and the countries suffering from the adverse effects (so called "impacted"). Furthermore, three pilot regions are analysed: "Sharra", "Tara – Drina – Sava" and "Adriatic Coast" Region.

The sub-project is implemented in several stages as follows:

1. Developing a Method for Environmental and Economic Impact Assessment.
2. Developing Environmental and Economic Impact Assessment Reports for each pilot region using the Environmental and Economic Impact Assessment Method. These reports help enhancing the knowledge of relevant stakeholders on floating debris impacts and associated costs.
3. Drafting Integrated Solid Waste Management (ISWM) Models based on the lifecycle analyses of the floating debris / floating debris and available Best Practices on preventing the deriving environmental and economic impacts.
4. Proposing Policy Recommendations, in order to create an enabling environment for the implementation of ISWM models.
5. Generating project proposals (i.e. fiches), deriving from the ISWM models, to support the relevant stakeholders in fundraising of follow-up activities.

This Integrated Waste Management Model has been developed for the Sharra pilot region. It comprises actions to monitor the floating debris in the environment as well as prevent and/or reduce its generation at the source. The geographical scope and information on area/population per municipality / country is explained in more details in chapter 2 below.

1.2 The Sharra Pilot Region

The pilot region “Sharra” encompasses 6 municipalities from three countries: Albania, Kosovo* and Macedonia (Table 1).

Table 1"Sharra mountain" cross-border region (Macedonia-Albania-Kosovo)*

Countries		
Macedonia	**Kosovo***[7]	**Albania**
Pilot Municipalities		
Jegunovce	Shtrpce	District Kukes
Tearce	Prizren	
	Dragash	

The pilot municipalities have been selected by the SWG in collaboration with the regional experts engaged during the project implementation.

The administrative boundaries of the pilot municipalities for each participating country are highlighted: Albania (Figure 1 - Municipality of Kukes), Kosovo* (Figure 2 – Municipalities of Dragas, Priren and Strpce) and Macedonia (Figure 3 - Municipalities of Tearce and Jegunovce).

*This designation is without prejudice to positions on status, and is in line with UNSCR 1244/1999 and the ICJ Opinion on the Kosovo declaration of independence

Figure 1 Albania - pilot Municipality of Kukes

Figure 2 Kosovo* – pilot Municipalitiesof Dragas, Prizren and Strpce

Figure 3 Macedonia – pilot Municipalities Tearce and Jegunovce

The provisional territorial distribution of the pilot municipalities in the “Sharra” region is highlighted in Figure 4 below.

*This designation is without prejudice to positions on status, and is in line with UNSCR 1244/1999 and the ICJ Opinion on the Kosovo declaration of independence

Figure 4 Geographical position of pilot municipalities in the Sharra Region

The area and population of pilot municipalities are presented in Table 2 below.

Table 2 Area and population of the pilot municipalities and of the Sharra pilot region

Pilot Municipality	Area (km^2)	Population
Albania		
Kukes	938	59,393
Total	938	59,393
Kosovo*		
Dragas	430	33,997
Prizren	640	178,112
Strpce	247	6,948
Total	**1317**	**219,057**
Macedonia		
Tearce	137	22,454
Jegunovce	174	10,790
Total	**311**	**33,244**
Total Pilot Region	**2,566**	**311,694**

Respective shares of area and population for each pilot country are highlighted in the figures below.

*This designation is without prejudice to positions on status, and is in line with UNSCR 1244/1999 and the ICJ Opinion on the Kosovo declaration of independence

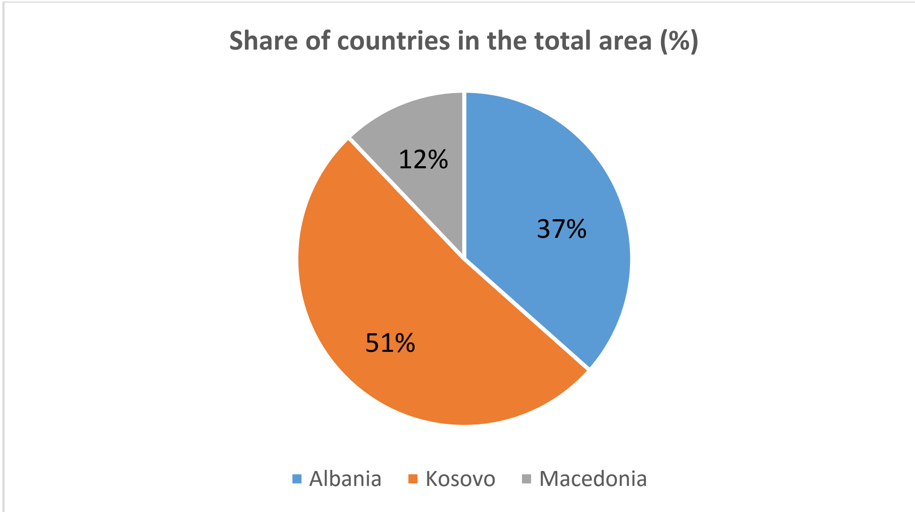


Figure 5 Respective shares of the area size of the countries in the pilot region

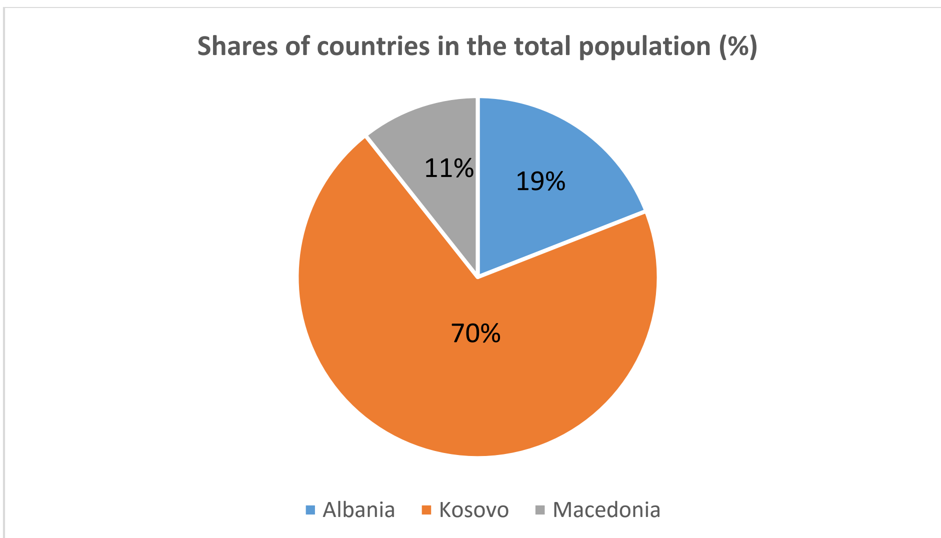


Figure 6 Respective shares of the population of the countries in the pilot region

2. Assumptions of the Integrated Solid Waste Management Model

The floating debris is a serious pollution problem in the Sharra Region, particularly in Albania, Kosovo* and Macedonia. Major transboundary environmental and economic impacts caused by floating debris in the Sharra Pilot Region have been identified during the development of the Environmental and Economic Impact Assessment Report as follows:

- Threats to the riverine wildlife (the rivers Drini E Bardhe (White Drin) and Lepenec);
- Destruction of protected areas: River Gashit in Tropoja; the watershed of the river Valbones in Tropoja; Tej Drini i Bardhe in Has; Korab-Koritnik; threatening the Sharr National Park`s high-mountain endemism (200 endemic taxa) comprising endemic-relict, endemic and steno-endemic species.

*This designation is without prejudice to positions on status, and is in line with UNSCR 1244/1999 and the ICJ Opinion on the Kosovo declaration of independence

- Human health problems in terms of potential injuries of people by sharp objects settled at the bottom of the rivers Drini E Bardhe (White Drin) and Lepenec as well as Fierzi Lake;
- Economic impacts on local communities (increased expenditure on cleaning floating debris at the Fierze reservoir and illegal dumpsites located near riverbanks), tourism in areas such as Valibona, Sistavec, Lake Fierzi and the protected area Korab-Koritnik (loss of income, bad publicity), fishing (reduced and lost catch) and lost revenues from electricity generation at the Fierzi Hydropower Plant due to blockages of turbines in the powerhouse.

Considering the richness of biodiversity and the presence of globally threatened species, on one hand, and the significant threat of the litter on these populations, on the other, waste dumping related prevention measures are a matter of urgency.

Albeit the environmental impacts could not be quantified due to lack of information, some effort has been made to assess the economic impacts related to floating debris and illegal dumps cleaning in the pilot area. It was estimated that each year ***529,000 EUR*** are spent on cleaning up illegal dumps and ***73,886 EUR*** a year is lost due to reduced electricity generation at the Fierzi Hydropower Plant (HPP).

Pilot municipalities contribute to the environmental impacts proportionally to the quantities of released floating debris. Some municipalities are responsible for the generation of floating waste and / or pollution, by inadequate waste management practices and particularly illegal dumping in flood / tide - prone areas. These are considered to be impacting municipalities. Other municipalities that are receiving the (unwanted) floating waste and / or pollution and need to bear (non-recoverable) costs for their clean-up and disposal are impacted municipalities.

Due to the specific character of the pilot region, the major impacted receiver of the floating debris is the HPP Fierzi, where the waste generated from the upstream communities – Dragas and Prizren. Impacted municipalities downstream Lepenec River which carries floating debris from the territory of Prizren and Strpce Municipalities can impact the Municipalities of Cucer-Sandevo, Gjorce Petrov and Karpos (Macedonia). Lepenec River has a torrential character and it floods the lowlands at its confluence. Floating waste can, therefore, strand onto the fertile agricultural land. Tearce and Jegunovce Municipalities also contribute to the floating debris generation in Vardar River.

Table 3 below presents the situation of impacting and impacted municipalities and the potential contribution of the upstream municipalities to the accumulation of the floating debris in the Fierzi reservoir and the transportation of the debris from Lepenec River to the catchment of Vardar River. It is assumed that 30% of total waste quantities not collected may enter the rivers as a floating waste.

Table 3 Potential contribution of upstream pilot municipalities to the accumulation of floating debris in the reservoir Fierzi, as well as to the transport of floating debris to the Vardar River`s wider catchment

Pilot Municipality	Waste not collected (tons/year)	Floating waste (30% of the waste not collected)
Prizren	8,777	2,633
Dragas	2,780	834
Kukes	6,070	1,821
Fierzi Reservoir	17,627	5,288
Prizren	8,777	2,633

Pilot Municipality	Waste not collected (tons/year)	Floating waste (30% of the waste not collected)
Strpce	20	6
Tearce	1,147	344.1
Jegunovce	551	165.3
Vardar River	10,495	3,148

Even though the Municipality of Prizren recently covered the whole territory with an organised waste collection service, local authorities reported that 15% of the population still dumps their waste in the countryside. Considering that the Municipality of Prizren is the biggest in terms of population and waste generation, it still contributes significantly to the floating debris streams in Drini E Bardhe (White Drin) and Lepenec. Table 3 above does not include the municipalities in the Black Drin catchment area which are also contributing to the generation of floating waste at the Fierzi Lake. Also, it does not include the Municipality of Hani Elezi which lays into Lepenec River catchment. Nonetheless, the figures below show the relative contribution of pilot municipalities to the accumulation of floating debris in the reservoir Fierzi and the Vardar River.

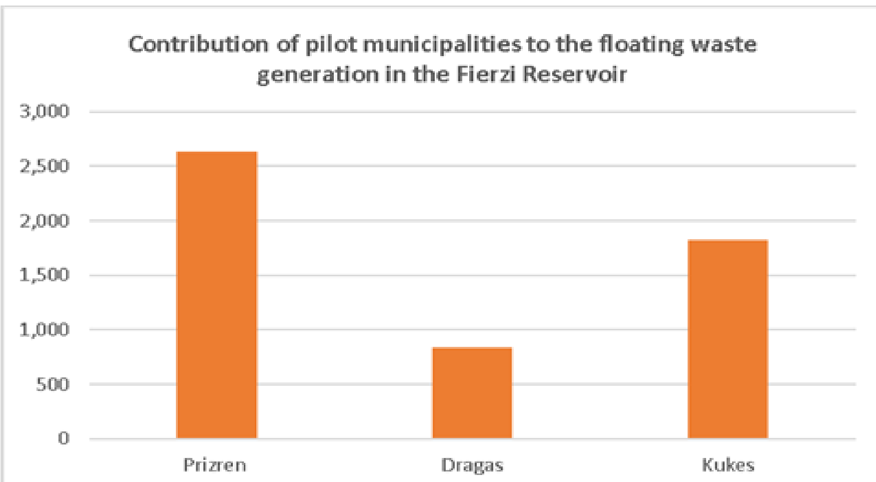


Figure 7 Contribution of pilot municipalities to the floating waste generation in the Fierzi Reservoir (Municipality Kukes)

It can be seen that Prizren and Kukes Municipalities are generating more floating waste than the Municipality of Dragas.

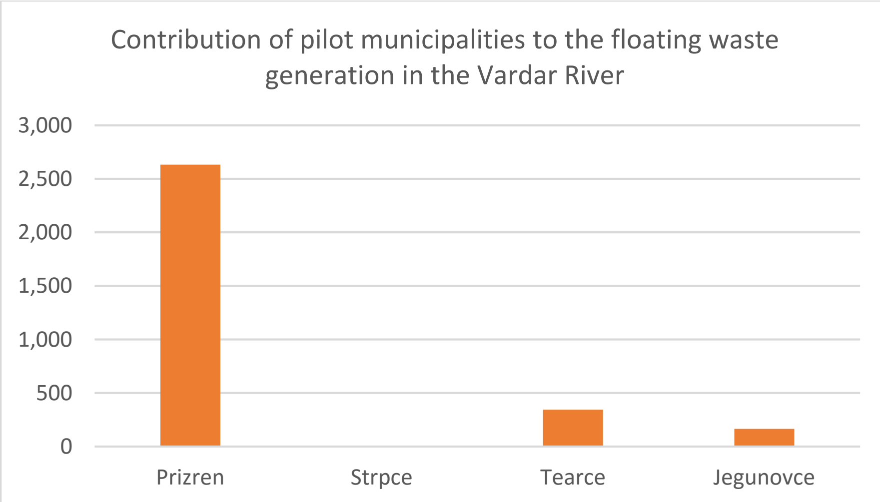


Figure 8 Contribution of pilot municipalities to the floating waste generation in the Vardar River (Municipalities Cucer-Sandevo and Karpos)

Floating waste in the Vardar River is originating mostly from Prizren, Tearce and Jegunovce Municipalities.

The influence of discharged waste is significant when looking at the total pollution of Drin (Drini E Bardhe) and Lepenec Rivers, and this problem must be solved urgently taking the economic, social and cultural situations into consideration. To solve the floating debris problem sustainably, it is necessary to synchronise efforts at national and international level because transboundary water resources and their preservation, protection and sustainable uses as well as the tourism development are of great importance for all countries.

Considering the above, the Integrated Solid Waste Management (ISWM) Model has been developed with the aim to minimise the environmental and economic impacts by synchronised efforts at national and transboundary level.

The main areas where improvements are needed to prevent/ reduce floating debris generation are:

- Scarce information on the amounts, composition and spatial distribution[11] of floating, settled (at the river / reservoir floor) and stranded floating debris at the riverbanks and reservoirs'` coastline.
- Incomprehensive municipal and hence national statistics on waste generation, composition and management (the latter including, as a minimum, collection rate from service users, recycling / recovery rate, the amounts of disposed waste, the inventory of sources of floating debris – non-compliant municipal landfills, illegal dumps, etc.).
- Insufficient waste management practices in the majority of pilot municipalities, constituting the root cause for the generation of floating debris: lack of organisational and financial capacity of operators to cover remote rural areas with an organised waste collection service; littering habits of population (and tourists) due to the low awareness of deriving adverse

[11] Spatial distribution of floating debris is linked to river / reservoir currents, tides and river information indications about the physical source, i.e. the litter input zone and its pathway.

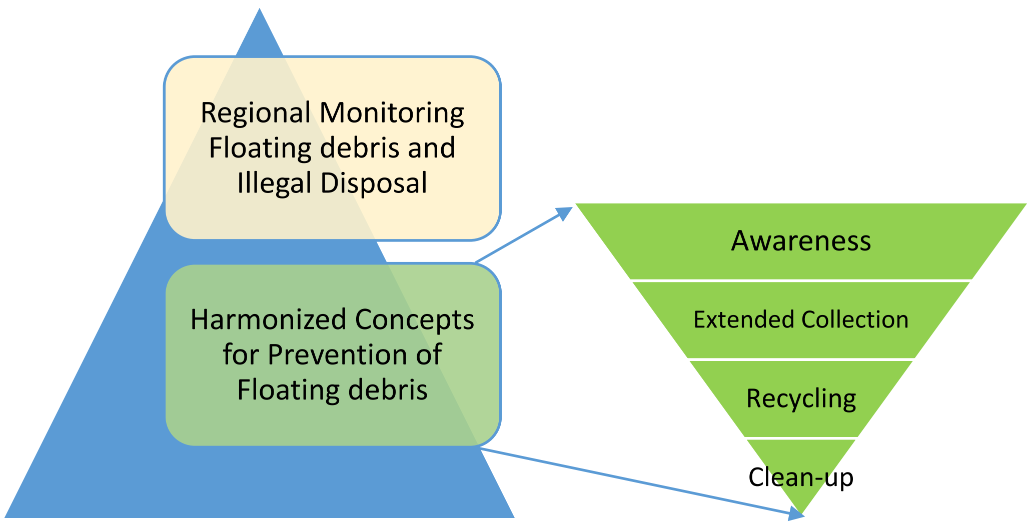
environmental and economic impacts; lack of responsiveness to newly introduced waste segregation practice in some municipalities; insufficient enforcement.

3. The Scope of ISWM

The approach of the ISWM Model has been discussed and agreed throughout the process involving various stakeholders of the pilot region (municipalities, waste management operators, NGOs, private recycling companies, etc.). The process comprised two subsequent Dialogue Platforms (DP): during the 1st DP the challenges for regional cooperation were discussed and the scope of the ISWM Model was analysed and established at the 2nd DP.

The ISWM Model proposes concepts and tools to improve the situation in three main areas:

1. Regional monitoring system of floating debrisand illegal disposal
2. Mechanism for improved and shared waste management information / statistics
3. Harmonised concepts for prevention of floating debris



The necessary improvements that are to be carried out via regional cooperation or on a national level are laid out below separated by subject area.

3.1 Regional Monitoring of Floating Debris and Illegal Disposal

Floating debris is found in almost every river catchment - in streams, rivers and lakes (reservoirs). It is composed of a variety of materials, ranging from plastic bottles to sage brush, including also wood in some shape or form--from whole trees to lawn furniture. Biodegradable waste degrades naturally in conjunction with biological agents. Non-biodegradable debris does not really decompose. Examples of non-biodegradable floating debris include municipal waste, cans, bottles, Styrofoam, etc. The material may be floating on the surface, or it may be a water-soaked or suspended at some depth beneath the surface. Also, it can strand along the riverbanks and reservoirs.

Surface water runoff is an important mechanism of bringing debris into the water bodies. Runoff can move some debris directly, but primarily it increases the stream velocities and water levels so that debris along the banks is swept into the stream. As water levels increase, the width of the affected land increases, and more debris can be carried on. The intensity of water flow under some flood conditions is such that the direction and width of streams (rivers) are changed, and dumped waste- buried in sandbars - can be washed loose (Cummins et al. 1983). Streambank erosion is the primary cause of wastes entering the watercourse (McFadden and Stallion 1976). The rapidly moving material is also a danger to many man-made structures such as hydropower plants (Klingman 1973, Rowe 1974). Submerged debris can build up in front of trash racks of hydropower plants turbines. High flows will also remove structures that are normally on land, as well as the loose debris that people dispose of in the watercourse.

Floating debris in the Sharra pilot region has not been monitored.

Considering the character and behaviour of the floating debris, this ISWM Model analyses existing monitoring methodologies for ***stranded litter at riverbanks and shorelines of reservoirs*** as well as for ***illegal disposal***.

3.1.1 Best Practice on Floating Debris and Illegal Disposal Monitoring Methodologies

Systematic efforts to collect data on the amounts, distribution and composition of floating debris along the riverbanks and coastlines of the Fierzi reservoir in the Sharra pilot region do not exist.

There are a number of best practice methodologies for monitoring of marine litter that are discussed herein, that can be applied in the Sharra pilot region. Even though the floating debris[12] may be different from the marine litter by its composition and sources[13], it eventually reaches the sea[14]; therefore, the marine litter monitoring methodologies, in the absence of tailored ones for the riverine environments, are considered to be relevant. By applying these methodologies, the contribution to the marine litter of the Drin River and the Lepenec River to the Adriatic and Aegean Seas respectively, can be established.

The most recent marine litter monitoring methodology has been developed under the DeFishGear Project[15], constituting three Guidelines:

- Methodology for Monitoring Floating debris on Beaches[16]
- Methodology for Monitoring Floating debris on the River / reservoir surface[17]
- Methodology for Monitoring Floating debris on the River / reservoir floor[18]

The methodology for monitoring floating debris on beaches is pertinent to the stranded floating debris at the riverbanks and coastline of the Fierzi reservoir.

Other relevant methodologies for monitoring floating debris include, but are not limited to:

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[12]The term “floating debris” is used for the debris found in the riverine environments.
[13]Sources of marine litter are sea and land based, while the sources of floating debris in the Sharra pilot region are exclusively land based, as the rivers are not navigable.
[14]The Drin River (Drini E Bardhe) enters the Adriatic Sea and Lepenec River inflows the Aegean Sea.
[15]http://www.defishgear.net/project/background
[16]http://mio-ecsde.org/wp-content/uploads/2014/12/Beach-litter_monitoring-methodology_complete.pdf
[17]http://mio-ecsde.org/wp-content/uploads/2014/12/Floating-litter_monitoring-methodology_complete.pdf
[18]http://mio-ecsde.org/wp-content/uploads/2014/12/River / reservoirfloor-litter_monitoring-methodology_complete.pdf

- UNEP/MAP MEDPOL Monitoring Guidance Document on Ecological Objective 10:Floating debris (2014)[19]
- The NOAA Marine Debris Program (MDP)[20]
- National Marine Debris Monitoring Program (UNEP and Ocean Conservancy, September 2007)[21]
- UNEP/IOC Guidelines on Survey and Monitoring of Floating debris[22]
- Guidance on Monitoring of Floating debris in European River / reservoirs (JRC, 2013)[23]

All above methodologies focus on abundance, types and concentration rather than analysing by potential source, as in many cases it is very difficult to connect a debris item to a specific debris-generating country or activity. Many published studies have attempted to attribute sank litter (at the riverbanks and reservoirs coastline) to a broad source, but this has often been based on local knowledge, assumptions and seemingly an absence of a rigorous methodology. For example, Willoughby (1986), found that rubbish slicks on islands surrounding the city of Jakarta, Indonesia, contained large quantities of freshwater hyacinth, a plant which does not grow on the islands, thus linking the source of the litter to rivers of the mainland. Such local knowledge and anecdotal evidence can be extremely useful. However, there are very few published studies that have set out to determine the precise source of sank litter (at the riverbanks and reservoirs' coastline) using a specific methodology; a repeatable and transferable method is desirable to allow comparison and use as a management tool. At present there is no accepted methodology that enables researchers to link litter items to their source.

Nevertheless, a number of techniques has been developed to assist in the identification of sources on the basis of litter items recorded in the marine environment e.g. the Matrix Scoring Technique to Determine Litter Sources at a Bristol Channel Beach (Tudor & Williams 2004)[24].The aim of this study was to create a method of assigning a source to litter found on beaches of the Bristol Channel but which could equally be used on any beach. The method adapts the elements from the Percentage Allocation (Method 5 - Earll et al. 1999) and Cross Tabulation Probability Scoring (Method 6 – Whiting 1998 Adaptations and different scoring schemes were tried to produce a refined 'Matrix Scoring Technique'. ***The method can be applicable to the riverine environment and reservoirs either.*** The process comprises several steps, namely:

- generation of lists of floating debris found at the beach (riverbank or coastline of the reservoir);
- elimination using various degrees of likelihoods of a litter item to descend from a number of sources (Table 4); and
- percentage allocation of each litter item to specific source.

Table 4 Litter items and the likelihood of source. Key to probability phraseology: Very unlikely (UU); Unlikely (U); Possible (P); Likely (L); Very likely (LL)

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[19]http://rac-spa.org/nfp12/documents/working/wg.408_06_eng.pdf
[20]http://marinedebris.noaa.gov/sites/default/files/Lippiatt%20et%20al%202013.pdf
[21]http://www.unep.org/regionalriver / reservoirs/marinelitter/publications/docs/NMDMP_REPORT_Ocean_Conservancy__2_.pdf
[22]http://www.unep.org/regionalriver / reservoirs/marinelitter/publications/docs/Marine_Litter_Survey_and_Monitoring_Guidelines.pdf
[23]https://ec.europa.eu/jrc/sites/default/files/lb-na-26113-en-n.pdf
[24]http://databases.eucc-d.de/files/documents/00000611_C10.119-127.pdf

Litter Category	Sources of Floating debris			
	Tourism (reservoir and riverbank beach)	SRD[25]	Fly tipping- land	Land (run off)
Sweet wrapper	LL	UU	UU	U
Food container	L	UU	UU	U
Plastic drinks bottle < 500 ml	LL	UU	UU	U
Take away food container	LL	UU	UU	U
Lollipop stick	LL	UU	UU	U
Straw	LL	UU	UU	U
Fishing line	UU	UU	UU	UU
Unidentifiable plastic fragment	P	UU	UU	U
Polystyrene piece	P	UU	UU	U
Cigarette stubs	LL	UU	UU	U
Cigarette box	LL	UU	UU	UU
Children's toy	LL	UU	UU	UU

This Matrix scoring system gives a new alternative and offers a transparent and usable method of establishing sources of floating debris stranded at the riverbanks and reservoirs` coastlines.

Considering the fact that the Environmental and Economic Impact Assessment Report identified illegal dumps as sources of floating debris, it is proposed to include the inventories of these sites in the regional monitoring as well.

There are various methodologies to monitor illegal disposal but no standardised and broadly recognised method exists. These span from using remote sensing tools to physical surveys which can be regular or incidental; combinations of these methods can also be found.

3.1.1.1. Floating Debris Monitoring

The Marine Strategy Framework Directive (MSFD –2008/56/EC) requires the EU Member States to establish monitoring programmes of marine litter by 15 July 2014.The monitoring programmes have to be "coordinated", "compatible", "coherent", "consistent" and "comparable".

The pilot countries are accession countries (Albania, Kosovo* and Macedonia) and therefore the floating debris methodology should comply with the MSFD. Other applicable conventions to adhere to include: OSPAR Convention, Barcelona Convention, Helsinki Convention (HELCOM) and Bucharest Convention. A full Floating Debris Monitoring Programme should cover the following categories and stakeholders:

- Monitoring of litter on river / reservoir floor: divers` associations should be involved.
- Monitoring of litter on the water surface of the reservoir: visual observations from boats are needed.
- Monitoring of stranded waste at riverbanks and coastlines of reservoirs: trained volunteers can implement this type of monitoring instead of professional surveyors.
- Monitoring of litter in biota. Involvement of scientific institutions and specialists on fauna, birds are required.

[25]SRD – sewerage related debris

*This designation is without prejudice to positions on status, and is in line with UNSCR 1244/1999 and the ICJ Opinion on the Kosovo declaration of independence

It is also possible to monitor the sediment in the reservoir changing under the influence of the sank litter as part of the standard monitoring of the sediment movement in the dams. Unfortunately, a globally recognised methodology does not exist and therefore we cannot propose a best practice on this.

The pilot municipalities can independently undertake monitoring of ***sank litter*** (at the riverbanks and reservoirs coastlines) only. Monitoring of floating, river / reservoir floor litter and litter in biota would require involvement of specialised institutions and experts which will absorb significant resources. Therefore, the best practice methods for monitoring of sank litter at the riverbanks and reservoirs coastlines are detailed in this ISWM Model.

A (best practice) regional monitoring of ***sank litter*** (at the riverbanks and reservoirs coastline) in the Sharra Pilot Region should therefore set a harmonised approach in the following compartments:

- Spatial distribution of monitoring: site selection strategy;
- Survey method: setting sampling units, monitoring frequency and surveyed litter categories;
- Identification and making available necessary resources;
- Data handling & reporting;

The site selection strategy has fundamental consequences for the monitoring analysis, as has the selection of the survey method. Monitoring programmes are not compatible or comparable if they use the same survey methods, but different site selection strategies (e.g. special site selection on the basis of litter pollution levels, or a randomised selection of sites). It is proposed to use a combination which is sometimes referred to as, “stratified randomised sampling strategy” (e.g. OSPAR beach litter protocol).

The proposed criteria[27] should take into account the following locations:

- Riverbanks and river mouths;
- Reservoirs coastlines;
- Tourists` destinations;

Additional criteria for the selected monitoring sites are to:

- have a minimum length of 100m[28];
- be characterized by a low to moderate slope (~1.5-4.5 º), which precludes very shallow tidal mudflat areas that might be kilometres long;
- have clear access such that floating debris is not screened by anthropogenic structures;
- be accessible to survey teams throughout the year;
- be known when the most recent cleaning activities have taken place[29] in order to determine the trends of floating debris over time;

[27]These criteria have been taken over from the DeGishGear Methodology for Beach Monitoring

[28] The National Marine Debris Monitoring Program (UNEP and Ocean Conservancy, September 2007) sets a minimum length of 500 meters.

[29] According to the National Marine Debris Monitoring Program (UNEP and Ocean Conservancy, September 2007), the monitoring should be undertaken every 28 days throughout a year; The monitoring will therefore start 28 days after the first clean up activity to avoid any skewing of the results by historical pollution not attributable to floating debris.

- be posing no threat to endangered or protected species, such as birds, marine mammals or sensitive vegetation.

A best practice Floating debris monitoring method comprises:

- setting sampling units,
- frequency,
- methods for identification of litter, and
- surveyed categories.

A sampling unit is defined as a fixed section of a monitoring site. A 100-metres stretch from the strandline to 10 meters back will be considered a sampling unit. Two sampling units on the same monitoring site should be monitored. The same sites should be monitored for all surveys. In order to identify the start and end points of each sampling unit permanent reference points can be used and coordinates obtained by GPS.

The monitoring frequency, as proposed in analysed methodologies, spans from every 28 days to 4 times a year.

The DeFishGear project proposes to undertake monitoring upon the following seasons:

1. Autumn: mid-September-mid October
2. Winter: mid-December-mid January
3. Spring: April
4. Summer: mid-June-mid July

Before any sampling begins, shoreline characterization should be completed for each 100m site. The GPS coordinates of all four corners of the sampling unit should be recorded. A site ID name should be created and used for the duration of the study. The site's special features, including characterization of the type of substrate (sand, pebbles, etc.), topography, land use, distances from urban settlements and river mouths, etc. should be recorded using a special "Monitoring Site Identity Sheet'. Digital photographs should be taken to document the physical characteristics of the monitoring site.

All items found on the sampling unit should be entered in the sank litter Monitoring Sheet. On the sheet, each type of item is given a unique identification number. Data should be entered in the sheet while picking up the litter item. The number of litter categories and sub-categories varies among different methodologies. There are, however, globally recognised 9 categories (Table 5) and 77 sub-categories (Annex 1) of sank litter (at the riverbanks and reservoirs'` coastline).

Table 5 Floating debris Categories

Class	Material Composition	Litter Code	Litter Form (and Examples)
1	Plastic	PL01	Bottle caps & lids
2	Foamed Plastic	FP01	Foam sponge
3	Cloth	CL01	Clothing, shoes, hats & towels
4	Glass & ceramic	GC01	Construction material (brick, cement, pipes)
5	Metal	ME01	Tableware (plates, cups & cutlery)
6	Paper & cardboard	PC01	Paper (including newspapers & magazines)
7	Rubber	RB01	Balloons, balls & toys

Class	Material Composition	Litter Code	Litter Form (and Examples)
8	Wood	WD01	Corks
9	Other	OT01	Paraffin or wax

The identification and correct categorization of litter items should be facilitated by a Photo Guide[30].

Figure 9 Photo Guide Developed under the OSPAR Methodology

Unknown litter or items that are not in the survey sheet should be noted in the appropriate “other item box”. A short description of the item should then be included in the survey sheet. If possible, digital photos should be taken of unknown items so that they can be identified later and, if necessary, be added to the survey sheet.

The unit in which litter will be assessed on the coastline will be number of items and it will be expressed as counts of litter items per square meter (m^2). In addition, the main category types of litter items should be weighed. The results shall be statistically processed and reported in an agreed format.

By applying best practice monitoring programmes the abundance, types, and concentration, and possibly links between the potential source and specific debris-generating countries or activities can be analysed in the Sharra pilot region. However, such comprehensive monitoring programmes can be costly and resource demanding in terms of qualified and skilled labour. Therefore, this ISWM Model proposes a simplified approach which is described in detail in section 3.1.2.1 below.

3.1.1.2. Illegal Disposal Monitoring

Best practice in monitoring of ***illegal disposal sites*** comprises two distinct methodologies: visual observation using remote sensing and field surveys. It does not preclude a combination of these methods from being useful for illegal domestic waste disposal sites monitoring and mapping.

Remote sensing comprises the following steps:

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[30]http://www.ospar.org/ospar-data/10-02e_beachlitter%20guideline_english%20only.pdf

1. Selecting high, moderate or medium spatial resolution remote sensors to be applied for mapping illegal municipal waste disposal sites;
2. Conduct visual identification of illegal municipal waste disposal sites observing visible indirect temporal land changes associated with illegal waste disposal such as thermal anomalies and/or vegetation: land degraded by the presence of illegal waste is usually noticeable for its spectral signature stability over time in comparison to other features such as urban areas, river / reservoir, salt evaporation pools, cultivation systems, etc.

Limited studies[31] have been conducted into techniques to analyse remote sensing data[32] towards illegal waste disposal sites monitoring and mapping. However, existing studies do provide some insight into the future opportunities likely afforded by different remote sensors and methods.

Silvestri and Omri[33] developed a method to map illegal dumps based on the spectral signature of stressed vegetation associated with the presence of (illegal) waste. Using this method, a spectral library with accompanying statistics that define the spectral characteristics of seven illegal waste disposal sites[34] was created. The resultant map was then validated; approximately 12% of the identified sites were actually illegal dumps. Maximum likelihood classification was achieved by analysing both digital orthophotos and very high-resolution IKONOS imagery to map illegal waste dumpsites.

The visual data observation using remote sensing requires utilisation of highly specialised staff. Data transformation alongside ISODATA[35] unsupervised classification can be useful for monitoring and mapping illegal domestic waste disposal and it does not require specially trained staff.

Various methodologies[36] for designing ***field surveys to locate, qualify and quantify illegal dumps*** exist. The method would vary depending on the survey objective: creating inventories of illegal dumps[37] and preparing for clean-up, or planning their closure and remediation. If closure and remediation are foreseen, the qualification and quantification of an illegal dump is followed by a Risk Assessment. A profound Risk Assessment may require additional investigations, including biological, geological / hydrogeological monitoring and groundwater sampling.

The staged approach for the implementation of field investigations is summarised as follows:

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[31] Yonezawa, C. Possibility of monitoring of waste disposal site using satellite imagery. J. Integr. Field Sci. 2009
[32] Remote sensing data are acquired through satellites such as LANDSAT, ALOS AVNIR-2, ALOS PALSAR, and FORMOSAT-2 (moderate resolution) and ALOS PRISM, IKONOS (high resolution).
[33] Silvestri, S.; Omri, M. A method for the remote sensing identification of uncontrolled landfills: Formulation and validation. Int. J. Remote Sens. 2007
[34] Biotto, G.; Silvestri, S.; Gobbo, L.; Furlan, E.; Valenti, S.; Rosselli, R. GIS, multi-criteria and multi-factor spatial analysis for the probability assessment of the existence of illegal landfills. Int. J. Geogr. Inf. Sci. 2009
[35] ISODATA is a method of unsupervised classification using Algorithm splits and merged clusters; computer runs algorithm through many iterations until threshold is reached: http://web.pdx.edu/~jduh/courses/Archive/geog481w07/Students/Vassilaros_ISODATA.pdf
[36] chrome-extension://klbibkeccnjlkjkiokjodocebajanakg/suspended.html#uri=http://www.litter.vic.gov.au/litter-prevention-tooklits/local-litter-measurement-toolkit; https://webcache.googleusercontent.com/river / reservoirrch?q=cache:0mzUsW9hslgJ:https://www.ru.ac.za/media/rhodesuniversity/content/environmentalscience/Group%25202.docx+&cd=1&hl=mk&ct=clnk
[37] Inventories of illegal dumps may be useful for assessing the climate change impact of landfill gas emissions.

1. Undertaking a stakeholder survey to focus the field investigations into the areas which are the most prone to emerging of illegal dumping;
2. Compare the results of the stakeholder survey and previous inventories of illegal dumpsites;
3. Establish a grid on a map with sufficient scale, covering the country territory into zones / polygons; classify these zones by the likelihood of illegal dumpsites emerging – high, moderate and low, based on the stakeholders` input and previous inventories. The zones may have an area of $1km^2$ or more. For countries with high density of illegal dumpsites the grid will be more condensed;
4. Develop visual observation sheets to record the locations, size, composition of dumped waste, distance from pathways (rivers, gullies, river / reservoir coast, reservoirs, etc.);
5. Plan and execute the field investigations: the resources needed encompass manpower (volunteers, staff of the waste management operators, civil society organisations, etc.), GPS devices, Clipboard for each surveyor; Recording sheets; pencils;
6. Design clean-up and prevention programmes.

To design successfully an illegal dumps inventory, a survey of public should be undertaken. An example of a survey questionnaire is provided in Annex 2. The survey should answer which areas are most likely prone to emerging of illegal dumping, i.e. gullies, riverbanks, roads, etc. Stakeholders should also help in the identification of the potential locations and size of dumpsites, as well as composition of dumped waste and distance from a pathway potentially leading to the river / reservoir. The information collected from stakeholders should be crosschecked with available information on illegal dumps inventories collected in the past.

Additional preparations are required for closing and remediating the illegal dumpsites as follows:

- The identified illegal dumpsites should be classified (based on the observations and records) as per the following attributes:

    - Sites below and above $500m^2$ of area;
    - Sites where there is high probability for dumping of hazardous waste;
    - Sites located within and outside a corridor of 20 meters along a pathway;

- Risk Assessment should be undertaken (including biological, geological / hydrogeological investigations and water sampling of the nearby river) for illegal dumps which have an area above $500m^2$, there is some hazardous waste dumped and which are located at a distance of 20m from a pathway.

Then, preparation of field observation and identification can start: the country area should be divided into sufficient number of zones (polygons) by the identification of horizontal and vertical "divide" lines on a map. The zones are purely to make the data collection process more efficient and to allow for no part of the country to be left out. Each zone should be classified by the likelihood for illegal dumps emerging. Once the zones are set, the planning of resources and the data collection method will take place.

Inventories of illegal disposal should be used for designing of suitable ***clean-up*** and especially for ***prevention programmes*** to eliminate or reduce illegal dumping practices. The key to successfully using this practice is increasing public awareness of the problem and its implications. Illegal dumping clean-up and prevention programmes use a combination of:

1. Clean up efforts

2. Community outreach and involvement
3. Targeted enforcement
4. Tracking and Evaluation

In the Illegal Dumping Preventing Guidebook[38] of the US Environment Protection Agency (EPA), a tool is developed for preventing illegal dumping focusing on the four programmatic areas outlined above (Box 1.).

Box 1. Four Programmatic Areas for Preventing Illegal Dumping (US EPA, 1998)

Cleanup Efforts
Cleanup projects will require a coordinated planning effort to ensure that adequate resources and funding are available. Once a site has been cleaned, signs, lighting or barriers may be required to discourage future dumping. Signs should indicate the fines and penalties for illegal dumping, and a phone number for reporting incidents. Landscaping and beautification efforts may also discourage future dumping, as well as provide open space and increase property values.

Community Outreach and Involvement
This may be the most important tool in ensuring that this practice is effective. The organization of special cleanup events where communities are provided with the resources to properly dispose of illegally dumped materials increases the understanding among residents of illegal dumping impacts and supplies opportunities to correctly dispose of materials which may otherwise be illegally dumped. Integration of illegal dumping prevention into community policing programs or use of programs such as Crime Stoppers may also be an effective way to increase enforcement opportunities without the additional cost of hiring new staff. Producing simple messages relating the cost of illegal dumping on local taxes and proper disposal sites will aid in eliminating the problem. Having a hotline where citizens can report illegal activities and educating the public on the connection between the illegal dumping and floating debris will decrease illegal waste dumping.

Targeted Enforcement
This tool involves the use of ordinances to regulate waste management and eliminate illegal dumping through methods such as fines, cost recovery penalties for cleanup, and permit requirements for waste management activities, to name a few. These fines and penalties can be used to help fund the prevention program or to provide rewards to citizens who report illegal dumping activities. Other recommendations for this tool include training of staff from all municipal departments in recognizing and reporting illegal dumping incidents, and dedicating staff who have the authority to conduct surveillance and inspections, and write citations for those caught illegally dumping.

Tracking and Evaluation

[38] http://nepis.epa.gov/Exe/ZyNET.exe/2000CNVU.txt?ZyActionD=ZyDocument&Client=EPA&Index=1995%20Thru%201999&Docs=&Query=&Time=&EndTime=&River /reservoirrchMethod=1&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&UseQField=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A%5CZYFILES%5CINDEX%20DATA%5C95THRU99%5CTXT%5C00000009%5C2000CNVU.txt&User=ANONYMOUS&Password=anonymous&SortMethod=h%7C-&MaximumDocuments=1&FuzzyDegree=0&ImageQuality=r75g8/r75g8/x150y150g16/i425&Display=p%7Cf&DefSeekPage=x&River /reservoirrchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1

This tool measures the impact of prevention efforts and determines if goals are being met. Using mapping techniques and computer databases allows officials to identify areas where dumping most often occurs, record patterns in dumping occurrence (time of day, day of week, etc.), and calculate the number of citations issued and the responsible parties. This allows for better allocation of resources and more specific targeting of outreach and education efforts for offenders.

The above tool highlights the most important issues which need to be examined when creating a clean-up and prevention programme. These include:

- The locations of persistent illegal dumping activity.
- The types of waste that are dumped and the profile of dumpers.
- Possible driving forces behind illegal dumping such as excessive user fees, restrictive curbside trash pickup, or ineffective recycling programmes.
- Previous education and cleanup efforts that have been used.
- Current prevention programmes and local laws or ordinances that address the problem.
- Existing sources of funding and additional resources that may be required.

Hence, the best practice methods for monitoring of illegal dumping require careful planning involving desk research and targeted surveys; the execution itself is a matter of good coordination of previously trained staff, while the reporting and record keeping should be designed in such a way that the dumpsites` inventories can be used for various purposes: to design clean – up programmes, closure and remediation of landfills posing higher environmental risk and setting enforcement programmes against illegal dumping. The most important outcome of monitoring activities executed concurrently with clean-up activities is the raising of public awareness.

Having in mind the limited resources of pilot municipalities, a simple monitoring programme for illegal disposal is outlined in section 3.1.2.2 below.

3.1.2 Proposed Monitoring Methods for Floating Debris and Illegal Disposal

The proposed approaches will simultaneously allow for coordinating and comparing the results on a regional scale and maintaining comparability to the results achieved by using harmonised monitoring methodologies across the pilot region. Another added value of the implementation of the monitoring of sank litter (at the riverbanks and reservoirs' coastline) and illegal disposal will be the raising of public awareness.

Key to the success of any regional monitoring programme will be the community involvement and more specifically adaptive co-management. Adaptive co-management relies on the involvement of multiple level actors and promotes building relationships between these levels in order to achieve a functional and reliable management system (Cundill and Fabricius, 2008).

In the pilot municipalities, municipal administration, councillors and Public Communal Enterprises (PCEs) will play a crucial role in managing floating debris and illegal disposal monitoring programmes. Community leaders need to be elected and start involving citizens in decision making and action. In this way, a community-mentality is gained whereby people act towards bettering their own area for the greater good of the whole community. If communities were more educated on the impacts of floating debris and illegal dumping and identified this as a social deviation, this could potentially begin to change their habits (McKinlay and Starkey, 1998).

3.1.2.1 Floating Debris Monitoring

The Guidance on Monitoring of Marine Litter in European Seas[39] recognises that the full scope is demanding in terms of organisation and resources; therefore, it suggests integration of monitoring with measures such as clean-up campaigns. ***Consequently, the first step to introducing a comprehensive floating debris monitoring in the Sharra Pilot Region would be to undertake sank litter (at the riverbanks and reservoirs' coastline) monitoring.***

The Guidance on Monitoring of Floating debris in European Seas recommends using the citizen-science based Marine Litter Watch[40]protocol (developed for the needs of the European Environment Agency - EEA). As stated elsewhere, even though this protocol has originally been designed for marine litter, it can also be useful for collecting sank litter (at the riverbanks and reservoirs coastline) data. It is based on a simple counting mobile application, which enables volunteers to count litter on beaches and submit the data on a central public data base that is hosted by the EEA. The process of floating debris monitoring and the interface of the mobile application are presented in the following Figure 10:

Figure 10Sank litter (at the riverbanks and reservoirs coastline) Monitoring-Overall Approach (left) and Interface of the Mobile Application Marine Litter Watch

Guidance[41]on implementing the beach cleaning and monitoring protocol using the Marine Litter Watch mobile application describes:

- How to join or create a community;
- How can communities help monitoring floating debris;

[39]https://ec.europa.eu/jrc/sites/default/files/lb-na-26113-en-n.pdf
[40]http://www.eea.europa.eu/themes/coast_river / reservoir/marine-litterwatch
[41]http://www.eea.europa.eu/themes/coast_river / reservoir/marine-litterwatch/get-started/how

- How to monitor and report litter found on beaches;
- How to generate data to support floating debris management and raise awareness;

As stated elsewhere, coordination at a regional/national level is required for the regular implementation of the monitoring system for sank litter (at the riverbanks and reservoirs coastline).The possible regional process of floating debris monitoring is illustrated in Figure 11.

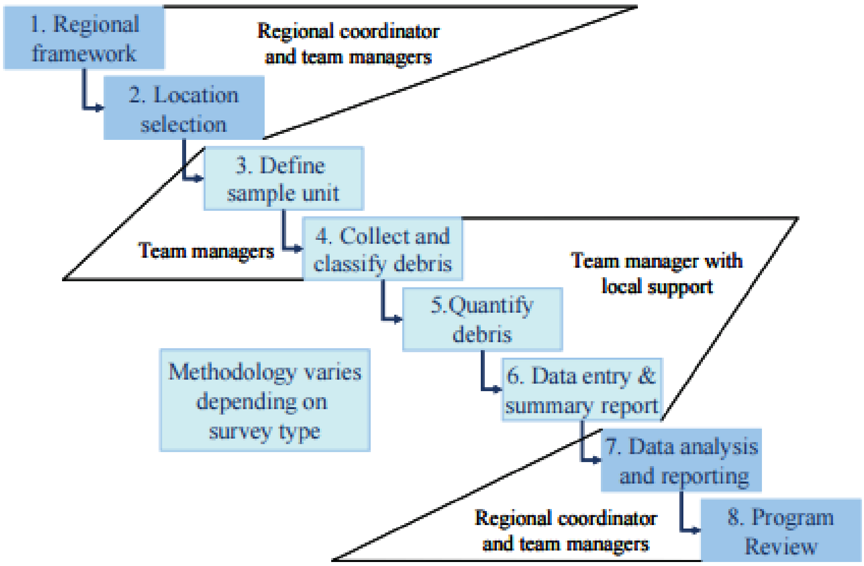

Figure 11 Regional Sank litter (at the riverbanks and reservoirs' coastline) Monitoring Process

At the 2nd Dialogue Platform[42], the stakeholders proposed the following institutional setup of the monitoring activities to be performed in spring 2016 session:

- Regional Coordinator: SWG Secretariat
- National Coordinators: SWG Offices
- Local Coordinators: Public Communal Enterprises (PCEs) and volunteers

Tasks of the regional coordinator are:

- identification and setting up of survey sites
- contact with the organizations/institutions carrying out the surveys
- development & maintenance of the survey system
- training of surveyors
- entering the data into the database/QA of data
- maintaining the database
- data analysis
- reporting
- (further) development of methodology
- participation in national and international workshops, working groups, etc.

For the overall coordination of four survey sites ca. 330 hours will be necessary in order to set up the monitoring system and about 250 hours/year will be required to maintain the system[43].

[42]The 2nd Dialogue Platform Session has been held in March 2016 in Prizren.
[43]https://ec.europa.eu/jrc/sites/default/files/lb-na-26113-en-n.pdf

Any long term floating debris assessment programme will require a specific and focussed effort to recruit and train field staff and volunteers. Consistent, high quality training is essential to ensure data quality and needs to explicitly include the development of operational (field based) skills. Staff education programmes should incorporate specific information on the results and outcomes from the work so that staff and volunteers can understand the context of the floating debris assessment programme. In summary there are a number of key issues that need to be considered when engaging volunteers in floating debris assessments and these include (adapted from Sheavly 2007):

- Volunteers need to be properly trained with hands-on training exercises and supportive training materials and programme manuals that detail responsibilities and procedures;
- Local coordination and management is needed to ensure that volunteers are available when needed and monitoring schedules are followed;
- Effective and frequent communication is a key element in keeping volunteers engaged and up-to-date with the programme activities, including how their monitoring activities are supporting resource and conservation management efforts;
- Succession plans are needed to ensure that as some volunteers retire or leave the programme, new volunteers are trained to provide replacements;
- Regular recognition efforts of the volunteers and their efforts can be effective in maintaining their involvement in the monitoring programme (e.g. media coverage, presentations by monitoring group members and/or management groups at local civic meetings, thank you notes, various memorabilia including t-shirts, hats, etc.);
- The monitoring programme needs to be realistic in terms of the expectations of labour and the length of time needed to conduct this type of study;
- Regional coordinator needs to make regular visits to sites to ensure that training is relevant and appropriate to the needs of the survey. Ideally follow-up visits should be scheduled to coincide with re-training efforts and other activities;
- Where appropriate, typically where local people are limited by financial or other resources, monetary support may be required to cover transportation expenses related to their efforts.

While the very nature of a volunteer is not to expect anything in return for his/her efforts, people do like to know that their efforts are meaningful and appreciated. In more general terms the following issues are also relevant when managing volunteer programmes (adapted from the "Model Code of Practice for Organisations Involving Volunteer Staff"; Volunteering Australia 2007)[44]:

- Interview and employ volunteer staff in accordance with anti-discrimination and equal opportunity legislation;
- Provide volunteer staff with a healthy and safe workplace;
- Provide appropriate and adequate insurance coverage for volunteer staff;
- Define volunteer roles and develop clear job descriptions;
- Differentiate between paid and unpaid roles;
- Provide all staff with information on grievance and disciplinary policies and procedures;
- Reimburse volunteer staff for out of pocket expenses incurred on behalf of the organization;
- Treat volunteer staff as valuable team members, and advise them of the opportunities to participate in agency decisions; and
- Acknowledge the contributions of volunteer staff.

[44] http://volunteeringaustralia.org/wp-content/uploads/VA-Model-Code-June-2005.pdf

3.1.2.2 Illegal Disposal Monitoring

The pilot municipalities do not have an efficient monitoring system for illegal dumpsites and do not know who needs to be fined for dumping or where all the illegal dumpsites are actually located. Therefore, a simple approach, applicable on regional scale is proposed.

The monitoring of illegal sites and creation of their regional inventory will not require site selection. Ideally all illegal dumps should be monitored. However, as a first step, only those located along the rivers, river / reservoir coast and lakes / reservoirs will be monitored.

Similarly to the Floating Debris Monitoring approach, the first step in reducing the impacts will be to create inventories of illegal dumpsites upon the clean-up campaigns. Therefore, the most suitable method to track the locations of dumpsites, volume and provisional composition of fly tipped waste will be the one developed by the initiative "Let`s Do It World"[45] - a civic-led mass movement that began in Estonia in 2008 when 50,000 people united together to clean up the entire country in just five hours.

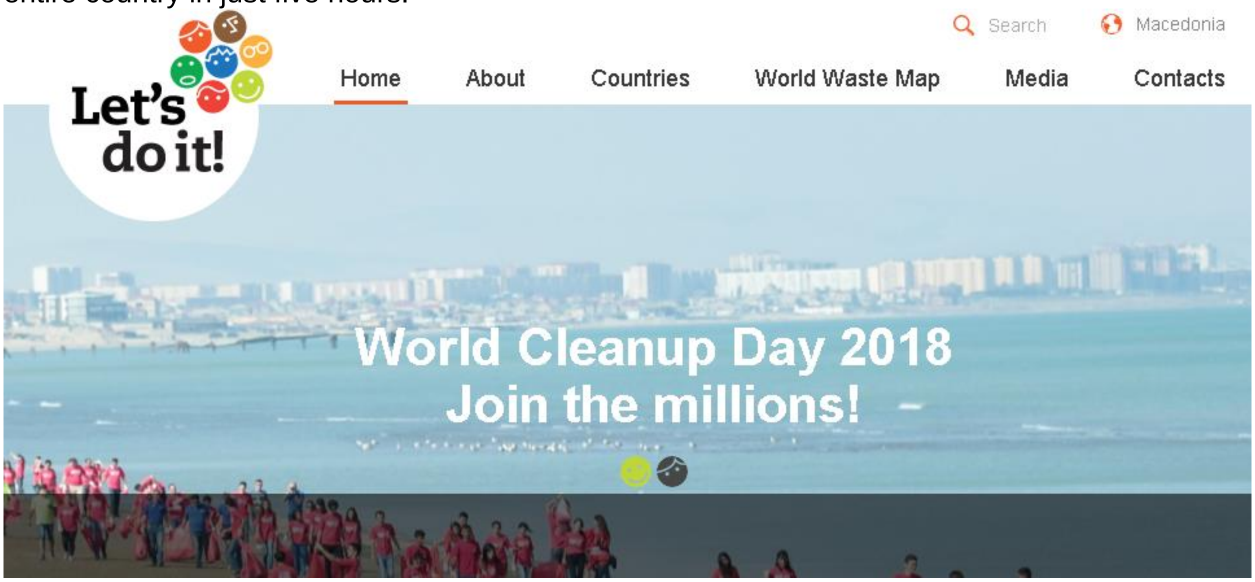

Figure 12 "Let`s Do It World" Platform

To date, 112 countries and 13,8 million people have joined this platform to clean up illegal waste. All the pilot countries joined the initiative; however, the driving forces behind the implementation of clean-up activities are non-governmental organisations and not the municipalities. The significance of organising clean-up campaigns for generating the inventories of illegal dumpsites and planning prevention / enforcement programmes is yet to be recognised by a broad range of stakeholders in the Sharra pilot region. Illegal dumping is an extremely complex issue and therefore implementing monitoring and clean-up programmes requires all stakeholders, including the government, local municipality, counsellors and community members, to participate if this problem is to be eradicated.

The method applied by the "Let`s Do It World" takes the following steps:

- Recruiting ambitious leaders to run the nationwide cleanups;
- Mobilizing various organizations, experts and volunteers;

[45] https://www.letsdoitworld.org/about/overview/

- Training the participants in the campaign;
- Conducting the cleanup campaign by using technology (a mobile application “Trash Out”[46], shown on Figure 11), to map the illegal dumpsites:
    - Taking a photo documentation on site;
    - Locating the site using GPS on a global satellite map;
    - Estimating the quantity and composition of dumped waste.

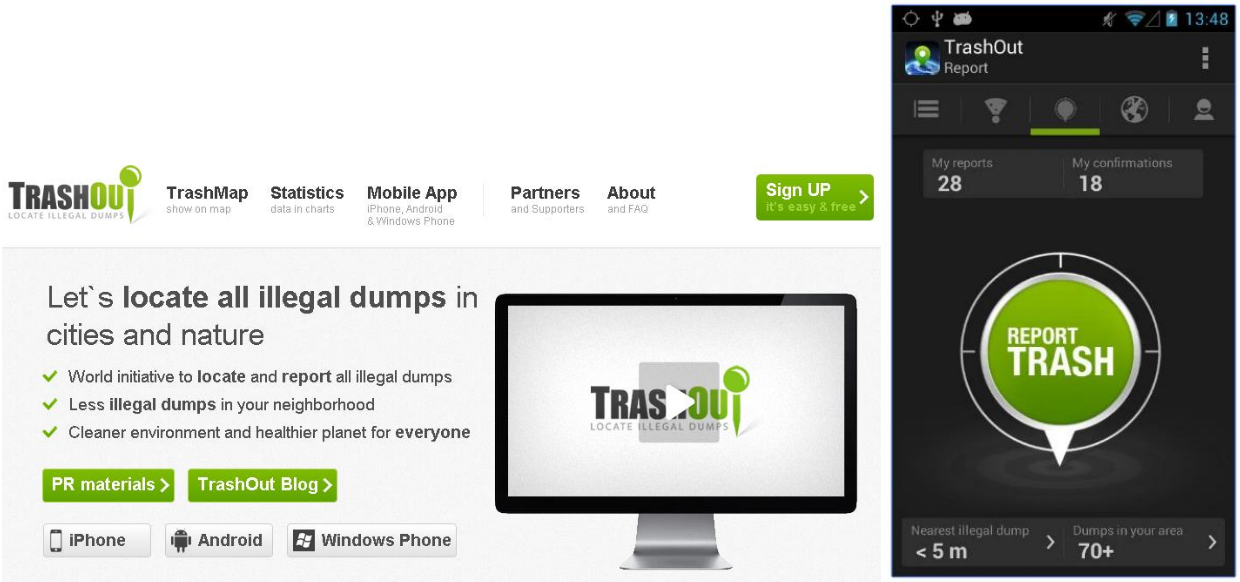

Figure 13 Trash Out Mobile Application

Ideally, the pilot municipalities should organize regionally coordinated cleanup campaigns at least twice a year. The same setup should be implemented as for the sank litter cleaning events. Preferably, the cleanup actions for both monitoring of sank litter (at the riverbanks and reservoirs coastline) and illegal disposal should be coordinated by regional coordinators and should take place in the same periods.

Information obtained from those cleanup campaigns should be used to design prevention programmes.

4. Improved and Regionally Harmonized Waste Statistics

In the Environmental and Economic Impact Assessment Report for the Sharra pilot region, an attempt was made to quantify the relative contribution to the floating debris generation by each municipality. Comparative analysis looked first at waste generation rates and quantities of waste collected versus waste not collected. Waste not collected was estimated by multiplying the per-capita waste generation figures and the population not covered by a regular waste collection service. It was assumed that the waste not-collected was dumped illegally at various locations, from where, taking the closest pathways (water courses and river / reservoir currents), it joined the stream of floating debris. Analyses showed that both the figures of waste generation and the percent of service coverage were based on estimations. Furthermore, these estimations were based on different methods. Therefore, it is of utmost importance for setting and monitoring suitable floating debris prevention programmes, to establish waste statistics related

[46] https://www.trashout.ngo/

(benchmark) indicators and design regionally harmonized methodologies for these indicators generating.

Benchmark indicators are required to deliver a well-functioning ISWM system. The key waste statistics related indicators are set in the Commission Regulation (EU) No 849/2010 of 27 September 2010 amending Regulation (EC) No 2150/2002 of the European Parliament and of the Council on waste statistics[47].

For the comparisons on the regional scale, the following indicators are proposed:

- Waste generation (kilograms per capita and year)
- Waste Composition
- Waste collection rate (tonnage of waste not collected and/or percentage of generated waste)
- Waste recycling rate (tonnage of waste separately collected by or voluntary drop off centers and/or percentage of generated waste)

This ISWM Model proposes regionally harmonized methodologies for collecting and evaluation data on waste generation & composition and waste collection rate (service coverage).

4.1 Methodology for Determining Waste Generation and Composition

Reliable data on waste generation and composition can be obtained only from waste sampling analyses. Waste sampling analyses are indispensable instruments to obtain waste generation rates and compositional data and enable waste management measures to be planned, monitored and optimized. Currently, the pilot regions have no systematic approach or standardised methodology for the analysis of solid waste.

The waste sampling methodology furnished by NALAS with the involvement of the Faculty of Technical Sciences, Department of Environmental Engineering and Safety and Health from Novi Sad, for collecting data on waste generation and composition was discussed at the 2nd Dialogue Platform (DP) in Prizren. For the most DP attendants, the presented methodology was acceptable; the representative of the Municipality of Prizren stated, however, that they already performed waste sampling analyses using a methodology proposed by international consultants engaged during the solid waste management project[48] for improvement of waste collection.

It is therefore proposed to set minimum requirements for a regionally accepted methodology which can be upgraded by more advanced municipalities. It is essential, however, to develop a sampling method[49] taking into account the following steps:

1. Pre-Investigation
2. Analysis Design and Planning
3. Execution of Waste Analysis
4. Evaluation of Waste Analysis

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[47] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:253:0002:0041:EN:PDF

[48] http://www.jica.go.jp/kosovo/english/activities/activity04.html

[49] The elements of the waste sampling methodology have been extracted from the SWA-Tool, Development of a Methodological Tool to Enhance the Precision & Comparability of Solid Waste Analysis Data, 5th Framework Program, EU, https://www.wien.gv.at/meu/fdb/pdf/swa-tool-759-ma48.pdf

4.1.1 Pre-Investigation

The pre-investigation stage is concerned with the provision of necessary background information for the pilot municipality intending to undertake a waste analysis.

The following background information to a waste analysis is suggested:

1. General Description of the Area under Investigation:
   a. Identification of the area or portion of the area to be assessed, its location and surface area;
   b. Identification of the various relevant districts.

2. General Population Information and Waste Management Information: The following data could be important to collect:

   a. General Population Information;
   b. Number of inhabitants;
   c. Number of households;
   d. Types and proportions of residential structures.

3. General description of the organisation of the waste management system (actors, responsibilities etc.);
4. Type of waste streams produced and collected;
5. Description of waste container systems in use such as household bins, communal bins and bin storage capacities;
6. Average numbers of households and/or persons using bins;
7. Total bin volume; spatial distribution of bins; collection intervals;
8. Method of waste collection such as open truck or refuse collection vehicles compactor and types of waste collected;
9. Description of collection rounds;
10. Disposal methods such as landfill.

Waste management stratification is important to derive statistically accurate information. Generally, stratification is not compulsory for a waste analysis programme, but may have advantages for both accuracies of results and additional waste management information (e.g. tourism). In practical terms it will be useful to set up a stratification matrix at the initial planning stage. This matrix will show if the necessary data and information for stratification are available. If the municipality would choose to perform stratification, it should consider the following criteria:

1. Seasonality: Generally, a seasonal waste analysis should be done based on a minimum of three and ideally four season sorting campaigns. Since waste analysis results tend to be similar for spring and autumn, one of these two seasons may be left out.
2. Residential Structure: The following types of residential structures and locations have been demonstrated to act as significant stratification criteria:

   a. Rural areas
   b. Suburban areas
   c. Inner city areas
   d. Multiple dwellings
   e. Multi storey buildings
   f. Tourist accommodation (if it can be separated by area)

3. Bin Size: Generally, waste analysis stratification according to the following bin sizes can be recommended:

    a. Bins up to 240 litres volume
    b. Bins above 240 litres volume

4. Collection System: it is important to delineate those areas with and without separate collection of recyclables;
5. Source of Waste: stratification according to the source of waste as either household waste or commercial waste is recommended where possible; tourism waste can be added as well;
6. Collection Day: whenever a significant difference between waste composition/generation is evidenced for different days of the week, it is recommended these days be used as stratification criteria.

4.1.2 Analyses Design and Planning

The design and planning are comprised of the following elements:

1. Type of sampling: This may encompass the whole area of a municipality or a defined part of a municipality although the former will generally be the case in order to obtain waste analysis results, which are representative of the whole area under investigation.
2. Number and type of strata: the decision concerning the number and type of strata to use in a waste analysis depends on several factors including the waste management information needs of the municipality, the availability of adequate waste planning data and sufficient resources.
3. Level of sampling: There are three principal levels at which sampling may take place, namely:

    a. Inside the household/business such as from an internal waste bin
    b. Outside the household/business such as from an external waste bin/container such as used in kerbside collection
    c. A refuse collection vehicle (RCV)

4. Type of sampling unit: There are three main sampling units that could be used to obtain the necessary waste samples for analysis, namely:

    a. A specific waste bin volume such as 240 litres (l) or 1100 l;
    b. A specific weight of household/commercial waste such as 100 kilograms (kg);
    c. A specific number of persons who generate relevant waste such as 30 persons.

5. Calculation of the Number of Sampling Units and Sample Size: depends on 2 main criteria:

    a. The variation (heterogeneity) of the waste, expressed by the natural variation coefficient. This variation coefficient is usually unknown and has to be estimated on the basis of results from past waste analyses.
    b. The desired accuracy of the results.

6. Generation of Random Sample Plan: According to the analysis design it is necessary to randomly sample addresses either from the whole parent population or from the relevant sub-populations according to the designated stratification criteria (stratified random sampling).
7. Duration of an Individual Waste Analysis Campaign: it is recommended that the duration for waste sampling and sample collection covers a minimum of one week’s waste. This will allow the sampling of waste to be spread over each working day (Monday to Friday) covering the full collection cycle and any potential variation due to non-collection of waste at weekends.

4.1.3 Execution of Waste Analyses

Each sample collected should be tagged with a unique identification reference code, capable of use in wet conditions. The following minimum data should be collated and recorded for each individual sample by the waste sample collection team at the time of collection:

a. Unique identification reference code
b. Sample address
c. Date of collection
d. Number and type of waste containers collected
e. Visual estimation of % filling level of waste containers collected
f. Visual estimation of % filling level of other containers at one address to get the information for calculating the waste quantity

Each sampling unit is weighed and the weight is documented. The waste generation per capita is obtained by dividing the average daily weight with the number of population in the sampling unit.

Each sampling unit has to be sorted separately. The sampling unit is sorted into the categories according to a developed Sorting Catalogue. The Sorting Catalogue contains 13 compulsory primary categories and 35 recommended secondary waste categories. Sorting is illustrated in Figure 12 below.

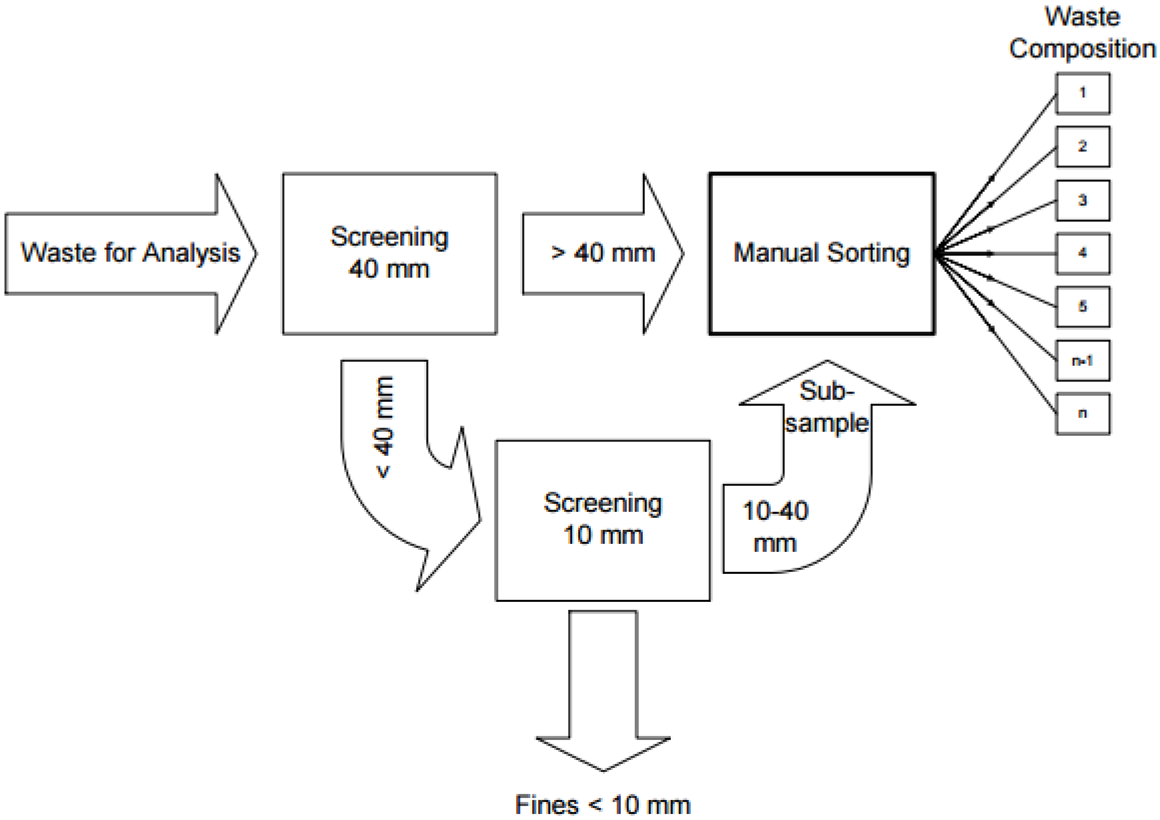

Figure 14 Waste Sorting

4.1.4 Evaluation of Waste Analyses

The basis for the evaluation are the basic weight results (kilograms per capita) and the outcomes of the sorting procedure (waste composition in kilograms) for each sampling unit. The basic weight results shall be transferred from the record sheet (paper copy) to the Excel sheet.

The following statistical values have to be calculated for each waste category, each campaign and for the total result:

- Mean
- Standard deviation
- Variation coefficient
- Relative confidence interval (%)
- Composition (%)

Extrapolation is another important element upon the waste sampling exercises. It comprises the conclusion from the obtained sample results to the total waste quantity. Two cases may be distinguished:

- Case 1: The investigated waste type of an area (e.g. daily household and commercial waste) is permanently weighed. Thus, the total waste amount is known. The total sample result (waste composition) can be apportioned to the total waste quantity, thus the extrapolation is not needed.
- Case 2: The total amount of the investigated waste type is unknown. This is the case if only household waste is subject of the waste analysis, but is not weighed separately (only the mixture of household and commercial waste is weighed). Hence, an extrapolation of the sample results to the waste of an area is necessary.

The waste quantity can be extrapolated by using the following data as a reference value:

- number of sampling units, or
- number of inhabitants, or
- number of households.

The format for the presentation of the results is an important aspect of the waste analysis methodology and will affect the comparability of waste analysis results between different waste analyses. The regionally harmonised methodology should derive standard reporting forms and procedures.

4.2 Methodology for Determination of Waste Collection Service Coverage

Currently, the pilot regions have no systematic approach or standardised methodology for the waste collection service coverage. Such a methodology should stem from comprehensive analyses of the following issues:

1. Statistical information on population, number of households and businesses (commercial and industrial establishments) in every settlement; map of spatial distribution of settlements and businesses and the road network, preferably in GIS format;
2. Overall figures of waste generation per capita for a certain period (day, week, month, year, as appropriate);
3. Calculations of the required containers sizes / numbers and number of lifts / frequency of lifts to cater the waste generated;
4. Up-to-date customer base including:

    a. Customer sector (households, businesses, institutions and industries)
    b. Actual container sizes / numbers
    c. Actual number of lifts/frequency of lifts
    d. Changes: larger businesses being replaced by smaller businesses or vice versa and seasonal variations to customer base e.g. return of immigrants, weekend houses, tourist accommodation

5. Map (in GIS format) indicating the actual placement of containers and their respective sizes in relation to the distribution of customers and waste generation;
6. Calculation of the waste quantities not collected as a percent of the total waste generated;
7. Calculation of the required container sizes / numbers and numbers of lifts to cater the waste not collected at present;
8. Update the customer base with service users not covered with a regular waste collection service;

9. Map (in GIS format) indicating where the adequate containers should be placed to be accessible by the service users in accordance with the selected collection system (kerbside or drop of, as well as waste segregation or mixed waste collection).

A detailed methodology should be developed and agreed among the pilot regions / municipalities. It would contribute to a better planning of the waste collection service extension and to reducing the floating debris.

5. Floating Debris Prevention Activities

The overall goal of the floating debris prevention activities is to improve the current waste by strengthening the organisational and financial capacity of operators to cover remote rural areas with an organised waste collection service and improve the recycling rate. Hence, the common objectives of the Sharra pilot region read as follows:

1. Extension of rural waste collection (%);
2. Improved rate of plastics recycling (%);
3. Reduced illegal dumping (% of population or volume of waste);
4. Reduced floating debris (%).

This ISWM Model focuses on best practices on extending waste collection in remote rural areas and provides concepts for planning of waste collection routes, defining also the required volume of containers and refuse vehicles and monthly fuel costs for each pilot municipality.

5.1 Best Practices on Rural Waste Collection

Best practices on rural waste collection presented in this ISWM Model have been collected from the following sources:

- Municipal Waste Learning Tool, Lesson 3 – solid waste collection[50]
- Guide to Developing Community Solid Waste Facilities[51]

By using the ***Municipal Waste Learning Tool***, the pilot municipalities can understand problems and concerns associated with MSW collection, compare and contrast privately and publicly operated systems, understand the types of collection systems, identify the benefits associated with the use of transfer stations, prepare an economic analysis of transfer stations and understand the design issues associated with transfer stations.

The major benefit for the pilot municipalities from using this tool is the possibility of analyzing:

1. Total required collection time
2. Number of vehicles and containers required
3. Number of customers a truck can serve per day
4. Collection frequency
5. Monthly costs of fuel

The tool sets an equation for calculating the total required collection time as follows:

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[50] http://msw.cecs.ucf.edu/collegestudents.html
[51] https://www.h-gac.com/community/solid-waste-management/documents/guide_to_developing_community_solid_waste_facilities.pdf

Y=a+(bc x N)+bkm+c(d)+e+f+g

Table 6 Input data to calculate total collection time

a+e	a - garage to route time, e- time to drive to garage at the end of the trip
N	Number of locations
Wg	Waste generation per location (kg)
Wsw	Waste specific weight (1.1m^3, or 120l)
CR	Compaction ratio of a truck (1:3)
bc	Collection time per location or pickup+put down time (min)
bkm	Time to drive between location (min)
d	Disposal time (time at landfill 30 min)
d	In/out garage
f+g	Off route time (15% of day)
c	Number of trips per month

- a, d, and e are a function of distance and speed – usually 30km/h;
- b is a function of the number of customers, time per customer, number of loads (full or partial); b is obtained by adding bc (collection time at the location) and bkm (time to drive in-between the locations); the time is a function of the travel length (distance) and average speed, the latter being set at 30km/hour;
- c is a function of the capacity of the vehicle and its compaction ratio;

The number of vehicles and containers required is a function of the waste generation in a given area. The number of required containers will depend on the volume of the containers and waste density. The volume of containers is set based on the residential area (single houses or multi-storey buildings) and the collection method: “kerbside” (”door-to-door”) or “bring” systems. Considering that the ISWM model mainly focuses onto the rural areas, door-to-door collection is applied using bins of 120l volume. The waste density is 15kg/120l. The total number of 120l bins is then calculated by dividing the quantities (kg) of waste generated for the period coinciding with the collection frequency (i.e. weekly quantity, if the collection is performed once a week, or any other period correlated with the collection frequency) with the waste density (15kg, for 120l bins). If 1.1m^3 containers are applied, the waste density used will be 120kg/1.1m^3.

To calculate the number of costumers a truck can serve a day, the volume and waste density (which is in correlation to the compaction ratio) should be known. Considering that weight of 1m^3 waste is approximately 110 kg, the usual compaction rate of a truck is 1:3, and an average per-capita waste generation in rural areas is 0.7kg, a 12m^3 truck can serve 2,772 customers a day.

Or:

Truck volume (m^3) x 110kg (density) x 3 (compaction factor) x 0.7 (waste generation per capita) = total served costumers a day.

Collection frequency is a function of the waste quantity intended for collection, the volume of the truck, the total waste collection time and number of shifts. Usually, the optimal waste collection frequency is once a week. Such collection frequency facilitates the optimised use of the refuse vehicles fleet and their maintenance. The collection frequency is planned for the entire territory of the municipality, taking into account the waste generation, the available truck volumes and the length of the routes.

The key to planning the waste collection in rural areas is the supply of sufficient volume of containers and optimising the routes of available refuse vehicles. An obstacle to planning these routes can be the road infrastructure, i.e. accessibility of remote areas by standard vehicles. Therefore, the best practice examples suggest splitting the services in such a way that:

- the standard refuse vehicles of 12-20m^3 volume utilise the main road network;
- smaller vehicles (with a volume of 3-6m^3), possibly even tractors, serve the households and transport the collected waste to certain collection points (rural transfer stations), which are located at strategic points – at crossroads with local roads.

The ***Guide to Developing Community Solid Waste Facilities*** prepared by Dannenbaum Environmental Corporation (1999) represents a collection of best practices for rural waste collection in remote areas.

These best practises demonstrate how to estimate the total costs of the existing solid waste system, showing also how rural transfer station may lower their cost-per-capita spent on solid waste activities. The rural transfer stations can also be used to offset costs of cleaning up the illegal dumpsites.

A rural transfer station is simply a location where residents can get rid of ordinary municipal waste and hard-to-dispose items. A wide spectrum of collection centre designs is possible, depending on the materials accepted, location, number of residents using the facility and funds available for construction and operation. These centres are suitable locations for recycling, too. These stations typically feature one or more movable trailer, dumpster, or roll-off bin to temporarily store and then transport the collected waste to a municipal or regional landfill.

Rural transfer stations can be either fixed or mobile. A fixed station is permanently located on a parcel of land and typically has some improvements to support the collection and disposal operations, such as fencing, lighting, a driveway, and an attendant's shed. Fixed collection stations can be relatively low cost operations with waste collection bins only or they can offer more extensive services, including recycling collection, used oil collection, household hazardous waste collection and composting. However, as waste collection service options expand, so do programme costs.

Mobile collection stations are collection vehicles that stop at a designated time to accept resident's trash at a particular location, such as a section of right-of-way along a commonly travelled road. Typically, there are little or no improvements at the places where they stop to collect waste, other than a sign to designate the times for collection, acceptable materials, and to identify the location. Some mobile collection sites use all-weather surfacing so cars and trucks can make safe use of the station even in poor weather conditions. Although not as common, it is possible to offer many of the full-service options typically found at a fixed collection station at a mobile station.

The rural transfer stations should be located in close proximity to frequently travelled. The location should also consider potential nuisance problems (doors and noise) or hazard problems (traffic or floodplain issues). Lastly, the location should be affordable and suitable to the design so that capital improvement costs can be minimized.

Ideally, all fixed rural transfer stations will meet certain minimum standards to ensure user safety, convenient access, ease of use, control of litter, prevention of scavenging and adequate waste collection service opportunities. The absolute minimum requirements for a convenience collection point include:

- All-weather surfaces on the access road and on the site,
- Easy access for residents and/or community elected operators to the site and to the containers,
- A perimeter fence for security and windblown materials control,
- Convenient hours of operation, including weekends,
- Posted signs that state the hours of operation, materials accepted, and a warning that illegal dumping violators will be prosecuted.

There are many different layout options for constructing a rural transfer station (drop-off) area. Three of these options and the pros and cons associated with each are shown at Figure 13.

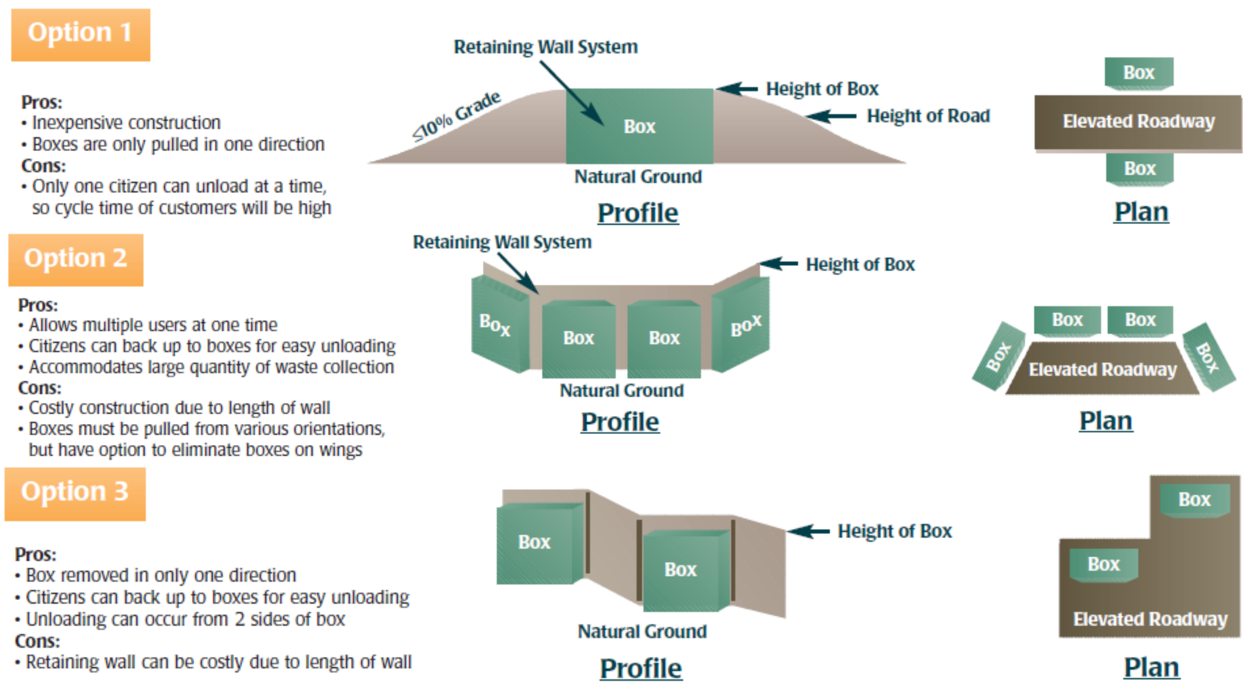

Figure 15 Layout options of a rural transfer station

Case studies provide examples for organising rural transfer stations which, in addition to providing a site for residents to dispose of bulky items, special waste and segregated household waste, can reduce the travel length (and time) of special refuse vehicles. Door-to-door collection of segregated waste is provided by an operator engaged by the local community or the population transports their wastes to the rural transfer station on their own.

Box 2. Chambers County Case Study

The population of Chambers County is approximately 25,000. The county is 5% urban and 95% rural. Approximately 87,000 tons of waste is generated annually. Chambers County believes that staffing their rural transfer stations ensures that citizens separate their waste properly, controls potential illegal dumping, and controls the cleanliness of the station itself. Prior to transfer stations were manned, the county would frequently find trash laying on the ground; also the waste segregation was not performed properly.

The county operates eight manned rural waste transfer stations which accept municipal waste, hazardous waste, used oil, used oil filters, tires, brush for grinding, white goods, and batteries. Citizens can bring their waste at the rural transfer stations on their own, or they can organize a door-to-door collection within their community. The residual municipal waste is then collected from the transfer station by the county operator while the recyclables are picked up by authorized private companies.

Figure 16Rural Transfer Station in Chamber County, Texas

Initially, rural transfer stations were in approximately twenty locations and they were only 1.1m^3 containers. It was very expensive to maintain this system. Eventually they decreased the number of rural transfer stations and increased the collection box size to 40 m^3 containers. Now, sites have compactor stations, roll-off containers, or both. The waste is trucked from rural transfer stations to the landfill by county owned roll-off vehicles and county employees.

5.2 Proposed Rural Waste Collection Concept

The best practice examples elaborated in section 5.1 have been deployed to derive concepts for rural waste collection in every pilot municipality.

The major objectives of the proposed rural waste collection are linked to reducing environmental and economic impacts of floating debris; these are:

- To prevent creation of illegal dumpsites by extending the service in areas where regular waste collection does not exist;
- To improve recycling rate of packaging (mostly plastics) and thus reduce this stream in the floating debris;

The proposed rural waste collection system is “door-to-door”, in order to prevent illegal dumping of citizens unwilling to bring their waste to distant locations / containers. Also, primary waste segregation is foreseen. The municipality can decide, however, whether the primary waste segregation will be implemented upon the start-up of rural waste collection operations or at a later stage. One should bear in mind that a “door-to-door” collection system is expensive (due to the length of the trip) and often cannot be implemented in rural areas due to accessibility issues (narrow, steep and unpaved streets where a regular refuse truck cannot drive). Therefore, it is proposed to establish two parallel collection systems:

1. Rural waste collection run on behalf of the ***municipality*** and operated either by a PCE or a contracted - out private waste management company. It is carried out by regular refuse vehicles of 10-20m^3 volume using main roads only for their routings and collecting waste from designated ***collection points***. Bigger volume vehicles (e.g. roll on / roll off trucks) can be made available, if the road layout can permit their passage and manipulation (i.e. turning).
2. Rural waste collection run on behalf of the ***local community.*** Citizens can bring their (segregated waste) bins to the closest ***collection point*** or they can hire a local waste collection agent, elected among the community members, to do it on their behalf. The local waste collection agent can be also a sub-contractor of either the municipal operator or the rural community. The municipality can decide which institutional form will take the local community driven rural waste collection, as it is a matter of the existing regulations. The local waste collection agent should have a suitable vehicle (i.e. a tractor) which is able to access the customers` properties located along local streets (if any), which can be unpaved, steep and narrow.

The ***collection points*** are locations where two parallel systems meet: the regular waste collection operated on behalf of the municipality and the local waste collection organised by the local community (village).

These collection points are always located along the main road. In some cases, the local network of streets is adjacent to the main road, or the local road is branching off leading to the village. In both situations the local population or local waste collection agents bring their waste to these collection points. They can be either mobile or fixed (rural) transfer stations. Mobile transfer is designated at locations where the local road branching off the main road connects one or two settlements. Fixed transfer stations are placed at strategic points where a group of settlements with relatively high population numbers can conveniently dispose their waste within the period between two scheduled collections.

At the mobile transfer point, which represents a section of the main road), collection vehicles stop at a designated time to accept the collected waste. The waste is reloaded from a smaller vehicle to a standard refuse truck. Hence, the two collection systems (of the municipality and local community) need to be synchronized in terms of timing.

The fixed rural transfer stations require a parcel of land which is fenced and supplied with suitable containers. The type and volume of the containers must suit the loading system of the municipal refuse vehicles fleet. An elevated driveway (ramp) enables waste unloading from a smaller vehicle (a tractor, in most cases) to a container. The advantage of fixed transfer stations is that collection schedule of standard refuse vehicles operated by the PCE or private waste management company engaged by the municipality does not need to be adjusted to the unloading schedule of the community driven collection system. The disadvantage is that their operation is more expensive.

The collection points can be used for temporary storage of recyclables. In case of primary waste segregation, separate containers are placed for particular recyclables at the rural transfer stations. Secondary waste segregation can be organised at the rural waste transfers, too. At the mobile collection points, recyclables can also be picked up, provided that the municipality organises the collection of segregated waste. Otherwise, authorised private recycling companies can be invited for the pick-up. Thus, the municipal operators would only collect the residual waste. It would minimise the waste quantities, the required waste collection frequency and - costs.

The planning of the rural waste collection is comprised of the following steps:

1. The settlements not covered by a regular waste collection service and respective population numbers were identified for each pilot municipality based on input of municipalities and/or public (the PCEs operating in Strpce and partially in Prizren), as well as private waste management operators (operating in Dragas, Kukes, Tearce and Jegunovce); settlements not covered by waste collection service have been located on a google earth map;
2. The waste generation was calculated for each settlement not covered by a regular waste collection service; it was discussed with the stakeholders to introduce a primary waste segregation so the residual waste would be collected by the waste management companies while the recyclables would be picked up by authorised recycling companies and biodegradable waste would be composted by the customers. However, the stakeholders stated that the recycling market is underdeveloped and the primary segregation would be initiated at a later stage.
3. The road infrastructure was analysed to optimise routing; routes have been indicated on a google earth map; routes have lead along main roads starting from the garage of the refuse trucks (located usually in the municipality capital) to the disposal site (either the regional sanitary landfill or the municipal non-compliant landfill) and back to the garage;
4. The number of collection points – either single settlements (mobile transfers) or rural transfer stations (fixed transfers) serving a group of settlements has been set per each route; distances in-between the collection points have been measured;
5. Rural (fixed) waste transfer stations were set at suitable locations – crossroads of the main and local roads, in the proximity of settlements with higher population numbers and hence higher waste generation;
6. The collection time per collection points and the total waste collection time has been calculated based on distance, legitimate breaks and speed;
7. The total volume of required vessels and the number of $1.1m^3$ containers (which can be easily converted into 120l bins, based on the ratio 1 container of $1.1m^3$ is equal to 8 x 120l bins) has been calculated; the average waste density of one $1.1m^3$ container is 120kg, but due to a reserve margin of 30%, the calculations operate with an average waste density of 98 kg;
8. The required volume of required refuse trucks has been calculated based on the residual waste quantities, number of routes, total collection time of a route and collection frequency (usually once a week);
9. The fuel costs have been calculated based on the total length of travel, average consumption of 15l diesel per 100km and current diesel prices in the pilot countries.

The routings and calculations for each municipality are available in Annex 3. Only the calculation model for the Municipality of Kukes falls short in providing the required volume of tracks / containers because the population data is not presently available. All the formulas are being integrated in the calculation model and upon providing input data (population and corresponding waste generation / composition) the required volumes will be generated automatically.

The example of Dragas Municipality is presented below.

The implementation of the rural waste collection concept developed for the Municipality of Dragas can be hindered by the current waste management system relaying on the operations of the regional (private) company “Eko Regjioni”. The current operator is not incentivised to cover the entire territory by an organised waste collection while the service contract with the Municipality does not contain an obligation for extending the service. Municipality Dragas can decide to contract out another operator to implement the rural waste collection. The authorities of the Municipality of Dragas appreciated the proposed concept as they can use it when developing technical specifications upon a tendering process to be launched.

The calculations of the required vehicles and containers volume are based on waste generation in the settlements in the Municipality of Dragas not covered by a regular waste collection service. The input figures to the calculations are shown in Table 7.

Table 7 Settlements / respective population not covered by regular waste collection and waste generation in the Municipality of Dragas

Settlements not covered by a waste collection service	Population	Indicator (kg/ capita/ day)	waste generation (kg/capita/day)	waste (tons / year)
Mike	92	0.7	64	24
Globocice	960	0.7	672	245
Krusheve	857	0.7	600	219
Zli potok	610	0.7	427	156
Restelice	4698	0.7	3,289	1,200
Dikanc	124	0.7	87	32
Brod	1544	0.7	1,081	394
Leshtan	783	0.7	548	200
Radesa	1224	0.7	857	313
Xerxe	236	0.7	165	60
Kerstec	420	0.7	294	107

One main route is established, so called “purple”. Colour coding of routes eases planning of trips and respective collection points. Existing collection routes applied by the regional company “Eco Regjioni” can be also colour coded, to distinguish between the current and the new to be executed operations.

The collection points along the “purple” route are:

Table 8 Collection Points along the "Purple" Route

Collection Point No.	“Purple” Route
1	Mike
2	Transfer st 1
	Globocice
	Krusheve
	Zli potok
	Restelice
3	Transfer st 2
	Dikanc

Collection Point No.	“Purple” Route
	Brod
4	Transfer st 3
	Leshtan
	Radesa
5	Xerxe
6	Kerstec
7	Transport to the (non-compliant) municipal landfill in Dragas

There are three mobile collection points (Mike, Xerxe and Kerstec) and three fixed transfer stations (Globocice, Dikanc and Dragas).

The route is shown in the Figure below.

Figure 17 The "Purple" Refuse Vehicle`s Route for Collecting rural Waste in the Municipality of Dragas

Each route starts from the garage located in Dragas; a truck drives in-between the collection points (including rural transfer stations), goes to the (non-compliant) municipal landfill, unloads the waste and goes back to the garage. Therefore, the number of collection points is n+1 (7 for the “purple” route). The total waste collection time has been calculated using the formula:

$Y=a+(bc \times N)+bkm+c(d)+e+f+g$

The travel times in-between the collection points and the total collection time for the “purple“ route are given in Table 9.

Table 9 Travel Times in-between the Collection Points along the “Purple” Route, to the (non-compliant) Municipal Landfill and Back

	Location No.	ROUTE (Purple)						
		1	2	3	4	5	6	7
a+e	a - garage to route time, e- time to drive to garage at the end of the trip	15	0	0	0	0	0	15
N	Number of locations	1	1	1	1	1	1	1
Wg	Waste generation per location (kg)	483	9,539	8,757	10,537	1,239	2,205	
Wsw	Waste specific weight	98	98	98	98	98	98	98
CR	Compaction ratio	3	3	3	3	3	3	3
bc	Collection time per location or pickup+put down time (min)	15	15	15	15	15	15	0
bkm	Time to drive between location (min)	4	8	20	16	5	15	10
d	Disposal time (time at landfill 30 min)	0	0	0	0	0	0	30
d	In/out garage	10	0	0	0	0	0	10
f+g	Off route time (15% of day)	0	0	0	0	0	0	72
c	Number of trips per week	0.25	3	3	3	0.5	1	3
YLOC	**Total collection time per location**	***44***	***23***	***35***	***31***	***20***	***30***	***137***
Y	**Total collection time (min)**	***957***						

The required volume of trucks and containers located at the collection points for the "purple" route is shown in table 10.

Table 10 Number of Containers and Trucks Needed for the "Purple" Route

Collection points	Waste at location (kg / week)	No. of containers needed	Truck volume needed	Collection Frequency
Mike	483	5	2	1 time a month
Transfer st 1	9,539	97	32 (12)[52]	3 times a week
Transfer st 2	8,757	89	30 (12)	3 times a week
TTransfer st 3	10,537	108	36 (12)	3 times a week
Xerxe	1,239	13	4	2 times a month
Kerstec	2,205	23	8	1 time a week

One should note that waste generation in some villages is high and the collection should take place more often than once a week. In Mike, due to low population number and waste arisings, the collection will be carried out once a month. Normally, Mike should be a collection point with mobile transfer, but storing the waste for one month may not be agreeable for the citizens. Therefore, one skip container of 5m^3 can be placed along the main road to be picked up once a month by a special skip refuse vehicle. The skip containers should be covered to prevent odour. In Xerxe, the waste should be collected twice a month. One alternative is to collect the waste from a collection point outside the village or the waste collected from the properties can be transported to the Dragas transfer station. It means that the routing for Dragas Municipality is

[52]The total required volume to collect the waste arisings at the transfer stations is 30-36m^3. Ideally a roll-on / roll-off container (up to 40m3) would be needed. Having in mind the road layout which does not allow for the manipulation of roll-on/roll-off refuse vehicles, it is proposed to use a truck of 12m^3 volume and increase the collection frequency to three times a week.

not carved in stone and alternatives are possible. Anyway, any route planning should deploy this principle in order for the collection to be efficient.

The diesel fuel costs have been calculated for the “purple” route based on the total distance (travel length), fuel consumption of 15l/km and actual price of fuel (Table 11).

Table 11 Diesel Fuel Weekly and Monthly Costs for the "Purple" Route

Costs	Total Length of Trip (km)	Weekly Fuel Costs (EUR)	Monthly Fuel Costs (EUR)
Truck (diesel engine)	193.02	25.48	101.91

Hence, to extend the waste collection service and cover all the settlements in the Municipality of Dragas, the following resources need to be made available:

- 335 containers of 1.1m^3 volume (to be placed at the collection points) and 2,680 bins of 120l (to be placed at customers` properties for the “door-to-door” collection) need to be purchased. The cost of 1.1m^3 volume containers is 117,250[53]EUR. The cost of the 120l bins is 80,400[54]EUR;
- One truck of 12m^3 volume needs to be made available for a total duration of 16 hours a week. If such a truck is not available, the investment is approximately 65,000 EUR;
- Staff of 3 persons (one driver and two loaders) will be engaged 16 hours a week;
- The monthly costs of fuel will be in the range of 102 EUR;
- If the citizens would engage a local waste collection agent, the costs of “door-to-door” collection and transportation to the collection point should be covered. One should bear in mind the number of trips of a fully loaded tractor (up to 6m^3 volume) will be more than one a week. The remuneration will be negotiated with the contracting authority, either the local community or the municipality, based on the volume of waste for collection, i.e. number of properties where the waste shall be picked up, as well as the travel length from the collection area to the collection point. A provisional amount of 400-500 EUR per a waste collection agent a month seems reasonable, given the current average salaries in the region. This remuneration should also cover the fuel costs and lease of the tractor.

Apart from the planning required to optimise the rural waste collection and making resources available to make it happen, an important prerequisite to the acceptance of the new service and especially the waste segregation is the public awareness raising and enforcement.

The public awareness raising activities should not be limited to sporadic campaigns only. Citizens should be involved since the early planning stage of the rural waste collection, ideally by reaching them out via the survey discussed in section 3.1.1.2 on inventories of illegal dumpsites above. Local community leaders should use their authority to explain the importance of ceasing the illegal dumping and properly disposing their waste into the dustbins. Communication between the municipal representatives and the citizens should continue until every single household has signed a contract and obtained a dustbin for the waste storage at the property. Once the household accepts the service (and pays for it), the waste management operator should maintain the universality, through non-discrimination, sustainability, quality and efficiency, transparency, economically acceptable price and full coverage of the area of service provision.

---

[53]The unit price used for 1,1m^3 container is 350 EUR.
[54]The unit price used for 120l bins is 30 EUR.

6. Conclusions

This ISWM Model can help in implementing comprehensive measures towards reducing the floating debris and its harmful impacts.

Floating debris monitoring is the only way to get a clear idea of the sources of floating debris as well as to assess whether the actions taken to mitigate the problem are effective. The importance of monitoring is reflected in the fact that, according to the Marine Strategy Framework Directive requirements, each Member State must develop and implement floating debris monitoring protocols. It is strongly recommended that, where practices that could have an effect on floating debris are implemented, they are accompanied by a well-designed monitoring programme, which will record the amounts and types of floating debris before and after the implementation of the practice to assess any changes and thus the effectiveness of the practice. In the case of the Sharra pilot region, both the monitoring and evaluation and effectiveness of the implemented policy and actions should be coordinated at a regional scale. The regional cooperation should result in consolidating existing performance monitoring tools and responsibilities and using harmonised approaches.

Once the waste management data collection and analyses of methodologies are harmonised and initial monitoring implemented, the following actions should be taken by each pilot municipality:

- Extend the rural waste collection and subsequently clean-up the illegal sites being previously used by the population not covered by the regular waste collection service;
- Implement instruments that apply ‘the polluter pays’ principle, by for example enforcing penalties for littering and other environmentally harmful behaviour;
- Organise a primary waste segregation and strengthen the collaboration with the companies active in the recycling market;
- Establish recycling on-the-go (i.e. beaches, recreational areas) by providing an adequate number, size and type of waste bins and recycling receptacles;
- Ensure that all public waste bins and recycling receptacles are emptied frequently and regularly.

Before any practice to reduce floating debris is implemented, one should think of the effect it is likely to have on the peoples` behaviour. For any action to be effective in the long term, it must cause a shift in behaviour that will be sustained in the long run. This is not always easy to achieve. It requires effective awareness raising in tandem to any other practice that is implemented.

In the pilot municipalities, municipal administration, councillors and waste management operators will play a crucial role in managing floating debris and illegal disposal monitoring programmes. Community leaders need to be elected and start involving citizens in decision making and action. In this way, a community-mentality is gained whereby people act towards bettering their own area for the greater good of the whole community. If communities were more educated on the impacts of floating debris and illegal dumping and identified this as a social deviation, this could potentially begin to change their habits.

Annex 1

Litter classification system for all surveys where litter is collected or identified in situ

Class	Material Composition	Litter Code	Litter Form (and Examples)
1	Plastic	PL01	Bottle caps & lids
2	Plastic	PL02	Bottles < 2 L
3	Plastic	PL03	Bottles, drums, jerry cans & buckets > 2 L
4	Plastic	PL04	Knives, forks, spoons, straws, stirrers, (cutlery)
5	Plastic	PL05	Drink package rings, six-pack rings, ring carriers
6	Plastic	PL06	Food containers (fast food, cups, lunch boxes & similar)
7	Plastic	PL07	Plastic bags (opaque & clear)
8	Plastic	PL08	Toys & party poppers
9	Plastic	PL09	Gloves
10	Plastic	PL10	Cigarette lighters
11	Plastic	PL11	Cigarettes, butts & filters
12	Plastic	PL12	Syringes
13	Plastic	PL13	Baskets, crates & trays
14	Plastic	PL14	Plastic buoys
15	Plastic	PL15	Mesh bags (vegetable, oyster nets & mussel bags)
16	Plastic	PL16	Sheeting (tarpaulin or other woven plastic bags, palette wrap)
17	Plastic	PL17	Fishing gear (lures, traps & pots)
18	Plastic	PL18	Monofilament line
19	Plastic	PL19	Rope
20	Plastic	PL20	Fishing net
21	Plastic	PL21	Strapping
22	Plastic	PL22	Fibreglass fragments
23	Plastic	PL23	Resin pellets
24	Plastic	PL24	Other (specify)
25	Foamed Plastic	FP01	Foam sponge
26	Foamed Plastic	FP02	Cups & food packs
27	Foamed Plastic	FP03	Foam buoys
28	Foamed Plastic	FP04	Foam (insulation & packaging)
29	Foamed Plastic	FP05	Other (specify)
30	Cloth	CL01	Clothing, shoes, hats & towels
31	Cloth	CL02	Backpacks & bags
32	Cloth	CL03	Canvas, sailcloth & sacking (hessian)
33	Cloth	CL04	Rope & string
34	Cloth	CL05	Carpet & furnishing
35	Cloth	CL06	Other cloth (including rags)
36	Glass & ceramic	GC01	Construction material (brick, cement, pipes)
37	Glass & ceramic	GC02	Bottles & jars
38	Glass & ceramic	GC03	Tableware (plates & cups)
39	Glass & ceramic	GC04	Light globes/bulbs
40	Glass & ceramic	GC05	Fluorescent light tubes
41	Glass & ceramic	GC06	Glass buoys
42	Glass & ceramic	GC07	Glass or ceramic fragments
43	Glass & ceramic	GC08	Other (specify)
44	Metal	ME01	Tableware (plates, cups & cutlery)
45	Metal	ME02	Bottle caps, lids & pull tabs
46	Metal	ME03	Aluminium drink cans
47	Metal	ME04	Other cans (< 4 L)
48	Metal	ME05	Gas bottles, drums & buckets (> 4 L)
49	Metal	ME06	Foil wrappers
50	Metal	ME07	Fishing related (sinkers, lures, hooks, traps & pots)
51	Metal	ME08	Fragments
52	Metal	ME09	Wire, wire mesh & barbed wire

Class	Material Composition	Litter Code	Litter Form (and Examples)
53	Metal	ME10	Other (specify), including appliances
54	Paper & cardboard	PC01	Paper (including newspapers & magazines)
55	Paper & cardboard	PC02	Cardboard boxes & fragments
56	Paper & cardboard	PC03	Cups, food trays, food wrappers, cigarette packs, drink containers
57	Paper & cardboard	PC04	Tubes for fireworks
58	Paper & cardboard	PC05	Other (specify)
59	Rubber	RB01	Balloons, balls & toys
60	Rubber	RB02	Footwear (flip-flops)
61	Rubber	RB03	Gloves
62	Rubber	RB04	Tyres
63	Rubber	RB05	Inner-tubes and rubber sheet
64	Rubber	RB06	Rubber bands
65	Rubber	RB07	Condoms
66	Rubber	RB08	Other (specify)
67	Wood	WD01	Corks
68	Wood	WD02	Fishing traps and pots
69	Wood	WD03	Ice-cream sticks, chip forks, chopsticks & toothpicks
70	Wood	WD04	Processed timber and pallet crates
71	Wood	WD05	Matches & fireworks
72	Wood	WD06	Other (specify)
73	Other	OT01	Paraffin or wax
74	Other	OT02	Sanitary (nappies, cotton buds, tampon applicators, toothbrushes)
75	Other	OT03	Appliances & Electronics
76	Other	OT04	Batteries (torch type)
77	Other	OT05	Other (specify)

Annex 2

Illegal Dumping Questionnaire

Household number:

<u>Section A: Basic Details</u>

Street name:

1. Gender (tick)

Male	
Female	

2. Employment (tick)

Yes ☐ No ☐

3. How long have you lived here? (tick)

Less than a year ☐ 1-3 years ☐ 4-6 years ☐ 7-10 years ☐ More than 10 years ☐

4. How many people live in your household? ....

<u>Section B: Awareness and extent of illegal dumping</u>

5. Are you aware of the illegal dump site located in your neighbourhood? (tick)

Yes ☐ No ☐

6. If yes, how many sites have you noticed? (tick)

0-1	2-5	More than 5

7. Do you think illegal dumping is a problem in your neighbourhood? (tick)

Yes ☐ No ☐

8. If yes, how would you rate the severity of the problem? (circle)

Minor Moderate Neutral Severe Highly Severe

9. How frequently does the problem occur? (tick applicable)

Daily ☐ Weekly ☐ Monthly ☐ River / reservoirs only ☐ Annually ☐

Other -- (specify)

10. How long has it been occurring? (tick)

A few weeks ☐ A few months ☐ A year ☐ 2-5 years ☐ 6-9 years ☐ >10 years ☐

11. Who do you think contributes to this illegal dumping? (tick applicable)

Construction, demolition, remodelling, roofing or landscaping contractors	
Garden services	
Vehicle repair or tyre shops	
Scrap collectors	
Waste pickers	
local residents	

Other -- (specify)

12. Why do you think people dump waste illegally? (tick applicable)

They don't know what else to do with it	
Proper disposal is costly	
They don't care/ lazy	
Missed refuse collection day	
No/unreliable waste collection services	
Unaware of the services available to them	

Other-- (specify)

Section C: Tackling illegal dumping

13. On a scale of 1 to 5, how important is it to eliminate illegal dumping? (tick)

Extremely Important	Quite Important	Don't know/Neutral	Not Very Important	Not Important
1	2	3	4	5

Explain answer?

----

14. What services can the municipality improve upon to prevent illegal dumping? (tick applicable)

Provide waste containers to specific locations	
Employ more workers	
Timely waste collection services	

Fence off area to prohibit dumping	

Other, -- (specify)

15. Is the community involved in combating illegal dumping?

Yes ☐ No ☐

16. How would you be willing to combat illegal dumping in your area? (tick)

☐ Money
☐ Petition
☐ Time
☐ Nothing
☐ Other

Section D: Illegal dumping effects

17. Does having a dump site in your neighborhood effect your quality of life in any way?

Smell	
Visual	
Aesthetics	
Vagrants	
Unwanted animals (stray dogs, donkeys)	

Other (specify): ____________________ 18.
____________________ 19.

20. Has the problem affected you, your family, pets, livestock?

Yes☐ No☐

If yes, how ____
____
____

21. Do you think the illegal dumpsites have negative effects on the environment?

Yes☐ No☐

22. If yes, in what way? (tick applicable)

Vegetation growth	
Soil pollution	
Water pollution	
Harmful to animals	

Other (specify): ______________________________

____

____

23. How would you rate the severity of these environmental impacts? (circle)

Minor Moderate Neutral Severe Highly Severe

Thank you for your time.

Annex 3

Rural Waste Collection calculations

ASSESSMENT REPORT

on the cross boarder adverse environmental and economic impact in Adriatic Coast

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Executive Summary

The marine litter is a serious pollution problem in the Adriatic Sea region, particularly in Albania, Montenegro, Bosnia and Herzegovina and Croatia. Major transboundary environmental and economic impacts caused by marine litter in the Adriatic Coast Pilot Region are identified during the development of the Environmental and Economic Impact Assessment Report as follows:

- Threats to the health and productivity of aquatic ecosystems as many species mistakenly ingest debris or can be entangled by it;
- Adverse environmental impacts on the key terrestrial ecosystems and protected areas deriving from stranded marine litter[1]: "Specially Protected area" - Drin River Delta; Important Bird Area (IPA) - Lumi Buna-Velipojë; the special habitat for mammals in Europe - Buna Delta; Ramsar Site - Lake Shkoder;
- Economic impacts on coastal communities (increased expenditure on beach cleaning), tourism (loss of income, bad publicity), fishing (reduced and lost catch, damaged nets and other fishing gear, fouled propellers, contamination) and shipping (costs associated with fouled propellers, damaged engines and litter removal).

Considering the richness of biodiversity and the presence of globally threatened species (especially birds and mammals), on one hand, and the significant threat of the litter on the bird and mammals` populations, on the other, waste dumping related prevention measures are a matter of urgency.

Albeit the environmental impacts could not be quantified due to lack of information, some effort has been made to assess the economic impacts related to beach and illegal dumps` cleaning and lost revenues from non-returning tourists who had negative perceptions on the cleanliness of the pilot area. According to the estimations based on non-returning[2] 2.5% tourists[3] at least ***34,450,365 EUR*** have been lost in 2015. Further, each year ***1,556,550 EUR*** are spent on cleaning up illegal dumps and ***2,018,280 EUR*** for cleaning beaches.

Pilot municipalities contribute to the environmental impacts proportionally to the quantities of released floating debris. Some municipalities are responsible for the generation of floating waste and / or pollution, by inadequate waste management practices and particularly illegal dumping in flood / tide - prone areas. These are considered to be impacting municipalities. The others who are receiving the (unwanted) floating waste and / or pollution and need to bear (non-recoverable) costs for their clean-up and disposal, are impacted municipalities.

Considering the origins and pathways of the waste or pollution moving across the borders, including the currents of the Adriatic Sea, the impacting and impacted municipalities were identified in the Environmental and Economic Impact Assessment Report as follows:

[1] ***Marine litter*** (floating or submerged litter and settleable matter) is litter or any material that is lost, discarded, dumped, or discharged into the marine environment, or that blows into the sea, or is carried down rivers in the form of ***floating debris*** and ends up in the sea (Eaton 1984). In this report the term of floating debris is introduced in order to set a boundary between the riverine inputs to the marine litter (at the sea).

[2] 2.5% of all calls to the Tourist Bureau in Montenegro in 2014 were complains for unclean beaches and litter in general; we assume they will not return as a result of their bad perceptions.

[3] It represents 2.5% of the total number of tourist overnight stays in the pilot region for 2014.

Table 1 Impacting and impacted municipalities

Pilot Municipality	Impacted by	Impacting
Albania		
Lezhe	Upstream communities along the Drin River before the Vau I Dejes HPP	High impact for Mljet and Slivno
Vau I Dejes	Upstream communities along the Drin River before the Vau I Dejes HPP	Moderate[4] impact for Mljet and Slivno
Shkoder	Ulcinj because the Buna / Bojana River is creating the border	High impact for Mljet, Slivno and Ulcinj (Buna / Neretva Delta)
Montenegro		
Ulcinj	Shkoder, because the Buna / Bojana River is creating the border	Moderate impact for Shkoder, high impact for Mljet and Slivno
Bar	Not impacted[5]	Not impacting
Herceg Novi	Low impact from municipalities located in the south - Shkoder, Vau I Dejes, Lezhe and Ulcinj (by sea currents)	Low impact for Mljet and Slivno
Bosnia and Herzegovina		
Neum	Not impacted	Not impacting
Croatia		
Slivno	BiH municipalities located outside the pilot region (by Neretva); Shkoder, Vau I Dejes, Lezhe and Ulcinj (by sea currents)	Not impacting
Mljet	Shkoder, Vau I Dejes, Lezhe and Ulcinj	Not impacting

Considering the above, the Integrated Solid Waste Management (ISWM) Model is developed with the aim to minimise the environmental and economic impacts by synchronised efforts at national and transboundary level.

[4] The municipality Vau I Dejes generates marine debris by the inflow of Drin River, after the HPP Vaui I Dejes, which is considered a moderate impact.

[5] The stakeholders stated that they are impacted by their own debris which comes back during high winds (Bura). It has been confirmed by analyzing the sea currents which pass by the area of Bar municipality (Figure 19 of the Environmental and Economic Impact Assessment Report).

1. Background

The Regional Rural Development Standing Working Group (SWG) and the Network of Associations of Local Authorities of South-East Europe (NALAS) are implementing a regional sub-project “Solid Waste Management in cross-border rural and coastal areas of South Eastern Europe” supported by the German Federal Ministry for Economic Cooperation and Development (BMZ) and the Government of Switzerland through the GIZ Open Regional Fund for South East Europe – Modernisation of Municipal Services (ORF MMS).

The SWG is engaged in improving rural livelihoods in the SEE countries. To this end, it promotes innovative and sustainable agriculture and rural development through regional cooperation of respective Ministries of Agriculture and other stakeholders. It supports the EU integration in the SEE, by:

- Fostering rural development policies;
- Improving implementing structures and systems for agriculture and rural development;
- Improving the understanding and use of implementation tools for agriculture and rural development; and
- Identifying and sharing information and application of good practice in agriculture and rural development to broaden the rural agenda.

NALAS brings together 16 Associations which represent roughly 9.000 local authorities, directly elected by more than 80 million citizens of this region. NALAS helps the associations to represent viably the local authorities vis-à-vis central governments. NALAS provides services to local governments and aspires to develop itself as the Knowledge Center for the local government development in the SEE. It promotes the:

- Process of decentralization, considering the local self-government as a key issue in the transition process in the SEE; and
- Partnerships in order to contribute to the EU integration as well as the reconciliation and stabilization process.

1 Goals and Objectives

The overall aim of the sub-project is to “improve the conceptual and organisational framework conditions concerning Integrated Solid Waste Management (ISWM) in cross-border rural and coastal areas in SEE”.

The specific goal of the assignment is to “assess and develop schemes (models) for integrated management of solid waste that are environmentally effective and economically affordable in order to reduce adverse environmental and economic impacts of solid waste mis-management and support the ecological and socio-economic development of the cross-border rural and coastal areas in the SEE countries”.

In order to define models for integrated management of solid waste in SEE countries (pilot rural and coastal regions), it is envisaged to carry out an assessment of the transboundary environmental and economic impacts from currently applied (insufficient) practices.

2 The Adriatic Coast Pilot Region

The sub - project covers three pilot rural and coastal areas which share natural resources: (1) a mountain range (Sharra Mountain); (2) transboundary river catchments (Tara – Drina and Drina - Sava); and (3) a sea coast (Adriatic Sea) area.

This Assessment Report on the Cross Border Adverse Environmental and Economic Impacts is focused on the pilot Adriatic coast region. It encompasses Albania (Figure 1 – Pilot municipalities of Shkoder, VauI Dejes and Lazha), Montenegro (Figure 2 – Pilot municipalities of Ulcinj, Bar and Herceg Novi), Bosnia and Herzegovina (Figure 3 – Pilot municipality of Neum) and Croatia (Figure 4 – Pilot municipalities of Mljet and Slivno).

The pilot municipalities have been selected by the Local Government Associations (LGAs) in respective countries – members of NALAS.

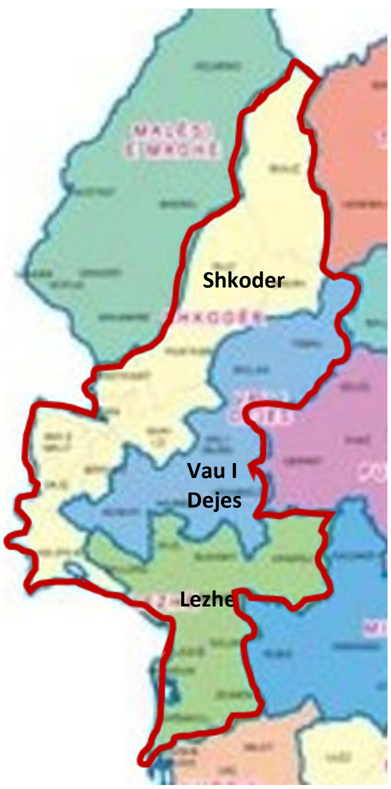

Figure 1 Albania - pilot municipalities Shkoder, Vau i Dejes and Lezhe

Figure 2 Montenegro- pilot municipalities Ulcinj, Bar and Herceg Novi

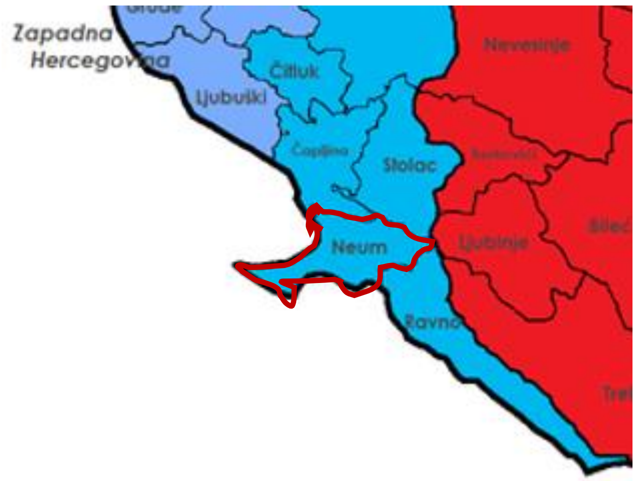

Figure 3 Bosnia and Herzegovina-pilot municipality Neum

Figure 4 Croatia - pilot municipalities Mljet and Slivno

The provisional geographical position of the pilot municipalities in respect to the Adriatic Sea is shown in a schematic way in the Figure 5 below.

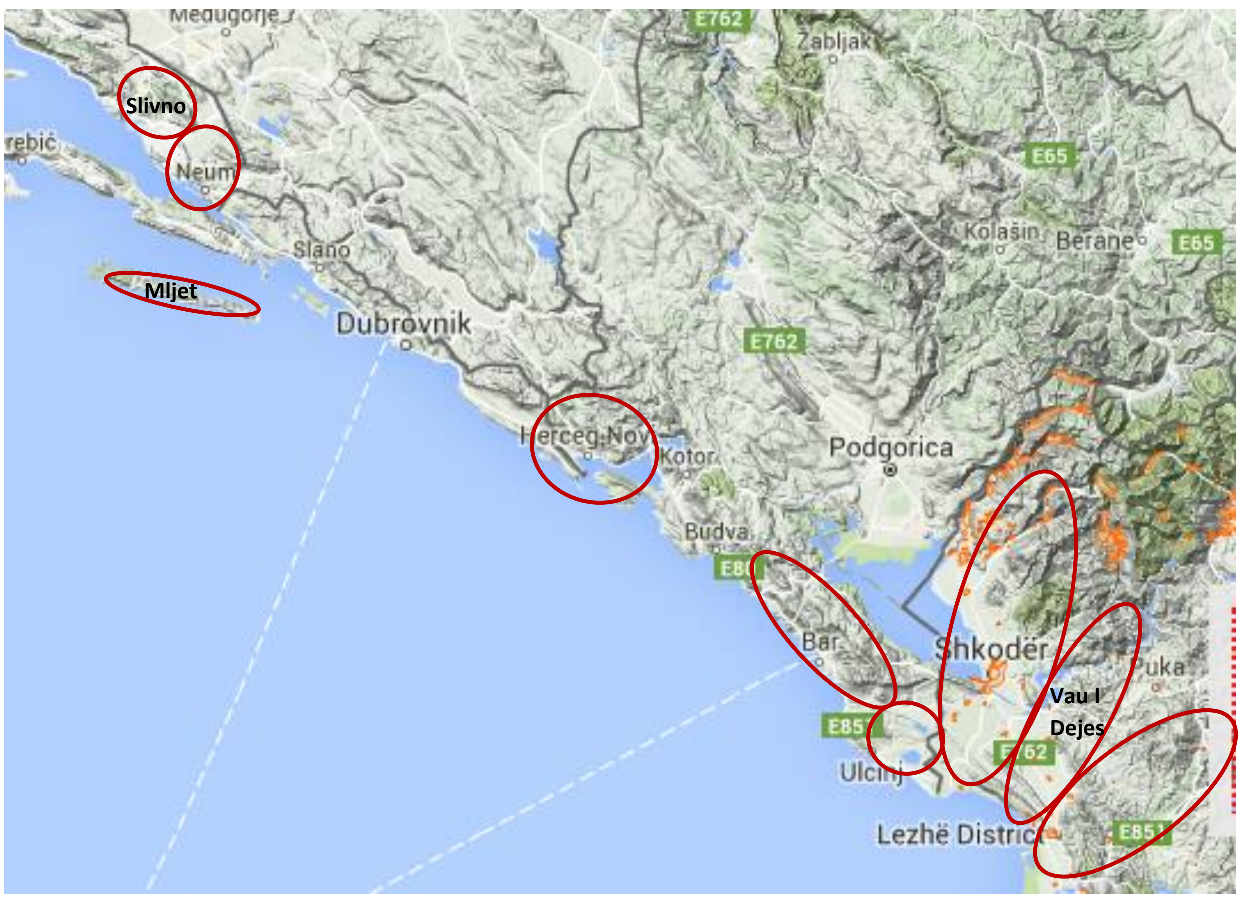

Figure 5 Geographical position of pilot municipalities along the Adriatic Coast

The area and population of pilot municipalities is presented in the Table 1 below.

Table 2 Area and population of the pilot municipalities and of the total pilot region

Pilot Municipality	Area (km^2)	Population
	Albania	
Lezhe	509.10	106,245
Vau I Dejes	499.09	48,966
Shkoder	872.71	200,889
Total (1) - Albania	**1,881.71**	**356,100**
	Montenegro	
Ulcinj	255	20,265
Bar	598	42,368
Herceg Novi	235	30,992
Total (2) - Montenegro	**1,088**	**93,625**
	Bosnia and Herzegovina	
Neum	**225**	**4,960**
Total (3) – Bosnia and Herzegovina	**225**	**4,960**
	Croatia	
Slivno	52.72	1,999
Mljet	98.01	1,088
Total (4) - Croatia	**150.73**	**3,087**
Total Pilot Region	**3,345.44**	**459,812**

Respective shares of area and population for each pilot country are highlighted in the figure below.

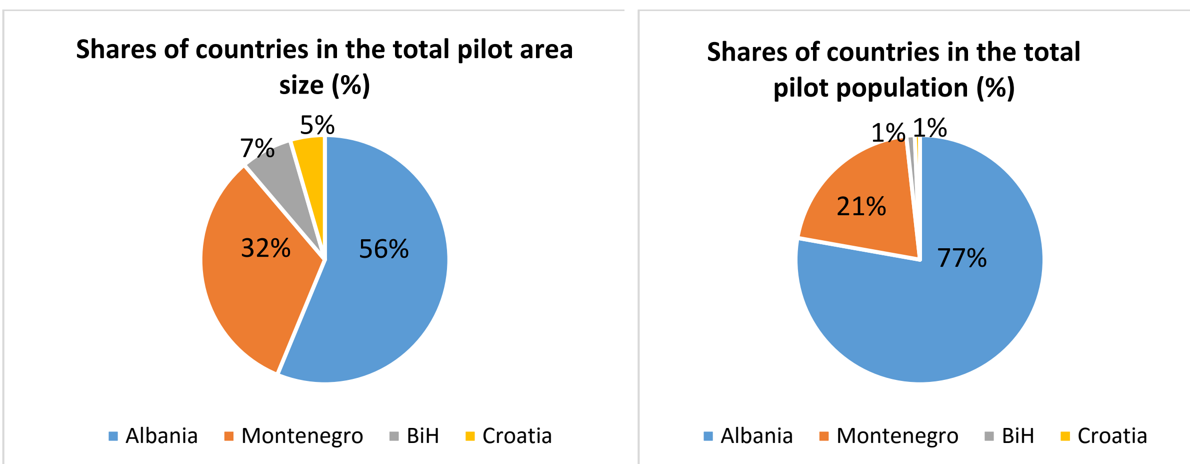

Figure 6 Respective shares of the area size and population of the countries in the pilot region

It is obvious that Albania with its pilot municipalities has the biggest share in the pilot region in terms of both population and area size; the share of Montenegro is also relatively high, while the participation of Bosnia and Herzegovina (BiH) and Croatia is negligible.

Provided that further analysis yields evidence of deficiencies in their waste management practices, it is to be expected that Albania and Montenegro would be the countries with the highest relative contribution to transboundary impact generation.

3 Environmental and Economic Impact Assessment of Marine Litter in the Adriatic Coast Pilot Region

3.1 Marine Litter in the Adriatic Sea

The sources of floating debris are diffuse including offshore and land-based. Land-based sources can be coastal and riverine. However, the identification of a particular source from an individual litter item is difficult. A number of initiatives and studies have looked at the differing proportions of litter from each of these sources and their results show that the greatest proportion is from land - based sources.

In the "Marine Litter study to support the establishment of an initial quantitative headline reduction target - SFRA0025"[6] it is estimated that between 53% (North Sea) and 93% (Black Sea) of beach litter originates from land-based activities and only 2% (Black sea) to 27% (North Sea) of the beach litter items are likely to be transported over a long distance. Hence, beach litter is primarily a regional matter and the cooperation among littoral countries is the only way to address the problem comprehensively.

In order to understand the current status of the marine litter problem in the Adriatic Sea information obtained from recent projects / studies focused on monitoring the marine litter at sea, beaches and sea floor is collected and analysed.

Information on the amounts and types of litter in the water of the Adriatic Sea is very scarce and limited to surface floating litter data from ship-based visual observations. A number of projects carried out to date recorded litter floating on the sea surface (so called "at-sea" monitoring) in the Adriatic Sea:

1 At-sea (floating) marine litter monitoring projects:

- in 2008 visual observations of floating litter and some of their initial findings have been carried out by the Hellenic Environment Protection Association (HELMEPA) and results were reported within the framework of the 'Assessment of the status of marine litter in the Mediterranean' related report, developed by UNEP/MAP-MEDPOL in collaboration with MIO-ECSDE, HELMEPA and Clean-up Greece. The densities of floating debris recorded at the time in the Adriatic Sea were 2.74 kg/km^2 or 5.66 items/km^2. The most abundant items included buoys, clothing, plastic containers and bottles, paperboard boxes. It should be noted that these data provide just an indication of the abundance of litter items at sea, considering that these were the output of limited number of surveys, which didn't cover large areas.

- In Slovenia, within the framework of the Marine Strategy Framework Directive (MSFD), a similar methodology was applied in monitoring surveys carried out in 2011. Results showed that 90% of all litter items recorded at sea surface were made of plastics and densities recorded were 1.98 items of litter items/km^2.

2 Sea Floor marine litter monitoring projects:

[6] The project is financed by the European Commission DG Environment and executed by ARCADIS in 2013.

- The first data reported on the composition, distribution and abundance of litter on the seabed of the Adriatic-Ionian Sea was recorded in 1993. The main findings indicated that sea-floor debris consisted mostly of either paint chips (44%) or plastics (36%).
- A more comprehensive study on the issue, published in 2000 by Galgani et al, investigated the distribution and abundance of large marine debris on continental shelves and slopes along the coasts of the Adriatic Sea, among other European Seas. The overall debris density in the Adriatic Sea was 3.78 pieces of debris per hectare (pd/ha) or 378 items/km2, which was considerably lower in comparison to the 19.35 pd/ha (1935 items/km2) mean concentration estimated in the North West Mediterranean by the same study. Plastics constituted the 69.5% of litter items found.
- SoleMon Project (Solea Monitoring - Rapido trawl survey in the Northern Adriatic Sea), carried out since 2005 in the Northern and Central Adriatic Sea. Until 2010 only data on the total amounts of marine litter were recorded, without any type of classification of litter items.
    - Only data regarding total amounts of marine litter have been analysed for the period 2005-2010. The highest value was recorded in October 2005 (34 ± 12 kg/km2), while the lowest in October 2006 (5 ± 1 kg/km^2).
    - Conversely, in the last three years (2011-2013) litter data were recorded and were categorized in 45 different types of litter (e.g. cigarette buds, bottles, etc.). However, due to the high variability of values among years and the short time-series actually available the monitoring results haven't been considered statistically reliable to draw a trend.
- Within the framework of a project carried out in Montenegro in 2009, investigating the trawling impacts on benthic communities, material was collected in depth ranging from 48 m to 746 m. The collected material was brought on board and measured. The inorganic fraction, mainly marine debris, in the different catches varied from 6.49% to 58.39% and was dominated by car tires and plastic bottles.
- In Slovenia, an initial assessment of debris on the sea-floor near the coast was performed in 2013 within the framework of the MSFD implementation. The Slovenian sea is shallow (up to 25m of depth) so scuba diving and snorkelling techniques were used to assess sea-floor litter quantity and types. Initial results showed that 55% of litter items were made of plastic, 37% of metal, the rest were made of glass, textile, wood and paper.
- Additional information on debris on the seabed of the Adriatic Sea region is restricted to anecdotal findings of underwater visual observations/surveys with SCUBA/snorkelling performed within seabed clean-up actions, organized along the coastlines of Montenegro (Boka Kotorska Bay) and Croatia (Zapara bay, Port of Sali, Zadar Channel).

At-coast monitoring projects:

- In 2007, a 2-year marine litter survey was carried out at the island of Mljet (Croatia) in order to assess the amounts and types of litter in sixteen coves and bays. The findings illustrated that more than 80% of the litter found consists of different types of synthetic polymers, while the rest was glass, metal, rubber and wood. Predominant polymers included polyethylene terephthalate (PET), polyethylene (PE) and polypropylene (PP). More than 70% of the collected items originated from neighbouring countries.

Considering the fact that the majority of marine litter items originate from the land based sources, the impact assessment is focused on the:

1. Root Problem: current waste management practices;

2. Locations of the land-based sources of marine litter (non-compliant landfills and illegal dumps);
3. Pathways of the litter from the origin to the sea and the shorelines where it strands; and
4. Effect (marine litter) and the deriving environmental and economic impacts.

Thusly, this Assessment Report sheds light on the matter of “how” and “why” the pilot municipalities contribute to, or are affected by marine litter in the Adriatic Sea. Once the questions of "how" and "why" are answered, the emergence of a regional model for the tackling of the issue of marine litter can become possible.

3.2 Environmental and Economic Impact Assessment Method

Marine litter is mobile, and it may be found relatively far from its original source. This movement is influenced by both winds, currents and circulation patterns (Figure 7).

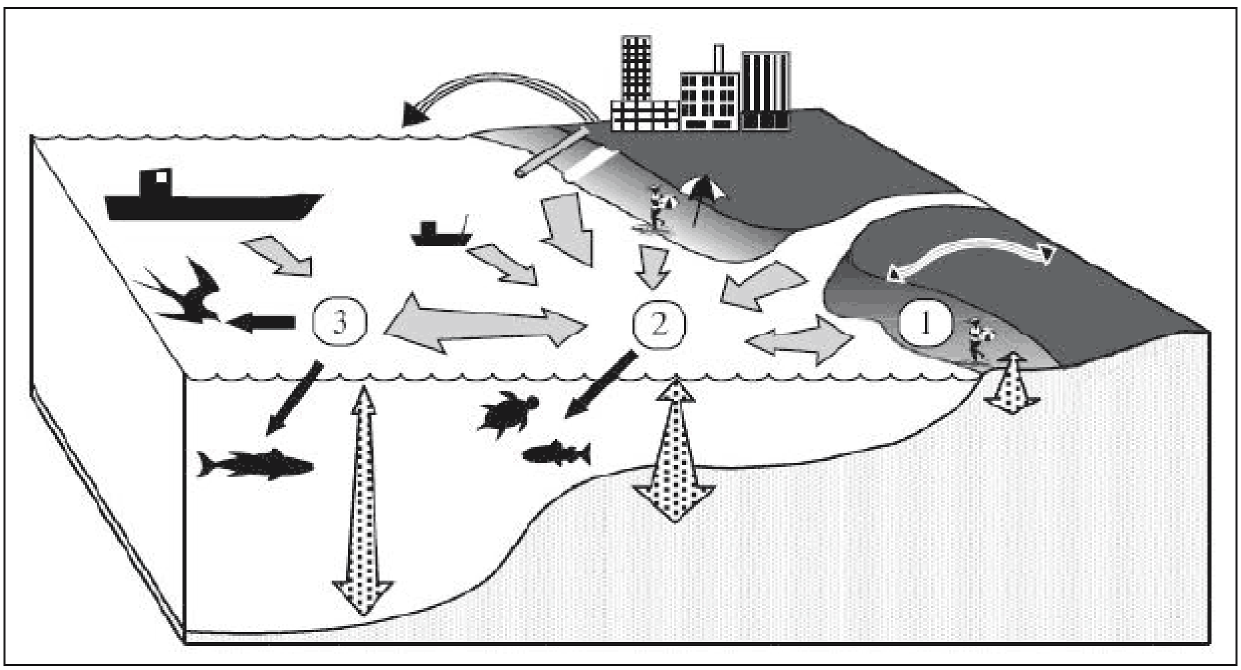

Figure 7 Origins, pathways and sinks of marine litter[7]

- *<u>Origins</u>* include land - based sources (landfills / dumps / recreational areas)
- *<u>Pathways</u>* are presented as wind-blown litter (curved arrows) and washed away litter transported by the sea current (grey arrows);
- *<u>Sinks</u>* into the seabed (stippled arrows): 1) coast; 2) shelf, 3) open sea / reservoirs in the river watersheds of the pilot areas (stippled arrows).
- Impacted wildlife and shipping industry (black arrows)

The Method for Environmental and Economic Impacts deriving from the current solid waste management (SWM) practices in the pilot countries / municipalities in the Adriatic coast pilot region, in response to the mobility character of marine litter is intended to:

[7] http://www.gov.scot/Publications/2013/07/9297/5

- Identify the origins and pathways of the land-based sources of the marine litter in each pilot municipality by analysing the:
    - Waste generation and composition;
    - Waste collection;
        - Capacity of the operator,
        - Waste collection rate (service coverage),
        - Waste not collected.
    - Waste disposal practice and locations of “hotspots”;
        - Non-compliant municipal landfills,
        - Illegal dumps.
    - Pathways of floating waste: rivers / sea currents;
    - Recycling operations and recycling rate.
- Assess types and significance of transboundary environmental and economic impacts:
    - Environmental Impacts;
        - Marine / riverine ecosystems,
        - Protected areas.
    - Economic Impacts;
        - Clean-up costs,
        - Lost revenue from tourism.
- Assess the contribution to the environmental and economic impacts of the marine litter of each pilot country / municipality (impacting and impacted municipalities).

A snapshot of the method for identification of origins is presented in the Figure 8 below:

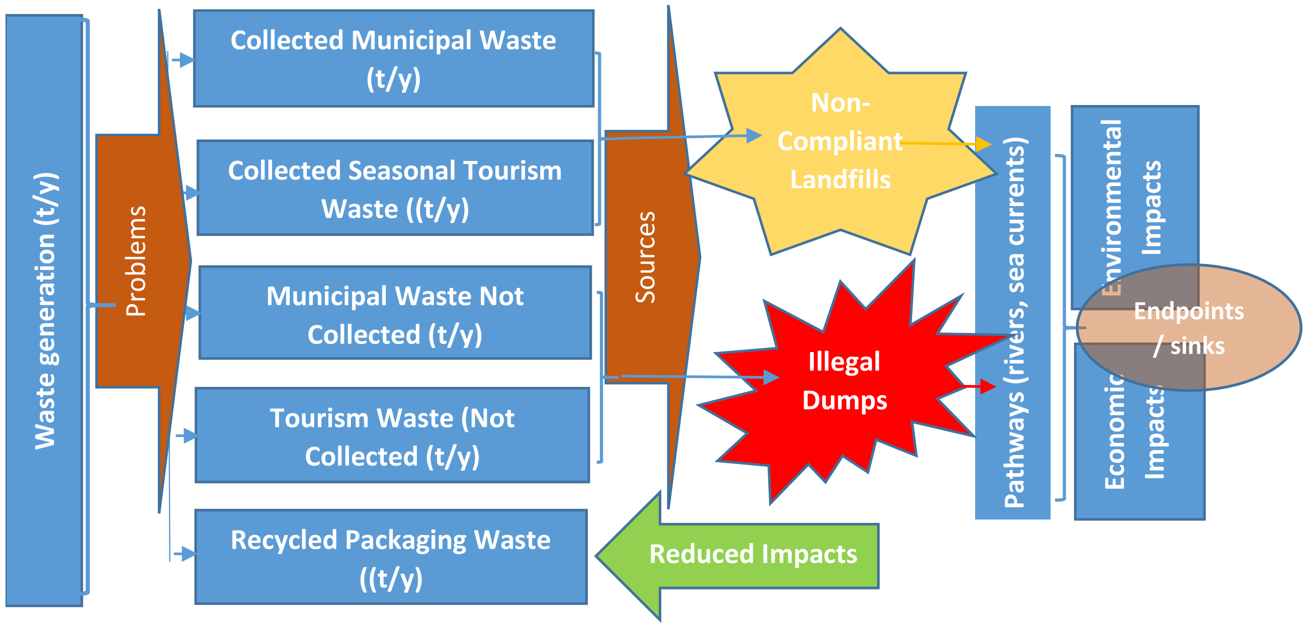

Figure 8 Method for Environmental and Economic Impact Assessment

3.3 Process of Environmental and Economic Impact Assessment

After the formulation of the Environmental and Economic Impact Assessment Method, two separate streams of data collection have been established:

1. ***Desk research***:
    a. Two types of questionnaires have been developed which are available in Annex 1. The following data was collected:
        i. Policy and legislation; waste generation; financing of municipal waste management; sources of marine litter (so called "hotspots"); pathways of marine litter;
        ii. Operational and technical capacity of waste management operators, more specifically: service coverage; frequency of waste collection; available collection vessels and refuse vehicle fleet; requirements for additional collection vessels and trucks; status of primary waste segregation, if any;
2. ***Participatory process for data collection and validation***, gathering relevant stakeholders, such as national and municipal authorities, waste management operators (including the regional sanitary landfills), private companies dealing with recycling, NGOs etc.:
    a. National Workshops in pilot countries[8],
    b. 1st Dialogue Platform[9];

Separate communication streams have been established with relevant institutions to complement the outstanding information as well.

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[8] National Assessment Workshops were conducted in October 2015 in Shkoder, Albania; Herceg Novi, Montenegro; Neum, BiH and Opuzen, Croatia.

[9] The 1st Dialogue Platform has been held on 26-27 November, in Sutomore, Montenegro.

In the following sections the outcomes of the identification of origins of land-based sources of marine litter in the selected municipalities participating in the Adriatic Sea pilot region are presented.

3.4 Origins and land-based sources of marine litter in the pilot municipalities in the Adriatic Coast Pilot Region

Data on waste generation, waste collection service coverage, recycling and disposal (including illegal dumping) have been collected using the pre-defined questionnaires which were filled in by the assigned National Experts. Data validation was performed by the local self-government representatives and contact points of the Public Communal Enterprises (PCEs), the operators of the regional sanitary landfills Bushat (located in the Municipality of Vau I Dejes) and Mozura (located in the Municipality of Bar), the public waste management company in Lezhe as well as the private operators who are currently assigned to perform solid waste management in Shkoder, Lezhe and Vau I Dejes[10].

The collected data on service coverage may not be accurate as the stakeholders pointed out the problem of customer base often lagging behind in providing an accurate number of total served households. Incoming waste is measured at the gates of regional landfills, however it remains unclear exactly what proportion of the collected waste is actually delivered for measuring. Irregular reporting by the recycling companies precludes determining the rate of recycling with any accuracy. All of the above makes presenting the waste flows into a challenging endeavour, however, the data provided herein is an attempt at deriving some preliminary quantities of marine litter originating from the territory of the pilot municipalities.

3.4.1 Waste generation

Waste generation figures for each pilot municipality were obtained as a product of the multiplication of population numbers in each pilot municipality and indicators on waste generated per capita and day. The waste generation indicators are adopted from respective national waste strategies and plans, waste samplings, if any, or from the stakeholders` experience.

In the Adriatic Coast pilot region waste generated by tourists adds up significantly to the overall waste figures. These quantities have been estimated based on the information on tripled waste collection frequency during 90 days high season (three summer months), provided by PCEs and private operators, which was cross-checked with the statistical information on the overnight stays. An exception was found in Montenegro where the indicator on waste generation per a tourist and day for each municipality was available. It must be noted that this indicator did not derive from waste sampling analyses and was based on estimations. For the sake of a consistent approach, for each municipality the tourism waste – triple quantities during three summer months - was added to the normal waste generation.

[10] Note: There has been a recent territorial reform in Albania which resulted in submerging communes to some municipalities. Plans for local development, including waste management, are currently developed for the pilot municipalities Shkoder, Vau I Dejes and Lezha with support of Swiss and Swedish governments through SIDA and SDC respectively.

Table 3 Waste generation in the pilot municipalities of the Adriatic Coast region

Pilot Municipality	Population	Waste indicator (kg/cap/day)	Waste generation (tons/year)	Tourism waste (tons/year)	Total waste generation (tons/year)
Albania					
Lezhe	106,245	0.43	20.730	13,500	34,230
Vau I Dejes	48,966	0.41	7.500	/	7,500
Shkoder	200,889	1,10	81.215	27,000	108,215
Total (1) - Albania					**149,945**
Montenegro					
Ulcinj	20,265	1.48	13,085.94	2,098.65	15,183.65
Bar	42,368	1.00	24,564.91	9,010,44	33,575.35
Herceg Novi	30,992	1.15	18,210.86	5,171.76	23,382.62
Total (2) - Montenegro					**72,141.62**
Bosnia and Herzegovina					
Neum	**4,960**	**0.64**	**3,157**	**1,080**	**4,237**
Total (3) – BiH					**4,237**
Croatia					
Slivno	1,999	1.07	824	159	983
Mljet	1,088	0,94	380	132	515
Total (4) - Croatia					**1,498**
Total Pilot Region					**172,242.62**

The respective share of pilot municipalities in the total waste generation in the pilot region are presented in the following figure.

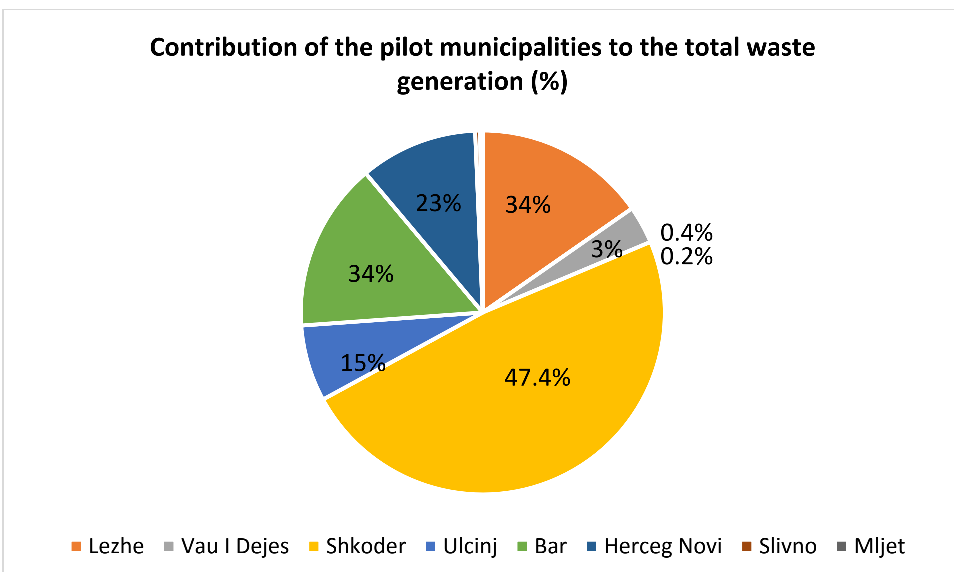

Figure 9 Contribution of the pilot municipalities to the total waste generation (%)

It can be seen that Albanian municipalities participate with the highest share in the total waste generation in the pilot region (e.g. Shkoder with 47%). Contribution of the Municipalities Slivno and Mljet (Croatia) is negligible.

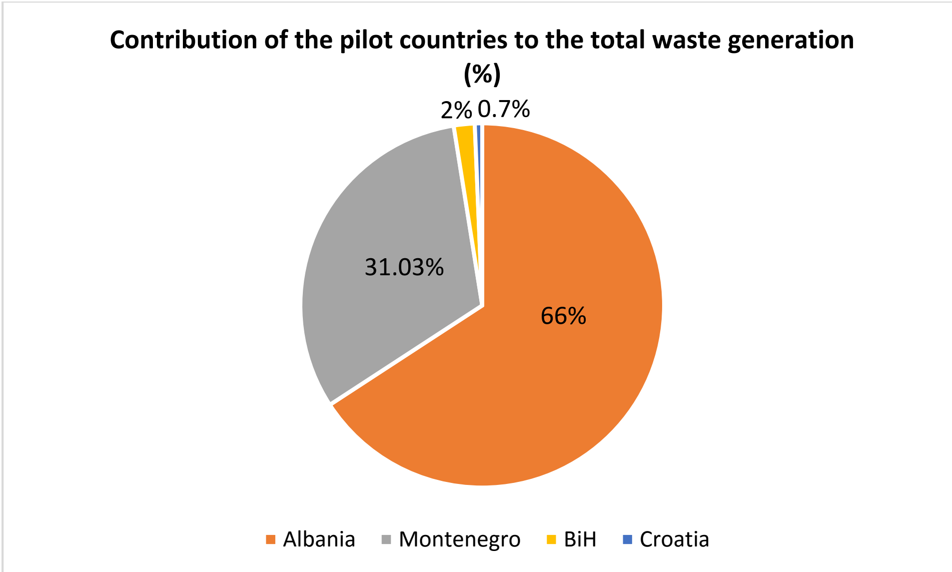

Figure 10 Contribution of the pilot countries to the total waste generation

The previous statement is proved with the analyses of the overall contribution to the waste generation by the pilot countries: hence, the share of Albania is 66%, of Montenegro is 31%, of BiH is 2% and of Croatia is 0.7%.

3.4.2 Waste collection

Waste collection is performed by the PCEs in Montenegro, BiH and Croatia and both public[11] and private operators in Albania. The operations are mainly financed by the user charges paid by the served population; the tariffs are set by the municipalities based on the purchase power of the population and not on the full cost recovery. The private operators in Albania are subsidised by the municipalities to compensate for their losses resulting from the low payment efficiency of households (e.g. 18% in the Municipality of Lezhe). In Montenegro a tariff per tourist/bed for apartments & houses is applied as an additional revenue of the PCEs, while in Albania a cleaning tax is paid by the tourists. Apart from that, no additional financing instrument to cover the increased expenditures during high tourist season exists in BiH and Croatia.

Typically, the waste in urban areas is collected in 1.1m^3 containers while in the rural areas located in plains kerbside („door-to-door“) collection is applied using 90l and 120l containers. In Neum the steep and narrow streets limit the access of regular refuse trucks; also there isn`t enough room to place the containers. Hence, the householders are forced to bring their wastes to containers, which are sometimes, far away from their properties.

Most often, rural settlements located at higher elevations and disconected from the road network are not included in the regular waste collection services (this is particularly true for the Municipality of Vau I Dejes). Kerbside collection is not performed in dispersed rural settlements at flat terrains, due to high costs involved and/or the refusal of rural population fo receive / pay for the service.

[11] In the Municipality of Lezhe the urban area is covered by a public (City of Lezhe) and the rural area is covered by a private operator "Vale recycling / Kurbin Lezhe". In the Municipality of Vau I Dejes the waste collection is performed by the landfill operator Bushat. In the Municipality of Shkoder the urban area is covered by a public and the rural area is covered by a private operator.

Conversely, skip containers to cater the waste are placed at crossroads of regional and local roads (i.e. „bring“ systems). The population, unwilling to bring their waste to the collection vessels` located over 300 meters away from their dwellings, takes the path of least resistance and fly tiping.

Both public and private operators are not capable of covering the entire territory by an organised waste collection due to the lack of suitable refuse trucks and containers. Only a few operators stated that they are able to invest in the extension of the waste collection service on their own. These statements do not seem to be grounded in any comprehensive analyses of the technical solutions and investment needs.

An evidence for the insufficient capacity of the operators to carry out an efficient waste collection is an extremely high waste collection frequency, especially during the tourist season (Table 4).

Table 4 Regular Waste Collection Frequency and Schedules during the Tourist Season

Pilot Municipality	**Regular Waste Collection Frequency**	**Schedules during Tourist Season**
	Albania	
Lezhe	Every Day	Three times a day
Vau I Dejes	Twice a week	Every day
Shkoder	Twice a week	Every day
	Montenegro	
Ulcinj	Every Day	Three times a day
Bar	Every Day	Three times a day
Herceg Novi	Every Day	Three times a day
	Bosnia and Herzegovina	
Neum	Every Day	Twice a day
	Croatia	
Slivno	Not available	Not available
Mljet	Not available	Not available

Waste collection rate (service coverage) varies among the pilot municipalities and spans from 100% in Croatia to 70% in Albania. Low waste collection rate renders significant amounts of waste not collected and potentially dumped along the rivers in the Adriatic Sea catchment (Neretva, Bojana/Buna, Drin, Mat and other smaller streams) the Shkoder and Spathar Lakes and beaches (Velipoje and Shengjin) (Table 5).

Table 5 Waste collection rate and amounts of waste not collected in the pilot municipalities

Pilot Municipality	**Waste Collection Rate (%)**	**Waste not collected (tons/year)**
	Albania	
Lezhe	75	5,182.5
Vau I Dejes	70	2,250
Shkoder	80	16,243
Total (1) - Albania		**23,675.5**
	Montenegro	
Ulcinj	73.33	3,490.02
Bar	90.67	2,291.91
Herceg Novi	91.67	1,516.96
Total (2) – Montenegro		**7,298.89**
	Bosnia and Herzegovina	
Neum	**95**	**157**
Total (3) - BiH		**157**

Pilot Municipality	Waste Collection Rate (%)	Waste not collected (tons/year)
Croatia		
Slivno	100	0
Mljet	100	0
Total (4) - Croatia		**0**
Total Adriatic Sea Region		**31,131.39**

In both the table 5 and the figure 11 it can be seen that the Municipalitis of Shkoder and Lezhe take the largest share in the total waste quantities not collected in the pilot region; the Municpality of Ulcinj is third on the list of biggest contributors.

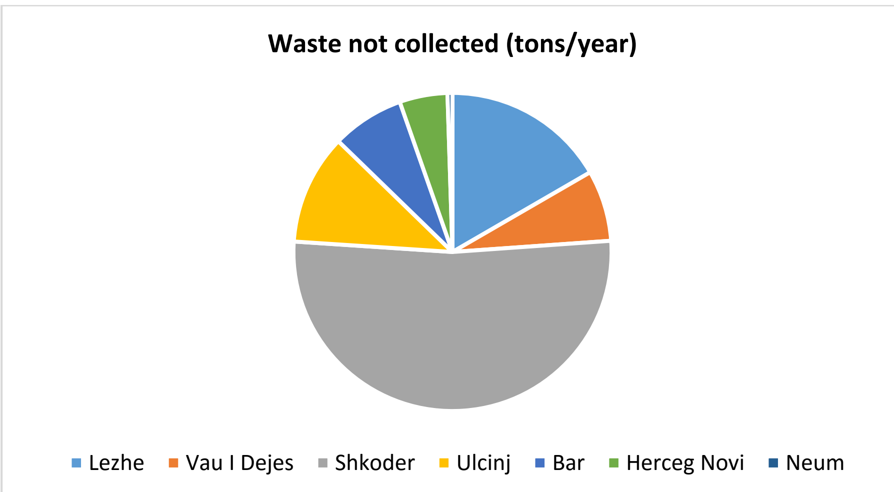

Figure 11 Shares of pilot municipalities in the total waste quantities not collected

Considering the population size, corresponding waste generation and the relatively low waste collection rate, almost 24,000 tons annually may potentially end up at illegal landfills on the territory of the Albanian pilot municipalities, many of which are located along the water courses – tributaries of the Adriatic Sea. This amount represents 62% of the total waste not collected in the pilot region; Montenegro contributes with 7,298.89 tons per year (19%) and BiH may release in the Adriatic Sea 157 tons per annum (0.4%).

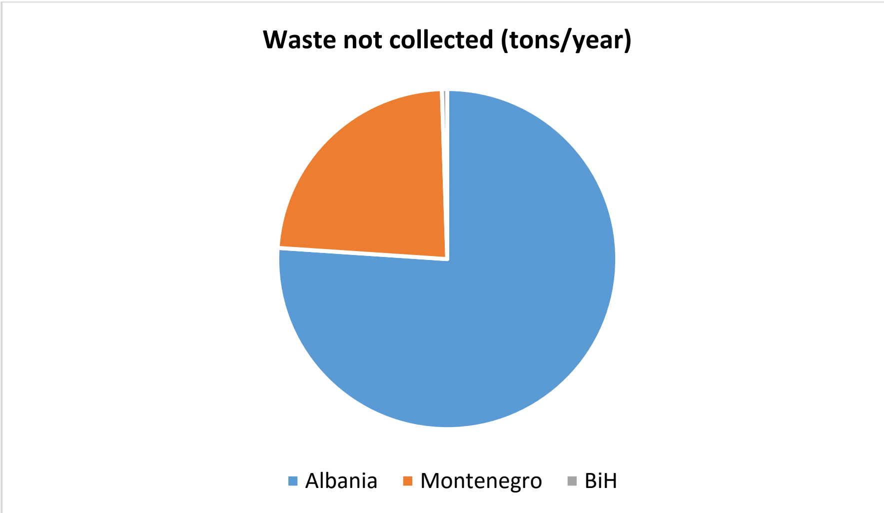

Figure 12 Shares of pilot countries in the total waste quantities not collected

Among the pilot municipalities, authorities of Shkoder, Lezhe and Ulcinj are responsible for leaving a significant portion of the population not covered by organised waste collection which inspires illegal dumping or waste burning by non-serviced households.

Based on the amounts of not collected waste, one can assume that pilot municipalities in Albania produces big amount of marine litter and hence causes significant environmental and economic impacts to the neighbouring municipalities downstream of the dominant sea currents; Montenegrin pilot municipalities are responsible for comparably moderate impacts, while the contribution of BiH is negligible.

The tourism waste is not accounted for in the analyses as the stakeholders stated that they take preventive measures for beach littering. Notwithstanding, one can argue the efficiency of beach clean-up activities performed during the tourist season in view of varied responsibilities, financing instruments available and methods applied. In Albania, for example, the private waste management operator is in charge of collecting waste from the beaches for which he/she obtains financial sources from the municipality. In Montenegro the authority assigned to manage the beach (the hotels, beach bar owners, other concessionaires etc.) is responsible for beach cleaning on their own costs. In BiH and Croatia the PCEs perform the beach cleaning; their employ seasonal staff which brings the overall costs very high, while no additional revenues are received from the municipality or the state. In addition, in Croatia taking care of the waste disposed in regular containers by nautical objects` owners is aggravating the burden of the PCEs.

Considering this, it is realistic to assume that some quantities of tourism generated waste escape the beaches and become marine litter. Also, the beaches and bays are locations where the marine litter usually strands during windy periods and tides. In the absence of any tangible data, and upon the suggestion of the stakeholders to adopt 0% tourism waste not collected, the beach litter cannot be quantified in the present analyses. It does not render the consideration of beach / tourism litter obsolete because there is evidence that illegal dumps are created (at least) along the beaches of Velipoje (Shkoder), Shengjin (Lezhe) and Velika Plaza (Ulcinj). Therefore, the comprehensive methods to deal with the tourism waste generation, collection, disposal and littering will represent an important element in the regional integrated solid waste management (ISWM) models to be developed.

The waste quantities potentially dumped in each pilot municipality is an important baseline information necessary to assess the significance of environmental and economic impacts of the present mismanagement of municipal solid waste in the Adriatic Coast pilot region. Another input to the assessment relates to the identification of non-compliant landfills and illegal dumpsites (“hotspots”) located nearby rivers – tributaries of the Adriatic Sea, the Shkoder and Shpatar Lakes as well as the sea shoreline.

3.4.3 Waste disposal and “hotspots”

The collected waste is disposed at either regional sanitary landfills or non-compliant municipal landfills. In some cases, the disposal sites are far away from the collection areas which may encourage illegal dumping to avoid excessive transportation (and gate fee) costs by the operators.

An overview of the destinations of the collected waste and distances from the collection areas for each pilot municipality is provided in the Table 6 below.

Table 6 Destinations of collected waste in the pilot municipalities and transport distances from the collection area

Pilot Municipality	Destination of collected waste	Distance from the collection area (km)
Albania		
Lezhe	Regional Sanitary Landfill Bushat	25
Vau I Dejes	Regional Sanitary Landfill Bushat	12
Shkoder	Regional Sanitary Landfill Bushat	25
Montenegro		
Ulcinj	Regional Sanitary Landfill Mozura; Non-compliant municipal landfill Kruce: it is used for the disposal of construction and demolition waste and waste tires only after joining the regional landfill Mozura.	20
Bar	Regional Sanitary Landfill Mozura	20
Herceg Novi	Non-compliant municipal landfill Tisove Grede	23
Bosnia and Herzegovina		
Neum	Non-compliant municipal landfill Klepavica	8
Croatia		
Slivno	Non-compliant municipal landfill Lovornik	30
Mljet	Non-compliant municipal landfill Grabovica	30

It can be seen that the municipalities of Herceg Novi, Neum, Slivno and Mljet dispose their collected waste at non-compliant landfills. Their locations are shown in the Figures below.

Figure 13 Non-compliant landfill Tisove Grede (Herceg Novi)

Figure 14 Non-compliant landfill Klepavica (Neum)

Figure 15 Non-compliant landfills Lovornik and Grabovica (Mljet and Slivno[12])

None of these non-compliant landfills can be source of marine litter, even though no adequate measures for daily cover to prevent the escape of waste by wind blowing are taking place. They are safely away from the shoreline or any water courses so the waste cannot be washed away towards the sea. Some groundwater pollution may be emitted (especially by the Klepavica landfill used by the Municipality of Neum) but in the absence of information on geomorphology it is difficult to draw any conclusions on transboundary impacts upon aquifers. Hence, the existing non-compliant landfills in the region are not sources of marine litter.

Various sources[13] indicate that waste transportation routes exceeding 25 km are not economically viable, especially if the waste is carried in small size refuse trucks (less than 10 tons). It implies that the operators in Lezhe, Shkoder, Slivno and Mljet should look for solutions to reduce the transportation costs, i.e. installation of waste transfers and possibly secondary waste segregation at these transfer points. It would reduce the environmental impacts from the non-compliant municipal landfills analysed above.

[12] These non-compliant landfills are outside the project region

[13] http://www.unep.org/ietc/Portals/136/SWM-Vol1-Part1-Chapters4.pdf

The waste which is not collected ends up at illegal dumps which proliferate along the roads and riverbeds. The construction and demolition waste mainly ends up at the kerbsides of the roads and these spoiled areas are also magnet for dumping of household waste. Still, considering the habits of local population, it is assumed that they fly tip their wastes predominantly near water streams. It leads to an assumption that approximately 40%[14] of the non-collected waste is dumped in marine litter prone areas – lakes, rivers, canals and gullies, from where the waste is washed away during high waters. This assumption was discussed and accepted by the stakeholders during the 1st DP session.

In the figures below the provisional locations of major illegal dumps in the Adriatic Sea pilot region are shown.

Figure 16 Dumpsites in the Shkoder municipality and along the Shkoder Lake

[14] Estimations have been made how much of the mismanaged coastal plastic waste actually washes into the sea Jambeck drew on existing literature on waste streams from places like South Africa and the Bay Area to reach an estimate of 15-40 percent; that range has been applied in the analyses:.http://billmoyers.com/2015/02/19/theres-horrifying-amount-plastic-ocean-chart-shows-whos-blame-2/ The worst case scenario (40%) has been used in this Environmental and Economic Impacts Assessment Report.

Figure 17 Dumpsites at the confluence of Bojana / Buna River in the municipalities of Ulcinj (left) and illegal dumps in the municipality of Bar (right)

Figure 18 Dumpsites in the municipality of Herceg Novi (left); the stranded waste in the Neretva Delta and the illegal dump "Bare" in Slivno (right)

There is an illegal dump, so called "Bare", located on the territory of Slivno. It is not in use anymore but it needs to be closed and remediated. There is a dump created by stranded floating debris in the Neretva Delta which originates from the upstream communities in BiH.

The potential sources of the marine litter were indicated by the stakeholders at the National Assessment Workshops and confirmed during the 1st DP session. It should be noted that they do not stem from a comprehensive inventory. Nevertheless, even if the coordinates of the "hotspots" are not accurate, the information used for the analyses provides an initial background for the dialogue on designating suitable prevention and/or cleaning actions. An inventory of illegal dumps ("hotspots") to derive exact locations of the marine litter sources will have to be created in order to organise for a sound monitoring in the future as part of joint activities at regional scale.

3.4.4 Recycling

Recycling operations in the Adriatic Sea Pilot Region are in infancy. There is some primary waste segregation in the municipalities Lezhe, Herceg Novi, Bar, Slivno and Mljet which is confined to the densely populated areas. No waste segregation exists in rural settlements.

In the municipality of Lezhe the private operator "Vale recycling / Kurbin Lezhe", in collaboration with the public waste management company (so called City of Lezhe) designated recycling spots for households to bring their segregated plastics and paper but their response is rather low: the containers are either not used sufficiently or the segregation is improper. Public awareness campaigns may not have been well targeted or their coverage was not sufficient. The occasion of the developing a new waste management plan as part of the undergoing territorial reform may be utilised to diagnose the reasons for failure and set measures to influence greater responsiveness and segregation discipline of the population.

In Herceg Novi and Bar the primary waste segregation using the "bring and drop" system was applied which resulted in segregated 2% and 1.29% of the total collected waste in Herceg Novi and Bar respectively. Problems with lack of responsiveness and improper segregation occur in both municipalities, similarly to the situation in Municipality of Lezhe. It is planned to extend the coverage by furnishing additional recycling spots (islands) in the urban areas. A closer look in the root causes of the insufficient segregation would be needed to derive a suitable awareness raising campaign.

In Slivno and Mljet the "bring and drop" system for segregated plastics and paper is operational for a while. In Slivno custom containers, supplied with Lock and Feed slot allowing items to be inserted by anyone, but only removed by authorized key holders, were placed to prevent improper segregation by the population. By contrast to the negative experience in other pilot municipalities, (including Slivno), this system yielded very good results. Municipal authorities claim that the quantities of the segregated plastics and paper and the relative distance of the municipalities from the major transportation corridors discourage the interest of the private recycling sector in taking over the recyclables.

The secondary waste segregation takes place at the Bushat landfill and a scrapyard owned by the private operator in Lezhe. The private operator "Vale recycling / Kurbin Lezhe" undertakes secondary waste segregation to reduce the waste quantities going to the Bushat landfill and generate additional revenue to compensate for the delayed payments of the contracting authority – the Municipality of Lezhe. In both Bushat landfill and the scrapyard the secondary segregation is carried out manually: no sorting equipment is available. The authorities reported that 12% and 10% of the total collected waste are segregated in Shkoder and Lezhe respectively.

There is plenty of room for improvement of the present recycling activities in all pilot municipalities. Suitable measures targeting the prevention of marine litter in the Adriatic Sea pilot region will be designed as part of the ISWM model.

3.2.1 Pathways of Marine Litter

As stated elsewhere, the main pathways of marine litter in the Adriatic Sea Pilot Region are the rivers Neretva, Drin, Mat, the interconnected pathway formed by the Bojana / Buna River and Shkoder Lake, as well as the sea currents.

The inflow of marine litter by the rivers in the sea is related to the following variables:

- River catchment area and number of settlements / population residing in the catchment,
- Discharge and streamflow`s (short-term) variations, including periodic flooding,
- Dynamics (turbulence, current velocity, cross-section profile stability).

The bigger the waste quantities of the land based sources and the discharge of the river, the greater will be the contribution to the marine litter. Hence, the greatest environmental and economic impacts will be generated by the abundant and turbulent rivers passing by high number of settlements, during high waters.

Neretva (341 m^3/s mean discharge) and Bojana/Buna, (320 m^3/s), rank as third and fourth by their relative freshwater contributions among all Adriatic Sea tributaries. Considering their discharges, Neretva and Bojana / Buna Rivers are the most important pathways of river floating debris which may adjoin the marine litter at the estuaries. Drin River has two sections, one inflowing the Bojana/Buna River and one branching out the confluence with Bojana / Buna and inflowing the sea near Lezhe. The combined discharge of Bojana / Buna and Drin (360 m^3/s mean discharge) after its inflow is 680 m^3/s. The discharge of the Drin`s branch towards Lezhe is one third of the Bojana/Buna`s tributary. Mat River has a mean discharge of 103 m^3/s. The contributions of Drin and Mat Rivers to the marine litter are of less importance compared to Neretva and Bojana/Buna.

Neretva is an upland river within its entire length in BiH, while in Croatia it takes a lowlands character and a calm course. The Neretva Delta formed before the estuary lies within the municipalities Metković, Opuzen, Ploče, Kula Norinska, Slivno and Zažablje (Croatia) as well as Stolac, Ravno, Ljubuški and Čapljina (BiH). The pilot Municipality of Slivno is a downstream community and as such it is impacted by the floating waste originating in the neighbouring communities in Croatia, but also in BiH. Stakeholders informed that Neretva brings floating waste (plastics, wood, tires, carcases) on their territory and that this disturbs the landscape and distracts tourists ‘pleasantness. Occasionally large quantities of floating litter are discharged to the sea by Neretva River due to uncontrolled dumping. The quantities of floating waste stranded / sunk in Neretva River Delta on the territory of the municipality of Slivno have neither been measured nor was the origin (i.e. from Croatia or BiH) of floating waste identified; also the quantities of river floating litter flowing into the sea are not known. Further analyses are needed to reveal the proportions of relative contribution of upstream communities to the floating litter. The initial assessment of the connection between the river floating waste and the marine litter point to the conclusion that one portion of litter will strand / sink at the delta (due to the slow water course) and another one will continue to the sea. During high waters, however, the stranded waste will be taken away and will become marine litter.

Figure 19 Neretva Delta

Bojana/Buna is a calm lowland river flowing out the Shkoder Lake. It takes certain portion of floating debris from the Shkoder Lake, which originates from the land based sources (illegal dumps) mostly located in Albania (Municipality of Shkoder, please see Figure 16 above). Yet, during high waters and under the influence of the sediments` inflow of its tributary Drin, it flows back to the lake and floods the adjoining agricultural land (there are sources which inform that approximately 20,000 ha of agricultural land can be flooded[15]). At the river delta illegal dumps have been identified which may be washed away and litter transported into the sea. The inflow of river floating debris into the sea has not been measured and further analyses are needed.

Figure 20 Bojana/Buna River Delta

Shkoder Lake has an area of 70 to 540 ha, depending on the season. During high waters its level can rise over three meters. Waste dumped in the inundation area of the Shkoder Lake can be

[15] http://www.monitor.co.me/index.php?option=com_content&view=article&id=2887:zanimljivosti-o-crnoj-gori-x-bojana-tee-i-uzvodno&Itemid=3216 and http://www.thegef.org/gef/sites/thegef.org/files/gef_prj_docs/GEFProjectDocuments/International%20Waters/Regional%20-%20(4483)%20-%20Enabling%20Transboundary%20Cooperation%20and%20Integrated/9-3-14_-_ProDoc.pdf

washed away and transported further by the Bojana/Buna River to the sea. Apart of the illegal dumps as sources of floating litter, Moraca River (its biggest tributary) can also contribute to the marine litter generation. The exact contribution of Shkoder Lake to the marine litter can be measured at the outflow of Bojana/Buna River.

Figure 21 Shkoder Lake

Once the litter enters the sea it is transported by the currents. An incoming (North-West) current is found along the eastern Adriatic coast, carrying the saline Levantine waters into the Adriatic, while less saline water flows out of the Adriatic along the western coast. The current gradients are the primarily cause for the general cyclonic (counter clockwise) circulation. The incoming current is more pronounced along the eastern coast in winter, while the outgoing current is more pronounced along the western coast in summer. This seasonal rhythm is primarily under the influence of gradient currents and the seasonal changes in the winds. In summer, the north-western wind (Maestral) is dominant, and it increases the outflow of marine waters in the surface layer, while the currents in winter are under the influence of the south-eastern wind (sirocco, jugo) that increases the inflow of marine litter.

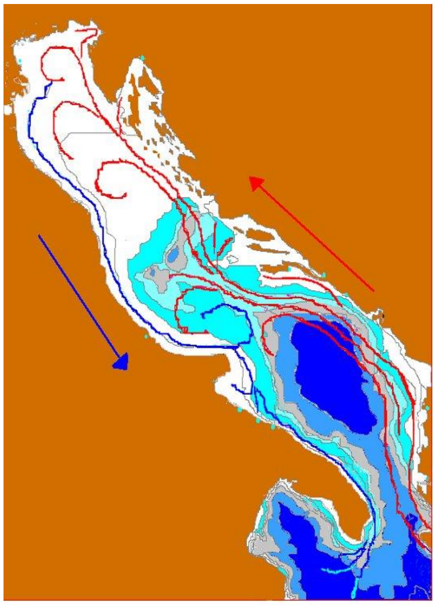

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Figure 22 Surface Currents during winter[16]

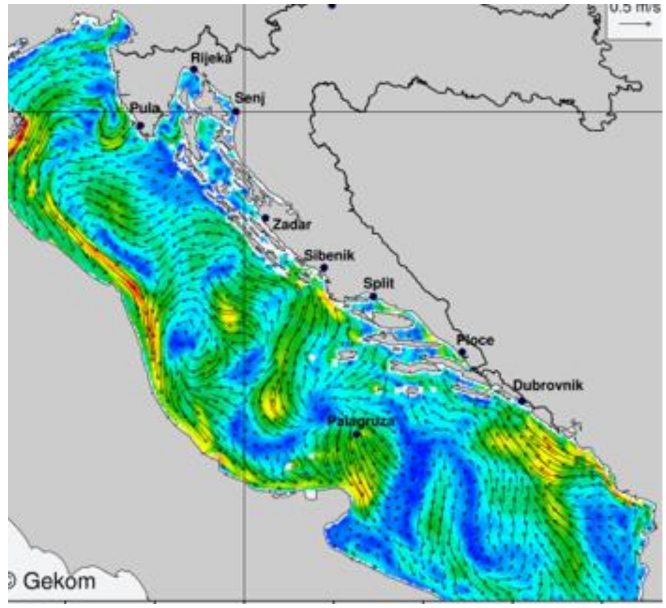

Figure 23 Surface currents during May[17]

Stakeholders informed that the most significant impact of marine litter stranding the beaches and bays is during Jugo blowing periods.

Plastic materials float and takes longer to sink to the seabed and its distribution primarily depends on the currents. On the southern shores of peninsula Pelješac and islands Mljet, Korčula, Lastovo and Vis, due to geographical position and orientation towards the currents, winds and waves, the appearance of large amounts of litter is observed repeatedly, particularly massive one in 2010[18].

3.5 Environmental and Economic Impacts Assessment

The transboundary impacts deriving from the floating waste in the pilot regions can be environmental and economic. The significance can be high, moderate and low. It is linked to the quantity and property of waste potentially released from each pilot municipality (please see the section 3.2 Origins and land-based sources of marine litter in the pilot municipalities in the Adriatic Coast pilot region above).

The *environmental impacts* encompass water pollution, threats to the marine wildlife / river ecosystems and protected areas, as well as human health problems in terms of potential injuries of people by sharp objects settled at the bottom of the sea / rivers or accumulated debris at the coast / river banks.

The *economic impacts* comprise of costly clean-up activities (either in the sea / lakes / reservoirs or at the coast / river banks), declining fisheries, loss of tourism and related revenues, damage of nautical objects and costs of their rescue, etc.

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16 http://www.azu.hr/en-us/Environmental-protection/Currents-in-the-Adriatic-Sea
17 http://www.azu.hr/en-us/Environmental-protection/Currents-in-the-Adriatic-Sea
18 http://bib.irb.hr/prikazi-rad?rad=782312

3.4.1 Environmental Impacts

Floating waste poses a considerable threat to the health and productivity of marine, lake and riverine ecosystems.

Many species mistakenly ingest debris such as plastic, monofilament line, rubber, aluminium foil and tar (Bjorndal et al., 1994; Derraik, 2002). Regularly, fishes (Boerger et al., 2010), birds (van Franeker et al., 2011), cetaceans (de Stephanis et al., 2013) and marine turtles (Campani et al., 2013; Lazar and Gracan, 2011; Tourinho et al., 2010) accidentally swallow micro and macro plastic debris that is often found in their digestive tracts.

There is very limited data available on the ecological impacts of litter on marine wildlife in the Adriatic Sea. Evidence of harmful effects of marine debris in wildlife is mostly restricted to observations on individual specimens of cetaceans, fish and turtles that have ingested litter items. Most of the reported data refer to few individuals collected on each occasion, making it hard to draw robust conclusions and presenting only a snapshot of the impacts occurring unseen at sea.

The methods applied to monitor the impacts of litter on marine wildlife in the Adriatic Sea focus on the assessment of the occurrence, abundance by number or mass and composition of litter items ingested by individual marine species. General necroscopy is performed on individuals, followed by the isolation either of the whole digestive tract (esophagus, stomach and intestines) or parts of it (mostly the stomach) and ingestion of debris is quantified as the frequency of occurrence (incidence) and/or percentage of dry mass of gut content of each animal. Classification of debris items follows expressed in incidence and abundance by number per litter category.

The first report on the deleterious effects of plastic debris ingestion on marine species in the Adriatic Sea was published in 1999. It brought to light the case of a dead female striped dolphin, Stenella coeruleoalba, found near the island Krk, in the North Adriatic Sea. The cause of death was ingestion of plastics, indicated by the findings of the necroscopy, according to which the entire volume of its stomach was occluded by different kinds of plastic materials, such as garbage bags, rubber glove, cellophane wrappings, etc. The blubber layer of the specimen was extraordinary thin, indicating starvation. A similar report recorded the death of a Cuvier’s beaked whale, Ziphius cavirostris, found in the Croatian part of the Adriatic Sea, which was induced by plastic bags.

A study on the occurrence and impacts of marine debris ingestion by logger head sea turtles, Caretta caretta, in the foraging habitats of the eastern Adriatic Sea (Slovenia and Croatia), revealed that marine litter was present in 35.2% of turtles, with plastic being the most frequent debris recorded. The types of litter items encountered in the gastrointestinal tract of 54 specimens found stranded or captured incidentally dead by fishermen, included soft plastics (mainly remains of plastic bags and wrapping foils), ropes, styrofoam and monofilament lines found in 68.4%, 42.1%, 15.8% and 5.3% of loggerheads that had ingested debris, respectively.

The impact of litter the originating from the pilot municipalities onto the marine ecosystem cannot be determined presently. It is obvious, however, that the pilot municipalities contribute to the impacts highlighted above, proportionally to the quantities of released floating debris.

The impact on the key terrestrial ecosystems and protected areas in the Adriatic Sea Pilot Region is from stranded floating debris and marine litter is also present. The key biodiversity spots in the pilot region which can be affected by the marine and floating debris are:

Drin River Delta is recognized as "Specially Protected area" in the framework of activity "Specially Protected Areas of the Mediterranean Sea" of Barcelona Convention (RAC/SPA, Tunis, 1995). Species in danger of extinction at the global level (IUCN, 2001) are: Phalacrocorax pygmaeus, Lutra lutra, Monachus monachus, Myotis myotis, Ophisaurus opodus, Emys orbicularis Telescopus fallax, Rana balcanica, Rana lessone and Acipenser sturio. Considering Drin River a pathway of floating litter, the impact over these globally threatened species is significant.

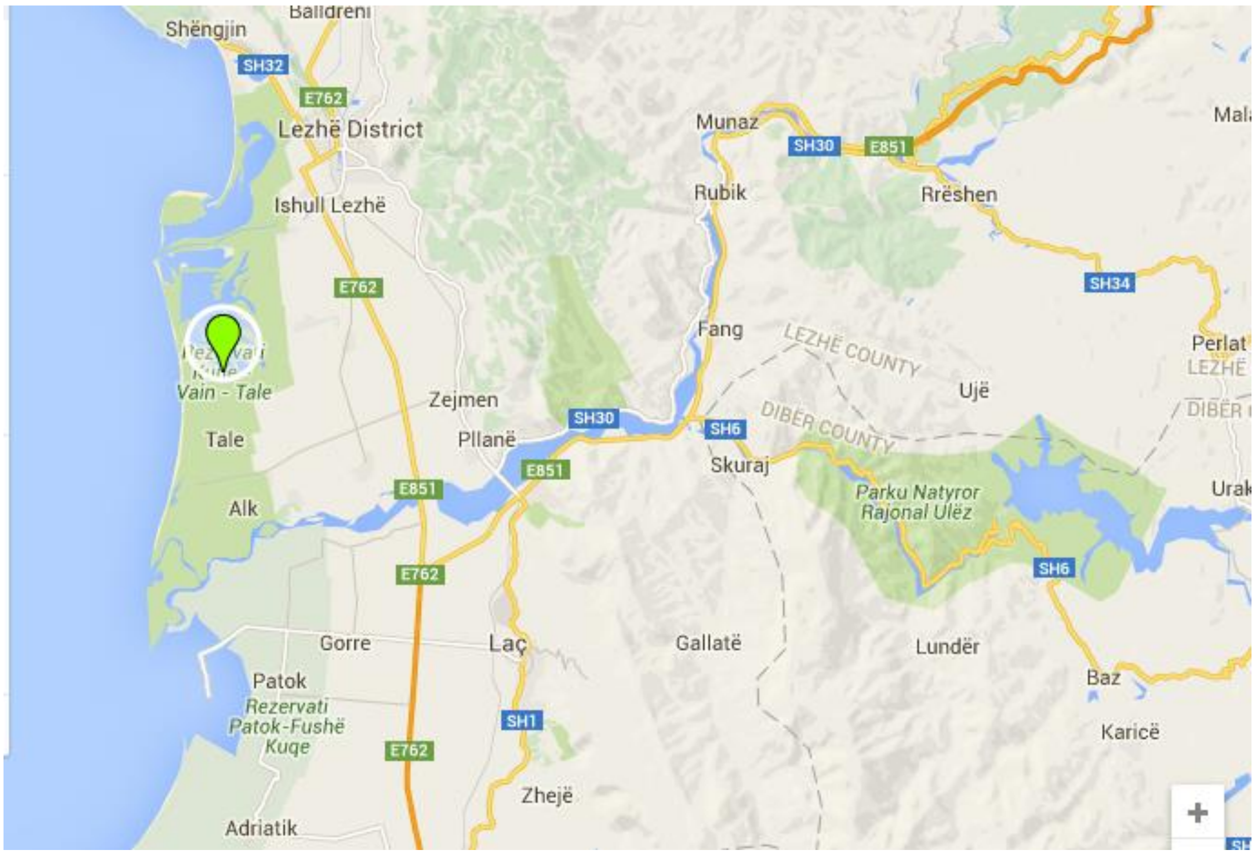

Figure 24 Drin River Delta Protected Area

Lumi Buna-Velipojë, situated in Shkodra district. It is an Important Bird Area (IPA); the river Domi, the lagoon and marshes are important areas for wintering migratory species, some of which are protected by the Bonn convention. Most important species include: sturgeon (Acipenser sturio), Water nuts (Trapa natans) globally threatened distinguish type of otter (Lutra Lutra), Phalacrocorax pygmeus, and jackal (Canis aureus). Threatened species can be severely affected by ingestion and entanglement of floating debris transported by Bojana / Buna and Domi River.

Buna Delta is a special habitat for mammals in Europe (18 terrestrial and 3 marine mammals are observed, including Bottle-nosed Dolphins, bears, Jackals, mound building mouse populations (*Mus spicilegus adriaticus ssp. Nova*), blind moles (*Talpa stankovici montenegrina*) etc. Floating and dumped debris can be a threat for these globally important and threatened species. There are numerous illegal dumps in the area and Bojana/Buna is recognised as a pathway for floating litter.

Lake Shkoder (Ramsar Site) lays on important migration routes, especially of fish and birds. For water birds the wetland area is also important as a breeding and wintering site. Floating islands with colonies of cormorants, herons and pelicans are unique in Europe. A breeding colony of Dalmatian Pelican, a globally threatened species, exists on Lake Skadar/Shkoder, one of only a handful of such colonies in South-Eastern Europe. Other important numbers of wetland birds include ducks, geese, waders, gulls, birds of prey, owls and passerines. The number of wintering water birds on the Albanian side only reaches 24,000 – 30,000 individuals. The globally-threatened Common Sturgeon, Stellate Sturgeon, and Adriatic Sturgeon, as well as other migratory fish, use the Buna/ Bojana River to forage and spawn upstream. This ecosystem is critically endangered by the nearby "hotspots" of fly tipped and floating litter.

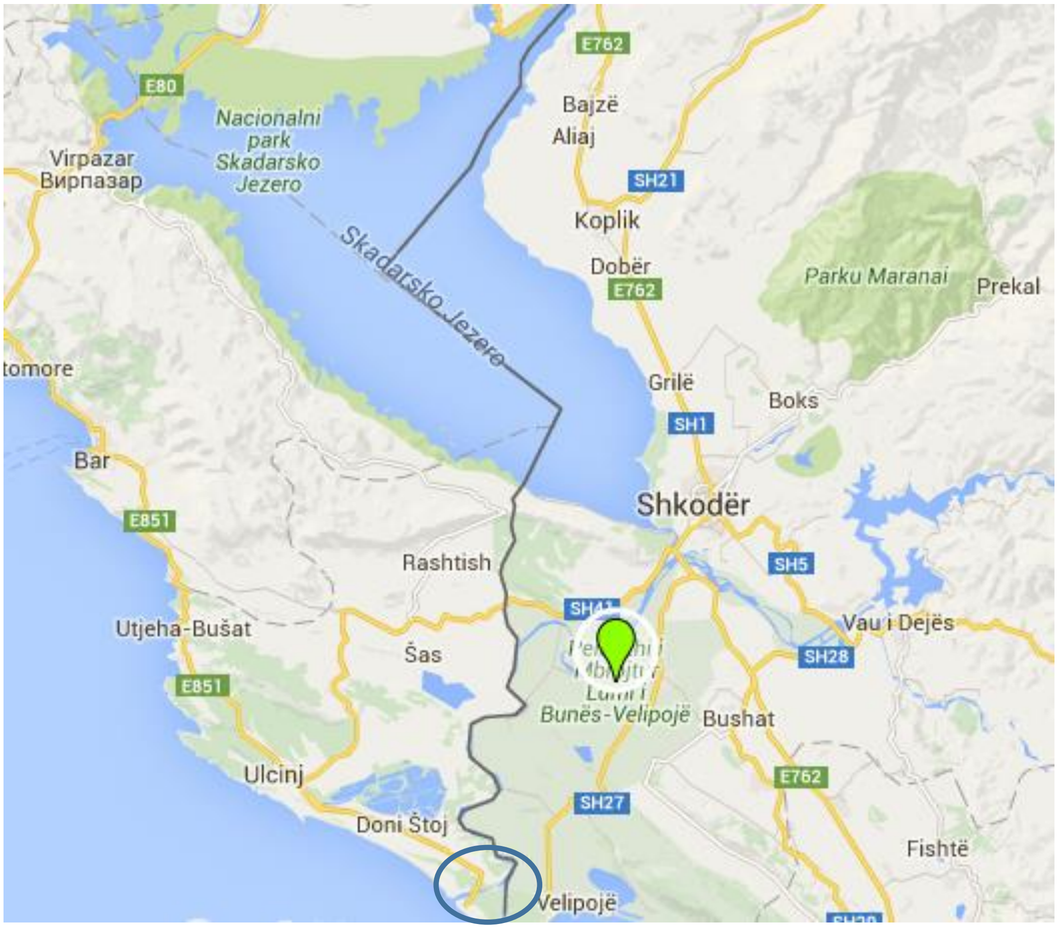

Figure 25 Shkoder Lake, Bijana / Buna Delta and Protected Landscape Lumi – Velipoje

Considering the richness of biodiversity and the presence of globally threatened species (especially birds and mammals), on one hand, and the significant threat of the litter on the bird and mammals` populations, on the other, waste dumping related prevention measures are a matter of urgency.

3.3.4 Economic Impacts

Floating debris can cause serious economic losses to various sectors and authorities. Among the most seriously affected are coastal communities (increased expenditure on beach cleaning, public health and waste disposal), tourism (loss of income, bad publicity), fishing (reduced and lost catch, damaged nets and other fishing gear, fouled propellers, contamination) and shipping (costs associated with fouled propellers, damaged engines, litter removal and waste management in harbours). Economic costs are lost benefits to society (negative welfare effects).

The following economic impacts are analysed:

- Costs for cleaning stranded litter at the coasts / river banks;
- Costs for cleaning illegal dumps – origins of floating waste (prevention activities);
- Lost revenues from tourism due to aesthetic disturbance caused by litter, floating and stranded waste;
- Lost revenue from fisheries.

These costs may be difficult to estimate in the absence of suitable records. The assessment of these costs will have to deploy an organised approach for monitoring at the regional scale in the future.

3.3.4.1 Costs for Cleaning Stranded Litter at the Coasts / River Banks

Costs for cleaning of stranded debris depend on the length of beach/ river bank, frequency (seasonal), human power (number of people involved), auxiliary equipment (i.e. bags), protective clothing / equipment used (i.e. gloves, masks etc.), transport (vessels, fuel) and disposal (disposal fees paid at the recipient landfill).

Stakeholders informed that they have not kept any records of expenditures for cleaning of beaches or river banks. Ulcinj authorities recollected that for 12 kilometres of beach (Velika Plaza and Ada Bojana) they spent 30,000 EUR. It derives a unit cost per kilometre of 2,500 EUR. When compared to data from literature[19], it seems to be low.

The Table 26 below provides information on expenditures for cleaning beaches in Europe.

Table 7 Beach cleaning costs per beach type (source Mouat, 2010; Arkadis, 2013; Reinhard et al; 2012)

Beach Type	Cost per km (EUR)	Year	Location	Sea
Bathing	34,450	2010	Touristic beaches NL & B 10 municipalities	NS
	28,320	2010	Touristic beaches; NL 6 municipalities	NS
	39,190	2010	Spain: bathing beach	MED
	31,796	2010	Portugal: bathing beach	ATL
	34,450	2010	Touristic beaches NL & B 10 municipalities	NS
Non-bathing	214	2010	Sweden, non-bathing beaches	BAL
	372	2010	Denmark, non-bathing beaches	NS
Bathing & non-bathing	7,150	2010	UK, also cleaning of less touristic beaches	NS
	3,750	2012	Latvia (Riga) bathing & non-bathing beach	BAL
	11,000	2007	NL: average total coast length	NS
	8,278	2010	Portugal: bathing & non bathing beach	ATL

[19] Marine litter study to support the establishment of an initial quantitative headline reduction target - SFRA0025

To establish bathing beaches` expenditure for cleaning two elements are needed: the length of bathing beaches in each pilot country and respective unit costs.

The expenditures of beach cleaning in the pilot region need to be established in line with the status of economic development (GDP per capita). In order to derive unit costs for bathing beach cleaning in Albania, Montenegro, BiH and Croatia, respective GDP per capita are compared with the GDP per capita in Spain (25617.55 US dollars) and unit prices are set proportionally to the unit costs per kilometre (39,190) in Spain.

Country	GDP/capita US dollars (2014)	% of the GDP/capita for Spain US dollars (2014)	Unit Costs/km bathing beach (EUR)	Length of beaches (Km)	Total costs (EUR)
Albania	3,994.63	15	5,878	56.5[20]	332,107
Montenegro	4,757.32	18	7,054	34.6[21]	244,068
BiH	3,450.00	13	5,094	15[22]	76,410
Croatia	10,561.27	41	16,067	85[23]	1,365,695
Total Region					**2,018,280**

The highest (annual) costs of beach cleaning incur to the authorities in Croatia, Albania and Montenegro. Considering the fact that beaches are cleaned repeatedly during the tourist season and at least once before and after the tourist season, the actual costs for beach cleaning are significantly higher.

The expenditures of beach cleaning are not to be covered by the user charges. In Montenegro the funds are made available by the "Morsko Dobro[24]" and concessionaires that manage the beaches. "Morsko Dobro" reports[25] that in Herceg Novi, for example, the management of 47 beaches is outsourced to concessionaires while 18 are to be cleaned by the PCE. In 2015 "Morsko Dobro" has transferred 167,000 EUR to the Municipality of Herceg Novi for the purpose of beach cleaning. In Lezhe municipality the private operator is in charge of beach cleaning for which the municipality transfers the necessary funds. In Shkoder the responsibility for beach cleaning is not clear at present: the private operator stated during the 1st Dialogue Platform session that the contract with the municipality does not include the beach cleaning activity. Hence, it is assumed that the public operator is responsible for the beach cleaning in Shkoder. In Neum, Slivno and Mljet the PCEs cover the costs of beach cleaning. They do not receive any funds from the municipal authorities which affects negatively the sustainability of their operations.

3.3.4.3 Costs for Cleaning Illegal Dumps

The inventory of illegal dumps in the Adriatic Coast Pilot Region is not complete at present, however, the estimations made for the purpose of this Impact Assessment Report show that approximately 31,131 tons of waste are not collected and may end up at illegal dumps. Assuming

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[20] It includes: 38 km in the Municipality of Lezhe; 14 km in the Municipality of Shkodra (Velipoje beach) and 14,5 km on Shkoder Lake (Shiroka beach).
[21] It includes: 20 km in the Municipality of Ulcinj; 9 km in the Municipality of Bar; 5.6 km in the Municipality of Herceg Novi
[22] The total seashore length in the Municipality of Neum is 25 km. but it is not entirely used for beaches.
[23] It includes 20 km in the Municipality of Slivno (including the Neretva Delta) and 65 km of the southern seashore of the Municipality of Mljet.
[24] "Morsko Dobro" or "Sea Wealth" is a Public Enterprises responsible for managing the sea waters in Montenegro.
[25] http://www.vijesti.me/vijesti/morsko-dobro-da-se-bolje-odrzavaju-nezakupljene-plaze-839912

a unit price of 50 EUR/ton for collection, transportation and disposal at the regional sanitary landfills, the annual costs for cleaning the illegal dumps are estimated at around 1,556,550 EUR.

3.3.4.4 Lost Revenues from Tourism

Floating and stranded debris can act as a deterrent to tourists. In this way, floating debris can reduce tourism revenue and consequently weaken economies, especially of the coastal areas.

An overview of tourist arrivals and overnight stays for 2014 in pilot municipalities in Montenegro and Croatia is provided in the Table 8 below.

Table 8 Arrivals and Overnight Stays in Pilot Municipalities

Pilot municipality	Arrivals 2014		Overnight Stays 2014	
	Domestic	International	Domestic	International
Herceg Novi[26]	36,677	177,982	299,419	1,336,455
Ulcinj[27]	22,257	116,845	173,000	832,836
Bar[28]	11,517	145,841	55,914	1,163,929
Slivno[29]	1,617	16,313	34,223	123,894
Mljet[30]	2,914	17,254	12,790	85,880

Information on tourist visits for the municipalities in Albania and BiH is not available. From the table above it can be seen that the tourism is a very important economic sector in all analysed municipalities. Assuming that one average tourist spends 100 EUR a day, the direct revenues from tourism in 2014 were in the range of:

- 163,587,400 EUR in Herceg Novi
- 100,583,600 EUR in Ulcinj
- 121,984,300 EUR in Bar
- 15,811,700 EUR in Slivno
- 9,867,000 in Mljet

To estimate the revenues from tourism in Albania and BiH an indicator of revenue per capita and year has been established which is 6,266 EUR in 2014 which multiplied with the population numbers provides the following figures:

- 214,502,097 EUR in Lezha

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26 http://www.monstat.org/userfiles/file/turizam/dolasci%20i%20nocenja%202014/godisnja/Turizam%20u%20Crnoj%20Gori%20-%202014.pdf

27 http://www.monstat.org/userfiles/file/turizam/dolasci%20i%20nocenja%202014/godisnja/Turizam%20u%20Crnoj%20Gori%20-%202014.pdf

28 http://www.monstat.org/userfiles/file/turizam/dolasci%20i%20nocenja%202014/godisnja/Turizam%20u%20Crnoj%20Gori%20-%202014.pdf

29 http://www.imamopravoznati.org/en/request/301/response/222/attach/2/Pregled%20dolazaka%20i%20nocenja%201%2012%202014.pdf

30 http://www.imamopravoznati.org/en/request/301/response/222/attach/2/Pregled%20dolazaka%20i%20nocenja%201%2012%202014.pdf

- 46,998,707 EUR in Vau I Dejes
- 678,128,672 EUR in Shkoder
- 26,551,136 EUR in Neum

Lost expenditure can be expressed as the product of decreased visitors and average visitor expenditure. When analyzing the trends in tourism overnights in the Adriatic Coast area, these show positive results, meaning that the tourist visits and overnight stays are on the rise in the period 2011-2014 in all pilot countries.

Another method will be to understand the perceptions of tourists regarding the cleanliness of the coast / river / lakes.

The Tourist Info Center in Montenegro records the complaints of tourists and therefore the national expert and the Local Government Association (LGA) in Montenegro contacted the Tourist Info Centre to obtain statistical information on the number of complaints on the beach cleanliness. The results of the survey are as follows:

Table 9 Survey on calls` structure addressed to the Tourist Info Centre in Montenegro

Received calls	01.06 – 30.09.2014	%
Information	4,302	74
Complaints	1,115 (139)	19
Praises	58	1
Total	5,475	100

Out of 1,115 complaints, 66 have referred to beach cleanliness, 73 related to illegal dumping, which in total makes 139 nauseated tourists (2.5% of the total calls).

Assuming 2.5% of the total visitors would not return, the lost revenues per municipality and for the region would be as follows:

Table 10 Estimated lost revenues from tourism

Pilot Municipality	Total revenues (EUR/year)	Lost revenues (EUR/year)
Albania		
Lezhe	214,502,097	5,362,552
Vau I Dejes	46,998,707	1,174,968
Shkoder	678,128,672	16,953,217
Montenegro		
Ulcinj	100,583,600	2,514,590
Bar	121,984,300	3,049,608
Herceg Novi	163,587,400	4,089,685
Bosnia and Herzegovina		
Neum	26,551,136	663,778
Croatia		
Slivno	15,811,700	395,293
Mljet	9,867,000	246,675
Total Pilot Region	**1,378,014,612**	**34,450,365**

Comparing the lost tourism revenues (54,460,003 EUR/y), expenditures for cleaning the beaches (2,018,280 EUR/one off cleaning) and the cleaning the illegal dumps (1,556,550 EUR/y), with the total investment for the in waste collection equipment of 7,888,200 EUR, it is obvious that the countries / municipalities must consolidate their waste management services in order to prevent the occurrence of further sunk costs and losses.

3.6 Impacting and Impacted Municipalities

Considering the origins, significance and pathways of the waste or pollution moving across the borders, there will be a need to highlight the relationships between the impacting and impacted countries / municipalities.

Impacting municipalities are responsible for the generation of floating waste and/ or pollution, by inadequate waste management practices and particularly illegal dumping in flood/ tide - prone areas.

Impacted municipalities are receiving the (unwanted) floating waste and/ or pollution. They are to bear additional costs for their clean-up and disposal, which they cannot recover from the service users and thus they face significant financial loss.

In the Adriatic Sea region, there will be impacting (downstream) and impacted (upstream) municipalities, the latter receiving the floating waste.

Considering the currents of the Adriatic Sea which bring the marine debris from south to north[31], the impacting and impacted municipalities are as follows:

Table 11 Impacting and impacted municipalities

Pilot Municipality	Impacted by	Impacting
Albania		
Lezhe	Upstream communities along the Drin River before the Vau I Dejes HPP	High impact for Mljet and Slivno
Vau I Dejes	Upstream communities along the Drin River before the Hydro Power Plant (HPP) Vau I Dejes	Moderate[32] impact for Mljet and Slivno
Shkoder	Ulcinj because the Buna / Bojana River is creating the border	High impact for Mljet, Slivno and Ulcinj (Buna / Neretva Delta)
Montenegro		
Ulcinj	Shkoder, because the Buna / Bojana River is creating the border	Moderate impact for Shkoder, high impact for Mljet and Slivno
Bar	Not impacted[33]	Not impacting
Herceg Novi	Low impact from municipalities located in the south - Shkoder, Vau I Dejes, Lezhe and Ulcinj (by sea currents)	Low impact for Mljet and Slivno
Bosnia and Herzegovina		
Neum	Not impacted	Not impacting
Croatia		
Slivno	BiH municipalities located outside the pilot region (by Neretva); Shkoder, Vau I Dejes, Lezhe and Ulcinj (by sea currents)	Not impacting

[31] Please see the sea currents shown in Figures 22 and 23 above.
[32] The municipality of Vau I Dejes generates marine debris by the inflow of Drin River, after the HPP Vau I Dejes, which is considered moderate impact.
[33] The stakeholders stated that they are impacted by their own debris which comes back during high winds (Bura). It has been confirmed by analyzing the sea currents which pass by the area of the Municipality of Bar (please see Figure 23 above).

Pilot Municipality	Impacted by	Impacting
Mljet	Shkoder, Vau I Dejes, Lezhe and Ulcinj	Not impacting

The influence of marine litter is significant when looking at the total pollution in the pilot region, and this problem must be solved urgently taking the economic, social and cultural situations into consideration. To solve the marine litter problem sustainably, it is necessary to synchronise efforts at national and international level because transboundary water resources and their preservation, protection and sustainable uses as well as the tourism development are of great importance for all countries.

4 Conclusions

The problem of marine litter / floating debris has obvious international dimensions. It affects the marine and riverine environment outside the jurisdiction of pilot municipalities, countries and regions. Sources of marine litter / floating debris are spread across the territory of the pilot municipalities; under the influence of various factors (wind, flood, tide, sea current etc.) the litter enters the river or sea and by way of some pathways it is transported over long distances.

Box 1. Life cycle of marine debris / floating debris

> The complicated nature of the distribution of marine debris / floating debris in the environment calls for a clear and defined approach to characterizing and assessing the problem. Marine debris / floating debris enters the sea / river / reservoir through many pathways, and the patchiness in the distribution of debris, and spatial and temporal variability in the drivers add to its complex life cycle (Ryan et al., 2009, Cole et al., 2011, Doyle et al., 2011).

The full cycle approach implemented herein is intended to track the marine litter from the source, through the pathway to the endpoint / sink. However, finding usable data on impacts and quantities of marine litter remains a challenge. Systematic scientific research on marine litter in the pilot regions is relatively scarce. This makes quantifying the impacts very hard. Notwithstanding, we attempted to characterize and whenever possible quantify the impacts based on stakeholders` input and literature, which is considered to be a step forward in understanding the marine litter problems.

Some municipalities, which are most plagued by litter, have no control over the production or disposal of that litter at the place of source. Furthermore, in the absence of a coordinated approach, efforts of some municipalities to reduce the intake of or remove the plagued debris may be undermined by the lack of action of the others. Therefore, an open, constructive and forward-looking dialogue on controversial topics is needed to identify joint visions and opportunities on solutions to marine litter.

Annex 1

Template Questionnaires used for data collection

Questionnaire 1

Country				
What documents are in place to guide waste management in the country?	**Document Title / Content etc.**	**Date Published**	**Date Due for Revision**	**Comments**
What are the key pieces of waste legislation?	**Waste Management**	**Special Waste Streams**	**Waste Treatment and Disposal**	**Others**
What are the main institutions involved in the governance of waste management, describe roles and responsibilities?	**National Government**	**Regional Authorities**	**Local Authorities**	**Waste Utilities (public or private)**
Recycling Targets	**Packaging Waste**		**Organic Waste**	
Are there additional revenues for the local authorities for managing waste?				**Yes / No**
Is there producers` responsibility for special waste streams?				**Yes / No**
Is there any landfill tax?				**Yes / No**
Local Regulations (e.g. Decision on Communal Order, Ordinance on Public Hygiene etc.)				**Yes / No**

Municipality	
Population	
Economic activities	
Waste generation per capita (per day and year)	
Waste Composition (%)	
Organic	
Paper	
Plastic	
Glass	
Metal	
Other	

Public Utility (name)	
Do the population pay waste management charges?	
Charging Method: – flat rate; – based on frequency of service; – based on waste volume (container);	
Payment efficiency (%)	
Cost Recovery	**Yes / No**
Is there any private waste management operator?	**Yes / No**
Waste Collection Rate (Service Coverage) (%)	
Municipality	

Name of non-compliant landfill(s), illegal dump(s)	
Area (m2)	
Waste origin (settlements, industry, healthcare establishments, etc.)	
Typical landfill operations (e.g. compaction, daily coverage)	
Typical technical measures applied (e.g. bottom sealing, leachate drainage, landfill gas extraction and flaring etc.)	
Likelihood for transboundary impacts (high, medium, low)	

Municipality	
Pathways (rivers, cannels, drains, gullies, reservoirs, aquifers, sea currents, atmosphere etc.)	
Migration Drivers (wind, precipitation / flood, erosion)	

Questionnaire 2

QUESTIONNAIRE FOR THE PUBLIC UTILITY ______

IN MUNICIPALITY OF ____________ _______________

1. Which settlements you collect waste from?

2. Which settlements you do not collect waste from?

3. How often you collect waste in most of the settlements?
    a. Once a week
    b. Twice a week
    c. Every day
    d. Other, specify

4. Is the collection frequency sufficient?
    a. Yes
    b. No

5. Which containers are used for the collection of waste?

Volume of Container	Number
90l	
120l	
240l	
1100l	
5,7, 9m3	
Others	

6. Do you need additional containers?
    a. Yes
    b. No

7. Which trucks you use for the waste collection?

Type of truck	Number / volume
Tractor & trailer	
Compaction refuse trucks	
Roto- press refuse trucks	
Skip trucks	
Others (small truck Piaggo for pedestrian areas)	

8. Do you need additional trucks?
    a. Yes
    b. No

9. Do you segregate the waste at source?
    a. Yes
    b. No

10. Which recyclables you collect?
    a. Plastic
    b. Paper
    c. Aluminum cans
    d. Others

11. Do you sell the collected recyclables:
    a. To private companies in the country?
    b. To private companies abroad?

12. Where the waste is disposed of? What is the transport distance from the collection area to the disposal site?

13. What is the composition of the disposed waste (e.g. household, industrial, construction and demolition, healthcare etc.)?

14. Is there any possibility that some hazardous waste is mixed with non-hazardous waste?

Yes, household hazardous waste is small quantities.

15. Is the landfill fenced?
    a. Yes
    b. No

16. Is the landfill located nearby a river, canal or gully?
    a. Yes
    b. No

17. Do you implement waste compaction and daily coverage?
    a. Yes
    b. No

18. Is there any leachate drainage and landfill gas collection & flaring at the landfill site?
    a. Yes
    b. No

INTEGRATED SOLID WASTE MANAGEMENT MODEL

in Adriatic Coast region

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Executive Summary

The marine litter is a serious pollution problem in the Adriatic Sea region, particularly in Albania, Montenegro, Bosnia and Herzegovina and Croatia. This Integrated Waste Management Model comprises of actions to monitor the marine litter in the environment as well as to prevent and/or reduce its generation at the source. In a nutshell, it is a response to the root problems of the marine litter generation:

Problem	Solution
Scarce information on the amounts, composition and spatial distribution[1] of floating, settled (at the sea floor) and stranded marine litter at the coastal areas (mainly bays and beaches).	Regional monitoring system of beach marine litter based on the Marine LitterWatch[2] protocol (developed for the needs of the European Environment Agency - EEA) for collecting beach litter data.

Incomprehensive municipal and hence national statistics on waste generation, composition and management (the latter including, as a minimum, collection rate from service users, recycling / recovery rate, the amounts of disposed waste, the inventory of sources of marine litter – non-compliant municipal landfills, illegal dumps etc.).	• Develop and implement regionally harmonised method for waste sampling analyses building upon the NALAS method and strengthening statistical analyses of waste generation with the stratification methods elaborated in the Methodological Tool to Enhance the Precision & Comparability of Solid Waste Analysis Data, 5th Framework Program, EU[3];
	• Develop and implement a regionally harmonised methodology for determination of the waste collection service coverage, taking into account:
	  ○ existing versus the required available volume of collection vessels,
	  ○ existing density and respective locations of containers versus the population density & waste arisings and locations of properties,
	  ○ existing versus the required vehicle routing and collection frequency;
	• Create inventories of illegal dumpsites upon the clean-up campaigns by tracking the locations of dumpsites, volume and provisional composition of fly tipped waste using the mobile application

[1] Spatial distribution of marine litter is linked to sea currents, tides and river information indications about the physical source, i.e. the litter input zone and its pathway.
[2] http://www.eea.europa.eu/themes/coast_sea/marine-litterwatch
[3] https://www.wien.gv.at/meu/fdb/pdf/swa-tool-759-ma48.pdf

Problem	Solution
	“TrashOut”[4] and joining the initiative “Let`s Do It World”[5]; • Exploit clean-up campaigns are a formidable tool to raise public awareness; • Strengthen enforcement against illegal waste dumping following the clean-up events. Set a mechanism for regional cooperation towards harmonising and synchronising the implementation of methodologies for waste statistics, waste collection service coverage and inventories of illegal dumpsites;
Insufficient waste management practices in the majority of pilot municipalities, constituting the root cause for the generation of marine litter: lack of organisational and financial capacity of operators to cover remote rural areas with an organised waste collection service; littering habits of population (and tourists) due to the low awareness on deriving adverse environmental and economic impacts; lack of responsiveness to newly introduced waste segregation practice in some municipalities; insufficient enforcement.	• Carefully plan the rural waste collection system by: ○ Setting convenient collection routes, ○ Establish suitable collection points for mobile or fixed transfer of waste delivered by the citizens or local community elected waste collection agents; ○ Plan the collection schedule (travel time per a route and frequency of collection) ○ Plan the required resources (containers, refuse vehicles, staff, fuel) • Establish “door-to-door” waste collection system in rural areas not covered by the service; initiate primary waste segregation upon the start-up of operations; • Implement public awareness campaigns to foster the acceptance of the new service, including the primary waste segregation; • Invite the private sector to take over segregated recyclables from the collection points;

4 https://www.trashout.ngo/
5 https://www.letsdoitworld.org/about/overview/

1. Background

The Regional Rural Development Standing Working Group (SWG) and the Network of Associations of Local Authorities of South-East Europe (NALAS) are implementing a regional sub-project “Solid Waste Management in cross-border rural and coastal areas of South Eastern Europe” supported by the German Federal Ministry for Economic Cooperation and Development (BMZ) through the GIZ Open Regional Fund for South East Europe – Modernisation of Municipal Services (ORF MMS) and the Government of Switzerland.

The SWG is engaged in improving rural livelihoods in the SEE countries. To this end, it promotes innovative and sustainable agriculture and rural development through regional cooperation of respective Ministries of Agriculture and other stakeholders. It supports the EU integration in the SEE, by:

- fostering rural development policies,
- improving implementing structures and systems for agriculture and rural development
- improving the understanding and use of implementation tools for agriculture and rural development;
- identifying and sharing information and application of good practice in agriculture and rural development to broaden the rural agenda.

NALAS brings together 16 Associations which represent roughly 9000 local authorities, directly elected by more than 80 million citizens of this region. NALAS helps the associations to represent viably the local authorities vis-à-vis central governments. NALAS provides services to local governments and aspires to develop itself as the Knowledge Center for the local government development in the SEE. It promotes the:

- procsess of decentralization, considering the local self-government as a key issue in the transition process in the SEE;
- partnerships in order to contribute to the EU integration as well as the reconciliation and stabilization process.

1.1 Goals and Objectives

The overall aim of the sub-project is to “improve the conceptual and organisational framework conditions concerning Integrated Solid Waste Management (ISWM) in cross-border rural and coastal areas in SEE”.

The specific goal of the sub-project is to “assess and develop schemes (models) for integrated management of solid waste that are environmentally effective and economically affordable in order to reduce adverse environmental and economic impacts of solid waste mismanagement and support the ecological and socio-economic development of the cross-border rural and coastal areas in the SEE countries”.

The sub-project project applies a regional approach, which is oriented towards the needs and perspectives of the countries contributing to the impacts of solid waste mismanagement (so called “impacting”) and the countries suffering from the adverse effects (so called “impacted”). Furthermore, three pilot regions are analysed: “Sharra”, “Tara – Drina – Sava” and “Adriatic Coast” Region.

The sub-project is implemented in several stages as follows:

1. Developing a Method for Environmental and Economic Impact Assessment.
2. Developing Environmental and Economic Impact Assessment Reports for each pilot region using the Environmental and Economic Impact Assessment Method. These reports help enhancing the knowledge of relevant stakeholders on marine litter / floating debris impacts and associated costs.
3. Drafting Integrated Solid Waste Management (ISWM) Models, based on the lifecycle analyses of the marine litter / floating debris and available Best Practices on preventing the deriving environmental and economic impacts.
4. Proposing Policy Recommendations, in order to create an enabling environment for the implementation of ISWM models.
5. Generating project proposals (i.e. fiches), deriving from the ISWM models, to support the relevant stakeholders in fundraising of follow-up activities.

This Integrated Waste Management Model has been developed for the Adriatic Coast pilot region. It comprises of actions to monitor the marine litter in the environment as well as to prevent and/or reduce its generation at the source. The geographical scope and information on area/population per municipality / country is explained in more details in chapter 2 below.

1.2 The Adriatic Coast Pilot Region

The pilot region "Adriatic Coast" encompasses 9 municipalities from three countries: Albania, Bosnia and Herzegovina, Croatia Montenegro, - (Table 1).

Table 1 Adriatic Sea Coastal region (Albania – Montenegro – BiH – Croatia)

Countries			
BiH	**Croatia**	**Montenegro**	**Albania**
Pilot Municipalities			
Neum	Mljet	Ulcinj	Shkoder
	Slivno	Bar	Vau i Dejes
		Herceg Novi	Lezha

The pilot municipalities have been selected by the Local Government Associations (LGAs) – members of NALAS in respective countries.

In the Figures 1 - 4 below the administrative boundaries of the pilot municipalities for each participating country are highlighted.

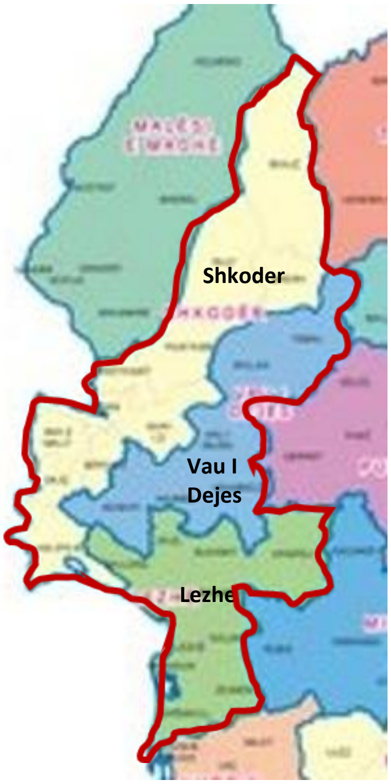


Figure 1 Albania - pilot municipalities Shkoder, Vau i Dejes and Lezhe

Figure 2 Montenegro- pilot municipalities Ulcinj, Bar and Herceg Novi

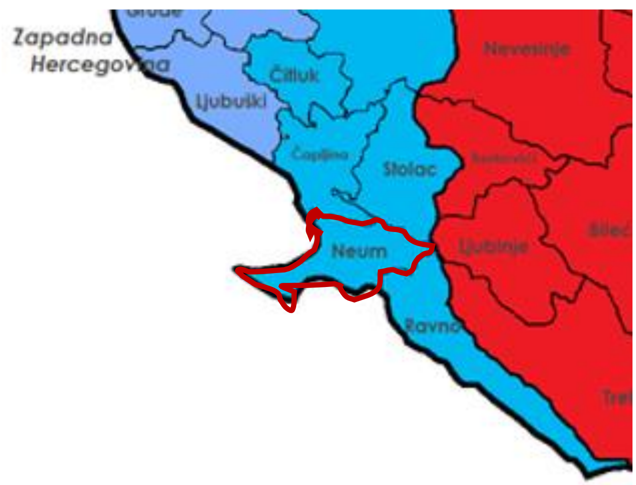


Figure 3 Bosnia and Herzegovina-pilot municipality Neum

Figure 4 Croatia - pilot municipalities Mljet and Slivno

The provisional territorial distribution of the pilot municipalities in the “Adriatic Coast” region is highlighted in the Figure 5 below.

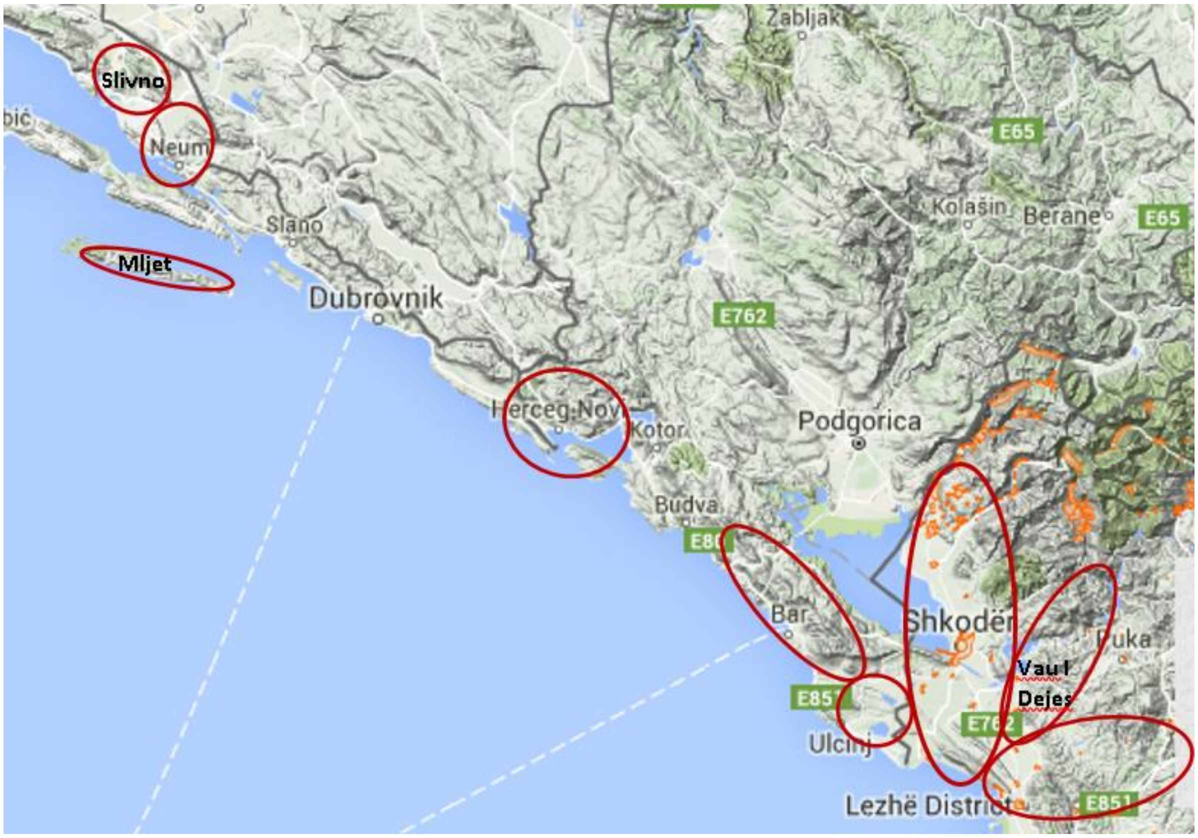


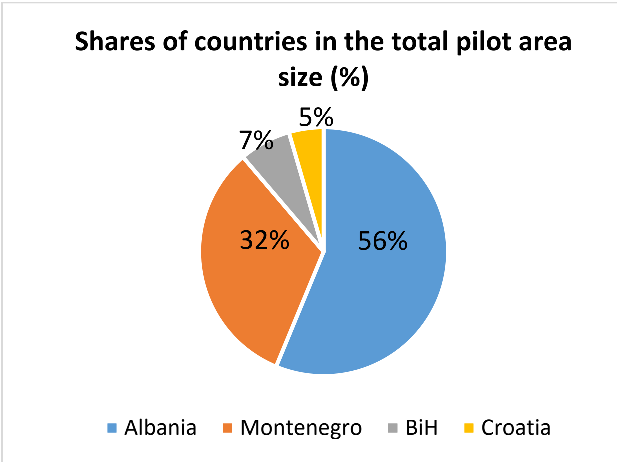
Figure 5 Adriatic Sea Coastal Region

The area and population of pilot municipalities is presented in the Table 2 below.

Table 2 Area and population of the pilot municipalities and of the total pilot region

Pilot Municipality	Area (km^2)	Population
	Albania	
Lezhe	509.10	106,245
Vau I Dejes	499.09	48,966
Shkoder	872.71	200,889
Total	**1,881.71**	**356,100**
	Montenegro	
Ulcinj	255	20,265
Bar	598	42,368
Herceg Novi	235	30,992
Total	**1,088**	**93,625**
	Bosnia and Herzegovina	
Neum	**225**	**4,960**
	Croatia	
Slivno	52.72	1,999
Mljet	98.01	1,088
Total	**150.73**	**3,087**
Total Pilot Region	**3,345.44**	**459,812**

Respective shares of area and population for each pilot country are highlighted in the figure below.



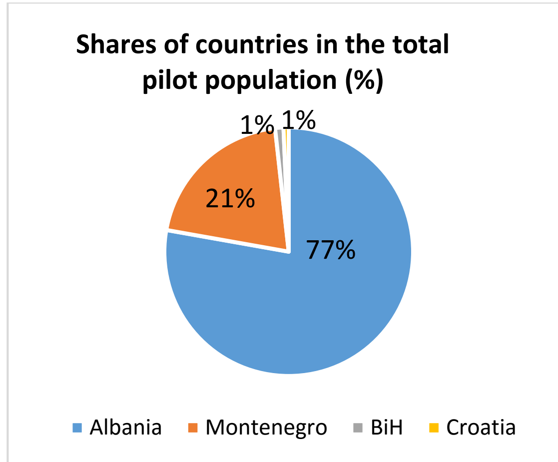


Figure 6 Respective shares of the area size and population of the countries in the pilot region

2. Assumptions of the Integrated Solid Waste Management Model

The marine litter is a serious pollution problem in the Adriatic Sea region, particularly in Albania, Montenegro, Bosnia and Herzegovina and Croatia. Major transboundary environmental and economic impacts caused by marine litter in the Adriatic Coast Pilot Region are identified during the development of the Environmental and Economic Impact Assessment Report as follows:

- Threats to the health and productivity of aquatic ecosystems as many species mistakenly ingest debris or can be entangled by it;
- Adverse environmental impacts on the key terrestrial ecosystems and protected areas deriving from stranded marine litter[6]: "Specially Protected area" - Drin River Delta; Important Bird Area (IPA) - Lumi Buna-Velipojë; the special habitat for mammals in Europe - Buna Delta; Ramsar Site - Lake Shkoder;
- Economic impacts on coastal communities (increased expenditure on beach cleaning), tourism (loss of income, bad publicity), fishing (reduced and lost catch, damaged nets and other fishing gear, fouled propellers, contamination) and shipping (costs associated with fouled propellers, damaged engines and litter removal).

Considering the richness of biodiversity and the presence of globally threatened species (especially birds and mammals), on one hand, and the significant threat of the litter on the bird and mammals` populations, on the other, waste dumping related prevention measures are a matter of urgency.

Albeit the environmental impacts could not be quantified due to lack of information, some effort has been made to assess the economic impacts related to beach and illegal dumps` cleaning and lost revenues from non-returning tourists who had negative perceptions on the cleanliness of the pilot area. According to the estimations based on non-returning[7] 2.5% tourists[8] at least 34,450,365

[6] ***Marine litter*** (floating or submerged litter and settleable matter) is litter or any material that is lost, discarded, dumped, or discharged into the marine environment, or that blows into the sea, or is carried down rivers in the form of ***floating debris*** and ends up in the sea (Eaton 1984). In this report the term of floating debris is introduced in order to set a boundary between the riverine inputs to the marine litter (at the sea).

[7] 2.5% of all calls to the Tourist Bureau in Montenegro in 2014 were complains for unclean beaches and litter in general; we assume they will not return as a result of their bad perceptions.

[8] It represents 2.5% of the total number of tourist overnight stays in the pilot region for 2014.

EUR have been lost in 2015. Further, each year 1,556,550 EUR are spent on cleaning up illegal dumps and 2,018,280 EUR for cleaning beaches.

Pilot municipalities contribute to the environmental impacts proportionally to the quantities of released floating debris. Some municipalities are responsible for the generation of floating waste and / or pollution, by inadequate waste management practices and particularly illegal dumping in flood / tide - prone areas. These are considered to be impacting municipalities. The others who are receiving the (unwanted) floating waste and / or pollution and need to bear (non-recoverable) costs for their clean-up and disposal, are impacted municipalities.

Considering the origins and pathways of the waste or pollution moving across the borders, including the currents of the Adriatic Sea, the impacting and impacted municipalities were identified in the Environmental and Economic Impact Assessment Report as follows:

Table 3 Impacting and impacted municipalities

Pilot Municipality	Impacted by	Impacting
Albania		
Lezhe	Upstream communities along the Drin River before the Vau I Dejes HPP	High impact for Mljet and Slivno
Vau I Dejes	Upstream communities along the Drin River before the Vau I Dejes HPP	Moderate[9] impact for Mljet and Slivno
Shkoder	Ulcinj because the Buna / Bojana River is creating the border	High impact for Mljet, Slivno and Ulcinj (Buna / Neretva Delta)
Montenegro		
Ulcinj	Shkoder, because the Buna / Bojana River is creating the border	Moderate impact for Shkoder, high impact for Mljet and Slivno
Bar	Not impacted[10]	Not impacting
Herceg Novi	Low impact from municipalities located in the south - Shkoder, Vau I Dejes, Lezhe and Ulcinj (by sea currents)	Low impact for Mljet and Slivno
Bosnia and Herzegovina		
Neum	Not impacted	Not impacting
Croatia		
Slivno	BiH municipalities located outside the pilot region (by Neretva); Shkoder, Vau I Dejes, Lezhe and Ulcinj (by sea currents)	Not impacting
Mljet	Shkoder, Vau I Dejes, Lezhe and Ulcinj	Not impacting

Considering the above, the Integrated Solid Waste Management (ISWM) Model is developed with the aim to minimise the environmental and economic impacts by synchronised efforts at national and transboundary level.

The main areas where improvements are needed to prevent/ reduce marine litter generation are:

[9] The municipality Vau I Dejes generates marine debris by the inflow of Drin River, after the HPP Vaui I Dejes, which is considered a moderate impact.

[10] The stakeholders stated that they are impacted by their own debris which comes back during high winds (Bura). It has been confirmed by analyzing the sea currents which pass by the area of Bar municipality (Figure 19 of the Environmental and Economic Impact Assessment Report).

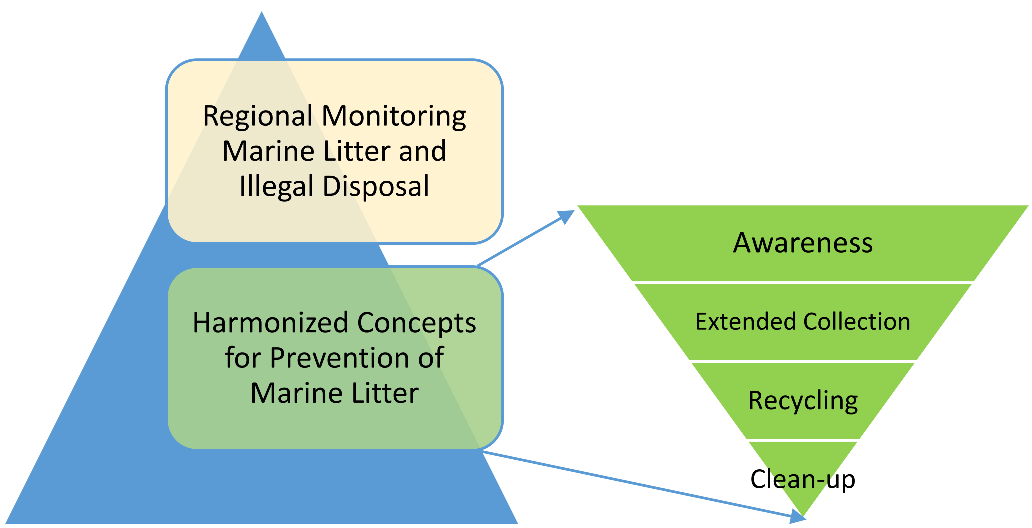
- Scarce information on the amounts, composition and spatial distribution[11] of floating, settled (at the sea floor) and stranded marine litter at the coastal areas (mainly bays and beaches).
- Incomprehensive municipal and hence national statistics on waste generation, composition and management (the latter including, as a minimum, collection rate from service users, recycling / recovery rate, the amounts of disposed waste, the inventory of sources of marine litter – non-compliant municipal landfills, illegal dumps etc.).
- Insufficient waste management practices in the majority of pilot municipalities, constituting the root cause for the generation of marine litter: lack of organisational and financial capacity of operators to cover remote rural areas with an organised waste collection service; littering habits of population (and tourists) due to the low awareness on deriving adverse environmental and economic impacts; lack of responsiveness to newly introduced waste segregation practice in some municipalities; insufficient enforcement.

3. The Scope of ISWM

The approach of the ISWM Model has been discussed and agreed throughout a process involving various stakeholders of the pilot region (municipalities, waste management operators, NGOs, private recycling companies etc.). The process comprised of two subsequent Dialogue Platforms (DP): during the 1st DP the challenges for regional cooperation were discussed and at the 2nd DP the scope of the ISWM Model was analysed and established.

The ISWM Model proposes concepts and tools to improve the situation in three main areas:

1. Regional monitoring system of marine litter and illegal disposal
2. Mechanism for improved and shared waste management information / statistics
3. Harmonised concepts for prevention of marine litter



The necessary improvements that are to be carried out via regional cooperation or on a national level are laid out below separated by subject area.

[11] Spatial distribution of marine litter is linked to sea currents, tides and river information indications about the physical source, i.e. the litter input zone and its pathway.

3.1 Regional Monitoring of Marine Litter and Illegal Disposal

Beach litter can be classified in two source groups, which can further be divided to allow a more valuable attribution. Firstly, ***marine-based sources*** of litter include all types of sea-going vessel as well as offshore installations (Earll et al. 1999). Secondly, ***land-based sources*** incorporate litter left by beach users, litter entering the sea via rivers or municipal drainage systems, and litter directly deposited at or near the beach (Golik & Gertner 1992; Nash 1992).

The analyses of existing methodologies will cover land-based sources: ***beaches and illegal dumpsites***.

3.1.1 Best Practice on Marine Litter and Illegal Disposal Monitoring Methodologies

Systematic efforts to collect data on the amounts, distribution and composition of marine litter along the coastline of the Adriatic Sea are limited. The main source of information are clean-up campaigns carried out by environmental NGOs in collaboration with local authorities. In addition, in 2007, a 2-year marine litter survey was carried out at the island of Mljet (Croatia) in order to assess the amounts and types of litter in sixteen coves and bays. Other monitoring activities have been carried out outside the pilot region (i.e. in Greece, Italy and Slovenia).

Previous marine litter monitoring activities in the Adriatic Sea applied the OSPAR[12] methodology or the International Coastal Clean-up (ICC) data card[13] has been used. These methodologies establish standardized, statistically valid approaches for assessing the debris material type and quantity present in a monitored location. The locations encompass three categories: coast (beach), seafloor and floating litter.

A recent Marine Litter Monitoring methodology has been developed under the DeFishGear Project[14], constituting three Guidelines:

- Methodology for Monitoring Marine Litter on Beaches[15]
- Methodology for Monitoring Marine Litter on the Sea Surface[16]
- Methodology for Monitoring Marine Litter on the Seafloor[17]

Other relevant methodologies for monitoring marine litter include, but are not limited to:

- UNEP/MAP MEDPOL Monitoring Guidance Document on Ecological Objective 10: Marine Litter (2014)[18]
- The NOAA Marine Debris Program (MDP)[19]

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[12] OSPAR guideline for monitoring marine litter on the beaches in the OSPAR maritime area, http://www.ospar.org/ospar-data/10-02e_beachlitter%20guideline_english%20only.pdf
[13] http://act.oceanconservancy.org/site/DocServer/ICC_Eng_DataCardFINAL.pdf?docID=4221
[14] http://www.defishgear.net/project/background
[15] http://mio-ecsde.org/wp-content/uploads/2014/12/Beach-litter_monitoring-methodology_complete.pdf
[16] http://mio-ecsde.org/wp-content/uploads/2014/12/Floating-litter_monitoring-methodology_complete.pdf
[17] http://mio-ecsde.org/wp-content/uploads/2014/12/Seafloor-litter_monitoring-methodology_complete.pdf
[18] http://rac-spa.org/nfp12/documents/working/wg.408_06_eng.pdf
[19] http://marinedebris.noaa.gov/sites/default/files/Lippiatt%20et%20al%202013.pdf

- National Marine Debris Monitoring Program (UNEP and Ocean Conservancy, September 2007)[20]
- UNEP/IOC Guidelines on Survey and Monitoring of Marine Litter[21]
- Guidance on Monitoring of Marine Litter in European Seas (JRC, 2013)[22]

All above methodologies focus on abundance, types, and concentration rather than analysing by potential source, as in many cases it is very difficult to connect a debris item to a specific debris-generating country or activity. Many published studies have attempted to attribute beach litter to a broad source, but this has often been based on local knowledge, assumptions and seemingly an absence of a rigorous methodology. For example, Willoughby (1986), found that rubbish slicks on islands surrounding the city of Jakarta, Indonesia, contained large quantities of freshwater hyacinth, a plant which does not grow on the islands, thus linking the source of the litter to rivers of the mainland. Such local knowledge and anecdotal evidence can be extremely useful. However, there are very few published studies that have set out to determine the precise source of beach litter using a specific methodology; a repeatable and transferable method is desirable to allow comparison and use as a management tool. At present there is no accepted methodology that enables researchers to link litter items to their source.

Nevertheless, a number of techniques have been developed to assist in the identification of sources on the basis of litter items recorded in the marine environment e.g. the Matrix Scoring Technique to Determine Litter Sources at a Bristol Channel Beach (Tudor & Williams 2004)[23]. The aim of this study was to create a method of assigning a source to litter found on beaches of the Bristol Channel but which could equally be used on any beach. The method adapts the elements from the Percentage Allocation (Method 5 - Earll et al. 1999) and Cross Tabulation Probability Scoring (Method 6 – Whiting 1998Adaptations and different scoring schemes were tried to produce a refined 'Matrix Scoring Technique'. The process comprises of several steps:

- generation of lists of marine litter found at the beach;
- elimination using various degrees of likelihoods of a litter item to descend from a number of sources (Table 4), and
- percentage allocation of each litter item to specific source

Table 4 Litter items and the likelihood of source. Key to probability phraseology: Very unlikely (UU); Unlikely (U); Possible (P); Likely (L); Very likely (LL)

Litter Category	Sources of Marine Litter						
	Tourism (Beach users)	SRD[24]	Fly tipping-land	Land (run off)	Shipping	Offshore installations	Commercial fishing
Sweet wrapper	LL	UU	UU	U	UU	UU	UU
Food container	L	UU	UU	U	U	UU	UU
Plastic drinks bottle < 500 ml	LL	UU	UU	U	U	UU	UU

[20] http://www.unep.org/regionalseas/marinelitter/publications/docs/NMDMP_REPORT_Ocean_Conservancy__2_.pdf

[21] http://www.unep.org/regionalseas/marinelitter/publications/docs/Marine_Litter_Survey_and_Monitoring_Guidelines.pdf

[22] https://ec.europa.eu/jrc/sites/default/files/lb-na-26113-en-n.pdf

[23] http://databases.eucc-d.de/files/documents/00000611_C10.119-127.pdf

[24] SRD – sewerage related debris

Litter Category	Sources of Marine Litter						
	Tourism (Beach users)	**SRD[24]**	**Fly tipping-land**	**Land (run off)**	**Shipping**	**Offshore installations**	**Commercial fishing**
Take away food container	LL	UU	UU	U	UU	UU	UU
Lollipop stick	LL	UU	UU	U	UU	UU	UU
Straw	LL	UU	UU	U	UU	UU	UU
Fishing line	UU	UU	UU	UU	UU	UU	LL
Unidentifiable plastic fragment	P	UU	UU	U	P	UU	P
Polystyrene piece	P	UU	UU	U	P	UU	P
Cigarette stubs	LL	UU	UU	U	UU	UU	UU
Cigarette box	LL	UU	UU	UU	UU	UU	UU
Children's toy	LL	UU	UU	UU	UU	UU	UU

This Matrix scoring system gives a new alternative and offers a transparent and usable method of establishing beach litter sources.

Considering the fact that the Environmental and Economic Impact Assessment Report identified illegal dumps as sources of marine litter, it is proposed to include in the regional monitoring the inventories of these sites as well.

There are various methodologies to monitor illegal disposal but no standardised and broadly recognised method exists. These span from using remote sensing tools to physical surveys which can be regular or incidental; combinations of these methods can also been found.

3.1.1.1. Marine Litter Monitoring

The ***Marine Litter Monitoring*** Marine Strategy Framework Directive (MSFD – 2008/56/EC) requires the EU Member States to establish monitoring programmes by 15 July 2014. The monitoring programmes have to be "coordinated", "compatible", "coherent", "consistent" and "comparable".

The pilot countries are either EU Members (Croatia) or accession countries (Albania, BiH and Montenegro) and therefore the marine litter methodology should comply with the MSFD. Other applicable conventions to adhere to include: OSPAR Convention, Barcelona Convention, Helsinki Convention (HELCOM) and Bucharest Convention. A full Marine Litter Monitoring Programme should cover the following categories and stakeholders:

- Monitoring of litter on (deep) seafloor using bottom trawling method. Fisheries industry should carry out the activities.
- Monitoring of litter on shallow seafloor: divers` associations should be involved.
- Monitoring of litter on the water surface. Visual observation from boats are needed.
- Beach Monitoring: trained volunteers can implement this type of monitoring instead of professional surveyors.
- Monitoring of litter in biota. Involvement of scientific institutions and specialists on fauna, birds are required.

The pilot municipalities can independently undertake monitoring of ***beach litter*** only. Monitoring floating, seafloor litter and litter in biota would require involvement of specialised institutions and experts which will absorb significant resources. Therefore, the best practice methods for monitoring of beach litter are detailed in this ISWM Model.

A (best practice) regional monitoring of ***beach litter*** in the Adriatic Coast Pilot Region should therefore set a harmonised approach in the following compartments:

- Spatial distribution of monitoring: site selection strategy;
- Survey method: setting sampling units, monitoring frequency and surveyed litter categories;
- Identification and making available necessary resources;
- Data handling & reporting;

The site selection strategy has fundamental consequences for the monitoring analysis, as has the selection of the survey method. Monitoring programmes are not compatible or comparable if they use the same survey methods, but different site selection strategies (e.g. special site selection on the basis of litter pollution levels, or a randomised selection of sites). It is proposed to use a combination which is sometimes referred to as, “stratified randomised sampling strategy” (e.g. OSPAR beach litter protocol).

The proposed criteria[25] should take into account the distance, i.e. proximity to:

- river mouths;
- coastal urban areas;
- tourists` destinations;
- remote areas.

Additional criteria for the select the monitoring sites / beaches are:

- Have a minimum length of 100m[26];
- Be characterized by a low to moderate slope (~1.5-4.5 º), which precludes very shallow tidal mudflat areas that might be kilometres long;
- Have clear access to sea (not blocked by breakwaters or jetties) such that marine litter is not screened by anthropogenic structures;
- Be accessible to survey teams throughout the year;
- It should be known when the most recent cleaning activities have taken place27 in order to determine the trends of marine litter over time;
- Posing no threat to endangered or protected species, such as sea turtles, sea birds or shore birds, marine mammals or sensitive beach vegetation.

A best practice Marine Litter monitoring method comprises of:

- setting sampling units,
- frequency,
- methods for identification of litter and
- surveyed categories.

[25] These criteria have been taken over from the DeGishGear Methodology for Beach Litter Monitoring
[26] The National Marine Debris Monitoring Program (UNEP and Ocean Conservancy, September 2007) sets a minimum length of 500 meters.
[27] According to the National Marine Debris Monitoring Program (UNEP and Ocean Conservancy, September 2007), the monitoring should be undertaken every 28 days throughout a year; The monitoring will therefore start 28 days after the first clean up activity to avoid any skewing of the results by historical pollution not attributable to marine litter.

A sampling unit is defined as a fixed section of a beach covering the whole area from the strandline to the back of the beach. A 100-metres stretch from the strandline to 10 meters back will be considered a sampling unit. Two sampling units on the same beach should be monitored. The same sites should be monitored for all surveys. In order to identify the start and end points of each sampling unit permanent reference points can be used and coordinates obtained by GPS. The monitoring frequency, as proposed in analysed methodologies, spans from every 28 days to 4 times a year.

The DeFishGear project proposes to undertake monitoring upon the following seasons:

1. Autumn: mid-September-mid October
2. Winter: mid-December-mid January
3. Spring: April
4. Summer: mid-June-mid July

Before any sampling begins, shoreline characterization should be completed for each 100m site. The GPS coordinates of all four corners of the sampling unit should be recorded. A site ID name should be created and used for the duration of the study (see relevant instructions). The site's special features, including characterization of the type of substrate (sand, pebbles, etc.), beach topography, beach usage, distances from urban settlements, shipping lanes, river mouths, etc. should be recorded using a special "Beach Identity Sheet'. Digital photographs should be taken to document the physical characteristics of the monitoring site.

All items found on the sampling unit should be entered on the 'Beach Litter Monitoring Sheet'. On the sheet, each type of item is given a unique identification number. Data should be entered on the sheet while picking up the litter item. The number of litter categories and sub-categories varies among different methodologies. There are, however, globally recognised 9 categories (Table 5) and 77 sub-categories (Annex 1) of beach litter.

Table 5 Marine Litter Categories

Class	Material Composition	Litter Code	Litter Form (And Examples)
1	Plastic	PL01	Bottle caps & lids
2	Foamed Plastic	FP01	Foam sponge
3	Cloth	CL01	Clothing, shoes, hats & towels
4	Glass & ceramic	GC01	Construction material (brick, cement, pipes)
5	Metal	ME01	Tableware (plates, cups & cutlery)
6	Paper & cardboard	PC01	Paper (including newspapers & magazines)
7	Rubber	RB01	Balloons, balls & toys
8	Wood	WD01	Corks
9	Other	OT01	Paraffin or wax

The identification and correct categorization of litter items should be facilitated by a Photo Guide[28].

[28] http://www.ospar.org/ospar-data/10-02e_beachlitter%20guideline_english%20only.pdf

Unrecognisable pieces of plastic smaller than 2,5 cm: number 117 on the survey form

Piece of plastic bag recognisable as a shopping bag: number 2 on the survey form

Piece of plastic bag recognisable as a small plastic bag: number 3 on the survey form

Figure 7 Photo Guide Developed under the OSPAR Methodology

Unknown litter or items that are not on the survey sheet should be noted in the appropriate “other item box”. A short description of the item should then be included on the survey sheet. If possible, digital photos should be taken of unknown items so that they can be identified later and, if necessary, be added to the survey sheet.

The unit in which litter will be assessed on the coastline will be number of items and it will be expressed as counts of litter items per square meter (m^2). In addition, the main category types of litter items should be weighed. The results shall be statistically processed and reported in an agreed format.

By applying best practice monitoring programmes the abundance, types, and concentration, and possibly links between the potential source and specific debris-generating countries or activities can be analysed in the Adriatic Coast pilot region. However, such comprehensive monitoring programmes can be costly and resource demanding in terms of qualified and skilled labour. Therefore, this ISWM Model proposes a simplified approach which is described in detail in section 3.1.2.1 below.

3.1.1.2. Illegal Disposal Monitoring

Best practice in monitoring of ***illegal disposal sites*** comprises two distinct methodologies: visual observation using remote sensing and field surveys. It does not preclude a combination of these methods from being useful for monitoring and mapping illegal domestic waste disposal sites.

Remote sensing comprises of the following steps:

1. Selecting high, moderate or medium spatial resolution remote sensors to be applied for mapping illegal municipal waste disposal sites;
2. Conduct visual identification of illegal municipal waste disposal sites observing visible indirect temporal land changes associated with illegal waste disposal such as thermal anomalies and/or vegetation: land degraded by the presence of illegal waste is usually noticeable for its spectral signature stability over time in comparison to other features such as urban areas, sea, salt evaporation pools, cultivation systems, etc.

Limited studies[29] have been conducted into techniques to analyse remote sensing data[30] towards monitoring and mapping illegal waste disposal sites. However, existing studies do provide some insight into the future opportunities likely afforded by different remote sensors and methods.

Silvestri and Omri[31] developed a method to map illegal dumps based on the spectral signature of stressed vegetation associated with the presence of (illegal) waste. Using this method a spectral library with accompanying statistics that define the spectral characteristics of seven illegal waste disposal sites[32] was created. The resultant map was then validated; approximately 12% of the identified sites were actually illegal dumps. Maximum likelihood classification was achieved by analysing both digital orthophotos and very high-resolution IKONOS imagery to map illegal waste dumpsites.

The visual data observation using remote sensing requires utilisation of highly specialised staff. Data transformation alongside ISODATA[33] unsupervised classification can be useful for monitoring and mapping illegal domestic waste disposal and it does not require specially trained staff.

Various methodologies[34] for designing ***field surveys to locate, qualify and quantify illegal dumps*** exist. The method would vary depending on the survey objective: creating inventories of illegal dumps[35] and preparing for clean-up, or planning their closure and remediation. If closure and remediation is foreseen, the qualification and quantification of an illegal dump is followed by a Risk Assessment. A profound Risk Assessment may require additional investigations, including biological, geological / hydrogeological monitoring and groundwater sampling.

The staged approach for the implementation of field investigations is summarised as follows:

1. Undertaking a stakeholder survey to focus the field investigations into the areas which are the most prone to emerging of illegal dumping;
2. Compare the results of the stakeholder survey and previous inventories of illegal dumpsites;
3. Establish a grid on a map with sufficient scale, covering the country territory into zones / polygons; classify these zones by the likelihood of emerging of illegal dumpsites – high, moderate and low, based on the stakeholders` input and previous inventories. The zones may have an area of 1km^2 or more. For countries with high density of illegal dumpsites the grid will be more condensed.

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[29] Yonezawa, C. Possibility of monitoring of waste disposal site using satellite imagery. J. Integr. Field Sci. 2009

[30] Remote sensing data are acquired through satellites such as LANDSAT, ALOS AVNIR-2, ALOS PALSAR, and FORMOSAT-2 (moderate resolution) and ALOS PRISM, IKONOS (high resolution).

[31] Silvestri, S.; Omri, M. A method for the remote sensing identification of uncontrolled landfills: Formulation and validation. Int. J. Remote Sens. 2007

[32] Biotto, G.; Silvestri, S.; Gobbo, L.; Furlan, E.; Valenti, S.; Rosselli, R. GIS, multi-criteria and multi-factor spatial analysis for the probability assessment of the existence of illegal landfills. Int. J. Geogr. Inf. Sci. 2009

[33] ISODATA is a method of unsupervised classification using Algorithm splits and merged clusters; computer runs algorithm through many iterations until threshold is reached: http://web.pdx.edu/~jduh/courses/Archive/geog481w07/Students/Vassilaros_ISODATA.pdf

[34] chrome-extension://klbibkeccnjlkjkiokjodocebajanakg/suspended.html#uri=http://www.litter.vic.gov.au/litter-prevention-tooklits/local-litter-measurement-toolkit; https://webcache.googleusercontent.com/search?q=cache:0mzUsW9hslgJ:https://www.ru.ac.za/media/rhodesuniversity/content/environmentalscience/Group%25202.docx+&cd=1&hl=mk&ct=clnk

[35] Inventories of illegal dumps may be useful for assessing the climate change impact of landfill gas emissions.

4. Develop visual observation sheets for recording the locations, size, composition of dumped waste, distance from pathways (rivers, gullies, sea coast, reservoirs etc.).
5. Plan and execute the field investigations: the resources needed encompass manpower (volunteers, staff of the waste management operators, civil society organisations etc.), GPS devices, Clipboard for each surveyor; Recording sheets; pencils.
6. Create clean-up and prevention programmes

To design successfully an illegal dumps inventory, a survey of public should be undertaken. An example of a survey questionnaire is provided in Annex 2. The survey should answer which areas are most likely prone to emerging of illegal dumping, i.e. gullies, riverbanks, roads etc. Stakeholders should also help in the identification of the potential locations and size of dumpsites, as well as composition of dumped waste and distance from a pathway potentially leading to the sea. The information collected from stakeholders should be crosschecked with available information on illegal dumps inventories collected in the past.

Additional preparations are required for closing and remediating the illegal dumpsites as follows:

- The identified illegal dumpsites should be classified (based on the observations and records) as per the following attributes:
    - Sites below and above 500m^2 of area;
    - Sites where there is high probability for dumping of hazardous waste;
    - Sites located within and outside a corridor of 20 meters along a pathway;

- Risk Assessment should be undertaken (including biological, geological / hydrogeological investigations and water sampling of the nearby river) for illegal dumps which have an area above 500m^2, there is some hazardous waste dumped and which are located at a distance of 20m from a pathway.

Then, preparation of field observation and identification can start: the country area should be divided into sufficient number of zones (polygons) by the identification of horizontal and vertical “divide“ lines on a map. The zones are purely to make the data collection process more efficient and to allow for no part of the country to be left out. Each zone should be classified by the likelihood for emerging of illegal dumps. Once the zones are set, the planning of resources and the data collection method will take place.

Inventories of illegal disposal should be used for designing of suitable ***clean-up*** and especially for ***prevention programmes*** to eliminate or reduce illegal dumping practices. The key to successfully using this practice is increasing public awareness of the problem and its implications. Illegal dumping clean-up and prevention programs use a combination of:

1. Clean up efforts
2. Community outreach and involvement
3. Targeted enforcement
4. Tracking and Evaluation

In the Illegal Dumping Preventing Guidebook[36] of the US Environment Protection Agency (EPA) a tool is developed for preventing illegal dumping focusing on the four programmatic areas outlined above (Box 1.).

Box 1. Four Programmatic Areas for Preventing Illegal Dumping (US EPA, 1998)

Cleanup Efforts
Cleanup projects will require a coordinated planning effort to ensure that adequate resources and funding are available. Once a site has been cleaned, signs, lighting or barriers may be required to discourage future dumping. Signs should indicate the fines and penalties for illegal dumping, and a phone number for reporting incidents. Landscaping and beautification efforts may also discourage future dumping, as well as provide open space and increase property values.

Community Outreach and Involvement
This may be the most important tool in ensuring that this practice is effective. The organization of special cleanup events where communities are provided with the resources to properly dispose of illegally dumped materials increases the understanding among residents of illegal dumping impacts and supplies opportunities to correctly dispose of materials which may otherwise be illegally dumped. Integration of illegal dumping prevention into community policing programs or use of programs such as Crime Stoppers may also be an effective way to increase enforcement opportunities without the additional cost of hiring new staff. Producing simple messages relating the cost of illegal dumping on local taxes and proper disposal sites will aid in eliminating the problem. Having a hotline where citizens can report illegal activities and educating the public on the connection between the illegal dumping and marine litter will decrease illegal waste dumping.

Targeted Enforcement
This tool involves the use of ordinances to regulate waste management and eliminate illegal dumping through methods such as fines, cost recovery penalties for cleanup, and permit requirements for waste management activities, to name a few. These fines and penalties can be used to help fund the prevention program or to provide rewards to citizens who report illegal dumping activities. Other recommendations for this tool include training of staff from all municipal departments in recognizing and reporting illegal dumping incidents, and dedicating staff who have the authority to conduct surveillance and inspections, and write citations for those caught illegally dumping.

Tracking and Evaluation
This tool measures the impact of prevention efforts and determines if goals are being met. Using mapping techniques and computer databases allows officials to identify areas where dumping most often occurs, record patterns in dumping occurrence (time of day, day of week, etc), and calculate the number of citations issued and the responsible parties. This allows for

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36 http://nepis.epa.gov/Exe/ZyNET.exe/2000CNVU.txt?ZyActionD=ZyDocument&Client=EPA&Index=1995%20Thru%201999&Docs=&Query=&Time=&EndTime=&SearchMethod=1&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&UseQField=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A%5CZYFILES%5CINDEX%20DATA%5C95THRU99%5CTXT%5C00000009%5C2000CNVU.txt&User=ANONYMOUS&Password=anonymous&SortMethod=h%7C-&MaximumDocuments=1&FuzzyDegree=0&ImageQuality=r75g8/r75g8/x150y150g16/i425&Display=p%7Cf&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1

better allocation of resources and more specific targeting of outreach and education efforts for offenders.

The above tool highlight most important issues which need to be examined when creating a clean-up and prevention program. These include:

- The locations of persistent illegal dumping activity.
- The types of waste that are dumped and the profile of dumpers.
- Possible driving forces behind illegal dumping such as excessive user fees, restrictive curbside trash pickup, or ineffective recycling programs.
- Previous education and cleanup efforts that have been used.
- Current prevention programs and local laws or ordinances that address the problem.
- Existing sources of funding and additional resources that may be required.

Hence, the best practice methods for monitoring of illegal dumping require careful planning involving desk research and targeted surveys; the execution itself is a matter of good coordination of previously trained staff, while the reporting and record keeping should be designed in such a way that the dumpsites` inventories can be used for various purposes: to design clean – up programmes, closure and remediation of landfills posing higher environmental risk and setting enforcement programmes against illegal dumping. The most important outcome of monitoring activities executed concurrently with clean-up activities is the raising of public awareness.

Having in mind the limited resources of pilot municipalities a simple monitoring programme for illegal disposal is outlined in section 3.1.2.2 below.

3.1.2 Proposed Monitoring Methods for Marine Litter and Illegal Disposal

The proposed approaches will simultaneously allow for coordinating and comparing the results on a regional scale and maintaining comparability to the results achieved by using harmonised monitoring methodologies across the pilot region. Another added value of the implementation of the monitoring of beach litter and illegal disposal will be the raising of public awareness.

Key to the success of any regional monitoring programme will be the community involvement and more specifically adaptive co-management. Adaptive co-management relies on the involvement of multiple level actors and promotes building relationships between these levels in order to having a functional and reliable management system (Cundill and Fabricius, 2008).

In the pilot municipalities, municipal administration, councillors and Public Communal Enterprises (PCEs) will play a crucial role in managing marine litter and illegal disposal monitoring programmes. Community leaders need to be elected and start involving citizens in decision making and action. In this way a community-mentality is gained whereby people act towards bettering their own area for the greater good of the whole community. If communities were more educated on the impacts of marine litter and illegal dumping and identified this as a social deviation, this could potentially begin to change their habits (McKinlay and Starkey, 1998).

3.1.2.1 Marine Litter Monitoring

The Guidance on Monitoring of Marine Litter in European Seas[37] recognises that the full scope is demanding in terms of organisation and resources; therefore, it suggests integration of monitoring with measures such as clean-up campaigns. ***Consequently, the first step to introducing a comprehensive marine litter monitoring in the Adriatic Coast Pilot Region would be to undertake beach litter monitoring.***

Hence, the beaches to select for monitoring should include those which are known by littering habits of tourists (e.g. Velipoja, Ada Bojana), the remote beaches (i.e. those which are not managed by either hotels or concessionaires), the river deltas (Drin, Buna/Bojana, Neretva), the outflow of Buna/Bojana from the Skadar Lake, and the bays in Mljet and Slivno municipalities where the marine litter accumulates. The monitoring sites will, however, be outside strictly protected areas.

Stakeholders proposed a number of sites for beach monitoring at the 2nd Dialogue Platform[38] session (Table 6). Examples of such sites include:

Table 6 Examples of possible sites for performing beach cleaning activities in some pilot municipalities

Municipality	Proposed Locations for Beach Cleaning
Slivno	- Blace - Duboka - Komarna - Moracna - Klek - Dubak
Mljet	- Blace - Sutmiholjska - Brijestova
Neum	- Hotel Neum - Hotel Sunce - Hotel Zenit

The Guidance on Monitoring of Marine Litter in European Seas recommends using the citizen-science based Marine LitterWatch[39] protocol (developed for the needs of the European Environment Agency - EEA) for collecting beach litter data. It is based on a simple beach litter counting mobile application, which enables volunteers to count litter on beaches and submit the data on a central public data base that is hosted by the EEA. The process of marine litter monitoring and the interface of the mobile application is presented in the following figure 8:

[37] https://ec.europa.eu/jrc/sites/default/files/lb-na-26113-en-n.pdf
[38] The 2nd Dialogue Platform Session has been held on 9-10 March in Dubrovnik, Croatia.
[39] http://www.eea.europa.eu/themes/coast_sea/marine-litterwatch

Figure 8 Beach Litter Monitoring-Overall Approach (left) and Interface of the Mobile Application Marine LitterWatch

Guidance[40] on implementing the beach cleaning and monitoring protocol using the Marine LiiterWatch mobile application describes:

- How to join or create a community;
- How can communities help monitoring marine litter;
- How to monitor and report litter found on beaches;
- How to generate data to support marine litter management and raise awareness;

As stated elsewhere, coordination at a regional/national level is required for the regular implementation of the monitoring system for beach litter. The possible regional process of monitoring marine litter process is illustrated in the figure 9.

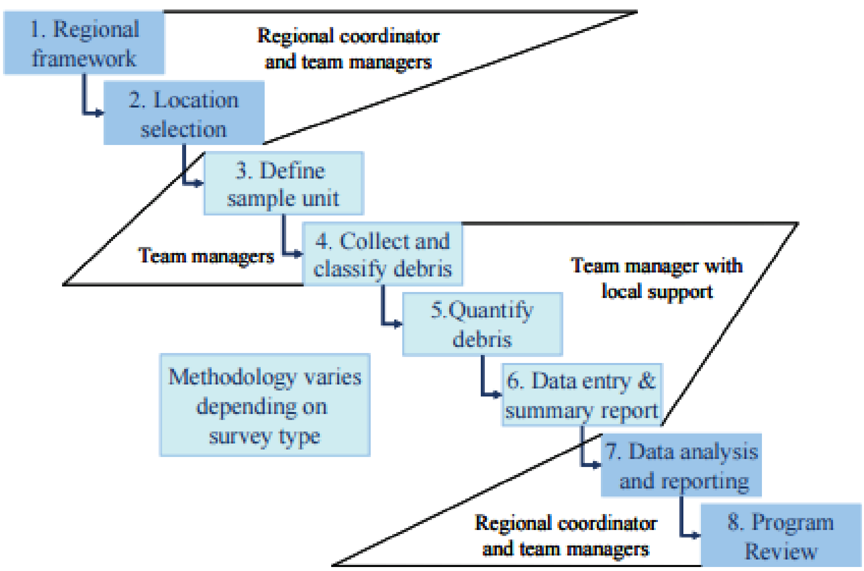

Figure 9 Regional Beach Litter Monitoring Process

Stakeholders proposed the following institutional setup of any future monitoring activities at the 2nd Dialogue Platform[41] session:

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[40] http://www.eea.europa.eu/themes/coast_sea/marine-litterwatch/get-started/how

[41] The 2nd Dialogue Platform Session has been held on 9-10 March in Dubrovnik, Croatia.

- Regional Coordinator: NALAS
- National Coordinators: Local Government Associations (LGAs)
- Local Coordinators: Public Communal Enterprises (PCEs) and volunteers

Tasks of the regional coordinator are:

- identification and setting up of survey sites
- contact with the organizations/institutions carrying out the surveys
- development & maintenance of the survey system
- training of surveyors
- entering the data into the database/QA of data
- maintaining the database
- data analysis
- reporting
- (further) development of methodology
- participation in national and international workshops, working groups, etc.

For the overall coordination of four survey sites ca. 330 hours will be necessary in order to set up the monitoring system and about 250 hours/year will be required to maintain the system[42].

Any long term marine litter assessment programme will require a specific and focussed effort to recruit and train field staff and volunteers. Consistent, high quality training is essential to ensure data quality and needs to explicitly include the development of operational (field based) skills. Staff education programmes should incorporate specific information on the results and outcomes from the work so that staff and volunteers can understand the context of the marine litter assessment programme. In summary there are a number of key issues that need to be considered when engaging volunteers in marine litter assessments and these include (adapted from Sheavly 2007):

- Volunteers need to be properly trained with hands-on training exercises and supportive training materials and programme manuals that detail responsibilities and procedures;
- Local coordination and management is needed to ensure that volunteers are available when needed and monitoring schedules are followed;
- Effective and frequent communication is a key element in keeping volunteers engaged and up-to-date with the programme activities, including how their monitoring activities are supporting resource and conservation management efforts;
- Succession plans are needed to ensure that as some volunteers retire or leave the programme, new volunteers are trained to provide replacements;
- Regular recognition efforts of the volunteers and their efforts can be effective in maintaining their involvement in the monitoring programme (e.g. media coverage, presentations by monitoring group members and/or management groups at local civic meetings, thank you notes, various memorabilia including t-shirts, hats, etc.);
- The monitoring programme needs to be realistic in terms of the expectations of labour and the length of time needed to conduct this type of study;
- Regional coordinator needs to make regular visits to sites to ensure that training is relevant and appropriate to the needs of the survey. Ideally follow-up visits should be scheduled to coincide with re-training efforts and other activities;
- Where appropriate, typically where local people are limited by financial or other resources, monetary support may be required to cover transportation expenses related to their efforts.

[42] https://ec.europa.eu/jrc/sites/default/files/lb-na-26113-en-n.pdf

While the very nature of a volunteer is not to expect anything in return for his/her efforts, people do like to know that their efforts are meaningful and appreciated. In more general terms the following issues are also relevant when managing volunteer programmes (adapted from the "Model Code of Practice for Organisations Involving Volunteer Staff"; Volunteering Australia 2007)[43]:

- Interview and employ volunteer staff in accordance with anti-discrimination and equal opportunity legislation
- Provide volunteer staff with a healthy and safe workplace;
- Provide appropriate and adequate insurance coverage for volunteer staff;
- Define volunteer roles and develop clear job descriptions;
- Differentiate between paid and unpaid roles;
- Provide all staff with information on grievance and disciplinary policies and procedures;
- Reimburse volunteer staff for out of pocket expenses incurred on behalf of the organization;
- Treat volunteer staff as valuable team members, and advise them of the opportunities to participate in agency decisions; and
- Acknowledge the contributions of volunteer staff.

3.1.2.2 Illegal Disposal Monitoring

The pilot municipalities do not have an efficient monitoring system for illegal dumpsites and do not know who needs to be fined for dumping or where all the illegal dumpsites are actually located. Therefore, a simple approach, applicable on regional scale is proposed.

The monitoring of illegal sites and creation of their regional inventory will not require site selection. Ideally all illegal dumps should be monitored. However, as a first step, only those located along the rivers, sea coast and lakes / reservoirs will be monitored.

Similarly, to the Marine Litter Monitoring approach, the first step in reducing the impacts from land based sources will be to create inventories of illegal dumpsites upon the clean-up campaigns. Therefore, the most suitable method to track the locations of dumpsites, volume and provisional composition of fly tipped waste will be the one developed by the initiative "Let`s Do It World"[44] - a civic-led mass movement that began in Estonia in 2008 when 50,000 people united together to clean up the entire country in just five hours.

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[43] http://volunteeringaustralia.org/wp-content/uploads/VA-Model-Code-June-2005.pdf
[44] https://www.letsdoitworld.org/about/overview/

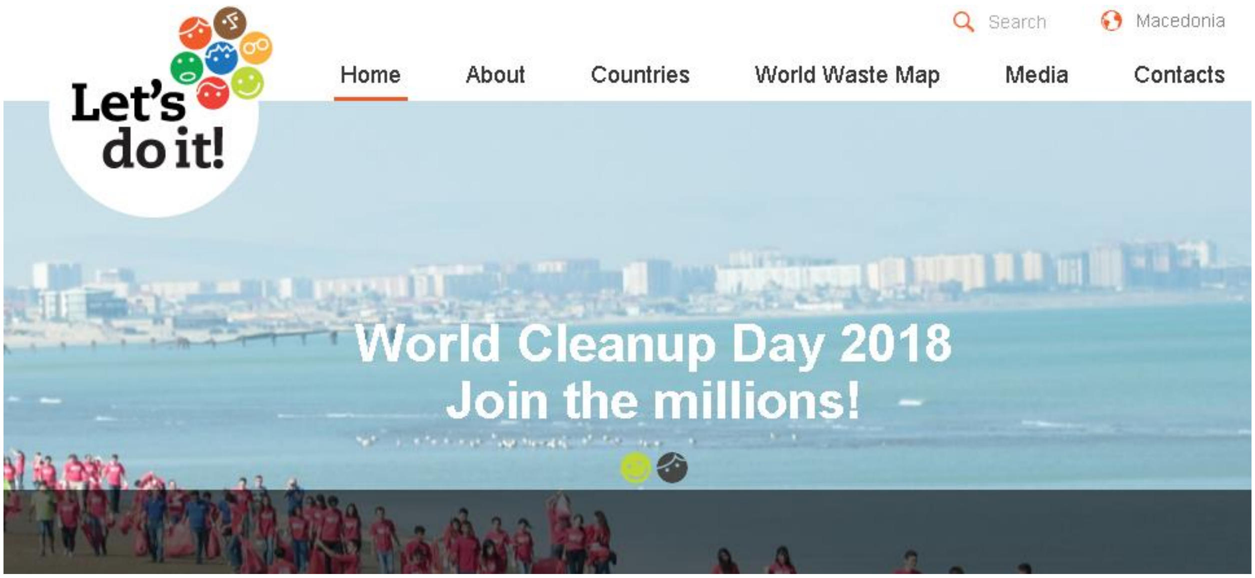

Figure 10 "Let`s Do It World" Platform

To date, 112 countries and 13,8 million people have joined this platform to clean up illegal waste. All the pilot countries joined the initiative; however, the driving forces behind the implementation of clean-up activities are Non-Governmental Organisations and not the municipalities. The significance of organising clean-up campaigns for generating the inventories of illegal dumpsites and planning prevention / enforcement programmes is yet to be recognised by a broad range of stakeholders in the Adriatic Coast pilot region. Illegal dumping is an extremely complex issue and therefore implementing monitoring and clean-up programmes requires all stakeholders, including the government, local municipality, counsellors and community members, to participate if this problem is to be eradicated.

The method applied by the "Let`s Do It World" takes the following steps:

- Recruiting ambitious leaders to run the nationwide cleanups;
- Mobilizing various organizations, experts and volunteers;
- Training the participants in the campaign;
- Conducting the cleanup campaign by using technology (a mobile application "TrashOut"[45], shown on Figure 11), to map the illegal dumpsites:
    - Taking a photo documentation on site;
    - Locating the site using GPS on a global satellite map;
    - Estimating the quantity and composition of dumped waste

[45] https://www.trashout.ngo/

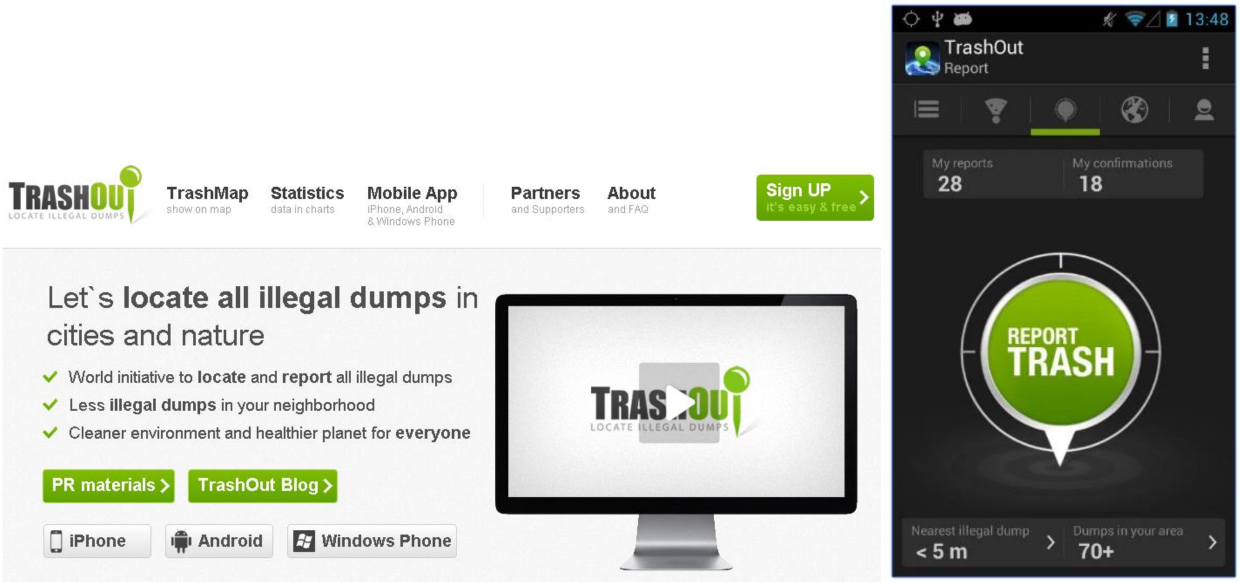

Figure 11 TrashOut Mobile Application

Ideally, the pilot municipalities should organize regionally coordinated cleanup campaigns at least twice a year. The same setup should be implemented as for the beach cleaning events. Preferably, the cleanup actions for both monitoring of beach litter and illegal disposal should be coordinated by regional coordinators and should take place in the same periods.

Information obtained from those cleanup campaigns should be used to design prevention programmes.

4. Improved and Regionally Harmonized Waste Statistics

In the Environmental and Economic Impact Assessment Report for the Adriatic Coast pilot region an attempt was made to quantify the relative contribution to the marine litter generation by each municipality. Comparative analysis looked first at waste generation rates and quantities of waste collected versus waste not collected. Waste not collected was estimated by multiplying the per-capita waste generation figures and the population not covered by a regular waste collection service. It was assumed that the waste not-collected is dumped illegally at various locations, from where, taking the closest pathways (water courses and sea currents), it joins the stream of marine litter. Analyses showed that both the figures of waste generation and the percent of service coverage were based on estimations. Furthermore, these estimations were based on different methods. Therefore, it is of utmost importance for setting and monitoring suitable marine litter prevention programmes, to establish waste statistics` related (benchmark) indicators and design regionally harmonized methodologies for generating these indicators.

Benchmark indicators are required to deliver a well-functioning ISWM system. The key waste statistics` related indicators are set in the Commission Regulation (EU) No 849/2010 of 27 September 2010 amending Regulation (EC) No 2150/2002 of the European Parliament and of the Council on waste statistics[46].

For the comparisons on the regional scale, the following indicators are proposed:

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[46] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:253:0002:0041:EN:PDF

- Waste generation (kilograms per capita and year)
- Waste Composition
- Waste collection rate (tonnage of waste not collected and/or percentage of generated waste)
- Waste recycling rate (tonnage of waste separately collected by or voluntary drop off centers and/or percentage of generated waste)

This ISWM Model proposes regionally harmonized methodologies for collecting and evaluation data on waste generation & composition and waste collection rate (service coverage).

4.1 Methodology for Determining Waste Generation and Composition

Reliable data on waste generation and composition can be obtained only from waste sampling analyses. Waste sampling analyses are indispensable instruments to obtain waste generation rates and compositional data and to enable waste management measures to be planned, monitored and optimized. Currently, the pilot regions have no systematic approach or standardised methodology for the analysis of solid waste.

NALAS has furnished a waste sampling methodology to derive the data on waste generation and composition with the involvement of the Faculty of Technical Sciences, Department of Environmental Engineering and Safety and Health from Novi Sad. It has been discussed by the pilot municipalities and it was agreed that it can serve the purpose with certain modifications to reflect the specificities of regions / municipalities.

It is therefore proposed to set minimum requirements for a regionally accepted methodology which can be upgraded by more advanced municipalities. It is essential, however, to develop a sampling method[47] taking into account the following steps:

1. Pre-Investigation
2. Analysis Design and Planning
3. Execution of Waste Analysis
4. Evaluation of Waste Analysis

4.1.1 Pre-Investigation

The pre-investigation stage is concerned with the provision of necessary background information for the pilot municipality intending to undertake a waste analysis.

The following background information to a waste analysis is suggested:

1. General Description of the Area under Investigation:
   a. Identification of the area or portion of the area to be assessed, its location and surface area;
   b. Identification of the various relevant districts.

2. General Population Information and Waste Management Information: The following data could be important to collect:

[47] The elements of the waste sampling methodology have been extracted from the SWA-Tool, Development of a Methodological Tool to Enhance the Precision & Comparability of Solid Waste Analysis Data, 5th Framework Program, EU, https://www.wien.gv.at/meu/fdb/pdf/swa-tool-759-ma48.pdf

a. General Population Information
b. Number of inhabitants
c. Number of households
d. Types and proportions of residential structures;

3. General description of the organisation of the waste management system (actors, responsibilities etc.):
4. Type of waste streams produced and collected
5. Description of waste container systems in use such as household bins, communal bins and bin storage capacities
6. Average numbers of households and/or persons using bins
7. Total bin volume; spatial distribution of bins; collection intervals
8. Method of waste collection such as open truck or refuse collection vehicles compactor and types of waste collected
9. Description of collection rounds
10. Disposal methods such as landfill.

Waste management stratification is important to derive statistically accurate information. Generally, a stratification is not compulsory for a waste analysis program, but may have advantages for both accuracies of results and additional waste management information (e.g. tourism). In practical terms it will be useful to set up a stratification matrix at the initial planning stage. This matrix will show if the necessary data and information for a stratification are available. If the municipality would choose to perform stratification, it should consider the following criteria:

1. Seasonality: Generally, a seasonal waste analysis should be done based on a minimum of three and ideally four seasonal sorting campaigns. Since waste analysis results tend to be similar for spring and autumn, one of these two seasons may be left out.
2. Residential Structure: The following types of residential structures and locations have been demonstrated to act as significant stratification criteria:

   a. Rural areas
   b. Suburban areas
   c. Inner city areas
   d. Multiple dwellings
   e. Multi storey buildings
   f. Tourist accommodation (if it can be separated by area)

3. Bin Size: Generally, waste analysis stratification according to the following bin sizes can be recommended:

   a. Bins up to 240 litres volume
   b. Bins above 240 litres volume

4. Collection System: it is important to delineate those areas with and without separate collection of recyclables;
5. Source of Waste: stratification according to the source of waste as either household waste or commercial waste is recommended where possible; tourism waste can be added as well;

6. Collection Day: whenever a significant difference between waste composition/generation is evidenced for different days of the week, it is recommended these days be used as stratification criteria.

4.1.2 Analyses Design and Planning

The design and planning is comprised of the following elements:

1. Type of sampling: This may encompass the whole area of a municipality or a defined part of a municipality although the former will generally be the case in order to obtain waste analysis results, which are representative of the whole area under investigation.
2. Number and type of strata: the decision concerning the number and type of strata to use in a waste analysis depends on several factors including the waste management information needs of the municipality, the availability of adequate waste planning data and sufficient resources.
3. Level of sampling: There are three principal levels at which sampling may take place, namely:

    a. Inside the household/business such as from an internal waste bin
    b. Outside the household/business such as from an external waste bin/container such as used in kerbside collection
    c. A refuse collection vehicle (RCV)

4. Type of sampling unit: There are three main sampling units that could be used to obtain the necessary waste samples for analysis, namely:

    a. A specific waste bin volume such as 240 litres (l) or 1100 l;
    b. A specific weight of household/commercial waste such as 100 kilograms (kg);
    c. A specific number of persons who generate relevant waste such as 30 persons.

5. Calculation of the Number of Sampling Units and Sample Size: depends on 2 main criteria:

    a. The variation (heterogeneity) of the waste, expressed by the natural variation coefficient. This variation coefficient is usually unknown and has to be estimated on the basis of results from past waste analyses.
    b. The desired accuracy of the results.

6. Generation of Random Sample Plan: According to the analysis design it is necessary to randomly sample addresses either from the whole parent population or from the relevant sub-populations according to the designated stratification criteria (stratified random sampling).
7. Duration of an Individual Waste Analysis Campaign: it is recommended that the duration for waste sampling and sample collection covers a minimum of one week’s waste. This will allow the sampling of waste to be spread over each working day (Monday to Friday) covering the full collection cycle and any potential variation due to non-collection of waste at weekends.

4.1.3 Execution of Waste Analyses

Each sample collected should be tagged with a unique identification reference code, capable of use in wet conditions. The following minimum data should be collated and recorded for each individual sample by the waste sample collection team at the time of collection:

a. Unique identification reference code
b. Sample address
c. Date of collection
d. Number and type of waste containers collected
e. Visual estimation of % filling level of waste containers collected
f. Visual estimation of % filling level of other containers at one address to get the information for calculating the waste quantity

Each sampling unit is weighed and the weight is documented. The waste generation per capita is obtained by dividing the average daily weight with the number of population in the sampling unit.

Each sampling unit has to be sorted separately. The sampling unit is sorted into the categories according to a developed Sorting Catalogue. The Sorting Catalogue contains 13 compulsory primary categories and 35 recommended secondary waste categories. Sorting is illustrated in the figure 12 below.

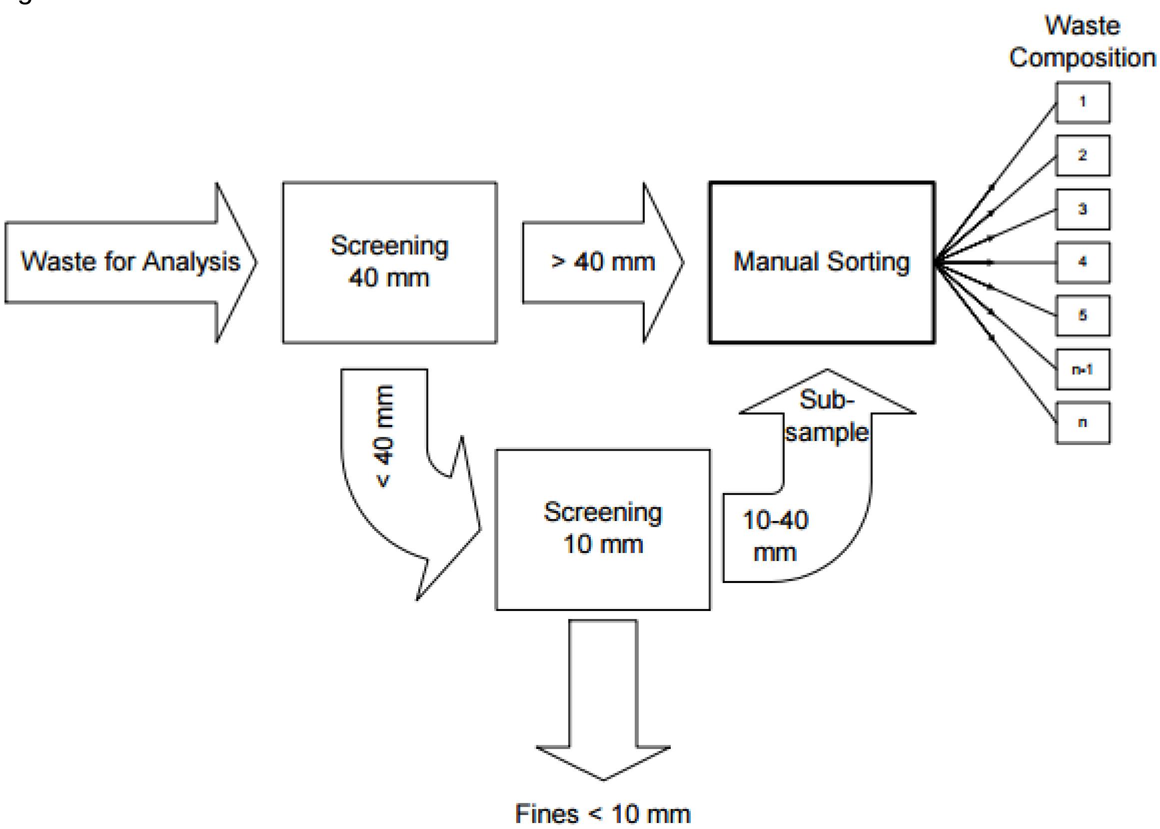


Figure 12 Waste Sorting

4.1.4 Evaluation of Waste Analyses

The basis for the evaluation are the basic weight results (kilograms per capita) and the outcomes of the sorting procedure (waste composition in kilograms) for each sampling unit. The basic weight results shall be transferred from the record sheet (paper copy) to the Excel sheet.

The following statistical values have to be calculated for each waste category, each campaign and for the total result:

- Mean
- Standard deviation
- Variation coefficient
- Relative confidence interval (%)
- Composition (%)

Extrapolation is another important element upon the waste sampling exercises. It comprises the conclusion from the obtained sample results to the total waste quantity. Two cases may be distinguished:

- Case 1: The investigated waste type of an area (e.g. daily household and commercial waste) is permanently weighed. Thus, the total waste amount is known. The total sample result (waste composition) can be apportioned to the total waste quantity, thusly the extrapolation is not needed.
- Case 2: The total amount of the investigated waste type is unknown. This is the case if only household waste is subject of the waste analysis, but is not weighed separately (only the mixture of household and commercial waste is weighed). Hence, an extrapolation of the sample results to the waste of an area is necessary.

The waste quantity can be extrapolated by using the following data as a reference value:

- number of sampling units, or
- number of inhabitants, or
- number of households.

The format for the presentation of results is an important aspect of the waste analysis methodology and will affect the comparability of waste analysis results between different waste analyses. The regionally harmonised methodology should derive standard reporting forms and procedures.

4.2 Methodology for Determination of Waste Collection Service Coverage

Currently, the pilot regions have no systematic approach or standardised methodology for the waste collection service coverage. Such a methodology should stem from comprehensive analyses of the following issues:

1. Statistical information on population, households` number and businesses (commercial and industrial establishments) in every settlement; map of spatial distribution of settlements and businesses and the road network, preferably in GIS format;
2. Overall figures of waste generation per capita for a certain period (day, week, month, year, as appropriate);
3. Calculations of the required containers sizes / numbers and number of lifts / frequency of lifts to cater the waste generated;
4. Up-to-date customer base including:

    a. Customer sector (households, businesses, institutions and industries)

b. Actual container sizes / numbers
c. Actual number of lifts/frequency of lifts
d. Changes: larger businesses being replaced by smaller businesses or vice versa and seasonal variations to customer base e.g. return of immigrants, weekend houses, tourist accommodation

5. Map (in GIS format) indicating the actual placement of containers and their respective sizes in relation to the distribution of customers and waste generation;
6. Calculation of the waste quantities not collected as a percent of the total waste generated;
7. Calculation of the required container sizes / numbers and numbers of lifts to cater the waste not collected at present.
8. Update the customer base with service users not covered with a regular waste collection service;
9. Map (in GIS format) indicating where the adequate containers should be placed to be accessible by the service users in accordance with the selected collection system (kerbside or drop of, as well as waste segregation or mixed waste collection)

A detailed methodology should be developed and agreed among the pilot regions / municipalities. It would contribute to a better planning of the waste collection service extension and to reducing the floating debris.

5. Marine Litter Prevention Activities

The overall goal of the marine litter prevention activities is to improve the current waste by strengthening the organisational and financial capacity of operators to cover remote rural areas with an organised waste collection service and improve the recycling rate. Hence, the common objectives of the Adriatic Coast pilot region read as follows:

1. Extension of rural waste collection (%);
2. Improved rate of plastics recycling (%);
3. Reduced illegal dumping (% of population or volume of waste);
4. Reduced floating debris (%)

This ISWM Model focuses on best practices on extending waste collection in remote rural areas and provides concepts for planning of waste collection routes, defining also the required volume of containers and refuse vehicles and monthly fuel costs for each pilot municipality.

5.1 Best Practices on Rural Waste Collection

Best practices on rural waste collection presented in this ISWM Model have been collected from the following sources:

- Municipal Waste Learning Tool, Lesson 3 – solid waste collection[48]
- Guide to developing Community Solid Waste Facilities[49]

By using the ***Municipal Waste Learning Tool***, the pilot municipalities can understand problems and concerns associated with MSW collection, compare and contrast privately and publicly

[48] http://msw.cecs.ucf.edu/collegestudents.html
[49] https://www.h-gac.com/community/solid-waste-management/documents/guide_to_developing_community_solid_waste_facilities.pdf

operated systems, understand the types of collection systems, identify the benefits associated with the use of transfer stations, prepare an economic analysis of transfer stations and understand the design issues associated with transfer stations.

The major benefit for the pilot municipalities from using this tool is the possibility of analyzing:

1. Total required collection time
2. Number of vehicles and containers required
3. Number of customers a truck can serve per day
4. Collection frequency
5. Monthly costs of fuel

The tool sets an equation for calculating the total required collection time as follows:

Y=a + (bc x N) + bkm + c(d) + e + f + g

Table 7 Input data to calculate total collection time

a+e	a - garage to route time, e- time to drive to garage at the end of the trip
N	Number of locations
Wg	Waste generation per location (kg)
Wsw	Waste specific weight (1.1m^3, or 120l)
CR	Compaction ratio of a truck (1:3)
bc	Collection time per location or pickup + put down time (min)
bkm	Time to drive between location (min)
d	Disposal time (time at landfill 30 min)
d	In/out garage
f+g	Off route time (15% of day)
c	Number of trips per month

- a, d, and e are a function of distance and speed – usually 30km/h;
- b is a function of the number of customers, time per customer, number of loads (full or partial); b is obtained by adding bc (collection time at the location) and bkm (time to drive in-between the locations); the time is a function of the travel length (distance) and average speed, the latter being set at 30km/hour;
- c is a function of the capacity of the vehicle and its compaction ratio;

The number of vehicles and containers required is a function of the waste generation in a given area. The number of required containers will depend on the volume of the containers and waste density. The volume of containers is set based on the residential area (single houses or multi-storey buildings) and the collection method: “kerbside” (”door-to-door”) or “bring” systems. Considering that the ISWM model mainly focuses onto the rural areas, door-to-door collection is applied using bins of 120l volume. The waste density is 15kg/120l. The total number of 120l bins is then calculated by dividing the quantities (kg) of waste generated for the period coinciding with the collection frequency (i.e. weekly quantity, if the collection is performed once a week, or any other period correlated with the collection frequency) with the waste density (15kg, for 120l bins). If 1.1m^3 containers are applied, the waste density used will be 120kg/1.1m^3.

To calculate the number of costumers a truck can serve a day, the volume and waste density (which is in correlation to the compaction ratio) should be known. Considering that weight of $1m^3$ waste is approximately 110 kg, the usual compaction rate of a truck is 1:3, and an average per-capita waste generation in rural areas is 0.7kg, a $12m^3$ truck can serve 2,772 customers a day.

Or:

Truck volume (m3) x 110kg (density) x 3 (compaction factor) x 0.7 (waste generation per capita) = total served costumers a day.

Collection frequency is a function of the waste quantity intended for collection, the volume of the truck, the total waste collection time and number of shifts. Usually the optimal waste collection frequency is once a week. Such collection frequency facilitates the optimised use of the refuse vehicles` fleet and their maintenance. The collection frequency is planned for the entire territory of the municipality, taking into account the waste generation, the available truck volumes and the length of the routes.

The key to planning the waste collection in rural areas is the supply of sufficient volume of containers and optimising the routes of available refuse vehicles. An obstacle to planning these routes can be the road infrastructure, i.e. accessibility of remote areas by standard vehicles. Therefore, the best practice examples suggest to split the services in such a way that:

- the standard refuse vehicles of volume 12-$20m^3$ utilise the main road network;
- smaller vehicles (with a volume of 3-$6m^3$), possibly even tractors, serve the households and transport the collected waste to certain collection points (rural transfer stations), which are located at strategic points – at crossroads with local roads.

The ***Guide to Developing Community Solid Waste Facilities*** prepared by Dannenbaum Environmental Corporation (1999) represents a collection of best practices for rural waste collection in remote areas.

These best practise demonstrate how to estimate the total costs of the existing solid waste system, showing also show how rural transfer station may lower their cost-per-capita spent on solid waste activities. The rural transfer stations can also be used to offset costs of cleaning up the illegal dumpsites.

A rural transfer station is simply a location where residents can get rid of ordinary municipal waste and hard-to-dispose items. A wide spectrum of collection center designs are possible, depending on the materials accepted, location, number of residents using the facility, and funds available for construction and operation. These centers are suitable locations for recycling too. These stations typically feature one or more movable trailer, dumpster, or roll-off bin to temporarily store and then transport the collected waste to a municipal or regional landfill.

Rural transfer stations can be either fixed or mobile. A fixed station is permanently located on a parcel of land and typically has some improvements to support the collection and disposal operations, such as fencing, lighting, a driveway, and an attendant’s shed. Fixed collection stations can be relatively low cost operations with waste collection bins only or they can offer more extensive services, including recycling collection, used oil collection, household hazardous waste collection, and composting. However, as waste collection service options expand, so do program costs.

Mobile collection stations are collection vehicles that stop at a designated time to accept resident's trash at a particular location, such as a section of right-of-way along a commonly traveled road. Typically, there are little or no improvements at the places where they stop to collect waste, other than a sign to designate the times for collection, acceptable materials, and to identify the location. Some mobile collection sites use all-weather surfacing so cars and trucks can make safe use of the station even in poor weather conditions. Although not as common, it is possible to offer many of the full-service options typically found at a fixed collection station at a mobile station.

The rural transfer stations should be located in close proximity to frequently travelled. The location should also consider potential nuisance problems (doors and noise) or hazard problems (traffic or floodplain issues). Lastly, the location should be affordable and suitable to the design so that capital improvement costs can be minimized.

Ideally, all fixed rural transfer stations will meet certain minimum standards to ensure user safety, convenient access, ease of use, control of litter, prevention of scavenging, and adequate waste collection service opportunities. The absolute minimum requirements for a convenience collection point are:

- All-weather surfaces on the access road and on the site,
- Easy access for residents and/or community elected operators to the site and to the containers,
- A perimeter fence for security and windblown materials control,
- Convenient hours of operation, including weekends,
- Posted signs that state the hours of operation, materials accepted, and a warning that illegal dumping violators will be prosecuted.

There are many different layout options for constructing a rural transfer station (drop-off) area. Three of these options and the pros and cons associated with each are shown as Figure 13.

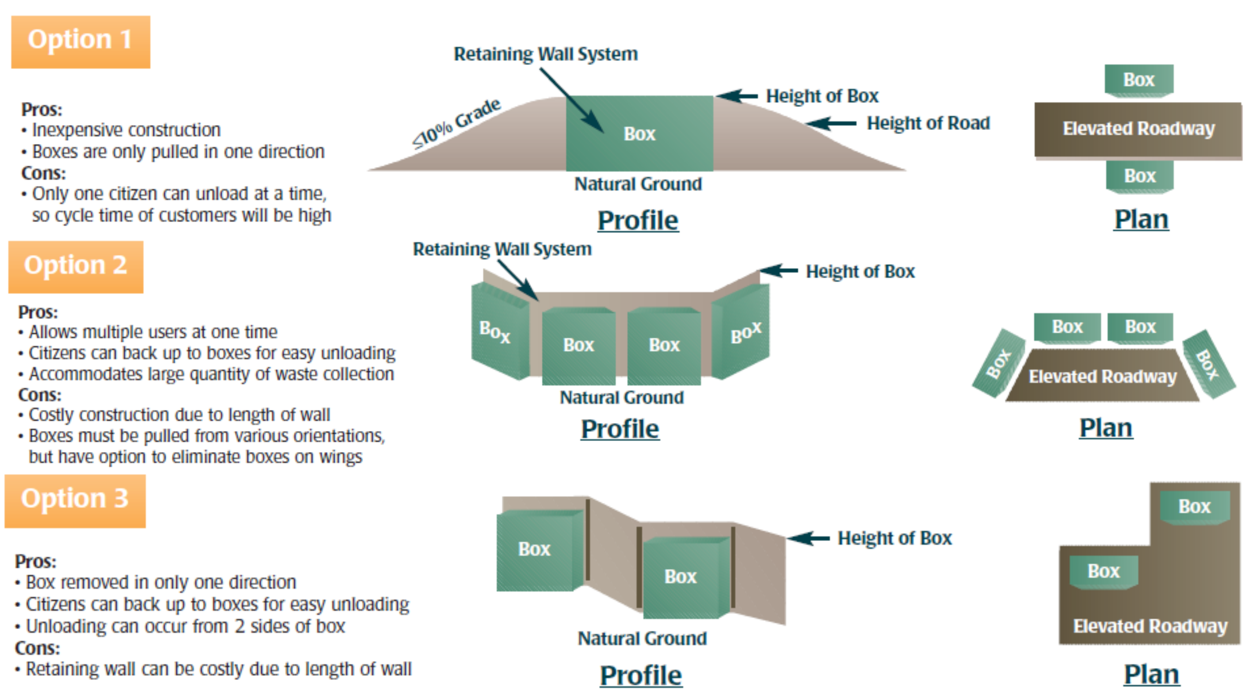


Figure 13 Layout options of a rural transfer station

Case studies provide examples for organising rural transfer stations which, in addition to providing a site for residents to dispose of bulky items, special waste, and segregated household waste, can reduce the travel length (and time) of special refuse vehicles. Door-to-door collection of segregated waste is provided by an operator engaged by the local community or the population transports their wastes to the rural transfer station on their own.

Box 2. Chambers County Case Study

The population of Chambers County is approximately 25,000. The county is 5% urban and 95% rural. Annually approximately 87,000 tons of waste is generated. Chambers County believes that staffing their rural transfer stations ensures that citizens separate their waste properly, controls potential illegal dumping, and controls the cleanliness of the station itself. Prior to transfer stations were manned, the county would frequently find trash laying on the ground; also the waste segregation was not performed properly.

The county operates eight manned rural waste transfer stations which accept municipal waste, hazardous waste, used oil, used oil filters, tires, brush for grinding, white goods, and batteries. Citizens can bring their waste at the rural transfer stations on their own, or they can organize a door-to-door collection within their community. The residual municipal waste is then collected from the transfer station by the county operator while the recyclables are picked up by authorized private companies.

Figure 14 Rural Transfer Station in Chamber County, Texas

Initially, rural transfer stations were in approximately twenty locations and they were only 1.1m3 containers. It was very expensive to maintain this system. Eventually they decreased the number of rural transfer stations and increased the collection box size to 40-m3 containers. Now, sites have compactor stations, roll-off containers, or both. The waste is trucked from rural transfer stations to the landfill by county owned roll-off vehicles and county employees.

5.2 Proposed Rural Waste Collection Concept

The best practice examples elaborated in section 5.1 have been deployed to derive concepts for rural waste collection in every pilot municipality.

The major objectives of the proposed rural waste collection are linked to reducing environmental and economic impacts of marine litter; these are:

- To prevent creation of illegal dumpsites by extending the service in areas where regular waste collection does not exist;
- To improve recycling rate of packaging (mostly plastics) and thus reduce this stream in the marine litter;

The proposed rural waste collection system is “door-to-door”, in order to prevent illegal dumping of citizens unwilling to bring their waste to distant locations / containers. Also primary waste segregation is foreseen. This will positively The municipality can decide, however, whether the primary waste segregation will be implemented upon the start-up of rural waste collection operations or at a later stage. One should bear in mind that a “door-to-door” collection system is expensive (due to the length of the trip) and often cannot be implemented in rural areas due to accessibility issues (narrow, steep and unpaved streets where a regular refuse truck cannot drive). Therefore, it is proposed to establish two parallel collection systems:

1. Rural waste collection run on behalf of the ***municipality*** and operated either by a PCE or a contracted - out private waste management company. It is carried out by regular refuse vehicles of volume 10-20m^3 using main roads only for their routings and collecting waste from designated ***collection points***. Bigger volume vehicles (e.g. roll on / roll off trucks) can be made available, if the road layout can permit their passage and manipulation (i.e. turning).
2. Rural waste collection run on behalf of the ***local community.*** The citizens can bring their (segregated waste) bins to the closest ***collection point*** or they can hire a local waste collection agent, elected among the community members, to do it on their behalf. The local waste collection agent can be also a sub-contractor of either the municipal operator of the rural community. The municipality can decide which institutional form will take the local community driven rural waste collection, as it is a matter of the existing regulations. The local waste collection agent should have a suitable vehicle (i.e. a tractor) which is able to access the customers` properties located along local streets (if any), which can be unpaved, steep and narrow.

The ***collection points*** are locations where two parallel systems meet: the regular waste collection operated on behalf of the municipality and the local waste collection organised by the local community (village).

These collection points are always located along the main road. In some cases, the local network of streets is adjacent to the main road, or the local road is branching off leading to the village. In both situations the local population or local waste collection agents bring their waste to these collection points. They can be either mobile or fixed (rural) transfer stations. Mobile transfer is designated at locations where the local road branching off the main road connects one or two settlements. Fixed transfer stations are placed at strategic points where a group of settlements with relatively high population numbers can conveniently dispose their waste within the period between two scheduled collections.

At the mobile transfer point, which represents a section of the main road), collection vehicles stop at a designated time to accept the collected waste. The waste is reloaded from a smaller vehicle to a standard refuse truck. Hence, the two collection systems (of the municipality and local community) need to be synchronized in terms of timing.

The fixed rural transfer stations require a parcel of land which is fenced and supplied with suitable containers. The type and volume of the containers must suit to the loading system of the municipal refuse vehicles` fleet. An elevated driveway (ramp) enables waste unloading from a smaller vehicle (a tractor, in most cases) to a container. The advantage of fixed transfer stations is that collection schedule of standard refuse vehicles operated by the PCE or private waste management company engaged by the municipality doesn`t need to be adjusted to the unloading schedule of the community driven collection system. The disadvantage is that their operation is more expensive.

The collection points can be used for the temporary storage of recyclables. In case of primary waste segregation, separate containers are placed for particular recyclables at the rural transfer stations. Secondary waste segregation can be organised at the rural waste transfers too. At the mobile collection points, recyclables can also be picked up, provided that the municipality organises the collection of segregated waste. Otherwise, authorised private recycling companies can be invited for the pick-up. Thusly, the municipal operators would only collect the residual waste. It would minimise the waste quantities, the required waste collection frequency and - costs.

The planning of the rural waste collection is comprised of the following steps:

1. The settlements not covered by a regular waste collection service and respective population numbers were identified for each pilot municipality based on input of PCEs and/or private waste management operators; they have been located on a google earth map;
2. The waste generation and composition was calculated for each settlement not covered by a regular waste collection service; the residual waste was intended for collection by the PCEs / private waste management companies while the recyclables were assigned to authorised recycling companies; biodegradable waste was intended for home composting.
3. The road infrastructure was analysed to optimise routing; routes have been indicated on a google earth map; routes have lead along main roads leading starting from the garage of the refuse trucks (located usually in the municipality capital) to the disposal site (either the regional sanitary landfill or the municipal non-compliant landfill) and back to the garage;
4. The number of collection points – either single settlements (mobile transfers) or rural transfer stations (fixed transfers) serving a group of settlements have been set per each route; distances in-between the collection points have been measured;
5. Rural (fixed) waste transfer stations were set at suitable locations – crossroads of the main and local roads, in the proximity of settlements with higher population numbers and hence higher waste generation;
6. The collection time per collection points and the total waste collection time has been calculated based on distance, legitimate breaks and speed;
7. The total volume of required vessels and the number of $1.1m^3$ containers (which can be easily converted into 120l bins, based on the ratio 1 container of $1.1m^3$ is equal to 8 x 120l bins) has been calculated; the average waste density of one 1.1m3 container is 120kg, but due to a reserve margin of 30%, the calculations operate with an average waste density of 98 kg.
8. The required volume of required refuse trucks has been calculated based on the residual waste quantities, number of routes, total collection time of a route and collection frequency (usually once a week).
9. The fuel costs have been calculated based on the total length of travel, average consumption of 15l diesel per 100km and current diesel prices in the pilot countries.

The routings and calculations are available in Annex 3. The calculation model for the Albanian municipalities falls short in providing the required volume of tracks / containers because the population data are not presently available. All the formulas are being integrated in the calculation model and upon providing input data (population and corresponding waste generation / composition) the required volumes will be generated automatically.

The example of the Municipality Ulcinj is presented below. The calculations of the required vehicles and containers` volume are based on waste generation in the settlements in Municipality Ulcinj not covered by a regular waste collection service. The input figures to the calculations are shown in table 8 and 9 below.

Table 8 Settlements / respective population not covered by regular waste collection and waste generation in the Municipality Ulcinj

Settlements not covered by a waste collection service	Population	Indicator (kg/ capita/ day)	waste generation (kg/per capita/day)	waste (tons / year)
Ambula	34	0.7	23.8	8
Zoganj	397	0.7	277.9	101
Bojke	161	0.7	112.7	41
Sveti Đorde	69	0.7	48.3	17
Bratica	241	0.7	168.7	61
Štodra	111	0.7	77.7	28
Ćurke	33	0.7	23.1	8
Darza	135	0.7	94.5	34
Donja Klezna	126	0.7	88.2	32
Sutjel	20	0.7	14.0	5
Draginje	72	0.7	50.4	18
Fraskanjel	57	0.7	39.9	14
Rec	63	0.7	44.1	16
Šas	239	0.7	167.3	61
Kodre	1039	0.7	727.3	265
Kolonza	232	0.7	162.4	59
Kosići	301	0.7	210.7	77
Kravari	551	0.7	385.7	140
Kruče	133	0.7	93.1	33
Kruta	194	0.7	135.8	49
Krute	534	0.7	373.8	136
Leskovac	78	0.7	54.6	19
Lisna Bore	175	0.7	122.5	44
Mide	234	0.7	163.8	59
Pistula	393	0.7	275.1	100
Rastiš	365	0.7	255.5	93

The waste composition is presented in table 9.

Table 9 Waste Composition in the Settlements not Covered by regular Waste Collection Service in Municipality Ulcinj

Settlement	Waste flows (kg/month)						
	Organic	Paper	Plastic	Glass	Metal	Other Recyclables	Residual Waste
Ambula	257	114	129	50	29	321	136
Zoganj	3,001	1,334	1,501	584	333	3,752	1,584
Bojke	1,217	541	609	237	135	1,521	642
Sveti Đorde	522	232	261	101	58	652	275

Settlement	Waste flows (kg/month)						
	Organic	Paper	Plastic	Glass	Metal	Other Recyclables	Residual Waste
Bratica	1,822	810	911	354	202	2,277	962
Štodra	839	373	420	163	93	1,049	443
Ćurke	249	111	125	49	28	312	132
Darza	1,021	454	510	198	113	1,276	539
Donja Klezna	953	423	476	185	106	1,191	503
Sutjel	151	67	76	29	17	189	80
Draginje	544	242	272	106	60	680	287
Fraskanjel	431	192	215	84	48	539	227
Rec	476	212	238	93	53	595	251
Šas	1,807	803	903	351	201	2,259	954
Kodre	7,855	3,491	3,927	1,527	873	9,819	4,146
Kolonza	1,754	780	877	341	195	2,192	926
Kosići	2,276	1,011	1,138	442	253	2,844	1,201
Kravari	4,166	1,851	2,083	810	463	5,207	2,198
Kruče	1,005	447	503	196	112	1,257	531
Kruta	1,467	652	733	285	163	1,833	774
Krute	4,037	1,794	2,019	785	449	5,046	2,131
Leskovac	590	262	295	115	66	737	311
Lisna Bore	1,323	588	662	257	147	1,654	698
Mide	1,769	786	885	344	197	2,211	934
Pistula	2,971	1,320	1,486	578	330	3,714	1,568
Rastiš	2,759	1,226	1,380	537	307	3,449	1,456

Two main routes are established, so called “green” and “orange”. Colour coding of routes eases planning of trips and respective collection points.

The collection points along the “green” and “orange” route are:

Table 10 Collection Points Along the "Orange" and "Green" Routes

Collection Point No.	“Green” Route	Collection Point No.	“Orange” Route
1	Zoganj	1	Rec
2	Donja Kleznja	2	Kodre
3	***Transfer station near Sas***	3	Bratica
	Mide	4	Pistula
	Sas	5	Kruce
	Fraskanjel	6	Mrkojevici
	Stodra		
	Kravari		
	Ostros		
	Bojke		
4	Krute		
	Transport to Mozura		

There are three mobile collection points (Zoganj, Donja Klezna and Krute) and one fixed rural transfer station established near the village Sas where the waste from Mide, Sas, Fraskanjel, Stodra, Kravari, Ostros and Bojke is temporarily stored until the pick up by the refuse trucks of the municipal service. The village Ostros is located in the neighburing Municipality Bar. It is proposed to include the waste collection of this settlement into the “green” route due to the convenience of the road network. Otherwise the Municipality Bar would face challenges to extend the rural waste collection in this village due to the relative distance from the municipal capital and the regional sanitary landfill Mozura.

There are six mobile collection points along the “orange” route as shown in the table 10 above. The routes are shown in figure below.

Figure 15 The "Green" and "Orange" Refuse Vehicle`s Routes for Collecting rural Waste in Municipality Ulcinj

Each route starts from the garage located in Ulcinj; a truck drives in-between the collection points (including rural transfer stations), goes to the Mozura regional sanitary landfill, unloads the waste and goes back to the garage. Therefore, the number of collection points is n+1 (5 for the “green” and 7 for the “orange” route). The total waste collection time has been calculated using the formula:

$$Y = a + (bc \times N) + bkm + c(d) + e + f + g$$

The travel times in-between the collection points and the total collection time for the “green“ route are given in table 11.

Table 11 Travel Times in-between the Collection Points along the “Green” Route, to the Mozura Sanitary Landfill and Back

ROUTE 1 (GREEN)						
	Location No.	**1**	**2**	**3**	**4**	**5**
a+e	a - garage to route time, e- time to drive to garage at the end of the trip	15	0	0	0	15
N	Number of locations	1	1	1	1	1
Wg	Waste generation per location (kg)	396	125	2,980	532	0
Wsw	Waste specific weight (1.1m^3)	98	98	98	98	98
CR	Compaction ratio of a truck	3	3	3	3	3
bc	Collection time per location or pickup+put down time (min)	1	15	15	15	0
bkm	Time to drive between location (min)	9.4	9.5	4.1	5.2	17.22
d	Disposal time (weighing, unloading)	0.00	0.00	0.00	0.00	30.00
d	In/out garage	10	0	0	0	10
f+g	Off route time (15% of day)	0	0	0	0	72
c	Number of trips per week	1				
YLOC	Total collection time per location	*49.4*	*24.5*	*19.1*	*20.2*	*144.2*
Y	Total collection time (min)	***257.3***				

The travel times in-between the collection points and the total collection time for the “orange“ route are given in table 12.

Table 12 Travel Times in-between the Collection Points along the “Orange” Route, to the Mozura Sanitary Landfill and Back

ROUTE 2 (ORANGE)								
	Location No.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
a+e	a - garage to route time, e- time to drive to garage at the end of the trip	15	0	0	0	0	0	15
N	Number of locations	1	1	1	1	1	1	1
Wg	Waste generation per location (kg)	132.67	392.02	1,135.65	240.40	18.00	0.00	18.00
Wsw	Waste specific weight	98	98	98	98	98	98	98
CR	Compaction ratio	3	3	3	3	3	3	3
bc	Collection time per location or pickup+put down time (min)	15	15	15	15	15	15	0
bkm	Time to drive between location (min)	29.5	3.2	3.0	14.2	4.4	36.0	5.8
d	Disposal time (weighing, unloading)	0.00	0.00	0.00	0.00	0.00	0.00	30.00
d	In/out garage	10	0	0	0	0	0	10
f+g	Off route time (15% of day)	0	0	0	0	0	0	72
c	Number of trips per week	1	1	1	1	1	1	1
Y	**Total collection time per location**	***69.5***	***18.2***	***18.0***	***29.2***	***19.4***	***51.0***	***132.8***
Y	**Total collection time (min)**	***338.1***						

The required volume of trucks and containers located at the collection points for weekly waste collection frequency for the “green” route is shown in table 13.

Table 13 Number of Containers and Trucks Needed for the “Green” Route (Weekly Collection)

Collection points	Weekly Waste at Location (kg)	No. of containers needed (1.1m^3)	Truck volume needed (m^3)
Zoganj	396	4	Vol=Tot waste/specific weight/compact ratio
Donja Kleznja	126	1	
Transfer station near Sas	2,981	30	
Krute	533	5	
Total waste	4,035	**40**	**13.72**

The required volume of trucks for weekly waste collection frequency for the “green” route is shown in table 14.

Table 14 Number of Containers and Trucks needed for the “Orange” Route (Weekly Collection)

Collection points	Weekly Waste at Location (kg)	No. of containers needed (1.1m^3)	Truck volume needed (m^3)
Rec	63	1	*Vol=Tot waste/specific weight/compact ratio*
Kruce	133	1	
Pistula	392	4	
Mrkojevici	1,136	12	
Bratica	240	18	
Kodre	1,036	11	
Total waste	**3,000**	***31***	***10.20***

The diesel fuel costs have been calculated for both “green” and “orange” routes based on the total distance (travel length), fuel consumption of 15l/km and actual price of fuel (Tables 15 and 16).

Table 15 Diesel Fuel Weekly and Monthly Costs for the "Green" Route

Costs	Total Length of Trip (km)	Weekly Fuel Costs (EUR)	Monthly Fuel Costs (EUR)
Truck (diesel engine)	34	6.14	24.58

Table 16 Diesel Fuel Weekly and Monthly Costs for the "Orange" Route

Costs	Total Length of Trip (km)	Weekly Fuel Costs (EUR)	Monthly Fuel Costs (EUR)
Truck (diesel engine)	71	12.63	50.54

Hence, to extend the waste collection service and cover all the settlements in the Municipality Ulcinj, the following resources need to be made available:

71 containers of 1.1m^3 volume (to be placed at the collection points) and 568 bins of 120l (to be placed at customers` properties for the “door-to-door” collection) need to be purchased. The cost of is 1.1m^3 volume containers is 24,850 EUR [50]. The cost of the 120l bins is 17,040[51] EUR;

[50] The unit price used for 1,1m^3 container is 350 EUR.
[51] The unit price used for 120l bins is 30 EUR.

- One truck of 15m^3 volume needs to be made available for a total duration of 10 hours a week. If such a truck is not available, the investment is approximately 70,000 EUR;
- Staff of 3 persons (one driver and two loaders) will be engaged 10 hours a week;
- The monthly costs of fuel will be in the range of 75 EUR;
- If the citizens would engage a local waste collection agent, the costs of “door-to-door” collection and transportation to the collection point should be covered. One should bear in mind the number of trips of a fully loaded tractor (up to 6m^3 volume) will be more than one a week. The remuneration will be negotiated with the contracting authority, either the local community or the municipality, based on the volume of waste for collection, i.e. number of properties where the waste shall be picked up, as well as the travel length from the collection area to the collection point. A provisional amount of 400-500 EUR per a waste collection agent a month seems reasonable, given the current average salaries in the region. This remuneration should also cover the fuel costs and lease of the tractor.

Apart from the planning required to optimise the rural waste collection and making resources available to make it happen, an important prerequisite to the acceptance of the new service an especially the waste segregation is the public awareness raising and enforcement.

The public awareness raising activities should not be limited to sporadic campaigns only. Citizens should be involved since the early planning stage of the rural waste collection, ideally by reaching them out via the survey discussed in section 3.1.1.2 on inventories of illegal dumpsites above. Local community leaders should use their authority to explain the importance of the ceasing the illegal dumping and properly disposing their waste into the dustbins. The communication between the municipal representatives and the citizens should continue until every single household has signed a contract and obtained a dustbin for the waste storage at the property. Once the household accepts the service (and pay for it), the waste management operator should maintain the universality, through non-discrimination, sustainability, quality and efficiency, transparency, economically acceptable price and full coverage of the area of service provision.

6. Conclusions

This ISWM Model can help in implementing comprehensive measures towards reducing the marine litter and its harmful impacts.

Marine litter monitoring is the only way to get a clear idea of the sources of marine litter as well as to assess whether the actions taken to mitigate the problem are effective. The importance of monitoring is reflected in the fact that, according to the Marine Strategy Framework Directive requirements, each Member State must develop and implement marine litter monitoring protocols. It is strongly recommended that, where practices that could have an effect on marine litter are implemented, they are accompanied by a well-designed monitoring programme, which will record the amounts and types of marine litter before and after the implementation of the practice to assess any changes and thus the effectiveness of the practice. In the case of the Adriatic Coast pilot region, both the monitoring and evaluation and effectiveness of the implemented policy and actions should be coordinated at a regional scale. The regional cooperation should result in consolidating existing performance monitoring tools and responsibilities and using harmonised approaches.

Once the waste management data collection and analyses methodologies are being harmonised and initial monitoring implemented, the following actions should be taken by each pilot municipality:

- Extend the rural waste collection and subsequently clean-up the illegal sites being previously used by the population not covered by the regular waste collection service;
- Implement instruments that apply ‘the polluter pays’ principle, by for example enforcing penalties for littering and other environmentally harmful behaviour;
- Organise for a primary waste segregation and strengthen the collaboration with the companies active in the recycling market;
- Establish recycling on-the-go (i.e. beaches, recreational areas) by providing an adequate number, size and type of waste bins and recycling receptacles
- Ensure that all public waste bins and recycling receptacles are emptied frequently and regularly

Before any practice to reduce marine litter is implemented, one should think of the effect it is likely to have on the peoples` behaviour. For any action to be effective in the long term, it must cause a shift in behaviour that will be sustained in the long run. This is not always easy to achieve. It requires effective awareness raising in tandem to any other practice that is implemented.

In the pilot municipalities, municipal administration, councillors and PCEs will play a crucial role in managing marine litter and illegal disposal monitoring programmes. Community leaders need to be elected and start involving citizens in decision making and action. In this way a community-mentality is gained whereby people act towards bettering their own area for the greater good of the whole community. If communities were more educated on the impacts of marine litter and illegal dumping and identified this as a social deviation, this could potentially begin to change their habits.

Annex 1

Litter classification system for all surveys where litter is collected or identified in situ

Class	Material Composition	Litter Code	Litter Form (And Examples)
1	Plastic	PL01	Bottle caps & lids
2	Plastic	PL02	Bottles < 2 L
3	Plastic	PL03	Bottles, drums, jerry cans & buckets > 2 L
4	Plastic	PL04	Knives, forks, spoons, straws, stirrers, (cutlery)
5	Plastic	PL05	Drink package rings, six-pack rings, ring carriers
6	Plastic	PL06	Food containers (fast food, cups, lunch boxes & similar)
7	Plastic	PL07	Plastic bags (opaque & clear)
8	Plastic	PL08	Toys & party poppers
9	Plastic	PL09	Gloves
10	Plastic	PL10	Cigarette lighters
11	Plastic	PL11	Cigarettes, butts & filters
12	Plastic	PL12	Syringes
13	Plastic	PL13	Baskets, crates & trays
14	Plastic	PL14	Plastic buoys
15	Plastic	PL15	Mesh bags (vegetable, oyster nets & mussel bags)
16	Plastic	PL16	Sheeting (tarpaulin or other woven plastic bags, palette wrap)
17	Plastic	PL17	Fishing gear (lures, traps & pots)
18	Plastic	PL18	Monofilament line
19	Plastic	PL19	Rope
20	Plastic	PL20	Fishing net
21	Plastic	PL21	Strapping
22	Plastic	PL22	Fibreglass fragments
23	Plastic	PL23	Resin pellets
24	Plastic	PL24	Other (specify)
25	Foamed Plastic	FP01	Foam sponge
26	Foamed Plastic	FP02	Cups & food packs
27	Foamed Plastic	FP03	Foam buoys
28	Foamed Plastic	FP04	Foam (insulation & packaging)
29	Foamed Plastic	FP05	Other (specify)
30	Cloth	CL01	Clothing, shoes, hats & towels
31	Cloth	CL02	Backpacks & bags
32	Cloth	CL03	Canvas, sailcloth & sacking (hessian)
33	Cloth	CL04	Rope & string
34	Cloth	CL05	Carpet & furnishing
35	Cloth	CL06	Other cloth (including rags)
36	Glass & ceramic	GC01	Construction material (brick, cement, pipes)
37	Glass & ceramic	GC02	Bottles & jars
38	Glass & ceramic	GC03	Tableware (plates & cups)
39	Glass & ceramic	GC04	Light globes/bulbs
40	Glass & ceramic	GC05	Fluorescent light tubes
41	Glass & ceramic	GC06	Glass buoys
42	Glass & ceramic	GC07	Glass or ceramic fragments
43	Glass & ceramic	GC08	Other (specify)
44	Metal	ME01	Tableware (plates, cups & cutlery)
45	Metal	ME02	Bottle caps, lids & pull tabs
46	Metal	ME03	Aluminium drink cans
47	Metal	ME04	Other cans (< 4 L)
48	Metal	ME05	Gas bottles, drums & buckets (> 4 L)
49	Metal	ME06	Foil wrappers
50	Metal	ME07	Fishing related (sinkers, lures, hooks, traps & pots)
51	Metal	ME08	Fragments
52	Metal	ME09	Wire, wire mesh & barbed wire
53	Metal	ME10	Other (specify), including appliances

Class	Material Composition	Litter Code	Litter Form (And Examples)
54	Paper & cardboard	PC01	Paper (including newspapers & magazines)
55	Paper & cardboard	PC02	Cardboard boxes & fragments
56	Paper & cardboard	PC03	Cups, food trays, food wrappers, cigarette packs, drink containers
57	Paper & cardboard	PC04	Tubes for fireworks
58	Paper & cardboard	PC05	Other (specify)
59	Rubber	RB01	Balloons, balls & toys
60	Rubber	RB02	Footwear (flip-flops)
61	Rubber	RB03	Gloves
62	Rubber	RB04	Tyres
63	Rubber	RB05	Inner-tubes and rubber sheet
64	Rubber	RB06	Rubber bands
65	Rubber	RB07	Condoms
66	Rubber	RB08	Other (specify)
67	Wood	WD01	Corks
68	Wood	WD02	Fishing traps and pots
69	Wood	WD03	Ice-cream sticks, chip forks, chopsticks & toothpicks
70	Wood	WD04	Processed timber and pallet crates
71	Wood	WD05	Matches & fireworks
72	Wood	WD06	Other (specify)
73	Other	OT01	Paraffin or wax
74	Other	OT02	Sanitary (nappies, cotton buds, tampon applicators, toothbrushes)
75	Other	OT03	Appliances & Electronics
76	Other	OT04	Batteries (torch type)
77	Other	OT05	Other (specify)

Annex 2

Illegal Dumping Questionnaire

Household number:

<u>Section A: Basic Details</u>

Street name:

1. Gender (tick)

Male	
Female	

2. Employment (tick)

   Yes ☐ No ☐

3. How long have you lived here? (tick)

Less than a year ☐ 1-3 years ☐ 4-6 years ☐ 7-10 years ☐ More than 10 years ☐

4. How many people live in your household ....

<u>Section B: Awareness and extent of illegal dumping</u>

5. Are you aware of the illegal dump site located in your neighbourhood? (tick)

   Yes ☐ No ☐

6. If yes, how many sites have you noticed? (tick)

0-1	2-5	More than 5

7. Do you think illegal dumping is a problem in your neighbourhood? (tick)

   Yes ☐ No ☐

8. If yes, how would you rate the severity of the problem? (circle)

   Minor Moderate Neutral Severe Highly Severe

9. How frequently does the problem occur? (tick applicable)

Daily ☐ Weekly ☐ Monthly ☐ Seasonally ☐ Annually ☐

Other .... (specify)

10. How long has it been occurring? (tick)

A few weeks ☐ A few months ☐ A year ☐ 2-5 years ☐ 6-9 years ☐ >10 years ☐

11. Who do you think contributes to this illegal dumping? (tick applicable)

Construction, demolition, remodelling, roofing or landscaping contractors	
Garden services	
Vehicle repair or tyre shops	
Scrap collectors	
Waste pickers	
local residents	

Other -- (specify)

12. Why do you think people dump waste illegally? (tick applicable)

They don't know what else to do with it	
Proper disposal is costly	
They don't care/ lazy	
Missed refuse collection day	
No/unreliable waste collection services	
Unaware of the services available to them	

Other-- (specify)

Section C: Tackling illegal dumping

13. On a scale of 1 to 5, how important is it to eliminate illegal dumping? (tick)

Extremely Important	Quite Important	Don't know/Neutral	Not Very Important	Not Important
1	2	3	4	5

Explain answer?

----

14. What services can the municipality improve upon to prevent illegal dumping? (tick applicable)

Provide waste containers to specific locations	
Employ more workers	
Timely waste collection services	
Fence off area to prohibit dumping	

Other -- (specify)

15. Is the community involved in combatting illegal dumping?

Yes ☐ No ☐

16. How would you be willing to combat illegal dumping in your area? (tick)

☐ Money
☐ Petition
☐ Time
☐ Nothing
☐ Other

Section D: Illegal dumping effects

17. Does having a dump site in your neighborhood effect your quality of life in any way?

Smell	
Visual	
Aesthetics	
Vagrants	
Unwanted animals (stray dogs, donkeys)	

Other (specify): ______________________ 18.

______________________ 19.

20. Has the problem affected you, your family, pets, lifestock?

Yes ☐ No ☐

If yes, how ____

____

____

21. Do you think the illegal dumpsite have negative effects on the environment

Yes ☐ No ☐

22. If yes, in what way? (tick applicable)

Vegetation growth	
Soil pollution	

Water pollution	
Harmful to animals	

Other (specify): ____________________

____

____

23. How would you rate the severity of these environmental impacts? (circle)

Minor Moderate Neutral Severe Highly Severe

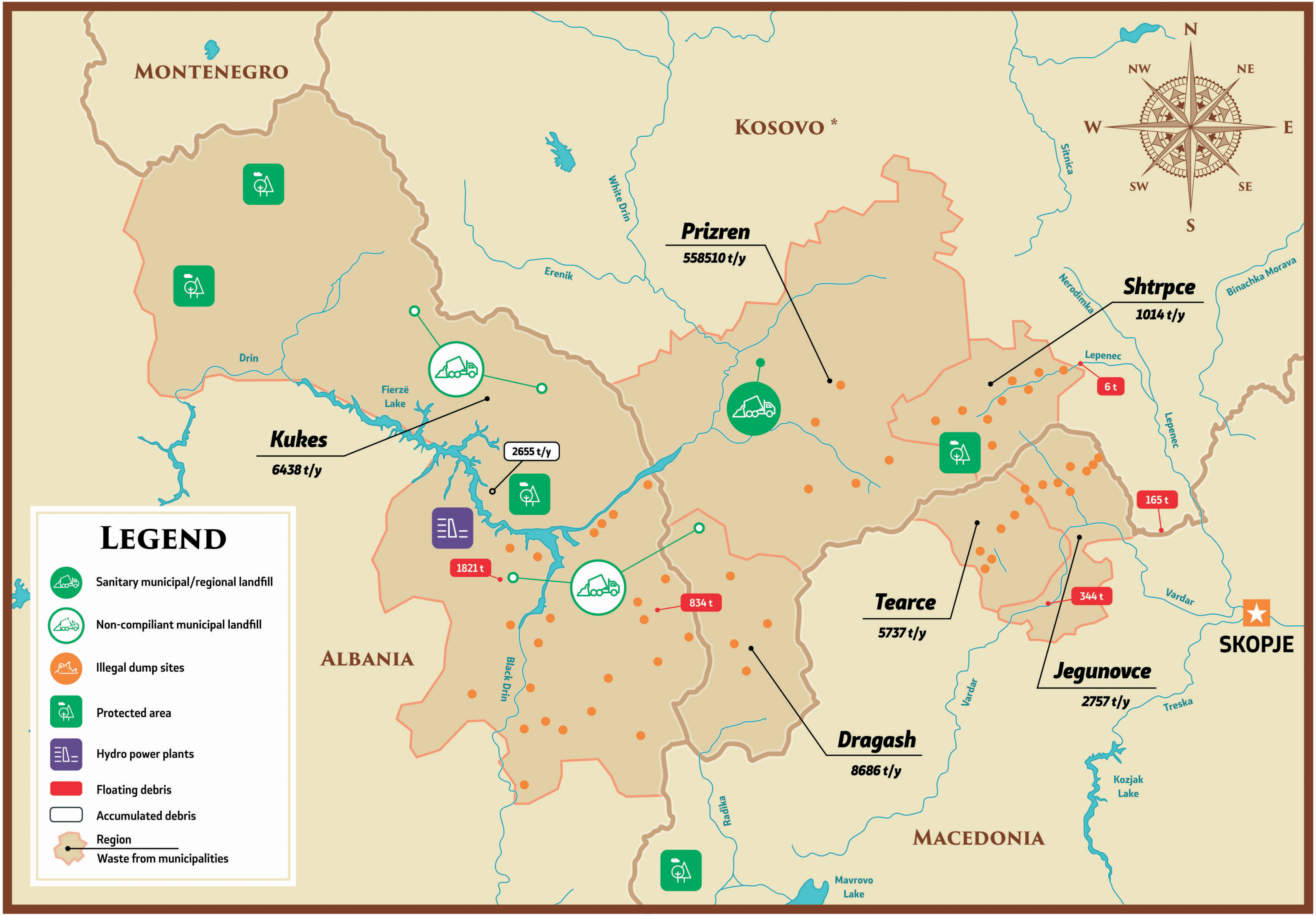
Thank you for your time.

Annex 3

Rural Waste Collection calculations

CROATIA
BOSNIA AND HERZEGOVINA
SERBIA
MONTENEGRO
KOSOVO*
ALBANIA
ADRIATIC SEA
PODGORICA
N
NE
E
SE
S
SW
W
NW
Neretva
Neretva
Piva
Tara
Lim
White Drin
Black Drin
Drin
Drin
Drin
Bojana
Mat
Erenik
Bileća Lake
Skadar Lake
Gazivoda Lake
Slivno
0
Neum
157 t/y
Mljet
0
62 t/y
Herceg Novi
1516 t/y
606 t
606 t/y
Bar
2291 t/y
916 t/y
Shkodër
16243 t/y
6497 t
Vau i Dajës
2250 t/y
900 t
Ulcinj
3490 t/y
7893 t/y
1396 t
2972 t/y
2072 t
Lezhë
5182 t/y
LEGEND
Sanitary municipal/regional landfill
Non-compiliant municipal landfill
Illegal dump sites
Stranded debris
Protected area
Floating debris
Marine litter
Region
Waste from municipalities

CROATIA
Dunabe
Bosut
Sava
Tisa
N
NW
NE
W
E
SW
SE
S
Ilok
1516 t/y
Sremska Mitrovica
7122 t/y
16384 t
2136 t
Bogatic
6438 t/y
Shabac
11788 t/y
Sava
Dunabe
BELGRADE
Brchko
0 t/y
Bijeljina
9398 t/y
2819 t
1931 t
950 t
638 t
Drina
3536 t
Lopare
3139 t/y
Ugljevik
2129 t/y
Jadar
4371 t
Loznica
14572 t/y
Modrac Lake
Zvornik
4315 t/y
1294 t
529 t
Krupanj
2565 t/y
SERBIA
4942 t
769 t
Mali Zvornik
1764 t/y
Bratunac
3099 t/y
BOSNIA AND HERZEGOVINA
Milichi
1095 t/y
329 t
929 t
734 t
Ljubovija
2448 t/y
357 t
Srebrenica
1190 t/y
Bajina Bashta
3990 t/y
Bosna
3464 t
Drina
1197 t
SARAJEVO
Vishegrad
913 t/y
Zapadna Morava
Uzice
7301 t/y
2190 t
Rudo
403 t/y
Rzav
Gorazde
1653 t/y
274 t
1054 t
Cajetina
257 t/y
496 t
120 t
77 t
Lim
Drina
3962 t
164 t
Priboj
547 t/y
Moravica
Ceotina
Prijepolje
1912 t/y
5741 t
Lim
740 t
Pljevlja
2468 t/y
Tara
2648 t
Piva
Bijelo Polje
8827 t/y
MONTENEGRO
Lim
LEGEND
Sanitary municipal/regional landfill
Non-compiliant municipal landfill
Illegal dump sites
Protected area
Hydro power plants
Floating debris
Accumulated debris
Region
Waste from municipalities



MONTENEGRO
KOSOVO *
ALBANIA
MACEDONIA
SKOPJE
N
NE
E
SE
S
SW
W
NW
Prizren
558510 t/y
Shtrpce
1014 t/y
Kukes
6438 t/y
Tearce
5737 t/y
Jegunovce
2757 t/y
Dragash
8686 t/y
2655 t/y
1821 t
834 t
6 t
165 t
344 t
White Drin
Erenik
Drin
Fierzë Lake
Black Drin
Sitnica
Nerodimka
Lepenec
Binachka Morava
Vardar
Treska
Radika
Kozjak Lake
Mavrovo Lake
LEGEND
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