Attila David Molnar & Gergely Hanko

AQUATIC PLASTIC

The transnational river cleanup handguide

Interreg
Danube Transnational Programme
Tid(y)Up

“The river has great wisdom and whispers its secrets to the hearts of men.”

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#dtptidyup #interregtidyup, #transnationalrivercleanuphandguide

CONTENTS

INTRODUCTION 4

FOREWORD 7

THE NATURAL HISTORY OF AQUATIC PLASTICS 8

1.1 The migration of marine litter 9

1.2 The discovery and scientific recognition of riverine litter 11

1.3 The elusive behavior of riverine litter 15

1.4 The formation of riverine litter accumulations 18

1.5 The origins of aquatic plastics 23

INTERNATIONAL RIVER CLEANUP INITIATIVES 28

2.1 Preventing plastic floods on rivers 29

2.2 The significance of river cleanup interventions 31

2.3 Professional river cleanup interventions 34

2.4 Community river cleanup interventions 37

2.5 The Tid(y)Up project 40

YOUR HANDGUIDE TO TRANSNATIONAL RIVER CLEANUP ACTIONS 44

3.1 Introduction - the complete beginner's guide to why to clean up rivers at all 45

3.2 Basics - the beginners guide to river cleanups 47

3.3 Location - how to find the best spots for the river cleanup 50

3.4 Calculation - things to do after pollution mapping 55

3.5 Motivation - bringing helping hands onboard 58

3.6 Mobilization - the tasklist before the river cleanup 61

3.7 Discussion - things to talk through right before the river cleanup 71

3.8 Instruction - what to tell to people at the start of the river cleanup 74

3.9 In action - things to keep in mind during the river cleanup 78

THE AFTERLIFE OF RIVERINE LITTER 84

4.1 Selection - recollection and separation of the collected riverine litter 85

4.2 Recollection and reporting - closing the river cleanup action officially 88

4.3 Resurrection - recycle and upcycle the selective riverine litter 93

EPILOGUE 97

PREFERENCES 98

INTRODUCTION

by ***Attila David Molnár***[1] *and* ***Gergely Hankó***[2]

The year 2022 started with serious river pollution cases across Europe. In January, the Borzhava river (Ukraine) was jammed by floating riverine litter accumulations. February saw the Slaná river (Slovakia) affected by a toxic influx of heavy metals from a deserted mine - still ongoing, as of August 2022. The Somes river (Romania) was struck by a massive plastic flood in March. By May, the size of the floating macroplastic accumulation in front of a hydroelectric power plant on the river Tisza (Hungary) reached the size of 1.4 hectares. River pollution knows no boundaries, eventually reaching our oceans - provided that we remain idle.

Plastic pollution affects all surface waters worldwide. Data suggests that min. 80% of all marine litter enters the seas via rivers, but according to scientific publications as of May 2020, no large-scale, transnational river cleanup operations were in service. Yet, by July 2022 - as a result of carefully accomplished river cleanup operations - more than 270 tons of river litter was removed from the Tisza water catchment area alone. With other environmental initiatives rising up to the challenge, waterways across the world, ranging from Europe to Asia, are receiving helping hands. Still, the job is far from being done.

With this manual we aim to provide help to everyone - professionals and enthusiasts alike – eager to participate in our efforts in managing international plastic pollution in rivers. To achieve this ambitious goal, we rely on scientific publications on riverine- and marine litter in addition to our 10+ years of field experience gained on the rivers of the Eastern Danube River Basin. During these 10+ years of organizing large scale river cleanups, we have been able to positively impact river-based ecosystems and communities in not just Hungary, but as many as 6 countries via our cooperation with the DTP Interreg project Tid(y)Up.

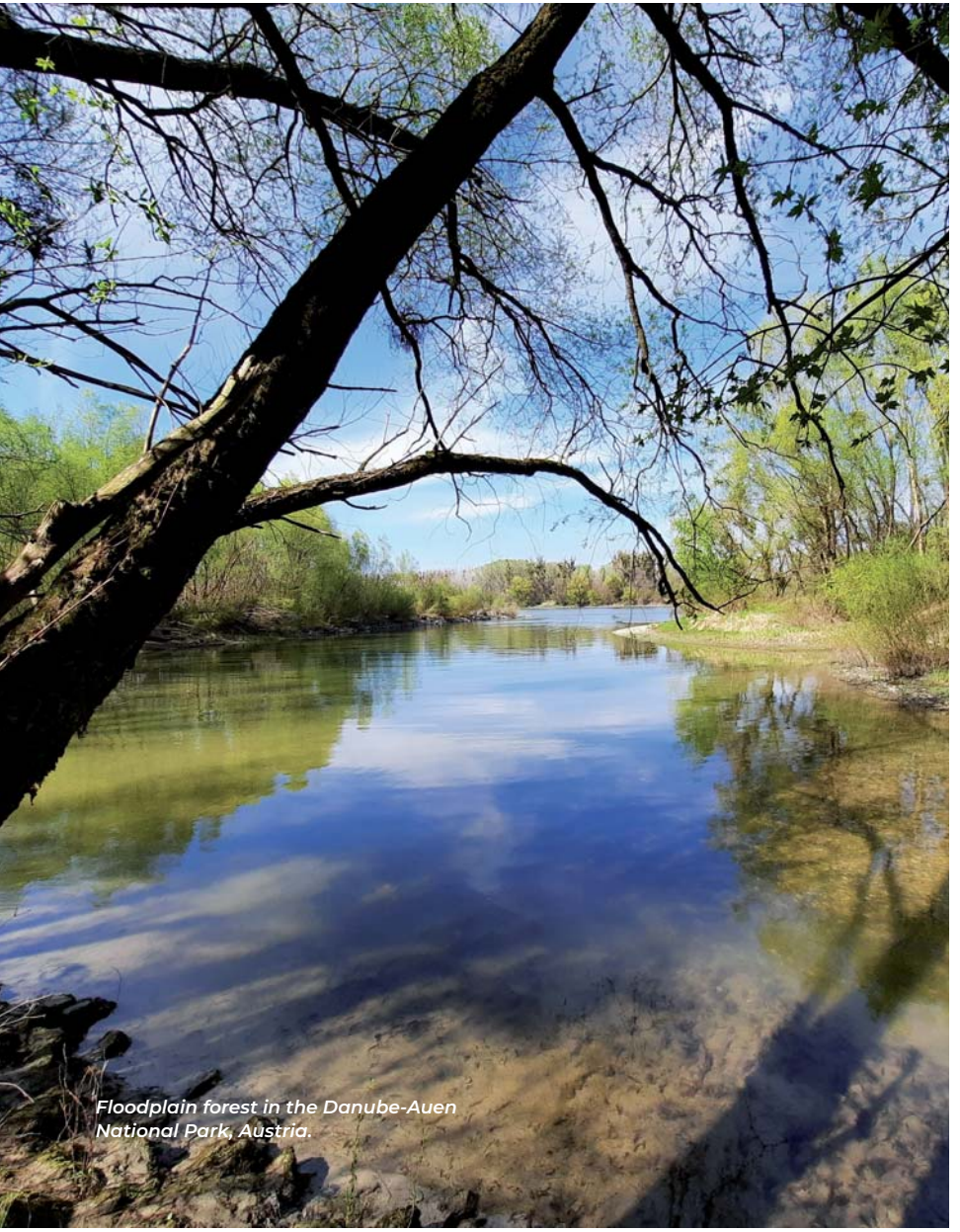
There is a growing agreement in the scientific community that cleanup interventions can mitigate the damaging effects of plastic pollution. To demonstrate how river cleanups can become much more than a

simple end-of-pipe solution, this book is different from an ordinary list of dos and don'ts. In managing complex environmental issues like riverine plastic pollution, best practices, basic scientific- and waste management knowledge, awareness-raising tips are more than necessary.

A river cleanup is not equal to a landfill fillup. We are not about to collect then simply discard the valuable riverine litter from the environment into a landfill. Instead, we re-use it. Marine litter alone causes losses of over one billion euro to the EU economy, and preliminary data has shown that as much as 70% of collected riverine waste can be recycled, thus raising the question: Why has so little been done to effectively capture, remove, and recycle litter from marine environments? On the following pages we will show a short selection of the multitude of products that can be created from selected riverine litter. The collection, sorting, and production process of these products can strengthen local communities, build stronger company teams and NGOs, aid in the development of new goods, and enhance education programs and international projects such as Tid(y)Up.

We are grateful to the Danube Transnational Programme of the European Union for supporting our project in which researchers and experts were involved not only in sampling, analyzing and publishing activities, but also in the dirty-work of waste collection. Witnessing large riverine macroplastic accumulations on video is shocking in itself, but being able to see the tons of litter with one's own eyes and then spending weeks cleaning it up is a life changing experience. We are proud to be members of a project in which all our partners have continually been involved in river cleanup actions on an international scale. This book is based on our shared experience.

July 2022, Danube River, Budapest



Floodplain forest in the Danube-Auen National Park, Austria.

FOREWORD

by ***Gudrun Obersteiner***[3]

Plastic is considered as the fundamental material of the 20th and 21st centuries due to its universal properties, which have established it in almost all areas of our lives. The material's prevalence can also be seen in its worldwide demand, which is still growing almost inexorably. In 2018, global plastics production reached almost 360 million tonnes. However, this development has also been associated with negative environmental effects. The careless and unsustainable management of the material causes plastic pollution in both the aquatic and terrestrial environment. Plastic waste also greatly threatens many animal species, with trace plastic particles having already been detected in human blood among other organs.

Poor (plastic) waste management is the main reason why land-based sources, involving various routes to the sea such as rivers, urban runoff and beach litter, represent about 80% of the plastic debris mass in the world's oceans. But it is not only environmental pollution that must be considered here, but also the irretrievable loss of resources. Only through orderly collection and appropriate recycling can plastics be returned to the cycle, which brings additional environmental savings by avoiding new production.

While plastic debris on beaches and in the seas have been investigated and documented since the 1970s, the sources and entry pathways as well as their environmental effects in rivers are still insufficiently researched. This manual can therefore provide a multifaceted discussion of current and future directions for aquatic plastic cleaning, collection, and recycling. Not only does it explain the process of cleaning actions, which results in less waste in the environment, but it also focuses on sorting the collected waste and recycling it. It will also help increase our knowledge about the dynamics of riverine litter, so that we can better respond in the future. Together with the support of the Tid(y)Up team, let's strive to make our environment more liveable again.

September 2021, Danube River, Vienna

THE NATURAL HISTORY OF AQUATIC PLASTIC

Danube's longest tributary, the Tisza in 2017. The ice flood, combined with a massive plastic flood, brought unprecedented amounts of riverine litter into the EU.

1.1 The migration of marine litter

Given that more than half of the human body (approx. 60%) is made up of water, sufficient freshwater resources are crucial to our survival. We depend on seas and oceans at least as much, still they are getting more and more polluted. The authors of this book are citizens of the European Union (EU) where the Water Framework Directive has been in force since 2000. It declares that ***water*** is not a commercial commodity, but a universal legacy, and as such we have a duty to protect it[4]. According to this directive, the EU member states must bring all their surface water bodies into 'good status' by 2027.

An ambitious goal, especially today, when multiple risk factors challenge all aquatic ecosystems. Global climate change alone poses a big-enough threat, but hereby we discuss yet another risk factor - pollution. Of the extensive types of pollutants finding their way into natural water bodies, this book will focus on a very specific form of water pollution, namely the increasing influx of thermoplastic polymers, also known as ***plastics***.

The general public is now well aware of the great marine litter accumulations aka. 'garbage patches' visible at great oceanic gyres[5]. The scale of this pollution is even more shocking once you consider that of all the mismanaged waste - household and industrial - entering the seas, about 70% sinks to the bottom, 15% is washed upon shores and only 15% keeps drifting in the water column[6]. In other words, the great oceanic garbage patches represent just the tip of the iceberg. At least a little comfort can come from the fact that the dynamics, distribution, composition and ingestion of ***marine litter*** have been well-studied for decades, with the first scientific papers published in the 1970s, and the number of relevant publications growing ever since[7]. However, the source of these massive amounts of marine litter was unclear for a long time.

Thanks to recent studies, we finally have a better understanding of the origins, migration and behavior of marine litter. We always suspected that rivers play an important role in the transport of mistreated waste, but the actual proportions are quite staggering. Data suggests that of all marine plastics, only about 20% can be linked back to maritime and seaside activities and industries like shipping, fishing or tourism[8]. The remaining 80% of oceanic plastic waste is transported from land-based sources into the sea by ***rivers***[9,10]. Of all ***riverine litter*** emerging from residential and industrial sources, up to 75% consists of various types of plastics[11].

The scale of riverine waste is truly staggering. Take for example Europe's second largest river, the Danube, which carries a daily plastic load of 4.2 metric tons, transporting about 1500 tons of plastic per year into the Black Sea[12]. An extensive study on more than 1000 rivers revealed that rivers in Asia (e.g. Ciliwung, Pasig) running through large cities carry even more ***riverine plastic***[13]. The exact quantity of the annual plastic influx into the seas is difficult to tell, with estimates ranging from approx. 0.5-3 million tons[14,15] to as much as 12 million metric tons[16] depending on the methods and approach used during the study.

Riverine litter accumulation: a mixture of plastic, metal, glass and communal waste.

In conclusion, millions of tons of household and industrial waste - mostly plastic - enters marine environments every year via natural waterways. Once in the sea, the vast majority of plastics sink to the bottom or wash up on shores. The remaining tiny fraction (about 15%) of plastic waste makes up the vast oceanic garbage patches, covering thousands of hectares, that consist of thousands of tons of floating plastic[17]. Reading such figures might suggest that rivers are nothing more than transport routes - channeling pollution from one place to the next. But the reality is much more complex - and interesting - than that.

1.2 The discovery and scientific recognition of riverine litter

The 1997 discovery of the Great Pacific Garbage Patch by Captain Charles Moore is a familiar story for many. Back at the time, a plastic accumulation of this size was indeed shocking, regardless of the already extensive knowledge on marine litter and its interactions with marine wildlife[18]. Trying to manage the emerging environmental issue of floating marine litter, the Netherlands-based Ocean Cleanup initiative started its operations in 2013. Shortly after, a landmark survey by professor Thompson and crew directed the attention of academic circles and the general public to the issue of microplastics and marine litter (including plastics) sedimentation[19].

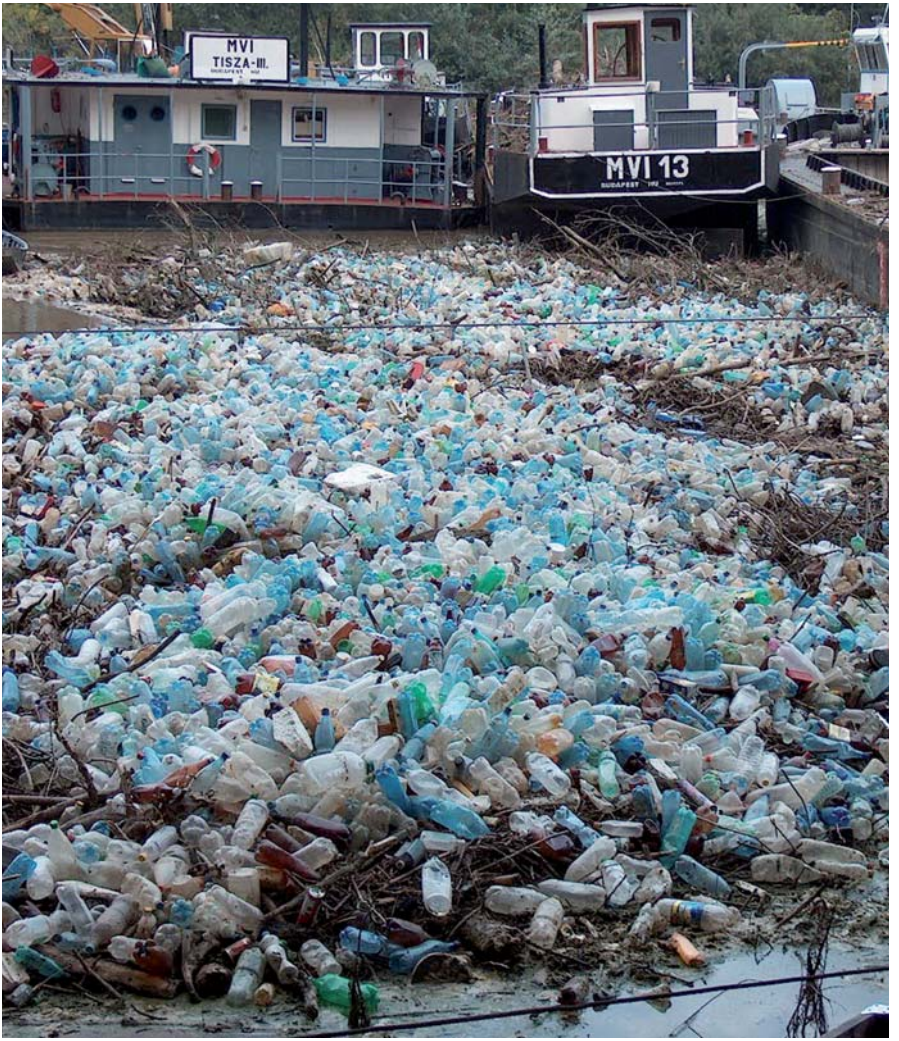
The next milestone towards a plastic free ocean was marked by the 2017 release of the BBC documentary series Blue Planet[20], presented by Sir David Attenborough, which encouraged millions of people, NGOs, and the mass media to take part in cleanup efforts. This shift in public opinion had an impact on consumer habits, and put pressure on legislative bodies to seriously approach resolving the marine litter management crisis. In the European Union alone, managing marine litter costs EUR 900 million every year, highlighting the scale of the issue[21]. From 2021 onwards the EU started to ban the use of some single use plastics, followed by Ukraine in 2022.

Rivers, in the meantime, got much less attention. Scientific output on the plastic pollution of running freshwaters was zero in 2010, with the number of publications slowly catching up by 2019[22]. The recognition of the scale of

plastic pollution in rivers came from different sources at more or less the same time. On the Danube river in Austria, Aaron Lechner was sampling riverine fish larvae but instead of catching larvae he ended up collecting plastics. In 2014 he concluded that 'pooling all samples, the mean density of plastic litter transported in the surface water of the Austrian Danube, was higher than those of larval fish'[23]. This research dealt with only a small subset of aquatic plastic pollution, namely microplastics. These particles are, in most cases, invisible to the human eye. Macroplastics on the other hand - e.g. plastic bottles - are much easier to see, but riverine plastic pollution still remained understudied for a long time. Luckily there are some rare exceptions, like the following study, carried out by water authority experts in the eastern parts of the Danube-river basin.

On the Tisza river (a heavily polluted tributary of the Danube) the Upper Tisza Water Directorate of Hungary has been monitoring the number of plastic bottles carried by the mean flow of the river during flood events since 2004. According to these long-term observations, high waters of the Tisza can carry as much as 500 plastic bottles per minute; a sadly spectacular event named the ***plastic flood***[24]. According to a non representative questionnaire[25] conducted in the Tisza water catchment area, local people's observations are in compliance with the above mentioned survey. Local community members were right when dating the peak plastic flood event to 2017, and mark the year 2000 as the approximate beginning of regular plastic flood events on the Tisza and her tributaries.

Rivers - and other surface fresh water bodies like lakes and creeks - are especially exposed to pollution, making them some of the most vulnerable and endangered of all natural ecosystems[26]. The socio-economic importance of rivers is beyond question, for thousands of years we have used them as a water source, a food source, for irrigation, recreation, and recently hydropower generation purposes, amongst many other uses[27]. Once we apprehend the vital role rivers play in our lives, it may come as a surprise that the recognition of the scale of riverine plastic pollution came only as late as the mid 2010-ties. Researchers, water authority experts, and members



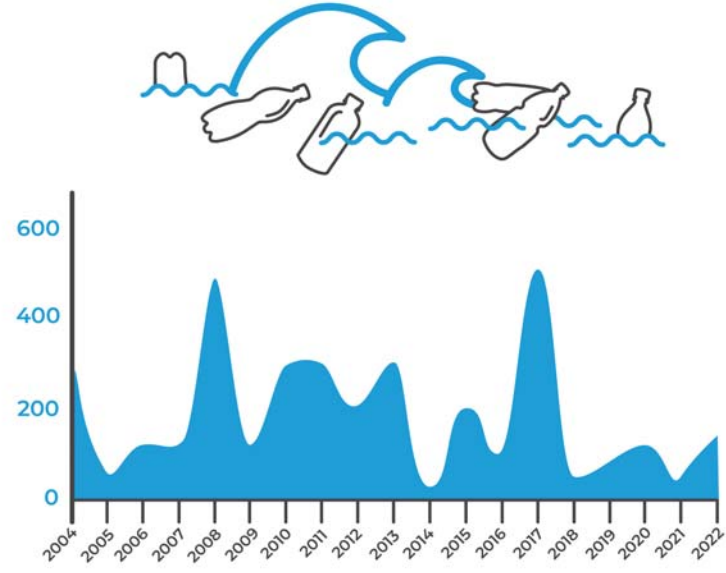
Plastic flood event on the Tisza river.
The mixed floating riverine waste is stopped by water authority barges.

of the general public had to ring the bell together for us to realize how much plastic our rivers truly carry.

This late recognition is caused by multiple factors. Firstly, there is a phenomenon called 'shifting baselines', describing a cognitive process wherein we get used to something, and accept it as natural even though it is not[28]. Single use plastics have been with us for decades, and by now only a few of us remember what life was like without plastic bags and plastic bottles. For the young generations, plastics are an integral part of their surroundings. Like it or not, the 'pre-plastic breed' of people - who vaguely remember how a river looked without plastic pollution - is vanishing. Fortunately, many of these people are active in researching and managing plastic pollution.

The other key reason behind the sadly late recognition of riverine plastics is that this type of pollution is only one of the many ***other threats*** humans have imposed on aquatic ecosystems. From diffuse nitrate pollution to mistreated sewage water; from the influx of abraded tyre particles to

Periodic plastic flood events are marked by a high abundance of plastic bottles on the river surface. Hungarian Water Authority experts data show that quantity can exceed 500 bottles / minute.



Floodplain of the river. The dense vegetation acts like a huge, breathing biological filter.

screen washing liquids and road salt; from microfibers to cosmetic products; from industrial pellets to toxic materials, the list is way too long[29,30]. Even the medicines we use make aquatic life suffer. Following a summer festival called the Balaton Sound, one of Europe's largest lakes becomes practically drugged[31], with fish behavior changing dramatically because of contraceptive agents getting washed into rivers via the sink[32]. To put it more simply, rivers make our comfortable lifestyles possible - and in turn, they pay a heavy price for it. Another important reason behind the late discovery of plastic pollution in rivers, as it will turn out on the following pages, is that riverine litter is really good at hiding.

1.3 The elusive behavior of riverine litter

Imagine that you are a plastic bottle, floating in a river. You might as well remember the 10 minutes of quality-time spent with your buyer, but these sweet times are over: in this mind experiment you are already empty, disposed and alone, floating along in the middle of the river, slowly riding the current and drifting in the sunset until you reach the sea. Now let's try and picture some of the things that can cross your way. Things like a motorboat with high tail-waves, a strong headwind, a hydroelectric power plant, a flash-flood, a big chunk of driftwood, a U-turn in the riverbed, a river clean-up volunteer eager to pick us up, or

even a drying up riverbed. Just from these few scenarios it is obvious that the movement of riverine litter is acutely influenced by the outside world, forcing it to make significant changes in its course again and again.

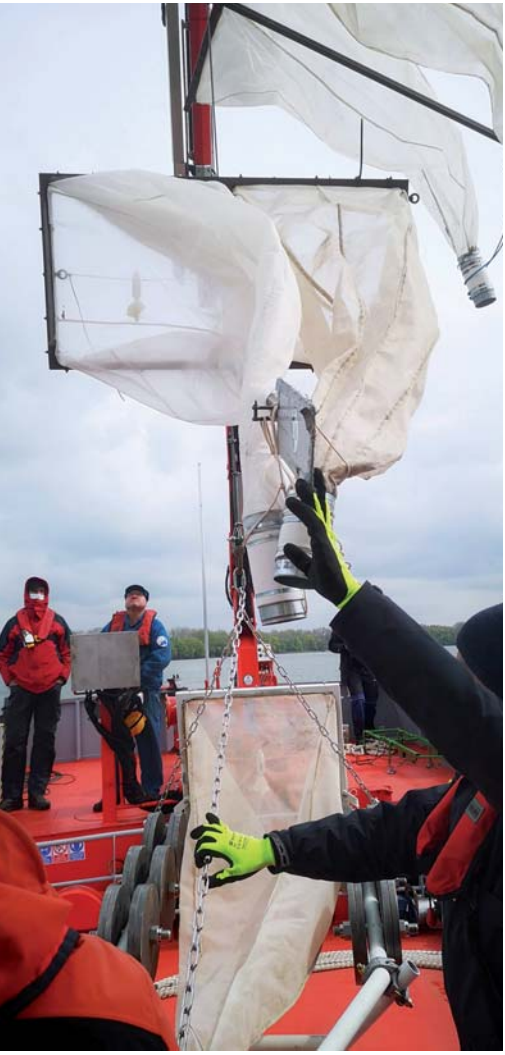
Let's take things a little further, this time imagine yourself as a discarded plastic bag. Wind and rain took you from the street into the river. Unlike a bottle you are not floating on the surface, instead - being neutrally buoyant - you drift below the surface like a jellyfish, towards the sea. As a speedboat surges past, its prop chops a neighboring plastic bag into pieces, while another one is caught on a tree branch - but so far you have made it. Then you find yourself getting heavier and heavier as small living organisms start calling you 'home.' They are happy and multiplying, and before you know it, you are sinking down into the abyss, hidden from sunlight, to the very bottom of the river. Do not think you are unlucky, this happens all the time. As microbial and multicellular life forms (e.g. Bryozoans) start covering marine litter, its density and therefore its buoyancy changes. After a certain point the litter stops floating and starts to sink, in most cases, thousands of meters deep[33].

Discarded plastic bottles during their migration. An adventure shared with large pieces of driftwood as well as wild ducks.

In this second thought experiment we demonstrated that aquatic plastic migration is affected not only by physical factors like wind, currents, and temperature, but by the varied interactions with wildlife. Rivers are complex ecosystems in most cases teaming with all forms of life, trying to colonize - and sometimes engulf[34] - plastics drifting in the water. Scientists describe the new border area between synthetic polymers and the biosphere as 'plastisphere', a new frontier in microbial research[35]. These many interactions with living beings led us to apply terms such as 'migration' or 'behavior' when describing the 'afterlife' of single use plastics once they are waterborne.

In summary, the common belief is that plastic floods on rivers are mostly made of loating garbage and sooner or later all this waste is going to end up in the sea, but this notion is misguided. Data on aquatic litter migration actually suggests that once waterborne, riverine litter behaves in ways very similar to marine litter meaning that a large proportion actually sinks down, gets deposited, and only a fraction is washed ashore or keeps on drifting[36]. As discussed above, riding the currents is not equivalent to reaching the sea in the first place. Rivers are complex, living ecosystems that alter the migration of aquatic plastics significantly.

Since most aquatic plastics stay hidden in the murky depths, or are fragmented into pieces invisible to the human eye, it is no wonder that the majority of riverine litter remained out of sight, out of mind for such a long time. Scientific research however, has seemingly begun to catch up with this significant environmental issue[37], and so our knowledge base is at last expanding. It is safe to say that riverine plastic flood events - just like the oceanic garbage patches - are only the tip of the trash iceberg. What we see during a plastic flood is only a small fraction of the entire pollution our unfortunate river is forced to carry. But this unfortunate nature of floating and washed up macroplastics makes them the easiest to study and to collect. On the following pages we are about to take a closer look at them.



On the hunt for submerged riverine litter. Researchers monitoring macroplastic particles in the Danube river during the Tid(y)Up project.

1.4 The formation of riverine litter accumulations

In 2006, a girl named Sonia (3) from Lviv spent her summer holidays in Transcarpathia, Ukraine. Helped by her sisters she placed a message in a bottle and entrusted it to the Tisza river at Vinogradov. In December 2021, Sonia's bottle was found during a river cleanup event near the city of Szeged, Hungary, with the message asking the finder to send the little girl some presents[38]. After 15 years, Sonia was surprised to find her wish fulfilled in the form of some nice Christmas presents. As this real-life story illustrates, a message in a bottle can travel across borders and is rarely considered a piece of trash. Instead, these floating displays of spirit are respected as a traditional form of communication and treated accordingly. This, however, does not apply to the tons of riverine litter - mostly plastics - found at the same site.

Sonia's famous letter was buoyant for approximately 700 river kilometers before being washed up on the shore in the company of thousands of other plastic bottles and floating riverine lit-

Message in a bottle. In Serbia, volunteers of Tid(y)Up found a kind letter written and drawn by a Hungarian girl.

ter particles, forming a so-called ***coastal riverine litter accumulation***. It is known that rivers do not simply transport waste into the sea, they also act as traps and depositional sites for riverine litter[39]. The accumulation and deposition of riverine litter depends on a number of factors from the litter particles' characteristics (size, buoyancy, composition, density, etc.) to the river's hydrodynamical parameters (velocity, discharge, turbulence, riverbed morphology, etc.)[40]. The retention capacity of a certain river section is also influenced by 'roughness' of the shorelines as low-flow sedimentation areas can also be generated by vegetation.

The river that carried Sonia's letter for so long is the heavily polluted Tisza, a left side tributary of the Danube, collecting water - and pollution - from countries such as Ukraine, Romania, Hungary, Slovakia and Serbia. In the floodplains, her shorelines are mostly covered with dense vegetation (alluvial forests with the size of 33.300 hectares in Hungary alone[41]). The mixed

population of poplar-, willow- and oak trees act as a giant filter, absorbing organic and inorganic particles alike. After floods, the retreating waters leave behind debris, and so coastal riverine litter accumulations are formed. A 2018 case study on a coastal riverine litter accumulation site at Tiszaszalka carried out by citizen scientists revealed litter densities as high as 12+ macroplastic items/m^2. For comparison, the subsequent river shore cleanup intervention carried out on the same site removed 4 metric tons of riverine litter from an area of 4 hectares, 41% of which consisted of recyclable materials such as plastics, glass and metal[42].

It is important to highlight that coastal riverine litter accumulations are only temporary formations. Similar to the stopover sites on bird-migration routes, they represent an interim stage on the great journey of riverine litter. Alternative routes of the accumulated riverine plastics include degradation, fragmentation, sedimentation, ingestion, or continuation of the journey with one of the ensuing floods.In any case, coastal litter accumulations will

Winter river cleanup in a floodplain forest close to Tiszaszalka.

Fossilized plastic' near the village of Zsurk. Over long periods of time, stranded riverine litter can be completely covered with sediment.

disappear from sight within a short period of time following the pollution event. The movement patterns and dynamics of drifting riverine plastic pollution particles is still greatly understudied. The few available reports show that telemetry methods include individual tagging - a method much akin to bird ringing - and the sophisticated GPS tracking, usually following riverine plastics for short distances in a narrow time window[43]. Long term observations include a 2845 km journey over 94 days on the river Ganges[44] and a 300+ km journey over one week on the river Tisza[45]. Real time GPS tracking data revealed that apart from coastal depositional sites, riverine litter is most likely to be halted at artificial river engineering structures like groynes and hydroelectric power plants (HEPPs). The result is the formation of ***floating riverine litter accumulations***.

There is still a gap in our knowledge about the riverine litter retention capacity of artificial river engineering structures like dams and HEPPs in fluvial systems[46]. In the Danube water catchment area, however, field reports reveal that massive floating riverine plastic accumulations are formed on the river Hron (Slovakia)[47], river Tisza (Hungary, Serbia) and Danube river (Romania and Bulgaria) on a repeating basis. Just like their coastal counterparts, floating litter accumulations are also temporary formations.

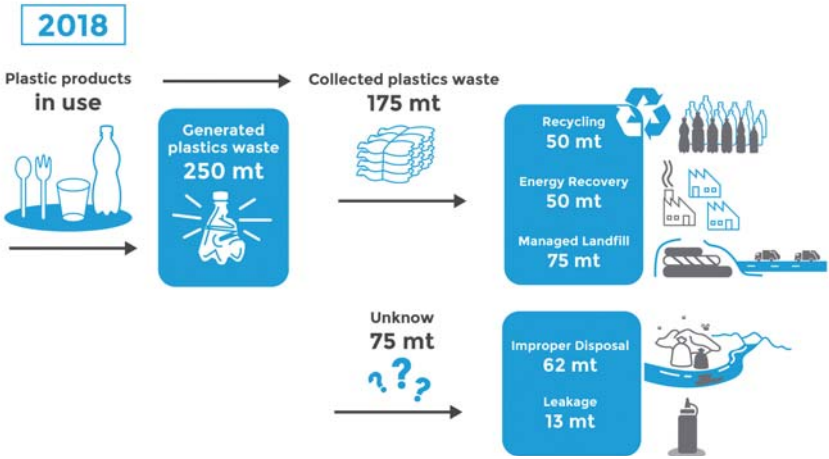
As can be seen above, riverine litter is capable of traveling long distances over long periods of time, forming multiple stopover-sites aka. accumulations along its way. In rivers, plastic accumulations are formed at low-flow stretches both above-, and below the surface, as well as at artificial structures such as HEPPs, making fluvial systems even more contaminated than marine benthic habitats[48]. As plastic floods have become a recurring series of events, riverine litter accumulations will probably continue to grow in their numbers and size. Before we investigate possible ways to intervene, we will discuss the sources of this riverine litter.

Riverine litter accumulation in front of a hydroelectric power plant near Kisköre, Hungary, on the surface of river Tisza.

1.5 The origins of aquatic plastics

Illegal dumping of domestic communal waste along natural waterways is a widespread phenomenon with multiple backing factors, such as changing consumer habits; the overall increase in plastic packaging and consumption; economic difficulties; improper waste management; lack of education and awareness; lack of infrastructure and expertise, etc. The rate of recycling lags far behind production, with hardly 15% of all produced plastics ever getting recycled[49]. 60% of all plastics produced do not get back in the loop, instead ending up in landfills, or worse yet, in natural environments[50]. In natural waterways plastic pollution poses a serious threat to wildlife and local communities[51,52]. It is a cause for concern that more plastic contamination is building up in the water columns and shores of rivers, as well as in riverbeds, in estuaries and in the oceans[53,54]. According to EU reports, approximately 80% of all accumulating environmental waste is plastic, with nearly half of these plastics being single use products[55]. Consumer habits follow a trend as if 'we were living continuously on a PanAm flight'[56]. As a result of this throwaway culture, aquatic ecosystems are more polluted than ever before.

The origins of environmental plastics. Mistreated domestic and industrial waste ends up in the environment in large proportions.



Most of the marine litter - including oceanic plastics - derive from land based sources and are transported to the sea by running waters[57]. The origin of the pollution can be a specific, pin-point location (e.g. plastic production plant, illegal landfill) or can refer to a diffuse source (e.g. road surface runoff water). Specific pollution entry points into the environment are described as leakage points[58] or ***hotspots***. After domestic and industrial waste is illegally discarded and left unattended, environmental litter is generated. Close to natural waterways the discarded litter is swept away by rising water levels, thus further contributing to the overall mass of riverine litter.

Following the identification of rivers as the main carriers of mistreated waste into marine habitats, studies on coastal leakage points (further referred as hotspots) started to emerge. A 2018 citizen science river pollution survey in Ukraine (Eastern parts of the Danube river basin) revealed that illegal dumping along rivers in the region is not an occasional, but a regular and - due to a lack of alternatives - a widely accepted way of waste disposal[59]. Over a short 60 kilometer river section between Vylok and Vinograd, volunteers reported 17 major hotspots: illegal coastal landfill sites, where habitat rehabilitation would require the application of heavy machinery. Before it's invasion by neighboring Russia, 400 million tons of household waste was not properly managed every year in Ukraine - a serious environmental issue most likely to intensify with the escalation of war[60]. Limited access to good quality tap water, and the influx of war-refugees from Eastern Ukraine, further increased the usage of single-use plastics in Transcarpathia, westernmost corner of Ukraine, where a third of the municipalities function without proper waste management. Illegal deposition of waste along natural waterways is not a problem localized to Ukraine, it is in fact a widespread phenomenon affecting all corners of the world.

A 2015 study along four Chilean rivers[61], and a 2019 comprehensive survey along the waterways of Germany[62] reported mean litter densities between 0.14 and 3.42 items/m^2 in the riparian zones. Illegal coastal landfills can be found across the EU including member states like Romania, where, according to Water Authority figures, coastal hotspots can load as much as 300 cubic meters of mistreated waste into the river Somes (a secondary tributary of the Danube) at a single flood

Coastal hotspot in Yasinya, Transcarpathia. At locations like this mistreated waste is deposited by its owner and so it exits the legal waste management system and enters the natural environment.

Coastal hotspot near Rakhiv, Transcarpathia, Ukraine.

event. The management of riverine litter of such quantities poses a special challenge during high waters.) Once the mistreated waste is waterborne and swept away, the origin-identification of the polluter becomes difficult if not impossible, as ***transnational plastic floods*** can cover large distances and cross borders easily. A questionnaire survey among inhabitants of the Tisza water catchment area shows that the local population is aware of the environmental problem (66% of them have personally witnessed plastic flood events and 83% have seen coastal riverine litter accumulations)[63]. The same survey reveals that riverside communities admit each country's responsibility for the plastic pollution; yet at the same time the inhabitants are quite adept at identifying which countries emit most of the plastic into the river - the resulting rank is in accordance with Water Authority figures[64].

Therefore, it is safe to conclude that all across the world people leave their trash - domestic and industrial waste - along natural waterways. Illegal waste deposits, aka. hotspots are formed sometimes out of ignorance, in other cases out of necessity, as a result of humanitarian or financial crises. It is important to note that these formations are not equivalent to coastal riverine litter accumulations. Hotspots contain all fractions of mistreated waste (heavy and light alike) while coastal accumulations are only made out of the floating/buoyant fraction, washed up onto the shore. On the previous pages we have given a brief description of the generation, formation and distribution processes of aquatic plastics and highlighted the multiple connections between riverine and marine litter. In the next chapter, we will discuss methods with which to approach river cleanups.

A riverine litter accumulation on the Latorica river, a tertiary tributary of the Danube, in Ukraine. The mitigation effect of the intervention changes the environmental status of lower sections of Latorica, the entire Bodrog, Tisza, and lower sections of the Danube for the better - not to mention the Black Sea.

INTERNATIONAL RIVER CLEANUP INITIATIVES

Given their relatively light weight, plastic bottles can be loaded into recreational crafts like this canoe in large amounts.

2.1 Preventing plastic floods on rivers

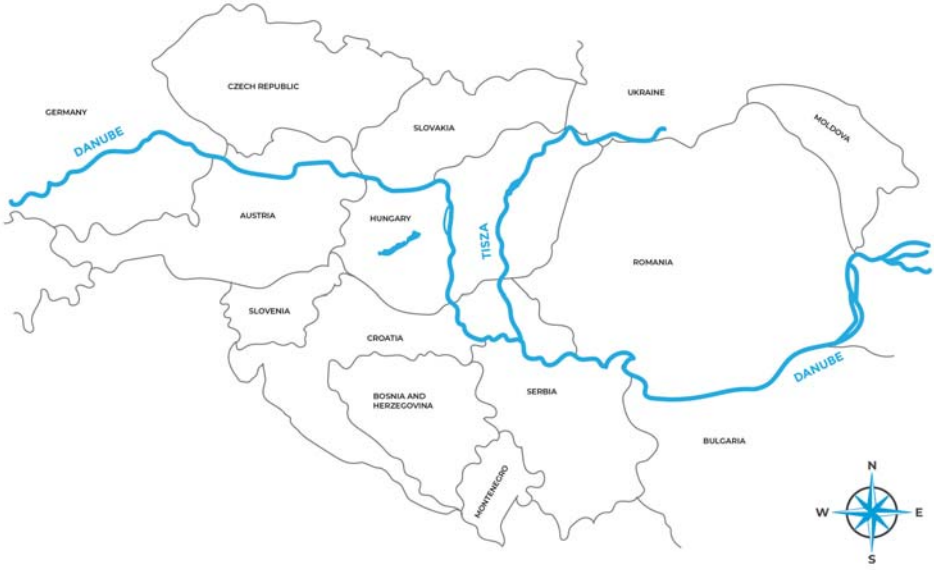
The general understanding among environmental and waste management experts alike, is that ***preventive actions*** - solutions managing the source of a problem (e.g., riverine plastic pollution) - are much more preferable than ***reactive actions***, such as river cleanup interventions. In theory improving the quality of polluted surface water bodies and restoring freshwater habitats affected by transnational river pollution depends on stopping mistreated waste from entering natural waterways[65]. In the case of river pollution, eliminating coastal hotspots seems to be an obvious solution - but putting theory into practice is usually more difficult than it sounds. As discussed earlier, sanctions are rarely effective, as it is generally hard, if not impossible, to enforce the 'pollutant pay principle,' especially when fines are small and enforcement is weak. The development and operation of effective waste management infrastructure usually involves a lot of investment (in both time and capital), with the river pollution growing in the meantime. Nevertheless, there are some exceptional examples and promising pilot projects on how to manage the pollution of rivers right at the source of the problem.

In the Eastern corner of the Danube river basin at the headwaters of the Black Tisza river, a crowdfunding campaign raised $10.000 to support a local environmental initiative[66] in its efforts to collect domestic waste selectively. The 'River Saver Truck'[67], purchased from these donations, serves approximately 10.000 people in and around the settlement of Yasinya (Ukraine). During the first year of its operation, the initiative collected approx. 5760 cubic meters of selective waste that otherwise would end up in the river[68], with the revenue from selective waste allowing for the employment of 5 people. Another example of an effective pollution management endeavor is the Call-Action project,[69] which supports waste management experts in Uzhhorod and Beregovo (Ukraine) in their efforts to extract at least 690 tons of selective waste from landfills and the environment. Meanwhile, the Zerowaste Tisza River[70] project has been setting up selective waste collection points and experimenting with the installation of Safe Water Access Points (SWAP)[71]. The purpose of SWAPs is to reduce the usage, and increase the recycling of, single use plastics while providing safe drinking water to those in need (refugees, off the grid populations).

The River Saver Truck in Transcarpathia, Ukraine. The minor 10K USD investment allows Ukrainian eco-activist and waste manager Francz Béla to collect selective waste from five settlements, preventing tens of tons of household waste from getting into the river.

Therefore, it is safe to say that preventing pollution from reaching natural waterways (primarily by addressing hotspots) is the most cost effective and environmentally friendly solution to managing riverine litter. Thus, those looking to limit riverine pollution should start by targeting hotspots, so as to avoid their formation or eliminate them before high waters can carry mistreated communal and industrial waste into waterways. However, effectively making use of this approach is very difficult, especially if a given country is facing financial or humanitarian difficulties (not to mention a crisis such as the war in Ukraine). Unless conflicts are resolved and conditions for a sustainable waste management system are provided, these preventive measures will remain in an early, experimental phase, making other measures, such as river cleanup interventions, ever more important.

Europe's second longest river, the Danube, and her longest tributary, the Tisza.



2.2 The significance of river cleanup interventions

The economic impact of plastic pollution in marine environments has long been recognized, namely its deteriorating effects on industries such as fishing and tourism[72]. According to a 2019 report, marine litter caused a €300 million loss to the EU economy (entanglement, lost revenues of the fishing industry). Responding to this growing environmental challenge, beach- and ocean cleanup activities have become more prevalent in recent years,[73] with the EU aiming to bolster support by contributing over €600 million annually[74]. Regardless of their staggering nature, these figures do not reveal the true sociological, environmental, and economic impact marine plastic pollution has, as they exclude its consequences on human welfare, the reduction of ecosystem services, and the loss of cultural values (e.g., recreation or landscape aesthetics)[75].

Polluted waterways repel not only wildlife but tourism, too.

Freshwater environments are no exception, as fishing and tourism[76] also suffer the consequences of riverine litter and plastic pollution. In addition to the above, rivers provide a lot of other vital services to human populations including water supply (drinking, irrigation), food production, recreation, and hydropower generation[77]. Even though rivers play such fundamental roles, they are among the most endangered ecosystems in the world, with their biodiversity in a serious decline[78]. Surprisingly, as of May 2020, no large scale international river cleanup efforts were in effect to mitigate this ecological issue[79]. This unfortunate lack of cleanup efforts can only partially be explained by the difficult conditions involved in riverine litter removal[80]- as the antiquated notion that river cleanup operations are end-of-pipe solutions likely plays a greater role in decreasing their prevalence[81]. Hereby we will discuss why this argument is out-dated and can no longer be considered valid:

Degradation. No matter how carefully they are manufactured, no plastics are immune to degradation. Photodegradation by UV light and oxidation affects mostly stranded plastics[82] (e.g. like in coastal riverine litter accumulations), resulting in beach and riverine litter that is susceptible to micronization by the application of a very light pressure[83]. Submersed aquatic plastics are either subjected to degradation via abrasion or bacterial decay[84]. River cleanup actions remove environmental plastics and prevent such degradation.

Interactions with wildlife. Regardless of their size, plastic particles cause a lot of interference with inhabitants of freshwater ecosystems. Aquatic plastics (micro- and macro plastic particles alike) cause entanglement, optical and acoustic pollution, ingestion, and, in severe cases, suffocation and starvation for all kinds of species[85]. Stranded riverine litter can alter shoreline conditions and can lead to the colonization of floodplains by invasive species. River cleanup actions remove environmental plastics and prevent such interactions with wildlife.

Infection. Harmful chemicals are adsorbed to the surface of plastic particles, leading to the incorporation of these contaminants into animal tis-

sues on lower trophic levels. This contamination can reach human populations via the aquatic food chain, thus raising concerns about not just animal but also human health[86]. River cleanup actions remove environmental plastics and prevent such infection cases.

Apart from preventing plastic degradation, harmful interference with wildlife, and obvious threats to human health, river cleanup actions have other benefits too. First and foremost, local communities and natural habitats are directly and immediately impacted by a cleaner and healthier environment after a river cleanup action. Less obvious, but still significant, is the indirect beneficial effect on downstream communities and natural habitats (lack of pollution, clear fresh water). In this respect, the closer a given river cleanup action is to the pollution source, the better.

Nowhere is the need for plastic waste mitigation more obvious than in the case of marine environments, where up to 80% of all plastic contamination

Plants grow in broken glass. Riverine litter influences the everyday life of plant and animal species in a myriad of ways.

is coming from rivers. Additionally, cleanup interventions can positively influence education, awareness raising, and recycling potential, amongst a variety of other fields. Thus, river cleanups can no longer be classified as part of end-of-pipe solutions. Instead, they are proven methods that play a critical role in the protection and restoration of natural freshwater resources. In recent years, the growing awareness about plastic pollution has finally led to a steep rise in the number of river cleanup initiatives across the world.

2.3 Professional river cleanup interventions

In this book, we use the term 'professional' to refer to river cleanup interventions that:

- are implemented by trained, officially employed, and experienced personnel;
- are carried out throughout the year, often in difficult conditions;
- lead to the removal of a considerable amount of riverine litter;
- involve the application of heavy duty machinery often developed for this very purpose.

The Netherlands based NGO, Ocean Cleanup (OCU) is leading the way with its meticulously developed series of riverine litter collecting workboats, called 'Interceptors'[87]. After fully examining the specific role rivers play in the contamination of marine environments, the OCU shifted its focus from the open sea to running freshwaters, and used its unique reputation and influence to set up these sophisticated workboats where they are most needed: on various rivers in Asia where plastic pollution is an around-the-clock phenomenon. On the other side of the globe, another Dutch NGO, Clean Rivers, applies the simpler 'Litter Traps' to capture floating riverine litter. These devices, often built from recycled plastics themselves, are low maintenance and mainly use the current itself to collect plastic particles of all sizes[88].

In the Danube river basin, floating riverine litter accumulations are targeted on a large scale by the workboats of Hungarian Water Authorities. The application of modified barges has proven to be especially successful on the fastly running and dangerous waters of the Somes and Upper-Tisza rivers. The temporary system of refurbished workboats has so far managed more than a thousand cubic meters of riverine litter and about 900 tons of organ-

Partial river bed blockage on the river Tisza at Vásárosnamény during a winter flood in 2021. The temporary structure operated by FETIVIZIG successfully recovers about 90% of the floating plastic particles to the shore for recovery

PETII, the low cost and maintenance workboat, on a winter river cleanup intervention on the Bodrog river. The arms on both sides, just like the front collector basket are detachable and can be adjusted according to the current in order to retrieve floating plastic during flood events

ic waste (mainly driftwood) since their first operation back in 2020[89].

The PETII is a lightweight fast-response riverine litter collector boat[90] developed by the Hungarian based environmental initiative PLASTIC Cup. The ship runs mainly on renewable energy (such as the flow of the river), and instead of setting up a complete closure of the river, it uses the special hydrodynamic characteristics of the floating litter for its separation and collection. PETII does largely the same jobs of the previously mentioned workboats, differing in the fact that it uses extendable arms. These arms swing out from both sides, making the PETII one of the most capable litter removal machines on smaller affluent rivers like the Bodrog, since it targets the mean line of flow where most of the buoyant riverine plastics are drifting.

Floating riverine litter accumulations that are hindered by HEPPs and dams provide much more comfortable conditions for mitigation efforts. Post-flood circumstances also provide more ideal conditions, as they are characterized by slower currents and a big time window to work in. The reliable infrastructure provided by water engineering structures often comes with the presence of trained personnel and the chance to work on plastic accumulations once weather conditions turn for the better. At the Kisköre dam and HEPP on the middle Tisza river, water authority experts of KÖTIVIZIG have handled repeating plastic floods for multiple years. During each intervention, they manage floating riverine litter accumulations over 1 hectares in size and with an overall mass of 8 to 10.000 tonnes–organic and inorganic waste combined (Fig. Professional river cleanup intervention on a floating riverine litter accumulation. The Middle Tisza Water Authority Directorate is pictured using ice breakers, barges and grappling machines). Such stagnant floating riverine accumulations are also successfully recovered by the German developed workboat CollectiX, which was tested on rivers like the Danube tributary Hron in Slovakia[91]. Fortunately, workboats applying a similar litter extraction method are being launched all over the world[92, 93, 94, 95].

Another frontline in the battle against riverine - and marine - plastic pollution is the application of litter collection technologies capable of working without a permanent staff. The 'Trash Wheel,' launched in Boston in 2014, is a classic example of such machinery that has been adapted to all kinds of rivers around the world in recent years[96]. The list is long, starting from structures much akin to the classic set of booms used to skim and contain oil after spill events[97, 98], through various kinds of lit-

ter traps[99, 100], to the semi- or fully automated litter collection devices like the River Skimmer[101] or the cutting-edge robots developed by the München Technical University to harvest litter from the water's surface, as well as from the seabed[102].

In conclusion, professional river cleanup interventions mainly target floating/drifting litter. They are often carried out in difficult conditions like winter floods, when plastic particles move at an increased speed due to greater flow. Other times they target stagnant floating accumulations of litter where workers remove large amounts of pollution from the environment. Professional river cleanup actions usually involve a small number of highly trained, skilled people. The application of specifically designed and/or heavy machinery comes with increased costs of production, maintenance and operation, but the application of sophisticated technologies often results in a higher amount of retrieved riverine litter.

2.4 Community river cleanup interventions

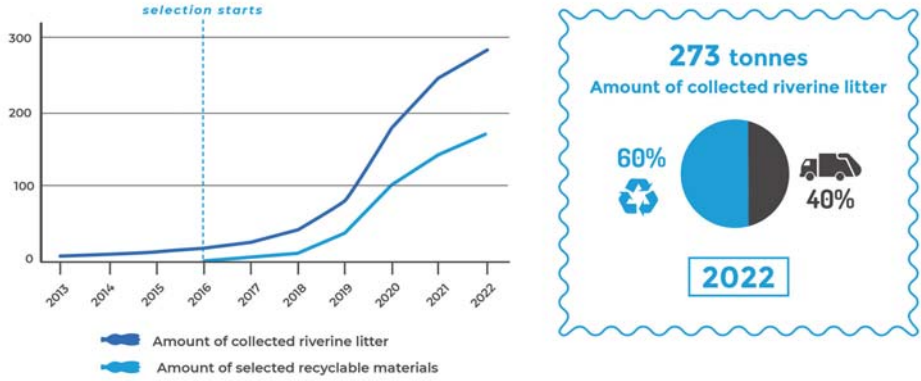
Unlike the professional interventions described above, community river cleanup efforts are most often grassroots initiatives that:

- are carried out by large numbers of people from different backgrounds;
- often involve coordination with an NGO and/or local communities;
- are implemented mostly by volunteers, nature enthusiasts and only partly run by experts or trained personnel;
- involve the application of privately owned boats and recreational crafts;
- have considerable awareness raising, team building and community building effects;
- lead to the removal and treatment of a relatively small amount of riverine litter, but to a comparatively large outreach presence;
- generally entail the collection of scientifically relevant data in addition to the collection of riverine waste
- affect local communities and the general public alike, as they are often accompanied by strong media interest.

Community river cleanup actions have lots in common with traditional beach- and ocean cleanup initiatives, but they have many unique features due to the unique nature of the given river they are trying to clean. The water velocity and depth-, the characteristics of the shorelines-, the availability of coastal infrastructure-, and the awareness of local populations to the level of pollution are all decisive factors that affect the protocol of each and every effective and carefully implemented river cleanup action.

Out of many emerging European projects, three initiatives have had the most significant results - each with a different field of expertise, but each very much related to the common cause of plastic free rivers and oceans. ***Plastic Pirates*** (funded in 2013) is a Germany-based, internationally acclaimed, environmental initiative leading the way in environmental education and citizen science projects with expertise in measuring the macro and microplastic particle count in running freshwaters[103]. The ***River Cleanup*** project is centered in the Netherlands, but grew to the international level shortly after its foundation in 2017. River Cleanup is the crown jewel of all river cleanup initiatives, characterized by an immense amount of retrieved riverine litter and a very broad volunteer base. By mobilizing more than 17000 people across the world, the environmental initiative has already removed more than 2500 tons of riverine litter from the environment[104].

The third international river cleanup initiative of note is the ***Plastic Cup***. Founded in 2013 in Hungary, the Plastic Cup (Pet Kupa in Hungarian) soon became the main driving force behind innovative river cleanup actions carried out in countries across the Eastern parts of the Danube river basin. Although the 300 tons of riverine litter managed by the initiative may seem small when compared to the aforementioned projects, the Cup's results in recycling speak for themselves[105]. Experience shows that by following their protocol, more than 60% of the retrieved riverine litter can be recycled. With more than 180 tons of riverine plastic, glass and metal derived from the environment as well as landfills, returned back to the cycle of reuse , Plastic Cup leads the way for all river cleanup initiatives with a circular economy concept in mind[106].



Riverine litter is not garbage. The recycling rate of retrieved riverine litter, based on the data provided by the Plastic Cup initiative suggests that more than half of the pollution can be turned into circular raw material.

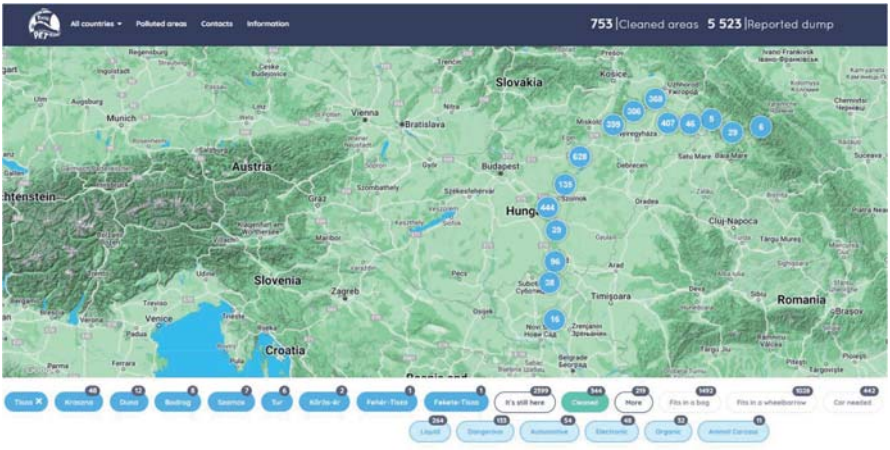
Regardless of their location, international community river cleanup initiatives have multiple features in common. One of them is that instead of focusing on floating plastic, they center their activities around coastal riverine litter accumulations. Much like during a beach cleanup, working along the shorelines of rivers - collecting litter from dry land - is much easier and safer than doing so from the water's surface. Another similarity is that the most prominent river cleanup initiatives measure contamination levels using some form of sample collection and data management, most often in the framework of citizen science projects. In this respect, river cleanup initiatives follow the trends set up by marine litter research projects. A 2015 study reported that out of 40 citizen science projects conducted about marine litter, the majority (38 projects) were carried out in the intertidal zone[107] - the equivalent of floodplains and littoral zones in fluvial systems -, with most of these projects (63%) lasting for a maximum of 1-2 years[108]. Plastic Pirates (Germany) is conducting a large scale and long term research survey (GoEurope!) focusing on the microplastic contamination of rivers. Plastic Pirates has launched the 'GoEurope!' survey with the help of international partners, research institutes, and schools which follow a carefully prepared protocol and guideline[109]. The results of the citizen science project are shared via an online platform[110].

When launching their citizen science project 'Clean Tisza Map', the Plastic Cup (Hungary) initiative decided to apply an open source smartphone application[111] for the purposes of data collection. The use of an application proved to be a novel approach, as out of 40 citizen science projects dealing with marine litter research, only one used a smartphone application for data registration[112]. The application, originally developed to report illegal domestic waste dumps in public areas, was successfully applied on the entire water catchment area of the river Tisza (5 countries) in the wild surroundings of alluvial floodplain forests. An international pollution monitoring effort carried out on the Tisza water catchment area between 2019–2022 revealed more than 5000 cases of large coastal riverine litter accumulations, a result also shared via an online platform[113].

Community river cleanup efforts across the globe tend to focus on coastal riverine litter accumulations; a wise decision given that grassroots operations work mainly with local volunteers with minimal equipment or background training. Community cleanup initiatives successfully invite and involve local communities into the much needed work of data collection and scientific research. To extend our knowledge about riverine plastic pollution and our progress in cleanup operations, citizen science projects are critical. It is safe to say that among the many strengths of community river cleanups, their high potential to mobilize environmentally sensitive people, to raise awareness and to contribute to the better ecological status of rivers by removing large quantities of waste from the environment are the most important.

2.5 The Tid(y)Up project

This book was written in the framework of the Interreg Danube Transnational Project (DTP) Tid(y)Up. As per the project's description '(...) *currently there are no standard methods and consistent data available on plastic pollution of rivers in the Danube Basin that would help harmonized actions of water management authorities and allow cooperation with other sec-*



In seven countries coastal riverine litter accumulations were monitored by volunteers. The result is the multilingual Clean Tisza Map, showing polluted areas in the floodplains of the Tisza River Basin.

tors. In Tid(y)Up, project partners develop and launch a set of integrated actions, consult and provide tools (...) with the aim of monitoring and eliminating the plastic pollution'[114]. One of the first integrated actions was the extension of pollution monitoring activities - on micro-, and macroplastic contamination alike - to every partner country. Macroplastic monitoring activities were carried out in 6 countries[115] following the same protocol[116] first presented on a joint river cleanup action at the Tisza lake[117]. After initial training, the monitoring activity started on the Slovakian section of the Bodrog river, which was soon followed by other Tid(y)Up partners registering and reporting coastal riverine litter accumulations across the project area.

One of Tid(y)Up's most important contributions has been to the development of the online pollution map, with Tid(y)Up partners playing critical roles in the extension of the database to other countries and new rivers. From small tributaries of the Tisza to the Danube, a multitude of natural waterways[118] were added to the database, resulting in a 5-fold increase in the lengths of represented rivers. Site developers used the riverbeds' geographical, hydrographical and morphological data (provided by water authorities) to represent the natural water bodies on the map as precisely as possible. The significance of this development is obvious, as pollution, just like rivers, knows no boundaries.

At first glance, the online river pollution map[119] is only a visualization of large riverine litter accumulations along rivers in the Tid(y)Up project area, but this is far from the case. In terms of the number of entries, Hungary (3500+) has the most, followed by Romania (950+), Slovakia (650+), Serbia (130+) and Ukraine (120+) as per August, 2022. One of the map's most important additional features, from a replicability point of view, is the 'Garbage Report' feature. Suppose we are interested in the biggest macroplastic deposits along the river Bodrog in Slovakia. First we have to choose 'Slovakia' from the drop-down menu in the top left corner and select the tag 'Bodrog' in the middle section. Litter accumulations will be shown on the map, but we will also be provided with an 'Excel download' function. In the downloaded data set, we will find references about the exact location, size and other characteristics (composition, accessibility, etc.) of each of the polluted sites.

Based on the shared data set described above, between 09/2021-05/2022 a series of large-scale, multiple-day, transnational river cleanup actions were carried out in Ukraine, Slovakia, Hungary, Romania, Serbia and Bulgaria on rivers like the Tisza, Bodrog, Bega, Túr, Arges and the Danube[120]. The 347 participants collected 14964 kgs of riverine litter, more than 50% of which was redirected into selective waste management systems[121]. At the beginning, these joint international river cleanup actions stuck to the protocol developed during the 10 year operation of the Plastic Cup initiative, with great success: ≈15 tons of retrieved riverine waste. But the most valuable conclusion of these joint pilot actions was that due to differences in the hydromorphology of rivers, the available infrastructure, and the legislative background in each country, the protocol had to be adapted to local conditions. The shared set of conclusions and experiences called for the release of a new, edited version of the Transnational River Cleanup Handguide - this very publication.

International river cleanup interventions, thus, need a set of special people, a solid technical background, and a unique set of tools and protocols to become more effective in managing riverine litter. As per August 2020, there are no conclusive hand guides available on how to manage transnational plastic pollution cases on rivers. The currently available publications, instructions, and hand guides on river pollution management only discuss the matter on a national or regional level[122, 123]. A recent UN study focuses on preventing plastic pollution and on

Community river cleanup actions provide a unique opportunity to bond with rivers, spend more time close to natural waterways.

system-level solutions, but provides little reference on how to deal with plastics that have already been disposed into the environment[124]. The treatment of transnational river pollution cases requires a comprehensive, well tested, and well proven protocol that can be altered to fit the specific attributes of a certain river. To achieve the ambitious targets of the EU Water Directive, or the System Change Scenario[125] set for 2040, international river cleanup interventions must rise up to the challenge and make use of all available tools. The main goal behind the release of this handbook, based on the shared experience of river cleanup experts across 7 countries, is to provide efficient and valuable help in this regard to not just waste disposal experts but also to lay-people looking to help return our shared waterways to their natural states.

YOUR HANDGUIDE TO TRANSNATIONAL RIVER CLEANUP ACTIONS

River cleanup action during wintertime. The volunteers of the Plastic Cup initiative work alongside Water Authority experts at the tributary of the Somes river into the Tisza.

3.1 Introduction - the complete beginner's guide to why to clean up rivers at all

In the first two chapters of this book we discussed the various ways aquatic plastics and other kinds of riverine litter are formed, transported, and transformed. Their journey from our doorsteps, to our rivers, and then to the vast ocean is a great adventure, yet one we must describe scientifically. To solve a problem - especially a complex issue like riverine plastic pollution - we should know every little detail and alter our approach accordingly. We have given an overview on existing river cleanup procedures from the most professional technologies to community efforts, but moving forward this book will change from addressing riverine pollution management from a scientific lens to a more practical one. We will try to find the Achilles heel[126] of riverine litter pollution and target the vulnerable spot(s) in the best ways we can. But before you grab your gloves and trashbags, it is once again worth asking: why do river cleanups at all?

In Chapter 2.2, we discussed some of the most important reasons why river cleanups should no longer be considered as end-of-pipe solutions. Still, this does not explain why anyone - notably you - should clean up someone else's mess - why not just leave it to them? Well, for starters, rivers need us, just like we need them. In order for our rivers to stay healthy and continue providing us with fresh water, fish, and energy, they need much more than a few helping hands. As discussed earlier, riverine pollution has grown immensely in recent years, with litter harming not just natural ecosystems, but human populations and industries as well. However, this reasoning only partially answers the original 'why me' question. After all, communities along rivers, responsible companies, decision makers, and polluters alike should all dawn gloves and fill some trash bags! While this statement is true enough, more help is needed. Still not convinced? Let's put it in another way.

Rivers attract people. Can you imagine Paris without the Seine, London without the Thames, Köln without the Rhein? Of course not. Cities are where they happen to be because of rivers. Unsurprisingly, the most beautiful buildings, passages, and views can

often be found alongside some form of running water. As humans we are attracted to water; we are mesmerized by its beauty, but also by its great power and history. Rivers are monuments - just like a statue, or an imposing building - they symbolize our past, present, and also our future; they are some of the most sacred symbols of our civilization. Imagine if Buda Castle, the Eiffel tower, or Tower Bridge were engulfed by mountains of litter, what message would we be sending? Ought we not keep these landmarks of society in their original state? The same thinking applies to our rivers, especially since they are daily sights, meandering their way through our cities. Thus, collecting riverine waste is not just an environmental, but a societal duty as well.

Cleaning waterways will move your muscles, help you forget your everyday problems, bring a smile to your face and give you the undisputed good feeling of: 'yes, I have done something useful today'. While you might not have made money, or been able to watch the latest film, you have turned a pile of trash into a glistening mirror teeming with wildlife. The results of your work could not be more obvious: the litter is no longer there. After all, there are few things as beautiful as a clear river. The result of a questionnaire among the volunteers of the Plastic Cup showed that additional benefits of river cleanup interventions can also include: the general feeling of belonging to a strong community, a better understanding of life around us, as well as short- and long term goals to work towards[127]. If you are still not fully convinced we can provide you with a short list of questions that can help you decide if you have what it takes to start cleaning up rivers[128].

In the following chapters we will provide an easy to follow guideline on how to implement community river cleanup actions. We will show how these kinds of actions have a positive impact not only on the environment, but on local communities as well. We invite you to carry on reading, whether you want to coordinate your own river cleanup event, just remove some waste alone/with a few friends, or even if you are still unsure about taking on such a daunting task. Picking up environmental litter only to be transferred to the nearest landfill is a great achievement in itself, but a well organized river cleanup action can do even better than that. In the following chapters we will discuss - among other things - the

amazing potential of riverine litter following collection, selection, recycling and upcycling. Let's see how riverine litter can be turned into something valuable.

3.2 Basics - the beginners guide to river cleanups

As a result of awareness raising efforts and environmental education, more and more people are getting involved in cleanup projects. On social media enthusiastic people with bags full of freshly collected trash smile and make us think: if collecting garbage is that simple, why write/read a book about it? Why not just go out and do it? Good question, and a valid point, gathering waste is easy and can be combined with a lot of sports and activities without any specific training; such spontaneous activities indeed make a big difference, and must be appreciated. However, there are some fundamental differences between occasional waste collection and transnational river cleanup operations. It is safe to say that waste picking and ad-hoc cleanups :

- are usually not preceded by comprehensive monitoring activity, or if so, their results are only accessible locally,
- are limited to a small area, most often occasional not regular,
- are mostly target results of littering,
- the collected waste is treated as garbage and moved directly from the environment to a landfill,
- are usually not scientific, since collected waste usually is not weighed, selected or reported,
- are not sustainable: the collected waste is rarely recycled with most being moved from environment to landfill
- have results that are usually not published in wide circles,
- have limited effect on the source of the pollution,
- have obvious positive effects but they rarely extend beyond borders.

Again, there is no doubt that spontaneous waste cleaning actions make a big difference and inspire a lot of people. But community river cleanups - especially international ones - can achieve even more than that. Carefully implemented river cleanup actions are outstanding because:

- they are based on community strength, collaboration, and teamwork,
- they are preceded by thorough fieldwork, surveys like pollution

mapping, sometimes cross border networking and volunteer recruitment,
- they share the results of their pollution monitoring efforts making it widely available,
- they are carried out in a regular systemic fashion often joined by volunteers from different countries,
- they successfully raise interest and awareness locally and even internationally,
- these actions go far beyond the collection of waste
- the collected waste is carefully sorted according to desired metrics,
- most of the collected environmental waste is recycled and upcycled, moving us closer to a cyclical plastic economy,
- data about the amount of collected waste and cleaned area is reported,
- through extensive communication these events raise international interest and can directly or indirectly affect the source of the pollution.

These are only some of the good reasons to do proper river cleanups, but it is no easy feat. There are no two identical rivers plus they are inherently chaotic and can change from one day to the next. Still we can hold on to a few reference points before starting out and do river cleanup actions by ourselves. The basic principles of any river cleanups are the following:

1. Safety first. Rivers can cause a lot of surprises, good and bad. Being cautious and keeping safe is a top priority when close to running waters especially when working. Because of this it is important to stay present while river cleaning. Alcohol and other drugs which might affect judgment should be avoided. Depending on conditions wear the necessary safety equipment, including but not limited to: life vests, work goggles, gloves, rubber boots, long sleeve shirts, and long trousers. Have a first aid kit, food, and drinking water at hand. Keep a close eye on the weather forecast, and place your mobile in a waterproof case; Contact in an emergency situation is key. Start small by making observations, or cleaning small areas, and with experience gradually increase your work area. Do not put yourself under extreme pressure or expectations, never place river cleanup ambitions above your personal safety. Be ready to cancel or temporarily halt the job at any time and have a place ready nearby to relax or in case of an emergency ask for assistance. Always be vigilant - storms can cause big enough problems, but so does a

dirty hand touching your sandwich before lunchtime or a rusty nail puncturing your skin.

2. Work in teams. Do not go out alone. Going for a kayak/canoe/SUP trip is very different from a river cleanup. Have somebody accompany you, such as a friend, family member, or consider joining a community effort. You would be surprised how many NGOs, boat clubs are involved with river cleanups. Work in a team, cooperate with others, keep yourself within their limitations, but also advocate for yourself and your own limits clear. Contribute with skills you are especially good at and work on learning new ones. Document everything in the best possible ways, ideally so others can make use of your data. Post to social media of course but in the meantime do not forget that your field data might be valuable for other cleanup efforts. Register relevant information such as locations or results and share them with the public.

3. Work on land, travel by water. Concentrate your efforts on coastal riverine litter accumulations. It is much easier,safer, and usually more effective to work on shore than trying to collect drifting aquatic plastics. Leave the floating riverine litter accumulations for professional river cleanups. Find the best possible ways to access polluted sites. Consider the vast variety of transport options (bicycle, car, boat, etc.) and find the most optimal one. If possible, use the river to approach the workzone. Once at the workzone do not attempt to clean up from your kayak or canoe, get out and clean from land, it is easier and more efficient. For those not fully aware why coastal operations are still called river cleanups, read chapter 1.4.

4. Respect and enjoy nature. Animals and plants living in and around rivers are subject to a lot of stress from people. Always consider wildlife and your effects on it before you intervene. Take special care in protected areas which require special attention. Contact park rangers or national park authorities to prevent the disruption of endangered species. To keep the negative impact of your action to a minimum, do not pollute. Use refillable

bottles, reusable cups, mugs, cutlery and dishes. In the meantime, do not forget to enjoy nature. Make sure to cherish the environment you are fighting for.

5. Manage litter with the utmost care. Collect selective waste (plastic, glass, metal) separately from communal waste (dirty plastics, polystyrene, PVC, polyurethane, etc.). Keep your distance from carcasses, treat biohazards (medical equipment, syringes) with extreme care. Watch out for bottles that contain liquids. It is ok to empty some mineral water left in a plastic bottle but never, under any circumstances, pour out toxic, dangerous materials (oil, paint, pesticides, detergents, etc.) into the environment. Use durable bags to contain the collected waste and once full, tie them with a strong but neat knot. Make sure you mark your bags properly so they reach the correct waste management facilities. Never leave trash / litter / bags behind.

In conclusion, community river cleanup operations provide a great opportunity to repay rivers for their key role in the ecosystem. The basic principles of sustainable community river cleanups can be summarized in five distinct points; but they only provide enough information if you join the actions of well established river cleanup initiatives (see chapter 2.4). To join these actions, the world cleanup day (09/17) provides an excellent occasion[129] and so do events hosted by local initiatives. If you are determined to do more, let's keep up the motivation and learn more about river cleanup interventions in the following chapters.

3.3 Location - how to find the best spots for the river cleanup

In 2020, a citizen science project[130] was launched along the river Tisza in order to find the biggest riverine litter accumulations. This project included a pollution monitoring field survey that lasted 95 days.Over 2142 kilometers 2792 coastal riverine litter accumulations were discovered in total. Among the volunteers who partook in the project the performance of Bence Párdy was outstanding (23). He alone covered 307 kilometers on foot, and during wintertime[131].

INTERVIEW

Bence: My mission was to find the exact sites where the plastic pollution gets stranded. At that time, I was in between jobs, so I had plenty of time. I decided to treat it not only as a scientific survey but also as a spiritual journey. We walked so much that we started to call it the 'PETCamino' (PET refers to polyethylene-terephthalate, a material plastic bottles are made of). And indeed, it was a long trek. To find the pollution, I walked more than 300 kilometers, in the winter. I chose to do the trip in winter because at other times the big forests on both sides of the river are simply too hard to cross. It is like a jungle, vegetation covers the plastic so it is very hard to find the pollution plus there are just too many mosquitoes. Winter however, was beautiful, I enjoyed every minute of it, apart from one very frightening experience. One day I was standing close to the shore and was busy with reporting a waste dump. I was so focused on my phone that I did not realize there was a pack of wild boars nearby. Shocked by the loud snorting, I came to my senses. I knew these animals can be very dangerous so I slowly started to retreat. I was so afraid that I prepared myself for the only sure way out of the situation, which was to jump in the cold water and escape. Fortunately, the wild boars showed mercy and never attacked. From then on I always wore a colorful cap on my head and made loud noises when walking in order to let wildlife know of my presence. Later I learned that if I had jumped in the water, I could have drowned - lifeguards told me it's impossible to swim in a soaked winter outfit. So, pollution mapping is great but you should never underestimate the dangers!

Bence Párdy reported hundreds of riverine litter accumulations in the floodplains of the Tisza river.

During this adventurous 'PETcamino', Bence Párdy used an open source online smartphone application described in chapter 2.4[132] to register polluted sites. There are many other options

like other apps[133], or a simple piece of paper. The reason we suggest you to follow Bence's example and report your findings online is because this way the results of your survey can be easily added to an online database. To fight river pollution, an online, responsive, up-to-date, riverine litter monitoring database such as the Clean Tisza Map[134] is needed. Apart from showing the distribution and size of large waste accumulations this map can also lead to interesting findings such as riverine litter's tendency to accumulate in the floodplain forests upstream from hydroelectric power plants. This is an important piece of information before starting a river cleanup action.

Once hearing Bence's risky adventures one might ask: why do this trek on foot? After all, it's the 21st century with all our modern technology. In order to keep an up-to-date database this survey has to be recurring, on a regular basis. But of course there are easier methods to find plastic accumulations than walking on foot. Detecting riverine pollution from a safe distance, in real time and possibly online, would be by far the best option. The list of potential remote sensing technologies includes methods like tagging and tracking plastic items with GPS tags, LiDAR scanners, or the analysis of high resolution aerial or satellite photographs. But putting theory into practice is much harder than it sounds. GPS tracking is able to provide sufficient data on moving riverine litter, typically over short distances and times[135]. Long distance GPS telemetry observations occasionally do occur but are just preliminary[136]. Attempts to detect plastic accumulations based on aerial footage (e.g. drone videos) show weak results when the area is covered by vegetation. For the same reason satellite images cannot reliably reveal the differences between polluted and unpolluted areas. To cut a long story short, until the more reliable technologies (e.g. LiDAR) become widely available and affordable, a periodical personal field survey is the best option. If no up-to-date pollution map is available of your areas and you are ready to grab your backpack and go for a hike, keep in mind the following rules of thumb:

1. Safety first. Again, your personal safety is above all else. Be methodical and plan for short distances, especially on your first field survey. Pollution mapping will greatly reduce your average walking speed. Prepare for obstacles like channel crossings, slippery river-

banks, mud, and bugs such as mosquitoes. Choose your outfit in accordance with the weather, preferably long sleeve shirts and long trousers. Remember, vegetation can be so thick that you might even need safety goggles, to protect your eyes from branches. Ask local people where to start and try not to map alone. When moving in groups do not stick together tightly but spread out evenly along a line to search the area more effectively. Before starting out, agree on a meeting point in case someone gets lost or there is an emergency! Do not blend into the environment! Brightly colored clothing differentiates you from the environment and makes you easily visible to your companions or others walking in the forest (e.g. hunters). If there's a chance of stray dogs or wild animals appearing, take a long stick and/or pepper spray with you. Do not be frightened, just be cautious at all times.

2. Good timing. Start pollution mapping when it's easy to move on the river's floodplain. In temperate climates late autumn, winter, and early spring are best. The sparse vegetation and stronger GPS reception helps you discover and report waste accumulations easier. In the tropics, the dry season may be more suitable for this work. Before setting out, make sure that the water levels of the river allow for monitoring, and to check the weather forecast.

3. Careful preparation. Prepare for a long walk. Make sure your phone is fully charged (during monitoring your battery gets depleted quickly) and that you have the newest version of the waste mapping application. If necessary, make a profile in the app. Choose an application which provides you a map of your reports, but also makes data sharing and data export (coordinates, size, description of the polluted site) possible[137]. At home login and complete a test run with the application (it is much harder out on the field). Start early so you can make it back to the starpoint on time or make sure you have a lift back once monitoring is completed.

4. Proper equipment. Apart from a good trekking outfit, make sure you have appropriate footwear (trekking boots or in rainy weather consider wearing rubber boots), food and drink (do not drink from the river), plus any necessary accessories (e.g. pocket knife,

torch, power bank). Taking traditional equipment (compass, paper map, notebook, pencil, GPS tracker) along will help you greatly if smart electronics fail. Do not leave your first-aid kit at home.

5. Thorough briefing. It is always best to have a good briefing before heading out. Double check your companions' equipment, especially their smartphones and waste mapping apps (if they do not know how to report pollution, teach them). If your group is large, split everyone into smaller teams, so you can cover a larger area. In your team keep everyone within the line of sight! Since plastic deposits can form not only in the immediate vicinity of the banks, but also deeper into the floodplain forest make sure to regularly check there too.)

6. Use the river appropriately. The river can be used as a reference point or for transportation, if you rent a boat. On floodplains with thick vegetation, boats provide a great way to cover larger distances. Be observant since coastal litter accumulations might be hard to spot from water level. Choose a reliable boat, use safety equipment (life vest), hire a good skipper if necessary, and be especially careful when getting in and out of the boat.

7. Handle contaminated areas with care. If you find a riverine litter accumulation, observe it, try to determine its extent. Mark the center of the plastic deposit in your waste mapping app. If the deposit is large, add more points! Take pictures and give a textual description with as much detail as possible about the composition (types of materials) and quantity of the waste. If you found a heavily contaminated area, check out the accessibility from land and water. Remember, you are a citizen scientist so do not start to collect the waste right away. You will need your backpack, clean hands, and strength to cover the rest of the area.

8. Nice farewell. Once back at the meeting point, take a headcount and once all there, say a few words. Do not forget to say thanks for every bit of help you received from the others. Double check if all reports were submitted properly. If necessary, collect the reports yourself to make sure they will be correctly registered (it is common that phones run out of batteries and people return with nothing but

coordinates). Once back home make sure all of your findings are listed on the online waste map.

Congratulations, you have done it. You chose the right application, the right people, and the right location. You made sure that your reports of the polluted sites are registered, reported, and shared publicly. Once polluted sites are cataloged on an online pollution map, the time for river cleanups has finally arrived. On behalf of the rivers and oceans of the world, thank you.

Henrieta, co-worker of ASRD Kosice, on the river Bodrog. Her first river cleanup attracted 150+ volunteers from 4 countries

DOWNLOAD[138]

You do not want to carry this book through the bushes but still want to refer back to it? Download the 'Do Not Forget Before Pollution Mapping' list checklist for a complete and successful field survey!

3.4 Calculation - things to do after pollution mapping

Henrieta Kiralvargova from Kosice, Slovakia was given the complex task of organizing an international river cleanup action in the framework of the Interreg project Tid(y)Up. After finishing the pollution map she immediately started coordinating cleanup efforts.

INTERVIEW

Henrieta: We started preparations for our river cleanup months in advance. Thanks to EU funding we could organize a 3 day event, with volunteers not only from Slovakia but from Hungary and Serbia as well. I was not

alone on the project, my fantastic colleagues like Terézia and Jaroslav helped out a lot. Receiving the first manuscripts of this handguide helped us get started. Following its instructions, we immediately involved the Slovakian Water Management Authorities and an NGO busy with organizing canoe trips on the river. It was a great idea showing the handguide's versatility, but sometimes, we had to adapt its instructions to fit our conditions. For example we do not have campsites along the river like in Hungary. So to accommodate the volunteers we chose one central spot and commuted to the river every day. It worked very well but we had challenges with getting some equipment and accessories. For example we could not buy proper trash bags, only small ones that tore easily. Getting reusable soda bottles was not easy either. Because of the understandably strict instructions we had to maintain zero waste standard and exclude all single use plastics from the event. This was hard since we do not traditionally use refillable soda bottles like elsewhere. An even greater challenge was finding good waste management partners who were willing to take part in recycling efforts. By the end of the event's 3 day we were all super tired. But believe it or not, within a year, we found ourselves doing it all over again, voluntarily cleaning the Bodrog river once more :-) So, all in all, organizing international river cleanups is not for everybody, but once you get involved, you can get easily infected with its joy!

Henrieta's example shows that with the right team, enough financial support, and expertise you can make a leap and organize a large-scale international river cleanup for the first time. It might come as a relief for starters, that there are plenty of other ways to get started with international river cleanups. For reference, in this book a river cleanup action is 'international' once it collects/manages riverine litter of international origin, involves volunteers from other countries, and/or improves water quality of natural waterways that cross borders. Either way your river cleanup action will have an international impact. In Henrieta's project all three conditions were met which made her job more fulfilling, but also more challenging. It took more than 5 months for this Slovakian NGO to organize this event. For your first international cleanup, we suggest having 7 to 10 months to prepare everything.

Before we discuss these many months in detail, first let's lay back for a moment and try to visualize a river cleanup action. We see people working hard. They smile and pick up plastic bottles enthusiastically. Everyone is busy from dawn to dusk. They ignore mosquito bites, scars and bruises. They are not into eating or drinking and do not care where they are going to sleep when night falls. All they want

to do is to clean up the river, no matter what. OK, that was great. Now come back from this imaginary world and let's face the realities. Apart from a few exceptions, most people are not as described. Many of us do not like to work for free - at least not for long. We do not fancy long emails, we have many problems to solve at home and at work, not to mention environmental issues. If anyone asks, we of course are concerned about nature and rivers, but usually we are far too busy to do anything. How will you, the coordinator, the heart and soul of a river cleanup action, mobilize us? How will things get moving if we are just average people?

Your first tool will be careful ***calculation***. You will make the most moderate estimates. Once you have a result, divide it by two. For example, a professional river cleanup activist is able to fill up as much as 40 large plastic bags with selected and hand pressed riverine litter on a daily basis. A beginner might gather 20 bags of worse quality, but because of your careful calculations and mindful leadership you will calculate only 10 bags a day per person. A professional company might answer business emails in a matter of minutes. An inquiry email, asking for river cleanup support, might not get a response for days or at all. Since you prepared for this, you will approach not 1 but 10 companies and wait double the time before sending a kind reminder. On a good day a good rower can cover as much as 40 river kilometers downstream. But for your inexperienced volunteers, busy with cleanup, you should calculate a maximum of 10 kilometers. In order to make an effective plan for your cleanup, you have to repeat similar calculations again and again to find the best estimates for the following questions:

- How do you plan to secure your event to make it as safe as possible?
- When and where will your cleanup take place?
- How many participants do you plan for?
- How much time is allocated to briefings, to taking breaks, and transiting to and from the polluted site?
- How much riverine litter do you plan to collect?
- How much time is left for the actual cleanup effort?
- How much do you think volunteers will collect?
- What will your expenses be, including catering, permissions, transportation, accomodation and waste management?
- Do you expect any revenue, if yes, how much?

Based on this information you are ready to make a planned summary of your river cleanup action. From now on, this will be your reference point, your guide. Add a few nice photographs and there you have it: your main source of ***motivation***, your second tool in order to get things moving. You, the volunteers, the sponsors, everyone needs it. Now what's left is to put all your trust in this one pager and start working out the details. We are more than happy to show how.

3.5 Motivation - bringing helping hands onboard

We mentioned a one-pager as a motivational tool, but this tool does not necessarily have to be a page of data or even a document. A well edited video, a good slideshow, or a smooth presentation can be just as effective. The important thing is that it answers all the important questions covered in chapter 3.4. Zsófia Farkas is the field coordinator of the Zero Waste River cleanup project. She successfully introduced and managed hundreds of river cleanup volunteers.

Zsófi is responsible for recruiting volunteers for river cleanup actions all year round.

INTERVIEW

Zsófia: For nearly 10 years now, I have been handling volunteers for at least 25-30 river cleanups a year. During this time I learnt so much about people, and how to deal with them. First and foremost, I am not the cute and kind girl I was. In the beginning, I was into writing nice and wordy letters,

begging for things to happen, but I quickly gave up on that. Now I am certain that volunteers need honesty not the 22nd kind reminder. Being straight, short and candid to your crew is the best thing you can do for them. Of course you should not be rude, but people appreciate it if your communication is concise. Sometimes all they need are ***bold*** *or even CAPITAL letters, leaving little room for misunderstanding. The same goes for out on the field. In my opinion, sitting in a canoe filled with river trash is not a service, nor a tourist trip, or a holiday attraction. First and foremost, it is a responsibility. You are there because other volunteers trust you. You are responsible for yourself and for them, and you have to validate their trust every day. Secondly, it is a mission. In a way, it is a fight against pollution. You have your buddies on your side, and you have an enemy to fight. Now you might think I am like a harsh general in the military. On the contrary, I do not make orders, I only ask for things. And I believe that in tight situations, like a storm, you can't just have anyone lead. You need people who will not fail you in times of need.*

Miklós Gyalai Korpos is the manager of the Zero Waste Tisza project. He successfully coordinated dozens of river cleanups and always does an astounding job when hosting international river cleanup teams like JoinTisza[139] or the ICPDR[140].

Miklós is taking care of international relations and manages multiple projects at the same time.

INTERVIEW

Miklós: I am 100% with Zsófi on this. Short and straightforward instructions provide a great way to maintain a closely knit and well tested community of volunteers. In my experience however, dealing with newbies is a different case. Recruiting and inviting people, especially first timers, is a bit different. Hosting foreigners from other countries, sometimes from overseas, requires a lot of gentle and kind reminders. Again it is true that not all of these people will be fit to become volunteers on a regular basis. But if a guest leaves with a positive experience, good memories and at least an

intention to come back, we have one more advocate who will support the cause of rivers. I am the most proud of the JoinTisza team, which came together from 4 continents and was made up of complete strangers. With a fantastic captain Diana Heilmann and under my supervision they were able to win the Plastic Cup in 2018[141] *which was beyond all our expectations.*

It is clear from these two interviews that the ways we motivate people can be very different. Now let's examine your motivation from up close. Why do you, in particular, want to do this: coordinate, manage, and organize river cleanups? An answer to such a difficult question can vary greatly depending on the person. An ***environmental activist*** might say as follows: I am doing it for nature; in order to protect endangered species; I am fed up with fossil fuels and single use plastics; enough of the multinational companies, etc... People with a ***practical approach*** might say: I want appreciation from other people; I look for a community to belong to; I am hoping for a good job and a salary; I want to prove myself; I am interested in science/conservation/water tourism, etc... More ***business*** oriented people might say: I like being on TV and being filmed; I want to be the first; I am a bit concerned that other people will clean up this area before me; I am worried that there will not be enough trash for us to collect, etc...

All of the above mentioned arguments are acceptable reasons to get involved in river cleanups. Rivers are in such a bad state that they need help in every way possible, from all kinds of people. Average people, municipalities, NGOs, international companies, they all are responsible, at least partially, for the pollution of rivers and so they are all needed to set things straight and improve the water quality of rivers. Concerning you in particular, knowing your true motivations can help a great deal in deciding your future actions. With a business-like attitude we suggest getting involved in professional cleanups where staff is on a payroll. Alternatively, you should think about starting your own business. There are so many ways to build careers on cleanups and even raise profits[142]. Still, do your best to cooperate with other types of people, for the sake of rivers, do not simply treat them as competition.

If you happen to be a more environmentally sensitive person, community

river cleanups provide a great way to show your talents. The term 'community' does not mean that people cannot get paid. There are multiple examples of cleanups that use funding and sponsorships to employ necessary staff, often locals[143]. Naturally, the coordination team, including you, deserves reimbursements and possibly a salary. There is nothing wrong about being paid for your hard work, as there will always be expenses on a cleanup that you must pay (e.g. catering, security, transport, accomodation, etc.). The important thing to understand here is that community river cleanup interventions are not commercial endeavors. They might be financially viable, but the income they generate is not there for raising profits. By definition, the ultimate goal of these actions is to eliminate the very waste they are built upon, even better, the source of pollution. From this aspect, after the best river cleanups you can hardly find any riverine litter.

After finding common ground on the non-profit nature of community river cleanup actions, let's see its five main principles: Safety first; Work in teams; Work on dry land & travel on water; Respect and enjoy nature; and Manage litter with care. We discussed the principles earlier (chapter 3.2) but the descriptions there did not did not help with motivating people. In the next chapter we are about to do exactly that.

3.6 Mobilization - the tasklist before the river cleanup

The time has come to combine basic river cleanup principles with good practices in order to inspire, motivate, and mobilize the true engine behind each successful community cleanup - the volunteer base. Miodrag Zivancev from Novi Sad, Serbia, was assigned to organize a multi day river cleanup on the lower sections of the Tisza river, close to its estuary into the Danube.

Miodrag, teacher at the University of Novi Sad on the field near Novi Becej, Serbia coordinating a cleanup.

INTERVIEW

Miodrag: To be honest, my main concern was how to gather enough volunteers for an effective cleanup. I wanted good results and for that I needed numbers. It was spring, schooltime,

and the local settlements we wanted to cooperate with (Becej and Novi Becej) were occupied by a large, national marathon event, planned at exactly the same time as our action. We invited some canoe tour organizations and also the Water Management Authority, but I still had my doubts. Then at one point I asked myself, why not recruit the students of our university, the UNS? And this was the solution. I knew the exact needs and requirements of my 'target group'. I did not offer free credits but for those who decided to turn up on the great day, good food, free accomodation and transport was provided. Not to mention branded shirts, and free coffee. In the end, the strategy worked. These young people worked really hard and together we removed a large amount of riverine litter. For me this was the turning point. Finding the right group of people I want to cooperate with and knowing exactly what they want, helped me turn a dream into a reality.

As a responsible coordinator, Miodrag tried to think everything through in advance. He carefully read the manuscript of this book, because of which he completed a thorough pollution mapping survey beforehand. Once he compiled a full list of polluted areas, with his respected colleagues from UNS they made up their minds about which spots to clean. Only then did they start to mobilize people and resources based on the following protocol.

I. SAFETY FIRST

In general, the chosen area is suitable for a river cleanup only if it poses no direct threat to human safety. Make sure well trained assistance (medical staff and lifeguards) and necessary infrastructure (mobile reception, roads) are never too far away. To keep safe you should pay special attention to the following things:

Hygiene. River cleanups are usually dirty. It is important to provide sufficient amounts of fresh clean water, not only for drinking but for personal hygiene as well. Make sure that there are certain locations where soap, towels and toilets are accessible at all times. Make sure participants have access to these locations if need be (e.g. a boat that transfers people there and back). Make sure everyone has access to disinfectants (e.g. before eating).

Protective gear. Compile and send a list of necessary equipment by email to all participants (see template below). Inform everyone about the heavi-

ly suggested outfit. Require volunteers to wear long shirts and long sleeves if possible (to avoid bruises and scratches) and also make them bring a spare set of clothes. Let them know of the proper footwear (boots are perfect, crocs are OK, flip flops should be avoided). Suggest bringing sunscreen, a hat, sunglasses in sunny weather, and a raincoat. Make sure people have waterproof cases for their valuables. Working in thick vegetation might require wearing protective goggles. Provide all participants with good quality gloves. For river cleanups, nitrile coated working gloves are the best choice. After the cleanup, they can be washed and used again. If possible, avoid surgical sterile gloves, they tear easily and cannot be used for long periods of time.

Life saving gear and crew. If needed, ask for assistance from trained lifeguard units or water rescue teams to secure your event. Working close to the river and moving around in boats or canoes will require the usage of lifejackets and life-buoys. Make sure there are enough jackets for everyone and make sure there are available first aid kits. If bees or wasps will be present during the cleanup have a few doses of Epipen[144] on standby. Make sure everyone's phone is charged and placed in a waterproof housings. In certain cases phones can be life saving. Before the cleanup buy a few packs of resealable bags[145] for those in lack of a proper waterproof case.

Security and permits. Acquire proper and up to date information about local safety instructions and legal regulations. If needed, apply for the necessary permits to carry out a river cleanup. Make sure you can provide a safe place or places to store equipment and personal belongings when they are not being watched (e.g. lockers, cars, safe buildings, during fieldwork). It is worth paying attention to the following legal requirements:

- event organizing regulations,
- fuel management regulations,
- waste management regulations,
- work, fire and accident prevention training,
- voluntary registration form and disclaimer,
- special protocols under special conditions (e.g. COVID-19).

Responsibility. Make sure from the very beginning that in order to participate in a river cleanup, one has to take full responsibility for his/her actions. Signing a liability form at the beginning of the action will be critical. For minors, adults or caretakers are allowed to sign the form for them.

Your safety. Do not rush. Take your time, give yourself plenty of time to think and prepare. Set realistic goals, make a work plan, and try to stick to it.

At the end of the day, a river cleanup action is only as good as the mental state of its coordinator.

II. WORK IN TEAMS

In all cases, river cleanups are a team effort. On a surface level, one person can only go so far in cleaning a polluted area, so a larger group is needed for more swift and efficient cleanup operations. That said, the involvement of locals also plays a critical role in maintaining good conditions once the natural habitat has been cleaned. Hereby we outline how to organize a cleanup and find potential participants, stakeholders, and groups who can contribute to the success of your river cleanup in an orderly manner:

Other river cleanup initiatives. Search and contact local NGOs and environmental initiatives already involved with river cleanups. With a bit of luck they will be nice and able to provide not only advice, but physical help (e.g. equipment, contacts, ideas).

Scheduling. Even if you have not found another river cleanup organization to work with, you can continue to move ahead. At this stage, it is time to complete your one-page proposal outlining the location and a rough schedule (when and where activities will take place). Do not make people hurry. Create a relaxed, easy to follow schedule. In an average 1 day river cleanup one hour is devoted for briefing, 1 hour to reach the polluted site, 2.5 hours for a cleanup, 1.5 hours for breaks (lunch, coffee) and 2 hours to select/sort the waste and get back to the starting point.

Local communities. Make good use of your proposal, and contact local communities at least 6 months prior to the event. Inform the mayors/representatives of nearby settlements about your idea. Ask for any necessary permits, contributions, support letters, etc. Contact local NGOs, schools, national parks, and water management authorities as well. When contacting these individuals and organizations, explain your proposal, what you will need for your cleanup, and, most importantly, how they will benefit if you succeed. Reach out to all kinds of folks - boat clubs, anglers, fishermen, rang-

ers - they will know the river like the back of their hands, and are usually eager to help.

Volunteers. Start recruiting volunteers 3-6 months before the event. Make an application form. Post to social media platforms, write to email lists. You can create a website if you want, but you can save a lot of headaches by making an event on social media. Share the event so people can learn more if they are interested. In your call for volunteers, provide information about the place and time of the event, along with additional information like how to get there and what to bring. Do not ask for any kind of sensitive information via online platforms. If you require sensitive information (allergies, food sensitivity, ability to swim, special illness) contact the applicant via secure channels (phone, direct email). To understand why this is important, learn more about the European Data Protection Directive and GDPR regulations[146]. From the outset inform prospective volunteers on what expenses they will have to calculate with.

DOWNLOAD[147] *- Use the attached list of the required personal data and personal equipment requirements: 'What To Ask From Volunteers' list. Before sending out, check and adapt if necessary to suit your needs.*

Local businesses & service providers. An effective river cleanup is low cost, and strengthens ties to local communities. Therefore, use local sources to secure equipment, food supplies or other services. Think twice before buying anything, check if there are possibilities for renting. Place special emphasis on waste management companies with permits to work in the area. Working with these companies will be very important, as the different types of selective riverine waste (plastic, glass, metal) require special treatment. Be ready to compromise about the exact place and time of loading (garbage trucks cannot go just anywhere) but do not give in if they tell you that riverine waste cannot be recycled. From our experience, over 50% of riverine waste can be recycled, with the recycling rate depending on the effectiveness of the selection process. Therefore, when holding discussions with waste disposal services, assert your intention to select and separate the collected riverine litter. In certain cases, you can ask for a discount, as environmentally sensitive companies

will appreciate your efforts by charging you less or even helping you for free.

Catering. River cleanups are tiring endeavors. You will not get far with hungry or thirsty volunteers, therefore it is important to decide from the outset on how to keep your crew happy and full of energy. If meals are an individual responsibility, keep in mind that some people might forget to bring enough supplies. If it is the other way around, and you provide catering, the event is going to be more expensive. In either case, inform everyone about your expectations, and make sure you have a supply of drinking water and snacks available at all times. If possible, order food from local catering service providers. When doing so, make sure you know the special diet requirements of your volunteers. Say a decisive no to single use plastics, make sure food and drinks are stored in reusable packaging (e.g. Tupperware boxes, large stackable water jars). Negotiate that food waste be handled in a sustainable manner(prefer composting or transfer to feed livestock).

Emergency response. Hope for the best, but prepare for the worst. If conditions make the river cleanup especially challenging (cold water, possible bad weather, long distances to cover on water, less prepared crew, large number of participants, participants with disabilities, etc.), you will likely require assistance from an experienced water rescue crew. Find out where the nearest emergency unit, hospital, and pharmacy is situated, making sure to note their contacts and opening hours in your proposal. Inform the water police or coast guard about your event in time. Be alert always, but do not worry: being precautious only means that help will be on its way in the case of an emergency.

Sponsors. At the end of the day, all river cleanups cost some money. To cover transportation, equipment, meals, and accommodation, you will need a certain budget. For a small event, maybe participants themselves can pay the bills. In case of a large-scale cleanup, try to find some sponsors. Local companies will most likely support the river cleanup with their products (supplies, catering, equipment) whereas larger international companies - especially those with a CSR programme going on - might join in with financial support. To give your one-page proposal the best chance to succeed, start looking for sponsors as early as possible. As discussed earlier (Chapter 3.5), companies too, should take part in cleanup efforts. Before accepting their support, make sure you are not going to be a victim of greenwashing[148].

III. WORK ON DRY LAND, TRAVEL ON WATER

Coastal riverine litter accumulations provide optimal targets for community river cleanup actions. Working on dry land however, does not mean that we have to avoid the river. Many volunteers enjoy being on water, so why not offer them the opportunity to paddle around, or get on a motorboat? Here are aspects not to forget:

Accessibility. An area is suitable for a river cleanup once it is easily accessible by road and/or water. This way, participants can readily get to the contaminated area, and the collected waste can also be removed and transported. Therefore, it is important to make sure a site is accessible (if it is not either carve a path, or look for other sites). Double check polluted areas a few days before the event. It is important to know if roads are accessible– make sure they are not blocked for some reason (e.g. special event, reconstruction). Once litter accumulations are accessible by boat as well, mark the mooring points. Make sure neither the mooring points nor the roads are too far from the polluted sites. This will be especially significant when managing the waste.

Proximity. Make sure that the meeting/starting point of your river cleanup is close enough to the polluted sites. Check distances to cover by the crew on land and/or water. You have to be 100% sure that participants can make it there and back in time. Think about worst case scenarios (e.g., a strong headwind). Take extra care of the transport of the collected waste. Your volunteers must be able to take the bags full of collected waste on foot to the deposit site (accessible by truck) and/or mooring points (accessible by motorboats). Make sure litter accumulations and deposit sites are not too far.

Free choice. Provide the opportunity to access the polluted site either by boat or on land. The possibility to paddle, even for just a short distance, will attract many volunteers. For those too afraid of paddling, provide the option to use a motorboat or to walk to the polluted site. This way they have a positive experience and will not find the event frightening or exhausting. For those who want to paddle, make sure that in each canoe/kayak there is at least one person who knows how to row and steer.

Equipment. During the cleanup try to select waste into three different colored trash bags (one for selective waste, the other for glass and the third

for communal waste). Make sure to bring enough of these bags for your cleanup. Buy protective nitrile work gloves at least in 3 distinct sizes (small for the young, middle and large for the adults). If you will take to the water as well, then make sure there is a sufficient number of kayaks/canoes. Make sure the provider transfers the boats in time and gives enough paddles and ropes to fix the boats when mooring. If possible, hire a motorboat as well, preferably along with a skilled skipper and a full tank.

IV. RESPECT AND ENJOY NATURE.

An area is suitable for a river cleanup if removing litter significantly improves the conditions of the environment without causing unnecessary stress to the local flora and fauna (and does not leave a large carbon footprint). To make your event as environmentally friendly as possible, please do not forget:

Wildlife. Regardless of the location of the cleanup, contact wildlife conservation experts about how to minimize the environmental stress caused by your event. Pay attention to vegetation, nesting birds, pollinating insects, etc. If you work in a protected area ask for permission from responsible authorities (e.g.,the directorate of a national park). Say no if somebody wants to cut a road for you into the forest to reach polluted sites. Say no to the application of heavy machinery, chainsaws. Use existing trails to remove the full trashbags between the polluted sites and the deposit sites. While doing so will likely take longer, you will not have caused permanent damage to the natural landscape. Encourage your volunteers to use kayaks and canoes if possible. Ask your motorboat skipper to drive slowly, and to avoid making big waves or unnecessary noise pollution.

Carbon footprint. During preparation, prefer online meetings to personal meetings. Avoid printing, limit the usage of handouts, leaflets, posters to a minimum. Use public transport when possible, and encourage volunteers to follow your example. Pay extra attention to car owners, ask them kindly to offer their free seats to other volunteers. Once at the meeting point, convince people to paddle or to walk to the polluted site. Ask your motorboat driver not to rev up–drive slowly and silently. As for the collected riverine litter, maximize selecting and recycling efforts (see later) to send back as much waste into the loop as pos-

sible. Minimize transportation costs by choosing local/nearby service providers. Make sure that the important locations of your cleanup (meeting point, polluted sites, mooring points, selection point - see in details later) are as close to each other as possible

Zero waste. Do not order, do not buy, do not accept bottled mineral water. Of course, people can bring their plastic bottles along, especially if they refill it, but you, as an organizer, should avoid offering them. Say a definite no to all kinds of single use plastics (plastic cups, straws, etc.) during your event. Ask volunteers to keep their mugs and water bottles with them at all times. Provide fresh, clear, drinkable tap water at all times. Provide a place people can rinse their mugs and bottles before reuse. In Eastern European countries the century old tradition of returnable soda bottles still holds. If you do not have access to soda bottles, fill up large water jars with drinkable water. Make sure you collect the waste generated by your event selectively (plastic, metal, glass, communal, compost). Pay special attention to the recollection, washing and drying of protective gear and equipment after the event (gloves and trash bags can be used multiple times).

Appreciate nature. Place multiple breaks (coffee break, elevensy, lunch break, etc.) into your schedule. This will allow everyone to have a snack and to stop for a few minutes and just enjoy being in nature. No matter how bad the pollution is, do not miss the ultimate reason for being there–to respect and appreciate the beauty of the river.

V. MANAGE RIVERINE LITTER WITH CARE

Remember, a community river cleanup is able to achieve much more than just moving waste from one place (river) to another (landfill). To fully exploit the recycle and community building potential of the riverine litter, please pay attention to:

Proper briefing. Apart from a few exceptions, most people have little knowledge about recycling and different types of selective waste (e.g. plastics), not to mention how to distinguish and handle them. Make sure that they are properly briefed before collection and also before the selection (see details below). Let people know exactly what they are supposed to do and how to do it. Prepare yourself for the briefing and if you think it is necessary, do not be afraid to ask for

help. This way you make sure that everyone knows their jobs.

Bags and gloves. Pre-order sufficient amounts of good quality trash bags in three different colors. The tricolor approach is important because for best results selection should start right at the polluted site (see details below). In general, bags should be stronger than an average communal trash bag with a minimal volume of 80 liters. For specifications, check out Downloads section at the end of this chapter.

Mark sites. To manage riverine litter in the most effective way, you have to highlight the following locations on a map, as close to each other as possible:

i. Meeting point: this is where people meet and the event starts.
ii. Polluted sites: the location of riverine litter accumulations.
iii. Mooring points: the places where full bags should be placed for transport by boat.
iv. Deposit sites: the places where full bags should be placed before road transport.
v. Selection point: the location where full bags are transferred to and where volunteers can prepare the collected riverine litter for recycling.

Selection protocol. Try to get the selection point and the meeting point very close, so the event can end where it started. For selection, you have to provide a long flat surface, ideally a very big table, or something similar (like the platform of a large trailer). The goal is that people can stand around it and can further select the contents of the filled trash bags. To contain the selective waste, so-called bulk bags (aka big bags) are required[149]. To contain the liquids and toxic materials, sealable plastic cans should be prepared. To keep people happy, arrange refreshments (water, hot beverage, snacks), make sure toilets, tap water is nearby and also have a speaker ready–selection is much better with some music.

Transport. Check and double check what fractions of selective waste the local waste management company can handle. Some prefer plastic bottles of different colors (white, blue, brown and colorful) completely separated. Others just require plastic bot-

tles mixed together because they rely on optical separators instead. In most cases polyethylene (PE) and polypropylene (PP) are highly valued and should be separated from PET plastic bottles. All across the EU, waste management companies will accept your glass and metal once they are separated. Place each fraction in different bulk bags and mark them. Be extra cautious when handling and professionally disposing of plastic cans full of dangerous liquids (oil, paint, chemicals). Make sure the transport happens at the scheduled time. Before the transport, put out information signs saying when exactly the transport is expected. Under no circumstances should trash bags and bulk bags be left behind.

DOWNLOAD[150] *- Use the attached checklist as a reference during preparations: 'Who To Contact And What To Bring' list. Check out the contents and adapt the tasklist to your specific needs. If necessary, download it to your smartphone to make sure it's available at all times.*

3.7 Discussion - things to talk through right before the river cleanup

After many emails, online meetings, and phone calls, you are within a month of the river cleanup. Viktória Doró, a member of the Plastic Cup coordinator team (often called the 'Admiralty'), is in touch with every participant - volunteers, participants, service providers, local helpers - continuously.

Viktória, one of the coordinators who knows every participant by their names, and is busy at the registration desk during a river cleanup.

INTERVIEW

Viktória: Officially I am an administrator. In reality, it is much more complex than that. To help everybody apply and register, I have no choice but to be an online friend, a team

member, sometimes even a psychologist - available nearly all the time. Not everybody is fit for the task, but without this help many people would give up and never join a single day river cleanup, not to mention longer actions. During the entire application and registration process, I have to keep my mind open to questions, suggestions, personal problems and difficulties. Sometimes it can be very exhausting, especially in the preparation phase when I am all indoors. My weapon is my smile. I never let it go because I know that there is a solution to every problem. I keep myself smiling even when I talk on the phone because I know people can hear it in my voice. The best part of this job is that when I finally meet someone–nice people that I know only by emails or phone calls–we instantly greet each other as friends, and often it is not just a gesture. In my experience river cleanups can really be life-changing experiences where friendships, professional- and personal relationships are born. For me, this result is just as important as the amount of collected waste.

Over the last ten years, Viktoria successfully managed the application process of thousands of volunteers, so her strategy undoubtedly works. She is famous for her precision and for doing her best to answer questions before they arise. Here are the most important things to take care of in the last 30 days before the river cleanup action:

30 days left. A month before your river cleanup action, compile a (close to) final schedule of your event[151]. To do so, review every little detail beforehand: where the meeting point will be, when and where the cleanup will take place, how you will get there and then back. Logistics are especially important. You have to know by heart when the partners arrive, where it is best to launch boats, where to store personal belongings, when and where to take a break, and when, where, and in what form the companies will take over the collected waste.

15 days left. Two weeks before the cleanup action, prepare the final schedule. Include a map with useful information about most important locations (meeting point, polluted sites, deposit and mooring sites, selection site, parking space, convenience stores, ATM). Send out a reminder for each of the applicants with the schedule, map and list of necessary equipment attached. Ask for confirmation if you have to be 100% sure about the number of participants (might be necessary for catering or boat rental). Check on service providers once more, being sure that your orders are confirmed and processed so there will be no shortag-

es and surprises. If you happen to have sponsors, make sure they know about everything and check if they need some kind of appearance possibility (poster, social media post, etc.)

7 days left. Create an online meeting for participants with a Q&A session. After the call, stay online with volunteers who are ready to assist you in special tasks. Make sure they understand how they can help (transportation, hosting, registration, photo documentation, canoes, catering). You will need these assistants to make sure complicated processes like registration, briefing, boat launches, or the selection go smoothly. Break down the main activities into smaller tasks to be performed during the event, and assign each to someone responsible. You might also need a helping hand in documenting the action. Good photos and videos never hurt. Call the water rescue team, make sure they are prepared, and that their boats have the necessary equipment (sonar, emergency kit, Epipen kit).

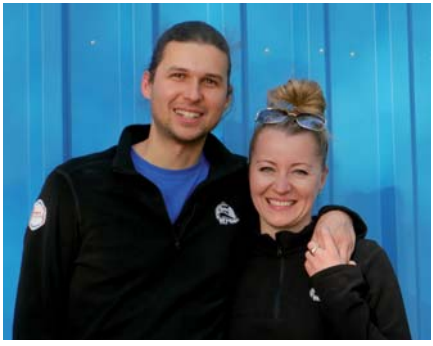
3 days left. Start to say no to long work hours, get some sleep. You will need your brain. Check weather forecasts. If conditions are favorable, send basic information about the event to journalists and reporters working for local, national, or international media. Now it is time to turn the printer on. Make sure you have all the important documents[152]–like the leaflet you want to distribute among volunteers–with you on paper. It is much better to have all the permissions, registration forms on paper with you, all the time. Also print out an official legal disclaimer[153] for people (making sure to have a copy for minors) to sign. Go out personally to the field, or send someone, to make sure all important places are marked. For example, a blue ribbon tied to a tree helps a lot when a volunteer tries to find a mooring point.

1 day left. Check the weather forecast, look at the expected water level one more time. Do not make alterations because of a little rain or a light wind. Only consider canceling or postponing the event if there is a strong chance for a storm. Make sure you have downloaded all the checklists to your phone. Charge all your devices (phone, laptop, camera) and put all the printed documents in your bag. Check the list[154] you sent out two weeks ago to everyone. Then, check the 'What To Bring As An Organizer List' (below) and download the 'What To Say During a Briefing List'. Make a good thermos of coffee or tea for tomorrow, just for yourself. Finally, pack your bag and make sure you have as little to do as possible before the morning of departure.

DOWNLOAD[155] *- Use this 'Do Not Forget Anything As An Organizer' list. Download it to your phone to make it available at all times.*

3.8 Instruction - what to tell to people at the start of the river cleanup

At last, the big day has arrived, along with a group of volunteers eager to know what comes next. Your river cleanup action pretty much depends on how you react. Krisztián Berberovics and Vikca Sóvári, the talented and experienced river cleanup coordinators of the Plastic Cup initiative, have been in this situation many times.



Krisztián and Vikca standing shoulder to shoulder before a river cleanup action. The couple knows by heart how to handle the most difficult situations.

INTERVIEW:

Vikca: *First, we welcome them and offer some hot beverages. Then comes the registration, signing the attendance sheet and the official disclaimer. Only then we start the briefing.*

Krisztián: *The thing I keep telling myself is to take it easy. To talk to this many people, with so many strangers among them, so early in the morning... I wait for the right moment, then I start to talk out loud. If the team is bigger, I use a loudspeaker. I speak in short, easy to understand sentences. I do my best so that my voice is calm, reassuring and from time to time I stop to ask if there are any questions.*

Vikca: *Sometimes, especially if the weather is gloomy, people are a bit tense. Inside I think they are a bit uncertain about what they are doing here. It is our job to cheer them up, to make a joke or two. It is super important not to discourage people. Once we had a water rescue official who scared people by stating that 90 percent of the canoes will flip over if somebody tries to get out to the shore - a blatant lie! We never asked him to come again. While we keep talking, I always ask assistants to take care of things like registration in the background.*

Krisztián: *Yes, this is very important, multitasking. When briefing, I like to screen the participants, how fit they are, who might need special attention. One time an elderly lady, who happened to be quite overweight, said she wanted to sit in a canoe. What do you do? Tell her, no sorry, you cannot do that?*

Vikca: *I remember you did not refuse. You put one of the most experienced rowers next to her, to keep her safe.*

Which, he did! The important thing is to give everybody a fair chance but do not let them out of your sight.
Krisztián: That's the hard part. As a coordinator you rarely have the chance to collect waste yourself, or really join in the cleanup. We mostly coordinate, organize, and check things. In a way, we are the hosts of the event, we have to keep an eye on everybody. To do that, I often sit in the motorboat, even though I very much like to paddle myself. Still, this way I can react quickly, and that is the most important.

With so many people in one location, every minute counts. To get to the polluted sites as quickly and as safely as possible is important, but no need to stress and hurry. Devote at least an hour to talk everything through by keeping the following in mind:

Be brief. Prepare a list for yourself on paper or using the template checklist[156] to make sure you do not forget anything. Be as short as possible. Never make people stand and listen in one place for too long. Remember, they are eager to get out and start collecting waste.

Right time, right spot. Start briefing according to your schedule. If necessary, have a list of things to say in your hand. Start talking in a good place. It is always reassuring if things go as planned. Turn towards the people, look them in the eye. If they chatter, ask them nicely to listen to you. Often it's best to split the briefing in two: keep the first part about general information close to the registration desk. The second part, more about practical things, is often better to be held on the shore.

First part - general briefing. First of all, talk about important, but more general things like:

- introduce yourself in no more than 2 sentences,
- introduce the most important people and their roles in 1 sentence each (e.g. water rescue staff),
- make sure everybody knows how to contact water rescue staff in case of an emergency (read out loud phone numbers),
- give a weather forecast for the day,
- describe the 3 major sections of your river cleanup (instruction, collection and selection) shortly,
- describe the schedule, tell them if/when there is going to be a lunch,
- explain where the toilets are,
- ask if people signed their paperwork,

- ask if there are any questions,
- tell them when and where briefing continues.

Second part - practical briefing. This part can be merged with the previous section, but experience shows that it is better to let basic information settle and continue a few minutes later. It helps if you make people walk down to the shore. Once everyone is listening, you:

- show a map of where you are at the moment (meeting point),
- show the most important other locations on the map (polluted sites, deposit sites, mooring sites, selection site),
- explain the function of each location in an easy to understand style,
- read out loud important phone numbers (yours, water rescue crew, boat driver),
- distribute basic equipment (snacks, drinking water, waterproof resealable bags, leaflet with the most important information[157]).
- distribute trash bags and gloves, making sure to explain their importance and usage (see collection protocol below),
- give clear instructions to the dry/land team (how to get to polluted sites, who is their guide, see below),
- give clear instructions to the waterborne team (separate instruction for those taking the motorboat and those who paddle, see below),
- ask everyone to be aware of their surroundings at all times,
- finally, ask if there are any questions.

Collection protocol. To properly introduce the secrets of riverine litter collection, prepare 3 trashbags of different colors. Also prepare the most common types of riverine litter (plastic bottle, empty glass, metal can or spray can, a piece of polystyrene foam, motor oil jar, dishwashing liquid jar/dish soap bottle and a flip flop). Once all there, you:

- describe the 3 types of bags (selective, glass and communal bags) and demonstrate where each piece of litter should be placed,
- explain 'selective bags' are to be used only for plastics (PET, PE, PP) & separately for metals,
- explain why 'glass bags' are only to be used for glass (they are heavy, they need special attention, bags should be only half full so they can be lifted),
- explain why all the rest (polystyrene, dirty plastics, things contaminated with oil, chemicals, flip

flops) go into the 'communal' bags,
- explain how plastic bottles with remaining water/beer/softdrinks in them should be emptied and squeezed before placing them in the bag,
- forbid pouring any oil, chemicals, paints, or detergents into the environment, and make sure these containers remain closed and put safely in a 'communal bag',
- forbid volunteers to handle dangerous waste such as carcasses or medical waste like syringes (biohazard),
- make sure that once close to full, volunteers close each bag with a neat–not too tight–knot,
- let them know about the most common mistakes (putting surgical needles in a bag, carrying a bag with broken glass on one's shoulder),
- ask everyone to be cautious (if they are in doubt tell them to ask coordinators by phone, collect glass very carefully, do not throw glass under any circumstances, bags with broken glass should be marked and treated with special care to avoid serious cuts),
- ask everyone to wear gloves at all times and walk in polluted sites very carefully,
- emphasize the importance of NOT collecting floating riverine litter (see canoeing instructions) and concentrate only on coastal accumulations,
- finally, ask if there are any questions.

Divide and conquer. At this point, everyone probably feels that they have everything, know everything, and are raring to go. Look at the team carefully once more. If everything seems to be OK, divide them in 3 groups (dry team, motorboat team, kayak/canoe team), making sure that everyone is happy and prepared for their role. Ask everyone to go to the restroom before the great adventure, then send all the three groups to their designated locations where their briefing will be continued.

Dry team. Take a headcount. Let people know where to meet next and how they get to the polluted sites (walk, take a car, a bus, bicycle). Introduce them to their guide (the coordinator who knows the way). Instructions end once everyone knows where they should go and what to do next.

Motorboat team. Take a headcount. Let people know where to meet next and introduce them to their captain and their guide (make sure you pro-

vide a coordinator who knows the way in addition to the boat skipper). Instructions end once everyone knows where they should go and what to do next.

Kayak / Canoe team. Take a headcount. Let people know where to meet next and introduce them to their captain and their guide (make sure you provide a coordinator who knows the way in addition to the tour guide). Instructions end once everyone knows where they should go and what to do next. To fully prepare volunteers to approach the polluted sites by paddling make sure they understand:

- the basics of paddling (how to hold a paddle/oar and how to use it),
- that they have to accept and follow the instructions given by the skipper of the kayak/canoe (always delegate this role for a more experienced rower),
- how to avoid flipping over (not to grab the edges of the canoe, try to balance, hit tail waves of passing boats perpendicularly, put oars into the water to help balancing)
- what to do if they flip over (keep calm, make sure you are OK, help others, wait for assistance),
- how to get in and out of the kayak/canoe (never step on a boat once on land, step in the middle of the boat, before doing anything as for permission from the skipper).

DOWNLOAD[158] *- 'What To Say During Briefing' List and 'Leaflet To Distribute Template'*

3.9 In action - things to keep in mind during the river cleanup

At this point, your volunteers will probably be itching to fight the plastic pollution. This is more than OK, but your job is to not get too carried away, and to think in a different way. Like it or not, sometimes things can stand in between you and the riverine litter. Szabolcs Fülöp from Satu Mare, Romania is a water rescue specialist with outstanding experience. He has secured community river cleanup actions in five countries.

Szabolcs in a rapid response rescue boat watching over a cleanup operation in Serbia.

INTERVIEW

Szabolcs: *Being on the water is beautiful–one of the best things in the world–but at the same time, it is dangerous. It is our job to make sure everyone knows this and behaves accordingly. During a river cleanup, people on water have to wear life jackets at all times, because they are doing a difficult job and need backup. But sometimes even that is not enough. Storm alerts are more common these days, I remember getting them in Bulgaria and Serbia lately. The one in Serbia was especially bad. With climate change, storms can get very violent, so we take them very seriously. The coordinator of this particular cleanup issued the alert at 11:00 CET. The wind was catching up quickly, so we instructed people to stop the cleanup immediately. We gave clear instructions to leave their canoes and bags behind and get back to the other shore in our rescue boats. By 11:45 we safely returned everyone back to the meeting point. We checked if there is a possibility for a road transfer of the collected waste, but there was not. So we loaded all the bags in the canoes and took all of them in tow. By 12:10 and 12:30 the waves were getting too high, at least for canoes loaded with full trash bags. One tour guide was sitting in the middle of this convoy of canoes when suddenly he shouted loudly. I saw the last canoe taking in too much water and was sinking. Being tied together, it started to drag all the other canoes in front of it under the water. This tour guide took instructions seriously and so had a pocket knife with him. With a quick move he'd cut the secure line and so saved the rest of the convoy. Later the canoe and all the trash bags were retrieved from the water as they fortunately were buoyant. I don't even want to imagine the same situation with a tour guide who did not have his knife. So all in all, never underestimate the power of elements and be prepared at all times.*

Fortunately, situations like this arise only occasionally. Most of the time, river cleanups go according to the schedule without any problems. To keep things going smoothly on land and on water during the cleanup, please ask everyone to respect the etiquette of river cleanup actions.

Etiquette at the polluted sites. Indeed, there is an etiquette of how to behave near coastal riverine litter accumulations. Once there, look around carefully. Check for trees with dead branches or wasp nests. If you find any, let people know about them and keep a safe distance. Make sure everybody is aware of the important locations around (mooring points, deposit points and also where to put personal belongings and most importantly, where to pee). After everyone knows where they should take their filled bags (mooring sites or deposit sites, depending on your cleanup) and they all have their gloves and bags, spread them out evenly. Sometimes it is best to collect every piece of litter found in a 10-15 sqm area into a single pile. If they find a polluted site, make sure your volunteers sit/kneel in the center of it then start to fill up the 3 different types of bags according to the protocol (Chapter 3.8). Make sure nobody throws litter through the air. While plastic bottles cause no problem when hitting others, glass can be dangerous. To liven the mood a bit, you can put on some music. From time to time, have a break, eat some snacks, coffee, tea. Have a first aid kit ready to treat small injuries (cuts, bruises, insect bites) and also an Epinephrine autoinjector in case of a hyperallergic reaction. Do not lose sight of each other and meet up at the designated area according to your schedule. Remind people not to put personal belongings in a trash bag, because any unattended bags will be treated as waste. When there is some free time, take a few photos and videos. As a coordinator you can leave the site once the headcount is done and everybody is there safe and sound.

Collection of riverine litter in a floodplain forest is not as easy as it might seem.

Etiquette on water. It is imperative that once on water, rules change. In a boat, no matter if it is a canoe, a kayak, or a motorboat, volunteers always have to listen to the instructions of the skipper/captain of the boat. On water sometimes there is no time for an argument but simply to obey. Before

doing anything, volunteers have to ask permission from the skipper/captain (permission to board, permission to step out, etc.). Make sure they understand that once on water they have to talk out loud, in an easy to understand way, in short sentences. Again, personal safety must be your top priority: regardless of weather, everyone has to wear a life jacket on water. In summertime. ask everyone to wear a protective cap, drink lots of water, use suncream, and in winter wear layered outfits. Let people have a break from time to time, to take a rest or grab a snack. Make sure the food is kept in a watertight box or bag, safe from contamination (river cleanup boats can get messy). Should anyone feel uncomfortable or unsecure, ask for assistance from the water rescue team. After all, rescue boats are there to help no matter what. Do not allow volunteers to collect floating riverine litter. To pick up a drifting plastic bottle is OK of course, but to target large floating accumulations on open water is very dangerous. Be adamant, make sure that people understand that their job is waiting for them on the firm land, in the form of huge coastal riverine litter accumulations. Do your best to step in a boat with clean footwear, if it is hard (e.g. muddy terrain) make sure you clean the boat after the action yourself. In a kayak/canoe it is especially important to keep your belongings safe from the water. Use a trash bag if necessary, but never leave it alone, as unattended bags will be treated as waste. When your skipper/captain allows you to, take a few photos and videos. Once the team reaches the mooring site, make sure everyone has stepped out of their boats, taken their food and personal belongings, and tied mooring lines properly. Do not leave boats unattended, check on them from time to time. Do not let people load full trash bags in their canoes by themselves. Stepping in and out of a canoe under weight is risky if the shore is steep or the currents are swift. Form a line of volunteers and pass bags from hand to hand. As a coordinator you accomplish the water crossing once a headcount is done and everybody is back on land safe and sound.

The element of surprise. If you have done your job right as a coordinator, your team will do their job like clockwork, making the river cleanup a pleasant experience. If you can, lay back and enjoy the moment. If you can't at least try. But in the meantime, always be ready for the element of surprise. After all, your job as a coordinator is mostly about being prepared for things which others might consider as 'unexpected'. Here are some tips on how to do that:

Good example. Always keep an eye on the river, have your life jacket on, not only for your own safety, but also because people will look at you and follow your example. Be available at all times, make sure your phone ringtone is set to loud and is also vibrating (when in a motorboat you do not hear the ringing). Have your own mug and provisions-, along with some extra snacks with you, always have a first aid kit (incl. Epinephrine autoinjector), a good pocket knife and strong duct tape ready. Wear a bright color cap if possible so people can recognize you from far away. Last but not the least, keep smiling. It is more important than you would think.

Keep in contact. Approach people, ask how they are doing, what they need. Call your team leaders on their phones just to check how things are going. Make drills. For example, try to call the water rescue team if they respond well. If separate teams are working in a close area, using walkie-talkies or VHF radios might be a good idea. Once on radio, communicate with short, straightforward sentences as all units will hear what you are saying. If someone is not responding, that is not necessarily an emergency. Maybe the phone ran out of battery or there was no signal. Contact the water rescue team and launch a small search team to find out what has happened.

Slovakian volunteers on the Bodrog river, wearing life jackets for the cleanup as per requested.

Keep an open eye. Check on the weather forecast every 2 hours. With climate change, storms can develop quickly and become violent. Always check on the horizon, use binoculars if necessary. You have to be fully aware of your surroundings. When working in a floodplain, especially in an alluvial forest, keep a close eye on the trees. Huge branches, even entire trees, might fall, especially if the wind is strong. Once out on the water, check for large vessels, large waves, changes

in the direction of the wind, and large pieces of driftwood. If you see anything that might be a cause for concern, do not hesitate to inform everyone.

Emergency etiquette. Think twice before you issue an alert. If you think it is necessary, consult others beforehand, but make sure it does not take too much time. Once you reach the decision and the alert is issued, immediately inform all parties involved. Start with the water rescue team, and then with the team leaders. Communicate in a calm, but assertive manner, in loud, easy to understand sentences. Ask people to remain calm, and return to the meeting points. Give clear instructions to leave bags full of waste behind, for later recollection. Make sure people are evacuated quickly and safely (on land or by a rescue boat). Do not make people head for open waters in kayaks or canoes once there is a storm alert. If some people are hesitant to leave the polluted site, use a firm tone and make sure they follow instructions.

Cleaning rivers, doing something good for the environment, teambuilding. It's fun.

Nothing unusual. Fortunately, storm alerts and emergency situations are very rare. Usually you do not have to make any sudden changes in your itinerary and things go as they were planned. Still, it does not hurt to make an inquiry about how things are going at the next meeting point. Ask your team leaders if everything is OK, if they need any assistance. Pay special attention to waste collection–people will arrive back with full trash bags, tired. A welcoming party on shore, telling them where to offload and where they can get refreshments, makes a big difference. Your river cleanup day is officially over once you have taken a headcount and everybody is back safe and sound. Double check that no equipment and trashbags are left behind, only your footprints.

DOWNLOAD[159] 'What to Remember During the River Cleanup' list

THE AFTERLIFE OF RIVERINE LITTER

Coastal riverine litter accumulation before a cleanup. In the old days this was all considered as garbage and transferred to the landfill. Now more than half of it can be recycled.

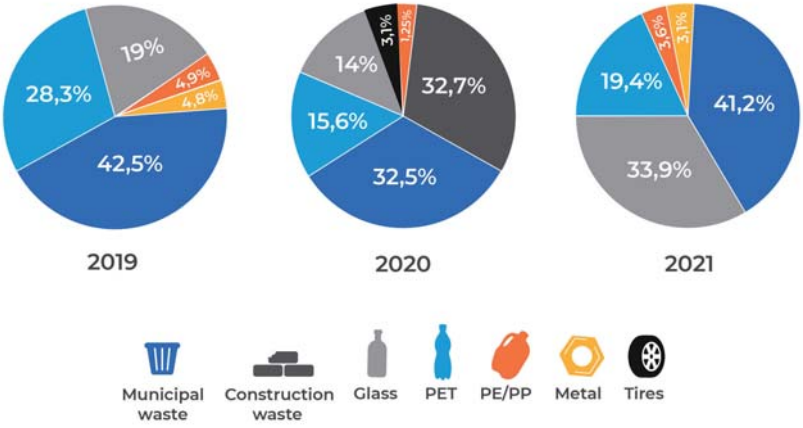
4.1 Selection - recollection and separation of the collected riverine litter

Congratulations, you have done it! With the help of your team, you have successfully cleaned your chosen area from riverine litter. Everybody is back at the meeting point, probably tired and dirty but at the same time happy and delighted. Ruslan Shvartz from Uhhorod, Ukraine knows this feeling inside out as he is regularly involved in river cleanups. (Fig. - Ruslan close to a huge riverine litter accumulation blocking the entire Borzhava river in Transcarpathia, Ukraine).

Ruslan (in the middle) is a devoted waste management expert who is setting up baler machines in small villages in the area of Uzhhorod.

INTERVIEW

Ruslan: From an event manager point of view, there is a great temptation to let people go home once they are back from the polluted sites. As a waste manager however, this is where the most important things start to happen. After a short briefing, everyone can join in the selection. Selection



Composition of the collected riverine litter in three consequtive years of river cleanups in the Tisza River Basin.

is crucial, because this is the step when we practically save the waste from being treated as trash. There is a fundamental difference between waste and trash. The latter is bound for deposition in a landfill. Trash does not have a value, on the contrary, you will most certainly have to pay a hefty deposit fee. Waste however, is full of potential. It holds a value not only as a raw material, but it has the force to strengthen communities and gives off the good feeling that we have done something for nature. Based on my experiences following cleanups on small rivers like the Latorica and the Borzhava, as much as 70% of the collected riverine waste can be recycled. So I suggest not to give up. Take a short rest after the cleanup, then jump into selection!

If you have thought everything over, there probably will not be any difficulties when transporting the bags full of riverine litter from the polluted sites to the selection point. No need to panic if there happens to be a 100 meter distance between mooring/offloading point and the selection point. Ask people to form a live line and pass bags over from hand to hand. Treat bags with glass in them individually. Once all bags are where they belong (selection point), the time has come to dot on the i.

Selection protocol. Make sure everything (tools, accessories, equipment) is prepared for selection[160]. Depending on the weather, provide cover (shade, raincover) against the elements for those who will work at the selection table. Make sure your assistants know their job. Delegate at least one person to provide a continuous influx of filled bags to the table. Another assistant should be responsible for collecting full bulk bags (and replacing them with empty ones). As for yourself, welcome everyone back, and say a few encouraging words. Say thanks for their great work and ask them for one last effort. If someone asks to leave (e.g. tired, exhausted, have other obligations) give them free passage. But as for others, time has come to put some music on. Make sure they have their reserves refilled (coffee break, snacks, lunch) and then you jump into briefing by not forgetting the following things:

- put on protective work gloves (for those afraid of touching litter, let them wear sterile gloves under the protective work gloves),
- in hot, dusty weather putting on a mask and/or protective goggles are advisable,
- again, put on some music (the more energetic, the better),
- explain that only the selective bags–neither glass nor communal–will be re-selected,
- reselection starts with pouring out the contents of the selective bags onto the table, then selecting the contents into the following categories:

a. PET (polyethylene-terephthalate) commonly known as plastic bottles (if your waste management partner requires, PET bottles can be further separated by their color). In this case:

- explain what 'white' or 'transparent' PET bottle means (it has no coloring additives), explain what 'blue' PET means (it contains blue coloring additives, faded blues can look white but once you check the bottom they are revealed), and what 'colored' PET means (it contains coloring additives that make the bottles brown, green, or other colors)

b. The second category to separate is usually that of polyethylene and polypropylene,

- PE and PP plastic items can be identified by their number codes (2,4 and 5 in the recycle triangle) or by the way they look and feel (they do not crunch like PET bottles, they are softer and often have a parting line on the bottoms),
- if time allows, unscrew the caps of the plastic bottles (caps are made out of PE or PP) and collect them separately,
- be extra cautious when handling oil and chemicals (in the heat of collection someone can accidentally put a transparent plastic bottle with oil (most often sunflower oil) into the selective bag),
- remove everything that has oil, chemicals (paint, detergents, pesticides, pharmaceuticals) from the selection loop by placing them in special containers (for dangerous waste),
- as for the rest (plastics that are too dirty and covered with mud, sand, or contaminated by organic matter) the communal waste bag is the final destination.

Make sure there are enough bulk bags for each category (PET, PE-PP, communal, dangerous). Supply plenty of plastic jars to collect and contain leftover liquids (water, beer, soft drinks) from selective plastic bottles. Check if bottles with dangerous waste (oil, chemicals) in them are treated separately. Provide constant support for the volunteers, from time to time tell them how many selective bags are left to give them a reference of their progress. If time allows, partake in the selection process.

Selection etiquette. Believe it or not, there is an etiquette for re-selecting the riverine litter, too. Chatting is not only allowed but encouraged, this is definitely the time to share some good anecdotes and stories. Singing is not forbidden. When pouring out the full selective trash bag onto the table, be extremely careful of others. Do not let litter fall on your fellow river cleanup volunteer. The same applies to throwing. When you throw a plastic bottle towards a designated bulk bag (most often placed somewhere behind you as the table is in front of you), make sure it does not hit anyone. The same goes for emptying the bottles. Unscrew caps carefully, pour out harmless liquids into the designated containers, and never, under any circumstances let it flow onto the volunteer next to you. If you get in contact with any kind of suspicious material, make sure you rinse it with water. Warn your volunteers to be extremely careful with containers of unidentifiable content. Unscrew the cap very carefully and observe the contents visually or try to waft its scent. Never, under any circumstances, sniff directly into the container. Instead, gently fan the air towards you with your hand, and try to figure out what is in it. If uncertain, ask for assistance, or if still in doubt, place the item into the communal or dangerous category. If you are selecting, shout LAST BAG proudly and happily when pouring out the last of the selective bags.

The announcement of the 'last bag' will surely cheer everybody up. Now people can rest, wash their hands, or have a shower and change their clothes. Make sure you give them feedback on the amounts of the collected waste (usually estimates at this level). Giving the team an evaluation of their performance is always a good idea. Take another headcount, ensure that everybody has access to photos and videos of the river cleanup action (usually via an online folder), and then thank everyone for their hard work and say a proper farewell.

It is so important to stay zero waste during a cleanup. Here redeemable soda bottles provide refreshment for the volunteers.

DOWNLOAD[161] *Use these lists to make sure you do not forget anything before and during selection. Download the What To Remember During Selection list your phone to make it available at all times.*

4.2 Recollection and reporting - closing the river cleanup action officially

A few minutes ago you might have made the 'last bag' call. We are sorry to say it was not meant for you. Most of the volunteers have left, but there you stand, along with a few entrusted assistants, left with the task of putting the finishing touches on the river cleanup. If you have done things right so far, bulk bags filled with all kinds of plastics; communal and dangerous waste surround you. But you still have a way to go. Gergely Hankó, the project manager and waste management expert of the Plastic Cup initiative have been at this point many times.

In the course of years, Geri perfected the way riverine litter can be selected and recycled.

INTERVIEW

Gergely: Do not make the mistake of underestimating the importance, and also the challenge, selection poses. With proper training, the separation of plastics can be done with volunteers, but the job is far from being over. First, there is the glass. In terms of overall mass, glass is one of the most prominent fractions of selected riverine waste. You should not allow beginners to treat bags full of glass, as glass can easily break and cause serious injuries–this job should be entrusted to more experienced personnel. Glass bottle caps can be made of metal or plastic, and we manage these too, separately. At Plastic Cup, we have the members of our riverine waste management team vaccinated against possible infections (typhus, tetanus vaccination). Safety precautions are also very important when handling the last fraction, namely, the communal waste bags. In our experience, beginner volunteers often mistake communal waste as recyclable waste. To improve the efficiency of the selection process, it is sometimes a good idea to reselect these 'communal' bags. This job, though, is definitely not for any greenhorns. Communal waste bags contain stuff that is always dirty, and usually smelly,

Selecting riverine litter after collection is a great challenge that requires determination and experience.

but we often find treasures within them. A common mistake, for example, is that people put a broken plastic bucket in the communal bag just because it is dirty. All you have to do is shake off the dirt and you can get kilograms of plastics back in the loop.

With proper gear even kids can join the cleanup efforts.

Once everything is done, the last and most important responsibility is to oversee the transfer of the waste. In my opinion, all waste management companies do a great job once you supervise everything and are constantly available. These companies often need information quickly, most commonly the truck does not find the selection point. And last but not the least, do not forget to pay your bills. This is the only way you can rely on these companies over and over again.

To carry out river cleanups with a circular economy approach in mind is not easy at all. Sometimes so much waste is collected that you and your assistants need to have a good night's sleep before carrying on the next day.

A single-days catch on a well organized community river cleanup can exceed a ton of plastic.

Members of the fast response riverine litter management unit of the Plastic Cup initiative with riverine litter selected, baled and ready for transport.

In any case, have some rest. When you are ready, close all ties properly–you need to recall the five basic principles of any given river cleanup:

Keep safe. Work extra carefully, tired people make more mistakes. Wear protective equipment at all times.

Work in teams. Distribute tasks among team members. Assign somebody the task of recollecting used plastic bags and gloves. Good quality equipment can be used from time to time. Make sure gloves are washed and dried as quickly as possible. Say a proper farewell and thank you to local communities, inform them about your results.

Work on dry land, travel on water. Selection should be done away from the river. Make sure you do not let any contaminants get into the river. Make absolutely sure that the meeting area and the selection area are free of any pieces of trash before you leave.

Respect and enjoy nature. Make sure your staff have a moment of peace to enjoy the river. Before cleaning all kayaks/canoes, just go out and paddle a little. Still, wear a life jacket, though.

Manage litter with care. Torn plastic bags should be placed in the selective waste (they are made of polyethylene), but good, strong bags should be rinsed and made ready for the next river cleanup action. Make sure all containers are handled by the waste management company. Double check to receive and store their reports. This way you will have precise figures on the results of your river cleanup action. If you are ready for more adventures, keep at least a fraction of riverine litter for experimenting (see chapter 4.3).

So, that is it. You have done it. Before

heading home, say goodbye to the river. With a little imagination, you might hear a reply saying: 'in the name of all running freshwaters and of course seas and oceans of the world, Thank You'.

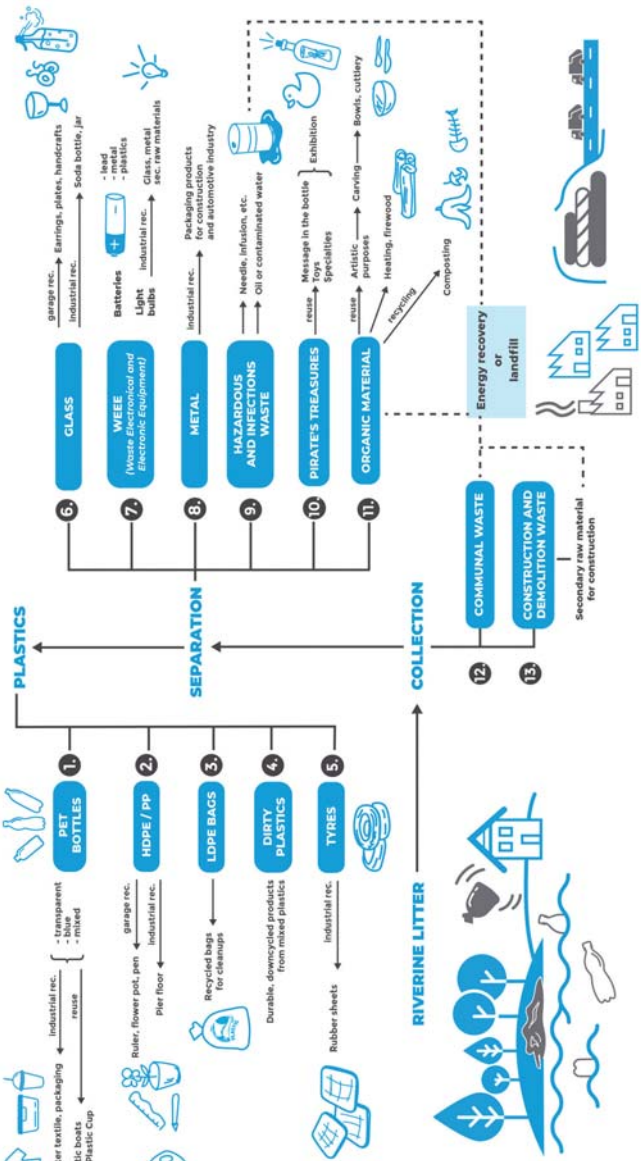
DOWNLOAD[162] *- Use the How To Complete a River Cleanup list to make sure you do not forget a thing when putting finishing touches to your river cleanup. Download it to your phone to make it available at all times.*

4.3 Resurrection - recycle and upcycle the selective riverine litter

The true cost of the increasing amounts of mistreated domestic and industrial waste present in natural water bodies is hard to estimate. Riverine litter affects different industries (fishing, shipping, tourism) either directly (e.g. cleanup operations) or indirectly (e.g. welfare, lost revenues), causing losses often referred to as economic costs. Other costs include ecosystem deterioration, and loss of species and habitats[163] causing a loss in environmental values, which is more difficult to quantify. Taking into consideration that plastics are made primarily from crude oil (not to mention additives), the notion that plastic floods can be considered as a special form of oil spills, is not unfounded. Naturally, there are differences between the spatial and temporal complexity of the two, but in the long term, plastic floods, just like oil spills, impact natural ecosystems negatively.

Once released into the environment, carbohydrates (e.g. diesel, gasoline) and synthetic polymers (e.g. plastics) disturb the original conditions in a natural habitat. In the floodplain forests of the Tisza, after plastic flood events European pond turtles *(Emys orbicularis)* are strangled in the floating plastic waste. Meanwhile, on the land, pairs of white-tailed eagles *(Haliaeetus albicilla)* are forced to leave their nests because of the constant cracking sounds, a special kind of noise pollution caused by thousands of plastic bottles, compressing and extending according to daily variations in temperature[164]. It is more than obvious that the price of these products, continuously contaminating the environment, are not in accordance with the true economical and environmental costs.

As a comparison, let's examine the most obvious price we are forced to pay because of plastic pollution: cleanups. The direct economic costs related to cleanup interventions on European beaches alone are staggering. A scientific survey carried out in the United Kingdom in 2010 revealed that for each kilometer of UK coastline, an average amount of €7000-7300 was spent each year[165]. To decrease the negative impacts of marine litter, the



The floating section of riverine litter can be selected and separated into 10+ distinct categories, once proper conditions (trained personnel, equipment, storage and transport) are provided. To increase the efficiency of recycling, cooperative waste management companies and innovation is also required, not to mention the compliance to local waste management regulations. For the Plastic Cup initiative, active in the Tisza River Basin it took nearly 10 years to surpass a 60% efficiency in recycling.

EU supports beach cleanup operations with €630.000.000 annually[166]. Fortunately, there is a wide range of instruments to use when trying to address the complex environmental issue of riverine (and marine) litter pollution. One of them is recycling. Below is a non-exhaustive list of best practices for the innovative recycling of ocean-bound riverine litter from the Danube river basin:

Use as is. Riverine litter often can be used as it was found. The volunteers of the Plastic Cup initiative are fighting back plastic pollution by using the very plastic they removed from the environment. Since 2013 they have been building plastic bottle boats that not only attract public interest, but prove to be useful tools during long distance and large scale river cleanup actions.

A traditional fishing dinghy, locally known as a 'ladik' can be made from riverine plastics. Unlike its wooden counterparts, this plastic boat requires little to no maintenance.

A whitewater kayak produced from selected, shredded, grinded and micronized riverine litter in the framework of the Zero Waste Tisza project.

Small litter, big value. An independent small business uses small quantities (5-10 kgs) of riverine plastics in order to create bracelets of all kinds[167]. The income from the sale of these recycled products is partly used to fund future river cleanup projects.

From waste to products. The real potential of recycled riverine plastics appears when it is exploited for the sake of local riverside communities. Experience shows that by using basic recycling technologies (grinding, injection, extrusion) riverine plastics can be turned into plastic beams and planks. From these-after applying additives to resist UV radiation and oxidation–time resistant pontoons and traditional fishing boats can be built. Using the rotational molding technology riverine waste can be turned into a small boat like a whitewater kayak.

From waste to a smile. The River Trashlab was developed in the framework of an Erasmus+ project called 5 countries 1 river. The interactive exhibition moves around in all of the Tisza river countries to educate schoolchildren and provide sustainable solutions for local businesses trying to invest in recycling[168]. The same motivation lays behind the launch of the Floating Exhibition (FLEX) in the framework of the Danube Transnational Programme Tid(y)Up. Able to move on the river as well as on the road, FLEX will raise awareness about plastic pollution in rivers, in addition to highlighting possible solutions to this complex and crucial environmental problem.

The mobile and modular zero waste exhibition of the Tid(y)Up project traveled around project countries under the name FLEX (Floating Exhibition), pictured here in Kosice, Slovakia.

Attila on a whitewater river cleanup in the Carpathian Mountains, Ukraine, on the Black Tisza river.

EPILOGUE

*by **Attila David Molnar***

Plastics can do many things. They can improve people's lives, but also wreak havoc on natural habitats; they can suffocate sea turtles and transport drinking water to dry areas; they can hold a smartphone or a car together, but can accumulate in the bodies of fish. Plastics are neither good nor bad, the only question is how we use them.

It is no longer enough to say no to single use plastics. To beat the plastic tide, to squeeze this rampaging genie of plastic pollution into the bottle, where it belongs, new competences and skills are required. We need more and more people who understand the many ways plastics work.

This handguide was written just for that. Here I say thanks to all the experts from seven countries (see contributors below) who helped to write this book. We took this task very seriously and worked together in the hope that you too will join us: an inspiring group of people working for our rivers.

You can help natural waterways in a myriad of ways. Some people are meant to work from their office and change laws and regulations for the better. Others should go out and face the pollution face to face. And yet others should develop new ways to collect and recycle plastics.

Only together can we say goodbye to aquatic plastics and other forms of water pollution. In the hope that you have decided to do more for the sake of our rivers, there is only one thing left for me to say: welcome onboard.

November 2022, Bodrog river, Sárazsadány

REFERENCES

please find all references to this handguide under the following URL:
https://kszgysz.hu/rivercleanuphandguidereferences

School children visit FLEX, the zero waste Floating Exhibition built 90% of recycled, 100% of recyclable materials. The reclaimed ferry with used containers onboard, sails the rivers of the Danube River Basin to raise awareness of plastic pollution

Csanád Iványfi on his source to tributary Tisza expedition on a kayak made of recycled PET bottles. As a volunteer of the Plastic Cup initiative, he is often called a 'plastic pirate'.

THE OFFICIAL WEBSITE OF THE DTP TID(Y)UP PROJECT

DOWNLOAD THE TRANSNATIONAL RIVER CLEANUP HANDGUIDE

PROJECT DOCUMENTARY

REFERENCES, ANNEX

SCAN ME!