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Danube Transnational Programme
lifelineMDD

TRAINING HANDBOOK

D.T3.1.1 Joint didactic materials and tools for transboundary trainings

Impressum

Developed by
WWF Adria, Zagreb, Croatia
WWF Adria Serbia, Belgrade, Serbia

Authors
Alice Thinschmidt, Tijana Pavlović

Editor
Nikola Matović

Contributors
Emőke Györfi, Jovana Dragić May, Kerstin Böck, Sonja Bađura

Photo on the cover
Ante Gugić

Design and layout
LUPO Design Studio, www.lupo.rs

Proofreading
Sandra Weitner

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Introduction/preamble

It has been a long journey.

For a long time, devoted people on the Mura, the Drava, and the Danube worked to protect these rivers and set conservation actions. Already in the early 1980s, the first initiatives included protesting against seven planned dams at the Mura river in Slovenia. Hungary followed in 1989, with protests against a dam on the Drava river, and Croatia set a campaign for the "Living Drava".

Firstly, their focus was on local regions. But the river is flowing. Its waters do not belong to a special place in your area but come from other countries upstream and leave your region to other countries downstream, where they flow into the sea. And also, seawater is flowing: it moves in a worldwide current all around the globe. A single drop of water could be on an over 1.000 years' journey through the Mediterranean, the Atlantic, and the Pacific Ocean. This image shows us that rivers are an international topic, and their protection cannot be anything other than an international concern. In the 1990s, a strong vision was formulated, and the idea of a Transboundary Biosphere Reserve arose.

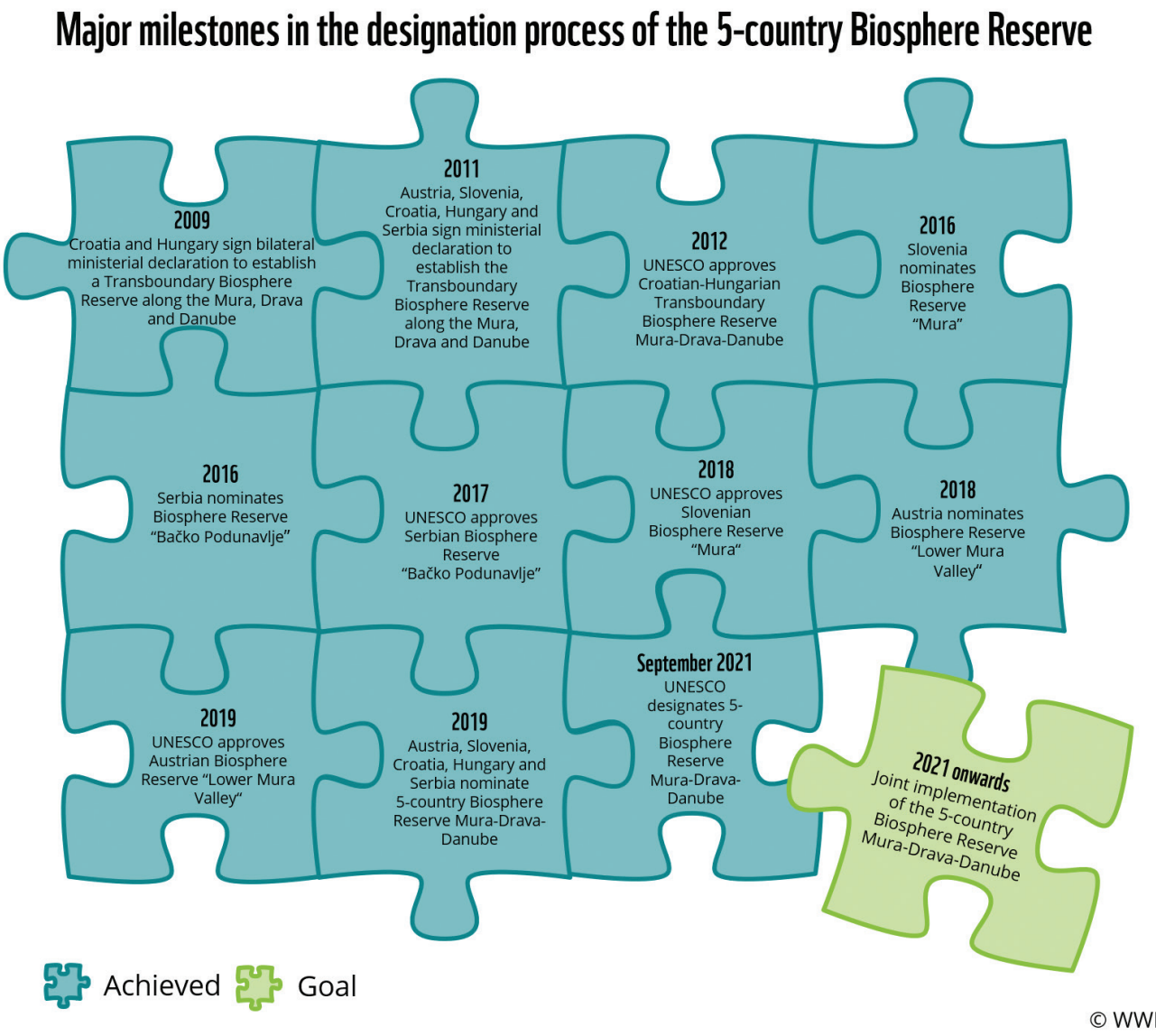
So the story goes on. Neighbours from both sides of the river started to talk about "their" river. Together. Not so much as a border between their countries but as a shared environment for nature and people. Neighbours have to collaborate also in daily life. And so did the neighbours on the river banks of Croatia and Hungary. This collaboration was the next of many milestones – or puzzle pieces – marking our path: in 2009, Croatia and Hungary signed a bilateral ministerial declaration to establish Transboundary Biosphere Reserve along the Mura, Drava and Danube.

Piece after piece was added, and behind each step, many people took action, worked on action plans, collected data, went into the field, sat around tables, and discussed. They took part in meetings, wrote reports, travelled to far away ministries, and talked with local people, sitting on the banks. The goals were aimed high, and there were times when it seemed impossible to reach them.

In September 2021, all those efforts of so many people in so many countries have been rewarded:

The world's first 5-country Biosphere Reserve Mura-Drava-Danube was designated by UNESCO.

But the journey goes on.



The last puzzle piece in the long-awaited nomination of the UNESCO 5-country Biosphere Reserve Mura-Drava-Danube.[1]

This important UNESCO 5-country Biosphere Reserve Mura-Drava-Danube (TBR MDD), the so-called "Amazon of Europe", is home to various species of insects, birds, plants, fish, and others. The floodplains are not only important as a rare natural habitat. They also lower the risk from floods, secure favourable groundwater conditions, and self-purification of water.

The years 2021 to 2031 will be a crucial period: There is a lot to do.

Let's continue our great work!

1 Retrieved from: http://www.amazon-of-europe.com/en/biosphere-reserve/

Highlights:

more than
140
breeding pairs of white-tailed eagle (biggest population in Europe/highest density of breeding pairs in Continental Europe)

2/6 two out of six sturgeons are still present in the TBR MDD: sterlet and the nearly extinct ship sturgeon (*Acipenser nudiventris*)

more than
5.000
animal species

more than
700km
long "green belt"

last retention area for rare bird species like little tern

more than
250.000
migratory waterfowl use the TBR MDD for resting and feeding

1.000.000
hectares of natural and cultural landscapes

In this Handbook, you will meet a strong river. The river has its source, its flow in which it intertwines through factors without which it would not exist, as well as obstacles, branches, and its mouth. To preserve the rivers and the knowledge about them, we integrated the knowledge of education into the understanding of rivers.

That is why we are travelling now down that River.

Our river has a strong source and flows down from the hills of pedagogy into the vast plains of environmental education. Here, the river divides into several branches like natural, free-flowing rivers do in their middle courses.

Our main river bed is where you find out everything about Aims of a Biosphere Reserve. Further on, River branches are bringing you knowledge about River dynamics and river restoration, River birds, Riverine fish species, and Impacts of Climate change. All five river branches are essential and intertwined, and one doesn't make sense without the other. But still, you may travel only on one and leave the other branches for your next journey down the rivers of environmental education. All five together flow into the mouth, the ocean of knowledge, the final chapter of this handbook.

Each branch has its theoretical and practical parts, but the main emphasis of this handbook is the practical part, which includes the activities. The theory behind it is important, but most importantly, we want to share knowledge on passing it on.

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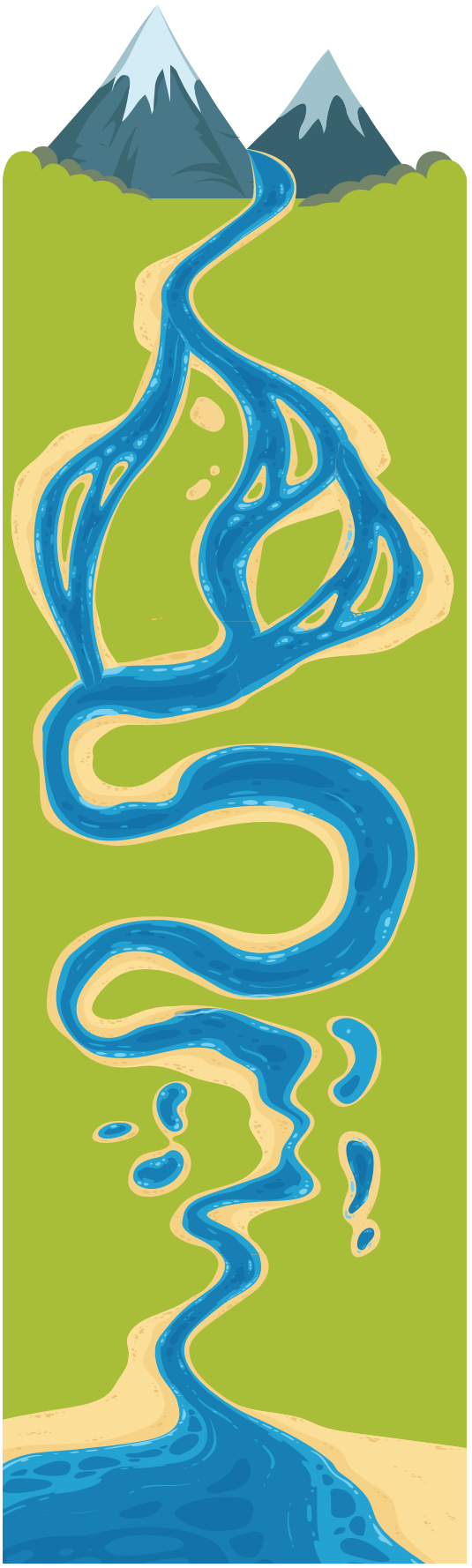

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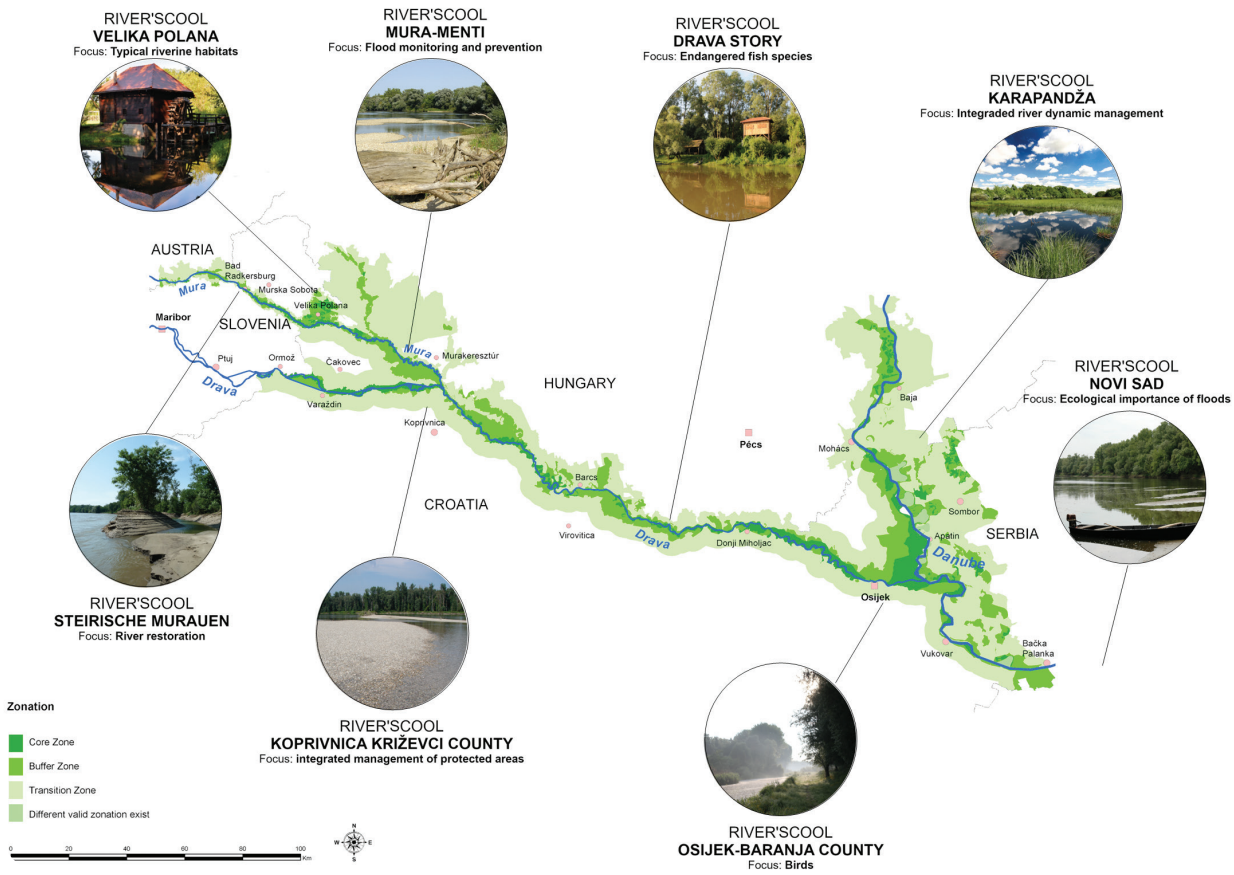
1. The Source

You are standing somewhere in the mountains. In front of you, right under a big rock, there is water coming out. A mighty source, seeking its way down from here. Sometimes it‘s bigger and sometimes smaller, but it never happens that it stops flowing. These are the sources that become creeks, streams, rivers. Where will this water flow? What will it take on its way down, and what will it bring to the people living on its shores? Where will it have its mouth and enter the sea?

Good, strong sources are crucial. Without them, there is no flow. So take your time, follow its steps, cascades, and jumps and get familiar with the sources of pedagogy - and with the sources of our environmental program.

1.1. River’Scools

The River’Scools are primarily outdoor and, in some cases indoor, learning environments connected to the characteristics of dynamic river systems, restoration, and conservation of the TBR MDD. There are eight of them, but this is not a finite number. They are the central fulcrum in educational and research sites across the whole TBR since each of them focuses on a specific topic.



Starting from Austria and “River’Scool Steirische Murauen”, which focuses on river restoration, the next downstream is “Velika Polana” in Slovenia, which concentrates on typical riverine habitats. After that, there is “Mura-menti” in Hungary with a focus on flood monitoring and prevention. Downstream in Croatia lies “Koprivnica-Križevci County”, dealing with integrated management of protected areas, followed by River‘Scool “Drava Story”, focused on endangered fish species. Afterwards comes “Osijek-Baranja County”, which focuses on birds. In Serbia are located two River’Scools: “Karapandža” with a focus on integrated river dynamic management and the “River’Scool Novi Sad” focusing on the ecological importance of floods. The aim is to educate the local population: children, young people, and other visitors, with the use of adequate didactic tools and methods.

Relying on the work and practice of River’Scools, thematic educational programs have been formed that can be further developed. Trainers selected for National trainings are prepared for the use of novel joint didactic materials and methods. By multiplying knowledge and skills from trainers to local educators and guides, we provide a stable further widespread flow of the river of knowledge.

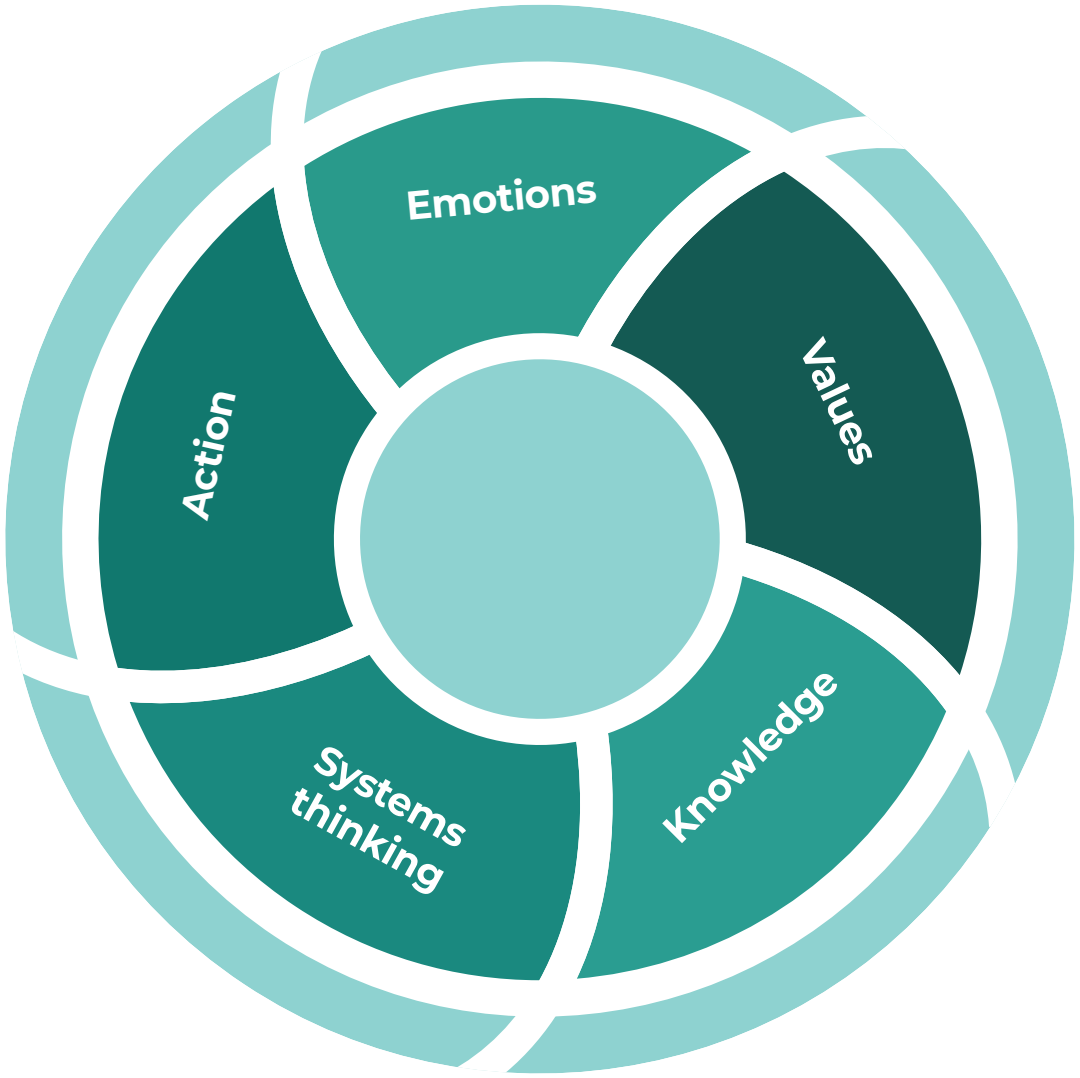
Therefore naturally, this handbook relies on the previous guidebook: Concept of Transboundary Learning Network of the River’Scools (TLN Concept).

1.2. So how does a person become an environmental educator?

Our TBR MDD is a specific biosphere reserve that includes five different countries with diverse educational theories and practices. This is why teaching competencies can be explained differently in the pedagogical literature of these countries. Yet, education for sustainable development has been the subject of various studies in Europe, and a group of authors defined the most important competencies for environmental educators.[2] Competencies are a combination of knowledge, skills, and attitudes.

In the following, you will find an overview of the most relevant competencies for trainers/facilitators in the TBR MDD.

2 Sleurs, W. (2008). Competences for ESD (Education for sustainable Development) teacher. Brussels.



Competencies related to Emotions

Learning, thinking, reflecting, valuing, making decisions, and acting are inseparably tied to emotions.

We develop feelings for the world around us, land, river, plant, or animal. Empathy doesn't exist only as a part of social relations, and we have to develop empathy for our environment. To learn from nature, one has to connect with nature previously. When we like something, we are ready to learn. When we understand something, we are prepared to protect it and think of ways of conserving it.

So to teach about the environment, we need to have strong feelings about nature as a prerequisite for its protection.

Developing empathy for nature means understanding nature, investing in ourselves, and engaging in nature. That's why it is essential to learn about real issues connected to the lives of participants.

During the learning process, the Trainer/Facilitator has to...

- ...understand one's own emotions and feelings as well as the emotions and feelings of participants, the impact of emotions on perception, judgment, decisions;
- ...create a learning experience in a way that allows everyone to express their feelings and innovative ideas and proposals without fear of failure;
- ...create learning situations and an appropriate atmosphere so that participants can develop feelings of empathy and identification with communities and nature in the biosphere reserve;
- ...use ways and methods to regulate self-emotions as well as of other participants in group communication;
- ...be aware that emotions are crucial to our lives and can often be related to former experiences and also depend on the surrounding culture;
- ...beware of the emotional dangers of domination (e. g. power relations).

Competencies related to Values and Ethics

Our values determine us as human beings. Our perception and way of thinking, decisions, and judgments, and feelings and actions are guided by our norms, values, attitudes, beliefs, and assumptions. The main guiding principle in environmental education is equity, ensuring that all communities are treated fairly and are participating.

"Education for sustainable development is fundamentally about values, with respect at the centre: respect for others, including those of present and future generations, for difference and diversity, for the environment, for the resources of the planet we inhabit. Education enables us to understand ourselves and others and our links with the wider natural and social environment, and this understanding serves as a durable basis for building respect."[3]

3 UNITED NATIONS. (2004). *Decade of Education for Sustainable Development 2005-2014*, Draft International Implementation Scheme, October 2004.

Trainer/Facilitator as a guide for learning values and ethics...

- ...believes that every learner is a competent participant in their learning and establishes an inclusive environment;
- ...should be able to clarify (making implicit beliefs explicit) their own beliefs, assumptions, and values related to educational goals of the TBR MDD;
- ...respects universal human values and encourages participants to follow them, supporting mutual understanding and respect, tolerance, respecting diversity, cooperation, and socializing;
- ...by personal example, influences the formation of value systems and the development of positive ones by participants;
- ...understands the importance of lifelong learning and continuous professional development.

Competencies related to Knowledge

It is not enough to know everything about river restoration or endangered species of fishes or birds in the biosphere reserve. A particular discipline's theories, principles, and concepts are good content knowledge, but it would be hard to pass on without pedagogical skills.

Trainer/Facilitator as a guide of learning processes...

- ...controls group dynamic and recognizes individual learning needs of participants in the specific learning environment;
- ...acquires relevant and embodied knowledge about biosphere reserve issues;
- ...values knowledge of cultural heritage and can critically reflect on it;
- ...helps participants to distinguish between factual knowledge and opinions;
- ...selects educational goals, taking into account the developmental stage and the prior knowledge of the participants, and the diversity within the group;
- ...continuously encourages the development and application of various thinking skills (problem identification, problem-solving, decision making) and forms of thinking (critical, analytical, and divergent);
- ...connects educational goals with previous knowledge and experiences of participants and their present and future needs, with examples from everyday life;
- ...knows a range of teaching/instructional methods/materials, i.e., research-based learning, real-life learning, project learning, role-playing games.

Competencies related to Systems thinking

Systems thinking helps learners view systems from a broad perspective, including seeing overall structures, patterns, and cycles in systems, rather than only specific events.

A systems approach to teaching ecological literacy provides a new way of thinking about and viewing the world, which includes shifting from parts to the whole, objects to relationships, measuring to mapping procedures, quantity to quality, and structure to process. Following the systems thinking approach means that nothing can be studied separated from the system in which it exists. However, it is only helpful in sustainable ways when linked to emotions, values, and ethics.

Systems thinking enables the observation of the phenomenon from different points of view and, consequently, critical thinking development. Critical thinking is not only one mental activity. It consists of three types of thinking: reasoning, making conclusions and decisions, and solving problems.

Trainer/Facilitator as systems thinking implementer...

- ...understands basic models of systems theory and applies them in different situations and for other issues;
- ...understands the mutual relationship of nature and man (man and the biosphere);
- ...can think in models and patterns, recognize patterns and relationships in systems, reflect on them, and consider them in decision-making and acting. It all requires well-developed imagination skills;
- ...encourages the participants to engage in open inquiry to look at issues from different perspectives as well as their short- and long-term consequences;
- ...guides participants to develop empathy by identifying themselves with others.

Competencies related to Action

Action is merging all other competencies to a meaningful process of participation and networking in environmental education.

> "Actions allow us to experience conflicting interests, change, to be involved (participation), learning from mistakes, synergies, and success. All of them can increase motivation for further learning and continuing action if they are chosen wisely." (Sleurs, 2008)

Trainer/Facilitator...

- ...can present creative solutions;
- ...has to know the possibilities of learners to participate in environmental action;
- ...explains his position and has civic courage;
- ...shares the responsibility for the teaching process with the participants;
- ...motivates participants to act.

All mentioned domains of competencies must be in ongoing supportive relationships. Keep in mind that nature should be primarily felt, seen, smelled, listened and touched. Experiencing nature with our senses inspires emotions and love for nature. Then we can move on to acquiring values and knowledge and developing thinking in systems. This is often the moment when a person might want to set action. And every step brings us to more understanding, more love towards nature.

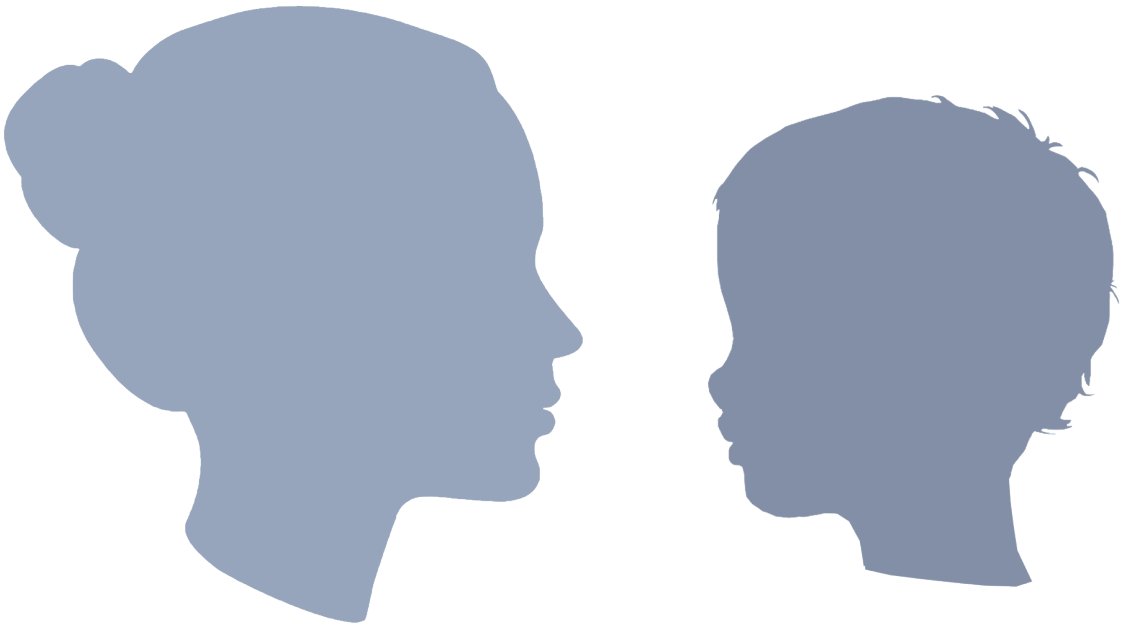
As an environmental educator in River'Scools:

You should take full advantage of the characteristics of the spot where you are carrying out your program. In addition to this, handbook learning activities should rest on the elements of the environment in which the activities are performed (natural, cultural, historical, social, linguistic, and other elements). This direct experience encourages the creativity of the participants.

1.3. Key differences between learning styles of Adults and Children

Participants in River'Scools are of different ages: children and young adolescents, working-age and elderly population are our visitors. Their process of learning can differ; adapting a program might be a big challenge. This is why the "Age of participants" in learning activities described in this handbook is defined by a recommended minimum age (e.g., "7+"). All groups, especially adults, can be very diverse in knowledge and experiences. Every facilitator has to find matching activities (from this handbook or other source) for the group they are working with.

Differences and similarities in learning styles of children and adults:[4]



Adults:

- Certain about what they want to be the subject of their learning;
- Already have a lot of experience, information, and values that affect their way of learning;
- Willing to learn if they see that the new knowledge can be applied later on.

Children:

- Interests are not yet fully developed, curiosity emphasized;
- Minimal experience and understanding of reasons for learning;
- Emotional connection with the educator is critical.

4 Matarasso, M., Nguyen, V.D. (2002). *Environmental education trainer's guide for nature conservation.* WWF Greater Mekong.

Some educational features and techniques are similar, no matter the age of the participants. Always rely on sensational information (e.g., biggest, oldest, strongest...) as kids and adults love them likewise. They are helping participants to make associations with concepts.

Considering the cognitive and social skills of the learners of different ages, we will have to use various educational techniques:

Educational techniques according to different age groups

Age group	Educational techniques
Preschool children	■ Have to identify the objects ■ Factual information ■ Learning distinctions (wide vs narrow) ■ Learning by role-playing and vivid images ■ Guided discovery, involvement, inquiry, discussion ■ Activities as energizers ■ Learning with fingers (tactile art) ■ Basic ecological principles ■ Explanation by demonstration, dramatization, personification
Children 7-11 years	■ Guided inquiry, discussion, imagery ■ Literal interpretations, ready for their storytelling ■ Focus on different and broader perspectives ■ Sensitivity to meet societal norms, development of empathy ■ Awareness and appreciation activities ■ Ready to learn about ecological principles and patterns ■ Basic management and conservation information ■ Introduce cultural aspects of environmental issues ■ Introduce consequences of environmental problems
Adolescent and adults	■ Guided discovery, inquiry, discussion ■ Structured socializing and adult treatment ■ Meaningful and highly relevant materials (differences, social injustice, ecological conservation...) ■ Cooperative group activities ■ Awareness and appreciation activities ■ Advanced ecological principles and patterns ■ Advanced management and conservation information ■ Explore cultural aspects of environmental problems

Nevertheless, don't forget that adults like to play, just like pre-schoolers. Learning through play has the magical ability that we adopt much information without much effort. Playing encourages concentration and motivation. The context of learning has personal or cultural relevance for adults, which you must be aware of. Rely on their experiences and involve them in planning the learning process. For adults, metacognitive strategies are an important part of gaining new knowledge. Adults know how to organise their learning process and how to evaluate it. Metacognition implies that they have the intention to think and learn.

Adolescents are ready to test authority, and you should be prepared not to be guided by that behaviour. It is a sensitive period and important to acknowledge adolescent feelings.

Every person has an individual learning style affected by different factors: environmental, emotional, sociological, physical, and psychological. The uniqueness of the learner has to be our guide in the process of transitioning the knowledge. The more time we dedicate to a group, it will be easier to recognise these differences and use them for a group learning situation.

1.4. Nature is for everybody, especially if you are special

Many studies reflect on children and adults with disabilities in different learning environments. There is no question that being in nature supports multiple development domains for every child. "Nature is important to children's development in every major way–intellectually, emotionally, socially, spiritually and physically".[5]

Since you will be working with groups of participants you don't know very well, gathering information in advance about the group is necessary. Don't hesitate to ask about the disabilities you will be working with; the more you know, the better you can prepare yourself.

Maybe there are some associations of schools for children with disabilities close to the River'Scools that you can invite to some future outdoor days and ask for help and cooperation. You can also invite experienced educators that have some of the impairments. They can advise you with the activities plan and mentor educators who are not experienced working with participants with disabilities. As educators, it is our responsibility to create space for everyone to spend time in nature and learn from it.

5 Kellert, S.R. (2005). *Nature and childhood development*. In: Building for Life: *Designing and Understanding the Human-Nature Connection*. Washington, DC., Island Press.

Here are some general recommendations - besides communication and social support - if you have participants with developmental disabilities in your group.[6]

- Ask for help. Rely on the support of trained professionals that are with the group. As an assistant, they can provide you with the information to adjust activities and stay with the group through activities.
- Be patient. Sometimes they need more time, and they are frightened of new situations and new people around them. Give them time. Sometimes you will have to carefully prepare the group for the transition from one activity to another.
- Be concrete. Indefinite terms may confuse them, and they need clear and precise instructions.
- Encourage them. Help them to ask questions, believe in their choices.
- Draw attention – visually, verbally or physically.
- Laugh. Sometimes it is all you need to make them feel comfortable and get them ready for new activities.
- Protect. Create a friendly and safe atmosphere for the group and each individual.
- Divide the roles for group work. Always plan cooperation so that everyone can participate, make pairs so they can help each other. Help them to find a mutual interest.
- Be ready to decide. If there is a problem in a group, the facilitator has to lead to the solution.
- An environment is also a learning tool, don‘t be afraid to use it. While working with outdoor activities, you can always provide a quiet place for relaxation for the participants.
- Don’t forget to believe in their achievement and don‘t lower expectations.
- Offer a solid daily structure and avoid surprises.

Nevertheless, concrete disabilities require special treatment. Further on, the main guiding tips for participants with disabilities are listed and should be followed when adjusting the activities. At the same time, the activities have additional tips on adjusting them in the “Barrier-free” paragraph. These tips are there to help facilitators to recognize a variety of adaptation of activities.

For persons with limited mobility, it is tough to participate in long activities. They get tired quickly and need much more energy and strength for individual movements. The space where activities are carried out has to be barrier-free, especially if they are using wheelchairs. Make sure that they have assistants and that the group is not moving too fast for them. They can always be the locomotive in the line; never let them be the last participant.

6 Lazor, M. (2008). *Priručnik za rad sa decom sa smetnjama u razvoju*. Novosadski humanitarni centar, Lito studio, Novi Sad.

Speech and voice difficulties are often paired with limited mobility. Due to their problems expressing themselves verbally, you should always pay attention to their desire to communicate. Because of their feelings of exclusion, persons may look unmotivated to participate. Use short, sufficiently clear instructions, tasks broken into small steps. It should be constantly checked whether you have heard and understood each other well.

One of the important characteristics of blind and visually impaired participants is a slow and unsteady walk in a wide-open space. To help them develop a sense of security, avoid rough terrain and provide these persons with a detailed description of the area or support of other participants. All activities related to sound, tactile and kinaesthetic experiences are welcome. Instead of drawings, use models they can touch. Tasks given to the group can be formulated to activate the rest of their senses (for example, the whole group can do an activity blindfolded).

For deaf people and persons with impaired hearing, the most important help is to provide a sign language translator. Communication can be established, but you have to always think of eye contact, speak slowly and clearly, and be aware of participants using lip reading. Think of them as visually gifted and prepare such materials and activities. If you are using sound for the beginning of the activity (e.g. whistle), make sure that you invite persons with impaired hearing with a previously agreed sign.

It is a great challenge to work with persons with behavioural disabilities. Besides that they are not at ease, they often have problems connecting to people. They need firmly set rules and precise timing of activities. Motivating are situations in which they help others or activities where they can move a lot.

Having now addressed the theoretical side, it is time to move to the more practical part of working with children. But many of the “ingredients” listed below are recommendable for adult groups as well. Find out your recipe!

1.5. How to cook a good children‘s program?

> magine you are a kid. What would you like to do most in nature? Did you get that opportunity when you were young? What did you miss?

Any group event organiser should carefully shape and design its program as closely as possible to the target group. For instance, you would not come up with the idea of a 5-hour enduring long walk with older people. But adults often forget to shape their program in the same careful way when they deal with kids.

With a school background squeezed in the system of hours, rooms, schedules and hierarchies, it might be hard to imagine doing something utterly different about learning and teaching. But it's worth it because nature gives us the chance to teach in a new way. Don't try to walk the old ways. Be brave and head for untrodden ones. Nature gives us an excellent opportunity (some call it "excuse") for new experiences, for students and teachers alike.

And now let's start with the cooking!

Imagine a big kettle. We add the ingredients to cook a potent potion. After drinking from it, the kids will be happy, have an exciting day, learn essential things and can't wait to return to nature again. An illusion? With gaining more experience, you will know what to take more, what to skip this time, what to take less ... and how to spice up your program.

These are the ingredients:

Use nature, not paper: Don´t make nature a classroom. Use what you find out there, natural plants, animals, water, etc.

Use different group sizes: Smaller groups are better if you want to explain something. Work in pairs is better if a task is very challenging. Tasks that should be done alone can help some kids who are not so happy with groups to trigger their talents. The whole class is a good size for some running games. Change and adapt the group size and switch between different ones.

From own experiences to common knowledge: Give the kids the chance to make their conclusions before handing over the explanation. Even better: Let them discover it on their own. Think the other way around than in school.

Harmonic group atmosphere: If one feels safe and happy, it is easier to learn. Conflicts in a group can destroy a whole program. Social skills are very welcome in teaching outdoors, maybe sometimes more as group dynamics can be more vivid.

Be flexible: Kids are quick and do sudden turns and will surprise you. Be aware of that, and don‘t stick too stubbornly to your plan. Instead, stick to your goal but let the kids take different ways to get there. Also, weather or other unpredictable issues can always demand a plan B.

Play with your voice: If you need better control over the group, try whispering if they are too noisy. You will sooner get their attention than trying to be heard with a louder voice.

Use all senses: Adults are very fixated on looking, in our online world even more. Besides listening to other humans, we neglect our ears and completely forget smell, touch, and taste. Kids are more “complete” in this sense, and learning goes deeper when they can grasp it in the very sense of the word.

Enough time to connect to nature: Don´t expect the kids to switch to “all senses open for nature” when they are not used to it. Give them time and prepare them to be ready for discovery. They need time to play, to rest, to do nothing as well. Outdoor programs ideally should not have a too-tight timeframe.

Meet their current needs: Being tired from a walk or wanting to run after a long bus ride, hunger and thirst, weather, group dynamics...adapt your program continually a bit if needed. The more you meet their needs, the easier they will follow you. That doesn’t mean that you should not challenge them from time to time.

From small to big: Start with one flower, one bug and get to know it, then find similarities and interaction with other things around and draw the big picture at the end. Kids are small and learn that way, step by step, from simple things to more complex theories. Adults are more used to learning the other way around, from top to bottom.

Playful approach: Kids learn while playing. So, games are not a waste of time but an essential part of teaching in nature. But they can also strengthen their bonds, create a good atmosphere or help them to get rid of too much energy.

Tell stories: Wrap the content into stories. Talk in pictures rather than in sentences. Invite people who are good storytellers. But leave it if kids don‘t react positively or are not in the mood to listen, for nature itself is more exciting.

Fun: To make funny programs doesn‘t mean that they are shallow or “no real teaching”. Find your good mix of challenge and discipline with joy and laughter.

Use different methods: You have a group of individuals, so the more diverse your approach is - the bigger the chance to reach all of them. And each individual has got many sides, talents, aspects...so why limit to one way only?

Beauty matters: The surroundings, the things we use, the way we arrange tools influence without noticing its learning processes. Please pay attention to the place you take a group to; check it before choosing a beautiful spot. Remove waste before they arrive, use friendly materials and let the beauty of nature help you in your work.

Emotions: We protect what we love. If people bond with nature, they will also take action and stand up for its protection. Going home full of good emotions after an outdoor activity is important. You can´t influence everything, but you should always take care of their little souls – and your own. And be a good example when treating animals, even if it is only the smallest water insect. Treat all living creatures with respect and with love.

1.6. The Rainbow flow

In many years of working with children in nature, we educators gathered many experiences. One of the main impressions was that children need time to connect to nature. You cannot let a whole bus of children explore the underwater world in an hour and expect them to have deep insights and learning effects. They might want to run around, play with the water; some are afraid of tiny insects and the ones interested don´t find the peace to investigate life underwater.

If you have one-week time, you can let things go their way. They will calm down, dissipate their excess energies, lose reservations and fears, and be ready for more deep contact with nature and its creatures. But we are talking here about shorter units, for instance, about a day´s program. That's why we suggest following specific steps and shaping but also shortening some processes actively. Nevertheless: Leave enough time and space for each step. And if you have less time than a full day or one part is too attractive for the group: adapt the plan!

The Rainbow flow is based on and connected to the didactical framework of the River'Scools, which describes three main units: Core time, Special offers and Open/free learning.[7]

Core time is related to the first two and the last step in the Rainbow flow: introduction of the program, connecting to nature in a playful and exploring way and saying good-bye. Opening and closing activities are always good because they offer a meaningful frame and are not too demanding.

Steps 3 to 8 from the Rainbow flow offer plenty of activities that can be used for Special Offers and Open free learning phases. The concept of River'Scools sees them as intertwined phases during the daily program. So, feel free to pick from the rainbow - we tried to sort them so that one activity builds upon the others before. Step by step, the group gathers more experience and knowledge, and if you notice at one point that they are overwhelmed - stop. It is up to you how much you facilitate and how much open space you leave for the participants.

We cannot expect a group of children, adolescents or adults, to share our enthusiasm, love nature as we do or have the same approach to plants, animals or nature in general - when they arrive and meet us for the first time. Our rainbow flow offers a guideline, a steering wheel to navigate through and create a good atmosphere and trust as a base on which you can build up and bring them to fundamental understanding and honest dedication.

A river does not only consist of one main river bed. All channels and oxbows are part of it, and so is our handbook set up. Since the branches are all equally important and connected, you can also regard the described activities like that. In all five branches (chapters), we suggest a model program with activities built one upon another, according to the topic. The order and

7 Retrieved from: *Concept of Transboundary Learning Network of RIVER'SCOOLs (TLN Concept)*, Interreg DTP coopMDD, 2018.

the dramaturgy of the activities are based on the rainbow flow. The activities lead from small to big, from personal experiences to the local level up to international scale. They are based rather on one's own observations and conclusions than on learning ready-made content. Feel free to pick activities that you think match perfectly from other branches or adapt our suggested flow to the group's needs (age, cold or very hot weather, the energy level in the group, etc.). You can mix activities from other branches (e.g. take another energizer). Cut the program into two pieces and do them on different days. Do parts outdoors and others indoors - feel free to adapt!

Let's start with the biggest branch - we call it our main river bed.

The key to successfully implementing an educational program in nature
The Rainbow Flow

Rainbow Phase	Flow	Activity (selection)
Create a good group atmosphere!	Start from where the group is! Consider their mood and aim to create a good atmosphere from the very beginning. If possible, use the first activity to introduce the topic of the day.	Servus and Zdravo! The longest river Welcome, birds! I am a fish! Weather is changing!
Experience nature with all your senses!	Let nature first touch children emotionally. Ecological knowledge comes later. Emotion goes along with all senses, especially with children.	Looking for something Blind river trail Song Contest Feel the river Our rivers are flowing
Calm down and focus your attention!	Some activities help us to be calm or use other communication channels than talking. Paying attention and focusing receptors on nature serve to deepen our experience of observing nature.	Found something? River sediment picture Find your chick! Silence of a fish Where have all the stones disappeared?
Trigger curiosity!	Curiosity forms the basis of every learning process. Without curiosity there is no successful education. Also storytelling leads us into new worlds.	Living map Three species – one secret Egg hunt Story of a skywalker Deforestation
Actively explore nature!	Where exactly does a certain species live? What does it live on? Questions lead us to observe more attentively. By using equipment for field work, we move significantly closer to nature and explore it from new perspectives.	Biodiversity hunt Rivers need space Bird monitoring Habitat exploration The hottest and the coolest place
Repeat and process information!	Now is the point to make sure that everybody is on the same level by repeating information in a playful way. Rely on these observations and own experiences of the day when drawing conclusions (e.g. like this: All species, including humans, are interrelated and depend on pristine habitats).	The longest food chain in the world Create your own river Owls and crows If fish could talk Web of Life in times of climate change
See things at a larger scale!	We decide how we will organize our lives and relationship towards nature. We can imagine a better world. Let's practice giving more space to nature and use it wisely. Simulation games and other challenges get us out of the box and let us fly high.	Mini-Biosphere Reserve Upstream and downstream Stepping stones Save the sturgeon game Letter to the past
Imagine solutions and prepare to get active!	How can we protect biodiversity well by using natural resources intelligently? Moving into real life and becoming active we imagine solutions and present our arguments. There are many ways that lead to sustainable ways of living. The future belongs to us.	Stakeholder Council River Reporter Our Action plan for birds Protect beluga! Repairing the future
Goodbye!	As important as a warm welcome is a decent farewell. Give them good emotions on their way back home. This is also the time to wrap up the day and pass on one or two messages you would like to share with the group.	In a nutshell The Goodbye-stone Write with a quill pen Fish of the Amazon of Europe We have learned something important

2. River branch "Lifeline´s learning hub"

You work in a biosphere reserve, like 257 million people worldwide in 129 countries like yours. These biosphere reserves cover a surface that is as big as Australia: 6,812.000 km². You are part of a growing family: your biosphere reserve is one of now 714 such "learning places".

You work in a learning place, where innovative ideas are tested and implemented – but what for? For sustainable development! Local knowledge is here regarded as important as scientific results. And the way to reach the goal is participatory: local communities and all interested stakeholders work together when it comes to planning and managing. Biosphere reserves want to prove that sustainable development and intact natural areas are a good match – and not at all contradictory.

2.1. Sustainable development based on intact natural areas

Biosphere reserves cover all major ecosystems on all continents, except Antarctica, where no one lives permanently. No wonder that all these reserves mirror the richness and abundant biodiversity of our planet. Nevertheless, all biosphere reserves contain 3 zones:

CORE ZONE
The ecological backbone of the reserve. It primarily covers the river and floodplain areas. The goals and measures in the core zone are focused on the conservation of landscapes, ecosystems, species and genetic variation, but also on the restoration of already degraded areas.

BUFFER ZONE
Extends along the rivers outside the inundation zone. It is characterized by a mosaic of cultivated land and village areas and also contains some smaller detached zones like oxbow lakes, fish ponds and small wetlands. Extensive agriculture such as cattle grazing, hay making, organic production, local products marketing and ecotourism are some of the key activities in this area.

TRANSITION ZONE
The outer transition zone provides regional economic and scientific support to the buffer zone. The majority of towns and universities are situated within this area.

Biosphere Reserves fulfil three functions[8]:

Maintaining ecosystems – conservation of biodiversity and cultural diversity

Developing the region in socio-economic and ecologically sustainable terms

Encouraging education, research and environmental monitoring

Most of the biosphere reserves in the world are located in one country. Nevertheless, there are 22 cross-border reserves, uniting the nature of usually two neighbouring countries. One good example of such a bilateral biosphere reserve is the Mura-Drava Transboundary Biosphere Reserve between Hungary and Croatia, established in 2012, marking one crucial step on the way to the pentalateral Amazon of Europe. 4 biosphere reserves in the world are trilateral.

But there is only one 5-country Biosphere Reserve in the world – and that’s the place you are working in - congratulations!

The wonderful Amazon of Europe - established in 2021! It is unique because it contains more than 700 km of natural, free-flowing rivers in Europe. But it‘s also unique because five countries joined together to conserve this riverine corridor, connect undisturbed habitats, and protect many important species. And that is something to be proud of.

2.2. Biodiversity

There are more than 1,8 million of so far known and described species on our planet - but biodiversity is more than counting their numbers.

Biodiversity means the genetic diversity within species as well, like thousands of apple or plum varieties in gardens that belong to our traditional cultural heritage. Biodiversity is also the variety of ecosystems where species (and their genes) live. Biodiversity is the diversity of our living world. It is the web of life.

Three levels of biodiversity can be observed:

- **Level of ecosystems**
- **Level of species**
- **Level of genes**

8 Retrieved from: http://www.amazon-of-europe.com/en/biosphere-reserve/

Europe has seen a 24% average decline in populations between 1970 and 2016. This decline is less than in other regions of the world due to different reasons for successful conservation measures. But in Eastern Europe, the populations are going down more rapidly – another reason why the recognition of the TBR MDD comes right in time.

Wetlands have seen the most significant loss: more than 85% of their area has been destroyed. It is evident in rivers that dams, hydropower use, and regulations significantly impact species decline.

Terrestrial ecosystems suffer predominantly from land-use change. That can be transforming pristine native habitats into agricultural areas but also giving up extensive, traditional land use.

Oceans have been overfished and polluted – and rivers have their share in this. Keeping our rivers clean is essential also for marine ecosystems. Everything is connected.[9]

Also, humans are connected and part of the game. Reduced biodiversity also means that our food supplies are in danger; pests and diseases threaten them and us, as we saw recently. Drinking water is a sparse resource. The loss of habitats, species, and genes is an environmental issue and a matter of concern for development, economics, and security. Biodiversity is the resource upon which we humans live in any meaning of the word “re-source”: you and your family, your local community, your country, your planet.

2.3. Sustainable Development Goals

The 17 colourful cards with funny logos – the Sustainable Development Goals (SDG)- have an excellent design. But do you know more about those goals, adopted by the United Nations Member States in the “2030 Agenda for Sustainable Development”?

This agenda “provides a shared blueprint for peace and prosperity for people and the planet, now and into the future. At its heart are the 17 Sustainable Development Goals (SDGs), which are an urgent call for action by all countries - developed and developing - in a global partnership.”[10]

The SDGs consider all three dimensions of sustainability:

social sustainability	**environmental sustainability**	**economic sustainability**

Declaration done in 2015, time frame set until 2030, so 15 years – that means there is a lot to do. This massive mountain of work is packed into 17 “chapters”, called goals, and small portions called targets. Let‘s have a look at some examples that are connected to our workplace, the TBR MDD:

9 See Living Planet Report 2020: https://f.hubspotusercontent20.net/hubfs/4783129/LPR/PDFs/ENGLISH-FULL.pdf

10 https://sdgs.un.org/goals

Goal 4 Quality education (Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all).

Target 4. a: “Build and upgrade education facilities that are child, disability and gender sensitive and provide safe, non-violent, inclusive and effective learning environments for all.”

The River’Scools in all five countries of the Amazon of Europe transboundary Biosphere Reserve are targeting this: providing an inclusive and effective learning environment for all. Our programs and activities want to include all learners. And we do think that the environment in which learning takes place is essential. Learning ABOUT nature should happen IN nature.

Goal 6 Clean water and sanitation (Ensure availability and sustainable management of water and sanitation for all).

Target 6.5: “By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate.”

Transboundary cooperation is one of the main characteristics in the Amazon of Europe Transboundary Biosphere Reserve. Intact riverine systems are crucial for groundwater formation - one of the primary sources of drinking water.

Goal 12 Responsible consumption and production (Ensure sustainable consumption and production patterns).

Target 12.2: “By 2030, achieve the sustainable management and efficient use of natural resources.”

The zonation in BRs aims to combine nature protection in the core zone, extensive agriculture in the buffer zone and economic support in the outer transition zone.

Goal 13 Climate action (Take urgent action to combat climate change and its impacts).

Target 13.3: “Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning.”

This target is one of the goals of our training in the TBR MDD, so we contribute to it together.

Goal 15 Life on land (Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss).

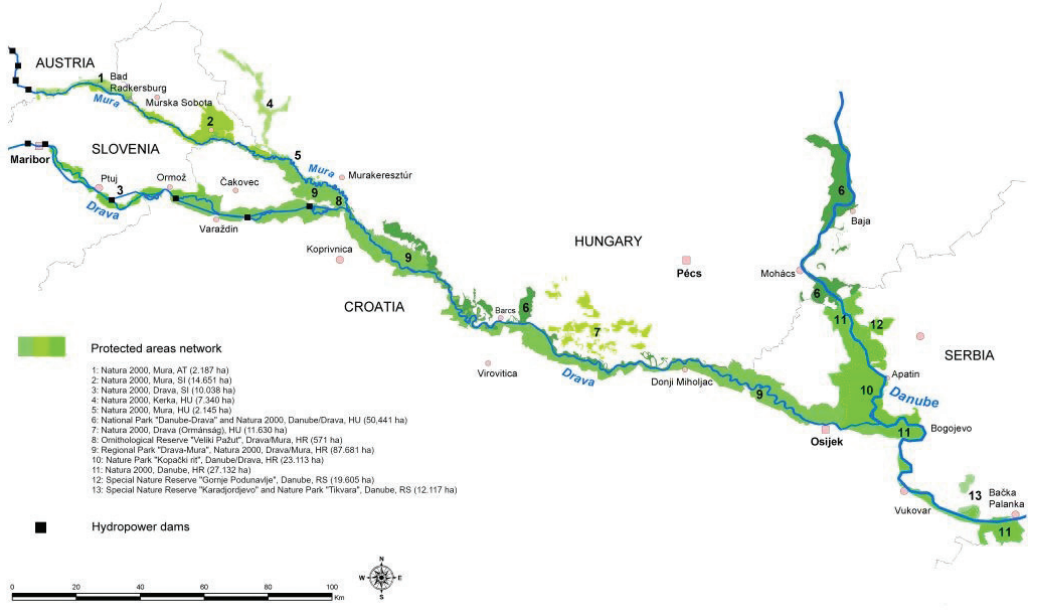
Target 15.5: “Take urgent and significant action to reduce the degradation of natural habitats, halt the loss of biodiversity and, by 2020, protect and prevent the extinction of threatened species.”

The Action Plan for Birds includes e.g. also the conservation of extensively managed meadows as they are very rich in insects - one of the primary resources birds rely on. This is just one example of actions within the Amazon of Europe transboundary Biosphere Reserve that contributes to this target and Goal 15 Life on land.

2.4. Nature conservation

Fish migrate upstream and downstream, and birds cross borders several times a day. White-tailed eagles that breed in Croatia look for food in Hungary. The gravel that the Mura eroded in the border Mura stretch between Spielfeld/Sentilj and Bad Radkersburg/Gornja Radgona ends up as a new island, emerging in the lower Drava, some hundreds of kilometres downstream. Riverine ecosystems are an ideal example of how only international collaboration and understanding make sense regarding nature protection and conservation.

The UNESCO 5-country Biosphere Reserve Mura-Drava-Danube is a chain of 13 protected areas of different categories and protection status, something like 13 precious beads on a chain. Or, in the words of environmentalists: they form a very important ecological corridor[11]. To protect it is one of the main goals of the TBR MDD.



Like beads on a river lace: 13 protected areas are the jewellery of the TBR MDD.[12]

11 Ecological corridors help maintain or recover cohesion in otherwise fragmented ecosystems and enable migration of species and thus genetic exchange.

12 http://www.amazon-of-europe.com/en/menu62/

2.5. Social and cultural development

UNESCO focuses on cultural heritage and preservation and finds new and innovative ways for societies to cope with current challenges and come up with solutions. Education is a key element in that, but also research. Archaeologists, ethnologists, local people who preserve their heritage, minorities and majorities, scientists and teachers - the TBR MDD would not be a reality without local enthusiasts such as them. The people-connecting initiative of the TBR MDD is, besides everything else, also a unique European peace project.

2.6. Ecosystem services

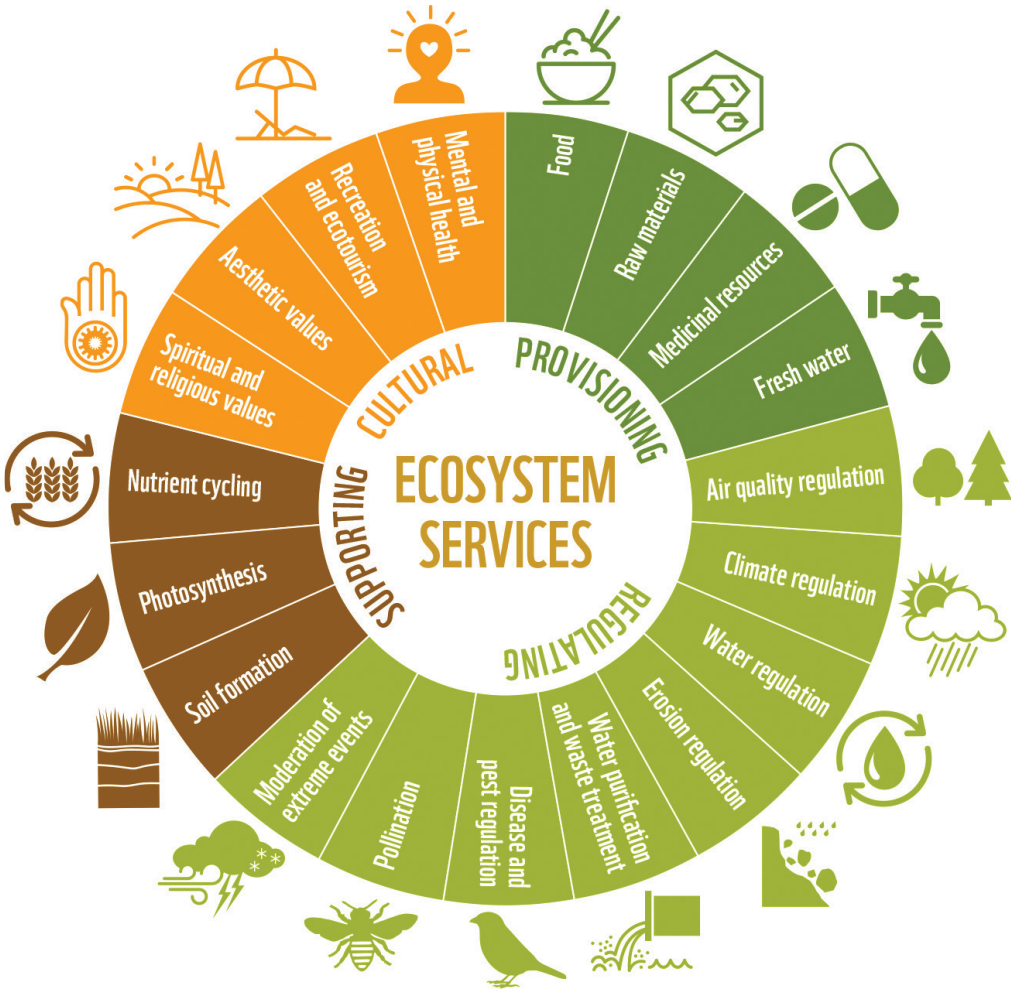
Don´t get it wrong: Ecosystem services are not a new invention of humankind. It‘s just a new way to describe all the beautiful gifts we get from nature - because we don‘t notice and take them for granted. Ecosystem services offer a different perspective on our existence, and this can change our life.

Go into a shop and buy raspberries for decorating a birthday cake. How much does a kilo cost? Go into the forest and pick raspberries. They are for free. That‘s the concept! When you pick raspberries in nature, you benefit from a free service, a so-called Ecosystem service.

How much would you have to pay for the wild raspberry when you would be charged for the soil their roots are growing in, the water they need, the insects that pollinate them so that we can have the berries later? Is it more or less than the price in the shop?

To make the concept of Ecosystem services easier to understand, they were grouped and finally sorted into four categories:

- supporting: services that support other processes in nature and that are crucial for life on our planet, like soil formation or photosynthesis
- cultural: services that give meaning and bring happiness to people‘s lives and make them feel well, like recreation, aesthetical or spiritual values
- provisioning: services that we need and use to survive, like water or food.
- regulating: services that help to protect us from extreme conditions, like water retention or air purification



The Ecosystem Services show what we often take for granted and get for free. Nature is generous!
(Source: WWF. 2016. Living Planet Report 2016)

If you take the river as an example, it becomes clear that natural ecosystems provide not only one but many services. How many do you count?

To deal with the concept of ecosystem services does not mean to capitalize on nature. Putting the services into numbers is a way to give them “real” importance when it comes to protection and efforts that have to be taken. Usually, these numbers only appear on paper when it is already too late when the damages of erosions (due to deforestation) have to be removed. The drinking water has to be bought due to pollution or drought. And the pollination of apple trees has to be done by workers (due to the decline in insects).

According to IUCN, the monetary value of goods and services provided by ecosystems is estimated to be around US$ 33.000.000.000.000 (33 trillion) per year[13]. Yet nature offers it all completely free of charge. Alone out of respect for this, we should treat nature well, if not out of love - or simple logic.

13 https://wwf.panda.org/discover/our_focus/biodiversity/biodiversity_and_you/

2.7. Sustainable use of natural resources

The time to rediscover our connection to nature is now! Our TBR MDD is a great place to do so. Aside from living river ecosystems in the Mura-Drava-Danube area, our goal is to stimulate nature-friendly development for local communities.

The UNESCO program Man and Biosphere, to which biosphere reserves belong, says it already in the title. We, humans, are part of the living world. There is a way to bring everything together: a decently good life in an intact natural environment.

This also concerns the field of agriculture. Many farms, companies, and countless consumers know it and show that producing food can be sustainable. Many generations before us lived with a conscious, wise use of their natural resources. We can learn from traditional and regenerative ways of farming as well as from modern movements and new approaches.

The people in the Transboundary UNESCO Biosphere Reserve Mura-Drava-Danube will live sustainably in a healthy ecosystem, with a diversified local economy and robust, vibrant and united cultures embracing the unique values of this area ... simply living rivers for nature and people!

This is our vision.

2.8. Rainbow flow with activities

1. Create a good group atmosphere!

Servus and Zdravo!

Age: 9+
No. of participants: 5-40
Duration: 10 min

Goal: Introduction to the topic and funny welcome energizer.

Method: Each participant gets a photo of a BR and the greeting word on it that is most common in that country (like Servus, Szia, Ojla, Zdravo, etc.). That indicates how one should greet (in German, Slovenian, Hungarian, Croatian or Serbian). The group stands in a circle, grouped according to their “countries”. The facilitator says hello to everybody – hello is as international as is the TBR MDD. Then he/she calls out the group of “Austrians” and asks them to teach the other participants how people greet in Austria. All follow their example. Then the group of “Slovenians” take over and so on... until it´s the “Serbians” turn. The order is the flow

of waters in the TBR MDD from the Mura to the Drava to the Danube. In the end, the group may practice all five new words together, make funny movements, or shout all the words simultaneously and very loud.

Material: A4 photos of all 18 BR in the 5 countries (provide 2 sets of cards for various group sizes).

Barrier-free: Blind or visually impaired participants need some assistance, but they are part of a group and can practice the word for greeting.

2. Experience nature with all your senses!

Looking for something

Age: 7+
No. of participants: 5-40
Duration: 10 min or more

Goal: Get to know the place, use more senses than your eyes, look more into details and get in touch with the topic of (bio)diversity.

Method: Choose one of the lists. List 1 offers a general approach to the place, and list 2 focuses on the river and its sediments. Each participant or team of two gets a paper with a list of several things to look for. Either they:

- have to look for all items with all senses like smell/hear/see/touch;
- OR they look only for one sort of “thing”, but more variations of it, maybe with different lengths, colours, different patterns, etc.;
- OR they look for 5 or 7 or 9 items and can choose from the entire list.

Cut the list into pieces if needed. When time is over, summit them back. The items will be used in the following activities.

Material: List for searching/1 - more general or List for searching/2 - focus on sediments (both in Supplementary materials)

Barrier-free: This activity can also be done in pairs. Be careful with sharp objects participants may find (like pieces of glass, metal...).

3. Calm down and focus your attention!

Found something?

Age: 7+
No. of participants: 5-20
Duration: 20 min

Goal: Share your findings and impressions in a trustful, attentive way.

Method: Each participant or team shows one after the other his/her/their findings from the previous activity and puts them in the middle of the circle. The facilitator may decide on the

order and length of statements. The main focus is on the diversity of colours, shapes, smells, noises - or different kinds of sediments. Be careful that this activity doesn´t get too long and tedious – keep it short and crisp. You can also invite the participants to lay their findings in a particular way, like a river or picture.

Material: the things the participants collected in the previous activity “Looking for Something”

Barrier-free: Give blind or visually impaired participants the chance to touch each element at any time.

4. Trigger curiosity!

Living map

Age: 5+
No. of participants: 5-15
Duration: 20 min

Goal: Storytelling about BR and simultaneously visualizing the story.

Method: The group is sitting in a circle. The facilitator tells the story about BRs. It‘s her/his choice where the focus is set (historical, ecological, economical, etc.) but important is that the BR is introduced like a story – and that biodiversity, sustainable development, and education have an important role to play. It should be clear that man and the biosphere are not contradictory elements but are intertwined and always have been. According to the flow of the story, the facilitator adds real elements (2D or even better 3D) to the virtual landscape in the middle of the circle. Start with the rivers, then add the floodplain forests, the settlements, roads, fields, dams, schools, universities that play an important role, etc. While telling the story about BR, it appears in the middle of the circle. Add the stones, plants, twigs, etc., that the participants collected in the previous activity (Looking for something). In the end, mark the spot with a colourful flower or something similar in the interactive BR map, where the group is sitting.

Material: Elements of the BR like houses and settlements, schools, rivers, touristic venues (see Supplementary materials), add the natural materials from the activity “Looking for something” – or use only natural materials and appeal to the participants´ fantasy.

Barrier-free: Give blind or visually impaired participants the chance to touch each element and the living map you are creating at any time.

5. Actively explore nature!

Biodiversity hunt

Age: 5+/12+
No. of participants: 5-30
Duration: 30 min

Goal: Learning by doing about biodiversity.

Method: Participants know at this point where they are in the Biosphere Reserve. The first aim of a BR is the conservation of biodiversity. What is biodiversity? To answer this question, we are going to observe the biodiversity on the site. Participants “collect” species by making drawings of animals or plants they find. Invertebrates can be also observed in cup magnifiers and then be released . If neither the participants nor the facilitator knows the name - it doesn´t matter at all. Just make a drawing and invent a name by yourself. The drawings are exhibited like a gallery on a rope with the help of clothes tags. You can group, count, or talk about them – it is important that all participants get the idea of what biodiversity means, in general, and especially there on the site.

Advanced version (“The 3 levels of biodiversity”)

Biodiversity is more than a list of species. There are two more layers of the term biodiversity: diversity of ecosystems and genetic diversity. The facilitator asks some of the participants to also “collect” different habitats (like wetland and dryland, sunny and shady, etc.) as drawings and to “collect” proof of genetic biodiversity (slightly different kinds of blossoms/leaves from one species, 3 different ants, etc.)

Material: blank A6 papers or templates (see Supplementary materials) and coloured pencils/felt pens, clipboards, long rope (20 m or more), clothes tags, magnifying glasses, cup magnifier, small boxes or glasses to put animals in for observing.

Barrier-free: If you have participants with mobility difficulties, give each participant or pair a defined spot from which they do their observations. Drawings are made in teams, so not everybody has to do it. Blind or visually impaired participants can collect audio recordings with their smartphones.

6. Repeat and process information!

The longest food chain in the world

Age: 5+
No. of participants: 5-30
Duration: 10 min

Goal: Show the relations between the found species.

Method: Group all drawings/findings on the rope as a food chain. Try to create together the longest chain possible. Please do not reveal the following trick already at the beginning

but only when the group gets stuck. Once you reach the level of a top predator like an eagle: it can die, and you continue with decomposers... like this, the idea of a cycle rather than a line can be introduced.

Material: drawings from the previous method “Biodiversity hunt”, same rope, clothes tags.

Barrier-free: As this is group work, all participants can take part in discussing. Make sure that blind or visually impaired participants know all the species on the drawings.

7. See things at a larger scale!

Mini-Biosphere Reserve

Age: 7+
No. of participants: 5-30
Duration: 60 min

Goal: By building a BR in miniature, participants repeat all the important parameters of a BR in general and learn about the other BRs in the Amazon of Europe.

Method: Participants experienced by now how diverse this little spot is. But there is much more biodiversity once you see it from a wider angle – for instance, from above like a white-tailed eagle. Divide the group into smaller teams of 5 to 6 members. Each team gets a “working kit” including materials and the task description. The units look for a good place within earshot and start to build “their” BR in miniature by using only natural materials they can find on the spot. The BR should not be bigger than 1 m^2 - the space they cover when using the rope and the 4 nails or tent pegs. Make clear that all BRs have to include the crucial elements given on the fact sheet but are free to build and shape their BR besides that. Creativity is very welcome.

Obligatory elements:

- 3 “main functions” (conservation of biodiversity and cultural heritage, economic development, research, education, etc.)
- 3 zones (core, buffer, transition)
- Items like human settlement, research, education & training, tourism & leisure

Basic version (“The easy sightseeing tour”)

After the given time for “building” the BR is over, all together go on a visiting tour along the Amazon of Europe. Each team presents their BR shortly, and the audience (all other participants) asks questions. With smaller kids, you can also use the metaphor of white-tailed eagles, flying from one to the other BRs and looking down from above.

Advanced version (“The very serious commission tour”)

To challenge participants a bit more the UNESCO MAB commission announced their visit. After the given time is over the facilitator and his/her assistants visit as members of the commission all the BRs. It‘s September 2021. The declaration of the world’s first 5-Country Biosphere Reserve

is happening – right here. All participants accompany this “MAB commission” and listen to the questions and answers/explanations. This “travel” should be half funny like a theatre play and half serious in the sense of having a bit of a learning effect, because all criterias and elements are again and again repeated and mentioned. Participants learn without noticing it. The very serious MAB commission can at the end decide if the BR is officially recognized or not - and hand over a written certificate with obligatory handshakes and photo shooting. Anyway: don´t forget to take photos – the BR´s remain here (without ropes and nails).

Luxury version (“The all-inclusive tour”)

The Mini-BRs can be upgraded with the topic “Sustainable Development Goals” before doing the sightseeing tour. The facilitator introduces BRs as “learning places for Sustainable Development”. He/she hands out the printed 17 A4-SDG goals (like little flags) to each BR team. The participants are now asked to stick the SDG goal- “flags” in their Mini-BR to indicate where the goals “happen”. They don‘t have to use all 17.

Material: working kits for each team, consisting of: 4 m rope, 4 long nails (15 cm or more) or 4 tent pegs and task description (see Supplementary materials), camera or smartphone, maybe also big maps of Amazon of Europe, perhaps some disguise for the “UNESCO commission” members.

For the luxury version: SDG goals as (max. A6) cards (copied on paper) with glued wooden sticks like small flags (see Supplementary materials).

Barrier-free: As this is teamwork, everybody can participate but mix teams well. If you have participants with mobility difficulties, make sure that the mini-BRs are not too far away from each other and that they are built on terrain accessible for wheelchair users. Blind or visually impaired participants must get the chance to help and touch the mini BR at any time.

Ecosystem Services - Nature is generous

Age: 10+
No. of participants: 10-30
Duration: 30 min or more

Goal: Getting an idea of nature providing us with different services in a playful way and connecting them to the real place.

Method: Participants should be already familiar with the Ecosystem Services cards. If not, the facilitator explains and shows them first. Have several photocopies of each card at hand and put them like card decks on a central spot in the natural area you explored. The facilitator asks the participants to walk around in pairs or groups of three to see animals or plants or water, stones or other natural elements on the spot again. Their task is to think which of those are connected to which ecosystem service. Suppose they find an obvious connection (e.g. a river and the ecosystem service “water purification”). In that case, they take the matching Ecosystem Services Card from the central spot and hang it or stick it to their element, in our case, the water edge. Like this, all participants decorate nature with “tags”. In the end, the whole group walks and visits all those spots with tags together and the participants who hung them tell the

others about their findings. The facilitator can emphasize sediments, water purification, flood prevention, groundwater supply and other benefits from Living rivers and living sediments.

Instead of providing photocopies, the kids can also prepare those copies by hand in the classroom in advance to prepare for this outdoor activity. Compromise: you provide black and white copies, and they colour them in the classroom. Either way, they get familiar with the cards before they use them.

Material: Ecosystem Services Cards in local languages or photocopies of the cards on A4 paper (see Supplementary materials), masking tape.

Barrier-free: Blind or visually impaired participants won´t have fun here. For wheelchair users in the group, set up the rule that only places can be chosen that are accessible for all.

8. Imagine solutions and prepare to get active!

Stakeholder Council

Age: 12+
No. of participants: 5-30
Duration: 60-120 min

Goal: First-hand experience of different interest groups living and working in a Biosphere Reserve. Understanding that mutually listening and going through democratic processes leads to sustainable solutions.

Method: Choose roles among participants (a team of two or even three people can also take on one role). Share the symbolic characteristics by which it will be easier to recognise the roles at a glance. You can also write them down on cards like place cards. Give the participants time to acquaint themselves with their role by reading a short description and assuming a stance regarding the given scenario (problem) addressed in the mayor´s letter. For communication to be more effective, it is recommended that participants sit in a circle or on chairs at the table facing one another. Start with an introductory circle: each participant or team briefly presents their role and opinion. The discussion should then continue with the first scenario/problem to be resolved. One person in charge of leading the activity should assume the role of a judge or mediator and may also provide additional information when required. Ensure that the basic communication rules are always respected (that others listen, don’t interrupt etc.). At the end of the first round of discussion, all stakeholders decide by voting. Continue with the next case. Play as much as the group wants and for as long as time allows.

Materials: cards with brief descriptions of each role and mayor´s letter (see Supplementary materials) and, optionally, one symbolic object for each role (e.g., hat for the mayor, binoculars for the tourist, fishing rod for the fisherman etc.)

Barrier-free: Each role can be acted out by pairs. So it‘s not a problem to read the description out loud for blind and visually impaired participants. Speakers are asked to introduce themselves

(their roles) each time before talking.

9. Goodbye!

In a nutshell

Age: 7+
No. of participants: 5-40
Duration: 20 min

Goal: Give space for participants to express their visions and wishes for the future.

Method: Participants make small boats that can float on the river. They can use any natural materials they find. A time limit of 10 minutes helps them focus on the activity instead of on their wishes and the perfection of their boat. Sit together at the shore and allow them to share their wishes/visions for the region‘s future. In the end, all participants put their boats on the river and let them start their journey downstream, taking their wishes/visions with them.

Material: half-empty nutshells from home or whatever natural floating material from the site.

Barrier-free: Except for putting the nutshells in the water, all participants can do the activity.

3. River branch "Let the rivers run free!"

Rivers create wetlands, and wetlands are praised for their rich biodiversity. Although wetlands cover only 1% of the surface of the Earth (oceans are not included here), they are home to 40% of all species worldwide. The best example is the Amazon river and its rainforests. But you don't need to travel to South America! Our Amazon of Europe is right in front of your door!

3.1. River restoration to improve natural dynamic processes and habitats

What is a river? Answer this question first by yourself and write it down or make a drawing. Then ask different people to do the same.

Aerial view of the Amazon of Europe, © Mario Romulić

When you ask this question, most people will answer: A river is just "flowing water". That is true and, at the same time, not. A river is much more than that! But, it's not easy to see what is that „more". Especially when you don't have a good example to compare with – and there are only a few "good examples" of natural, free-flowing rivers without dams and artificially modified banks left in Europe!

Our languages are not helpful either in this case. What is the word you use for a habitat that consists of many trees? It will be “forest” or “wood”. People call many different habitats by this name - a tree plantation, managed as one-crop agriculture of spruce trees in Austria, as well as a natural forest with an abundant richness of biodiversity in the Carpathian Mountains. It is the same with the word “meadow” - it can be a colourful, diverse habitat with rare plant species and even orchids, but people also call intensively managed grassland with only a handful of favoured species like this - a meadow. And the word “river”?

If you come to the rivers Mura, Drava or Danube you might say: it‘s wonderful here. You can see and hear many birds, you swim or relax and might ask yourself: Aren´t the rivers good enough like they are now?

Despite all the beauty and natural bounty of the rivers like Mura, Drava and Danube in our region, one cannot close one‘s eyes to the continuous degradation of habitats and loss of endangered species. For a long time, local people observed these changes, and for decades now, they gathered, together with scientists, data to find proof for their impressions and observations. It‘s true: The loss of biodiversity is a fact, and it‘s the consequence of actions that had been taken in the past. The state the rivers are in is not as good as it seems at first glance.

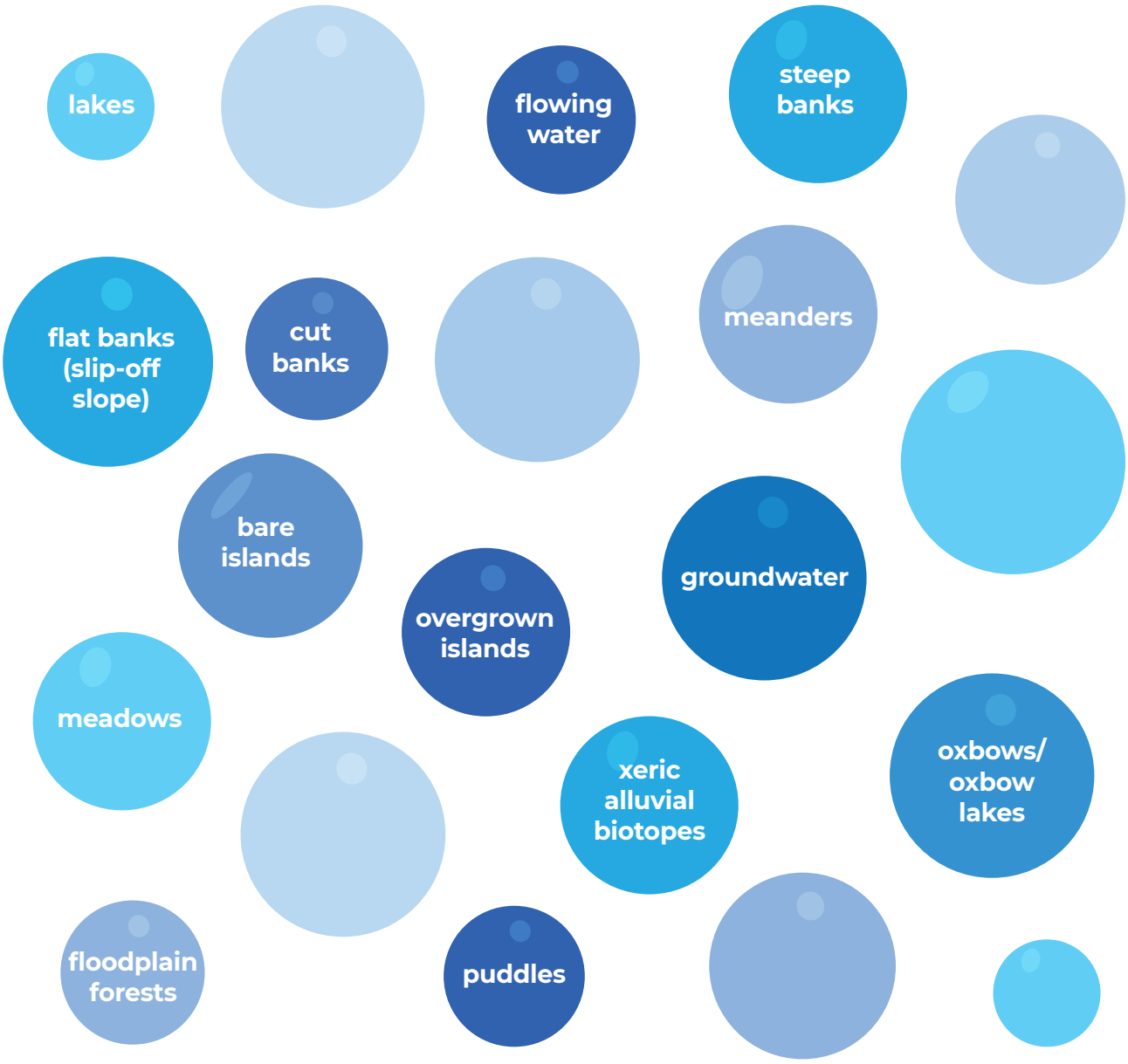
3.2. Living rivers

Dynamic - this is what living rivers are, in a word. Rivers that are close to their natural state continually change their course again and again. High water and strong current erode river banks and leave new, bare, steep river walls behind them. The material they take away (stones, sand, soil) is taken downstream and dropped somewhere when the current slows down. A gravel bank, a sandbank, a new island is created. Peaceful channels with a slower flow are suddenly „flushed“ again; other channels get blocked and become stagnant oxbows when the river changes its bed. Natural rivers are mighty and strong in times, and they create landscapes and sculpt the surface of our Earth.

Natural rivers are ecosystems that rank among those with the highest biodiversity, more than lakes or boglands. The coexistence of flowing and stagnant water creates many feeding, resting, and breeding places. Wet meadows, marshes and forests of many types, depending on how far away they are from the river, are extending the riverine ecosystem many kilometres right and left its bed. Even dry habitats, the so-called xeric alluvial biotopes, that you might find within riverine systems result from the water: extraordinarily high water levels pile up huge islands that are left dry later when the water goes down again. Not being in contact with the water anymore, their sandy or stony ground is a well-drained, dry and sunny spot for plants adapted to xeric habitats - in the middle of wetlands! This diverse mosaic is one of the reasons why riverine ecosystems are so rich. Ceaseless dynamic circumstances create innumerable niches

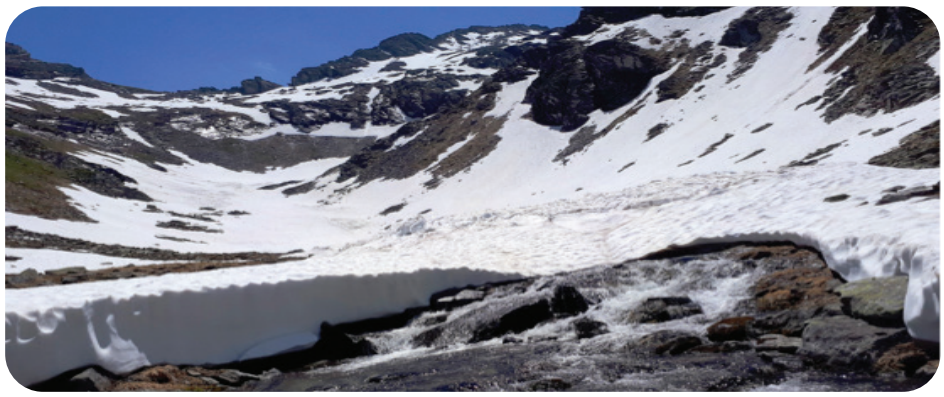
and ecosystems, one close to the other: a vast diversity in habitats leads to an extraordinarily high number of plant, animal and fungi species – a huge diversity in species. A river is a whole diverse world itself – for flora and fauna.

A living river is...



The **sources** of all three of our rivers, Mura, Drava and Danube, are in the mountains.

The Mura’s source is the highest and originates from the Austrian Hohe Tauern mountains – right at the national park Hohe Tauern border and the biosphere reserve Lungau-Nockberge.



The highest source of the Mura, 2050 m, Salzburg County, Austria (Source: commons.wikimedia.org)

The Drava’s source is in the Italian Alps high above Toblach/Dobbiaco, where the German and Italian speakers live together. Its 5 main sources unite at 1210 m above sea level after coming down hundreds of meters on steep slopes with meadows and forests.

At the level of 1210 m, the main sources finally form a river bed and continue as “Drava” (Source: wikipedia.org)

Although the Danube is the longest of our rivers (2875 km), it has the lowest source at approximately 1000 m above sea level.

In its **upper course**, a steep river usually goes straight. In mountain areas, it seeks its way down the fastest route, straight ahead. The strength of a young river is enormous: mountains are taken down and washed away when we look at a timeline of some millions of years. We find big stones and rocks in a river bed; most are sharper rather than round. Water temperature is low, and according to that, the oxygen saturation is high. Only in some stagnant bays do the waters slow down and drop smaller grains like gravel or sand. But erosion is dominating sedimentation.

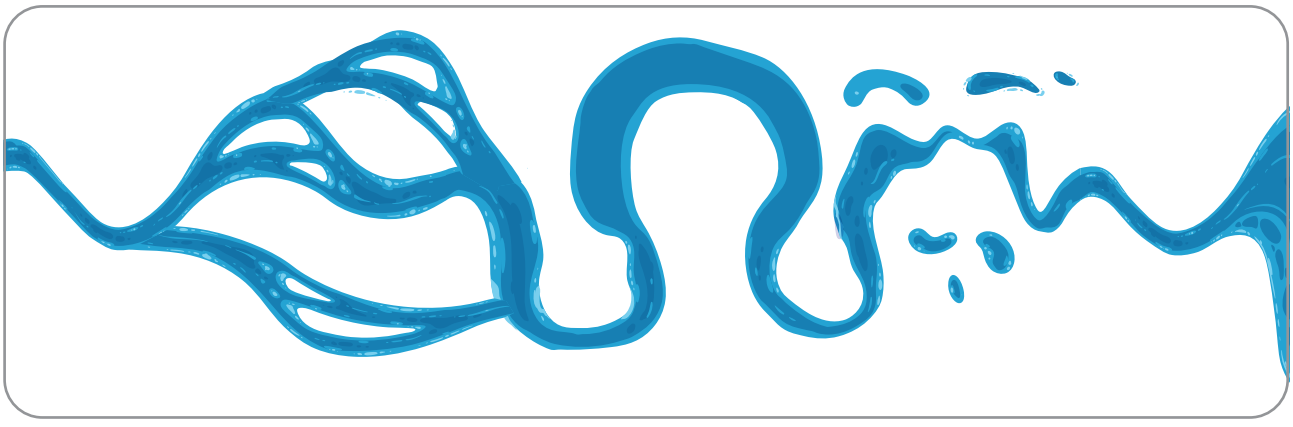
In the **middle course**, the river leaves the mountainous, steep slopes like the Drava around Maribor in Slovenia. It slows down immediately when broadening, drops sediments, and a large gravel field is created. A natural, free-flowing river with a mediate slope does not “use”

one riverbed only, but several of them. The river divides into many branches or bifurcations and starts to flow in bends. Seen from above, it looks like a “braided river”. Sediments that are still carried along are smaller – the bigger ones were dropped somewhere upstream. They also became more roundish: The constant rolling on the river bed ground sharp-edge rocks to round, smooth pebbles. But still, a river in its middle course is strong and fast enough to erode banks, especially with higher water levels. With each flood, the river changes its map: new river arms appear, and new gravel and sand islands grow out of the sinking river water level. Highly dynamic, but - erosion and sedimentation are in balance.

Near Varaždin, the Drava was once a “braided river”

(Source: Austrian 3rd Landesaufnahme 1879-1902, 1:75.000)

In the **lower course**, the river winds or meanders widely in flat, plain landscapes with a downhill gradient of a few centimetres per kilometre - in ONE bed. The Mura is a perfect example of a river in our region whose bed doesn‘t dig any deeper but occupies more space on both sides. Its waters now carry only sand or very fine gravel and tend to deposit material rather than erode new. But also here, the river still likes to play with sediments. On the outer river bends (the cut bank), it takes away materials and deposits them on the inner river bends (the slip-off slope), like that the bends are becoming more and more extreme until the day when the river cuts them off by breaking through. An oxbow is created, more stagnant water that is only facing some current when flooded. Due to their different ages, a mosaic of oxbows in different states is typical for natural rivers in that part of their course. Only living rivers create new oxbows and keep like this a high biodiversity level. Their dynamic is the clue!



Natural course of a river

The Mura flows into the Drava; the Drava contributes its waters to the Danube – the most international river in the world, flowing through 10 countries and taking the waters from 10 more countries to enter the Black Sea in Romania finally. But the journey didn‘t come to an end by that. The seas and oceans are in constant motion as well. The sea and ocean currents and the water cycle with evaporation and precipitation ensure that the water drop that started its journey somewhere in the Alps comes back one day to our rivers Mura, Drava and Danube.

Rivers as landscape architects

Floodplains

The lowland along a stream or river, characterized by the changing high and low water levels, is in permanent contact with the river itself and its catchment area. Floodplains are highly dynamic and constantly create new habitats for pioneers among plants and animals – also because of the change in sedimentation and erosion.

The active floodplain area distributed along all of the rivers stretches has 132.341 ha in total, 22% of its former extent - the “morphological floodplain”. About 465.136 ha or 78% has been lost by constructing flood dikes.[14]

Side branches

Rivers in their middle course are not flowing in one bed but divide into several arms or branches; some are wider, some more narrow. The surface area of the rivers and side-branches has decreased in some parts of our region by 65% in the last 120 years.

14 Retrieved from: WWF. (2014). *Assessment of the River and Floodplain Restoration Potential in the Transboundary UNESCO Biosphere Reserve “Mura-Drava-Danube”*, Executive Summary, Vienna, page 5.

Oxbows or oxbow lakes

A widely meandering river deposits sediments on the slip-off slope and erodes and undercuts on the cut bank. Continuous deposition and erosion let the meander get more pronounced, and the two cut banks get closer. Finally, the river cuts through the narrow neck of land between these two neighbouring cut banks. Suddenly the river straightened its bed again and left an abandoned meander loop. Ongoing sedimentation seals off this old cut off river bend from the main river channel. In oxbows the water doesn‘t flow anymore, so you can also refer to them as oxbow lakes. Occurring floods accelerate this process but can also reconnect an oxbow lake with the main river by eroding the materials sealing it off. In natural free flowing rivers, you can find oxbows in all states and ages - also a very important reason for the tremendous biodiversity in riverine ecosystems.

3.3. Living sediments

Not only the “transport” of water defines a river. The transport of sediments, like rocks, gravel and sand, is as important as the water flow. Sediments are an integral and indispensable part of living rivers. In other words: A living river is playing with sediments of all kinds, grain size and quantities from the source to its mouth.

There is always a balance between the transport capacity that a river has in a certain part of its course, and the mass of sediments it takes with it. Fast flowing waters are strong and carry even big rocks with them. The slower the waters get on their journey towards the sea, the smaller their capacity of sediment transport becomes, and sediments are deposited continuously. Concurrently, the grains of sediments taken by a river are getting smaller and smaller. Fine sand is the last “toy” of a living river – and a gift for us, when we stay at its banks with our feet in warm sand.

But the velocity of flowing water doesn‘t depend only on the actual river section like upper, middle or lower course. The profile of its bed also has an important role. If we force rivers into narrow channels the waters gather speed. It‘s simple logic again: the same amount of water going through sudden narrow passageways gains velocity. So many nowadays channelled rivers show this pattern: their water runs fast – and with high waters the damage of floods is worse even more - and the flood wave arrives quicker. If a river has space, it slows down and loses energy - and drops sediments in big quantities.

Flowing water is also weakened by dense vegetation like in alluvial forests. Trees, bushes and shrubs function as obstacles and the river slows down. Intact floodplain forests, side branches,

oxbows and a lot of space for the river are the best ways to reduce flood damage. Moreover, vegetation is also beneficial for trapping the pollutants coming downstream.

The sediments of a river are like building materials, they form landscape and create niches. A big rock in the river bed is a space for small animals to find shelter: in the “shade” they are saved from being swept away by the current. Even in fast flowing rivers the current can come almost to zero on its banks. The more diverse a river is, the more niches and the bigger the biodiversity.

A bare gravel bank or island is home for bird chicks like the rare little tern, but also for pioneer plants like tamarix or willow trees. Their seeds, or only some parts of them, are landing on the bare ground – and life starts again. They can only grow here but can’t compete with the following generation of bushes and trees – and disappear again, when the bare island becomes overgrown. Steep river banks are also overgrown after some years and bird nests in dug out holes aren‘t safe anymore because snakes or weasels may climb up. The next high water creates new chances.

We are all sitting in the same boat, also in terms of sediments. The stones, that the Mura erodes in the free-flowing stretch between Spielfeld/Spilje and Bad Radkersburg/Gornja Radgona, are deposited downstream somewhere in the Drava river and form a unique gravel or sand island – home for rare bird species like little tern or spawning grounds for fish like the barbel. The rolling stones are shared between all countries as well as the waters. This is a nice metaphor for our collaboration.

Rivers as landscape architects

Steep river banks

Along the Drava river, steep cliffs up to the height of 40 metres are of natural origin. The vertical walls of sand, clay or loess are chosen as breeding spots by sand martins, bee-eaters and kingfishers. Outer curves of the river, where the current is strong, are preferred erosion sites and are called cut banks. High waters erase them and take off sand, clay and stones from their surface, as well as vegetation. So, with each flood the river banks get bare and steep again – it is important to feel safe from climbing predators when you are a bird such as sand martin.

In 2005 only 21% of the former amount of the steep river banks on the Mura and Drava between Mursko Središče (Slovenia) and Osijek (Croatia) remained uncovered, meaning almost 80% of the banks were reinforced with artificial protection infrastructure.[15]

15 Retrieved from: Action A.7, Action Plan for River birds, LIFE14 NAT/HR/000115 – DRAVA LIFE, 2019, page 26.

Gravel and sand banks

In inner curves the current is less strong and suspended matter settles here due to the decreasing velocity. In these slip-off slopes you can find sediments, naturally sorted by their grain size. In still water zones fine sands settle near the bank, in parts with more flowing water grains are larger in size.

In the whole area of the TBR MDD about 70% of gravel and sand banks, and more than 50% of natural river banks have been lost to hydropower dams, navigation improvements and flood protection within the last 100 years.[16]

River islands

The process of their formation: with higher waters an accumulation of stones slowly creates an obstacle in the river, which the water masses avoid. When the flood drains, the power of the river decreases and first larger stones are dropped here. The flow rate slows down around them and the island begins to grow. The island grows upstream when the water level falls and finer material accumulates as the current decreases.[17]

16 Retrieved from: *Action A.7, Action Plan for River birds*, LIFE14 NAT/HR/000115 – DRAVA LIFE, 2019, page 26.

17 Schneider-Jacoby, M. (1996). *Drau und Mur*. Leben durch Flussdynamik, Überlingen, page 32.

3.4. Living cooperation

If we want to stop the biodiversity loss on our rivers, there is only one way to achieve this. It‘s simple: dynamic rivers create an immense habitat and species diversity. If we want to restore biodiversity, we have to allow the rivers to have their “old way of living“. The species number will only improve if the dynamic conditions in the rivers Mura, Drava and Danube are restored. That means that a chain of connected protected areas secures a free flow of water and sediment transport. Therefore, relevant institutions and organizations focus their efforts on experience exchange when various practices and restoration measures are implemented in different countries, and this is fostered within the lifelineMDD project. It is important that the practitioners learn from each other and benefit from this cross-border cooperation.

Protecting a small forest area or a meadow, or even a mountain, is comparably easy to protecting rivers which are extremely elongated habitats, flowing through different countries. River restoration is an international challenge and there is only one solution: we have to set actions together - as nature knows no borders.

Three steps to free our rivers in the TBR MDD are being taken:

1. Removal of river bank reinforcement
2. Reconnection of side branches
3. Large scale reconnection of floodplain areas with the rivers

Example 1: DRAVA

Within the DRAVA LIFE project (planned 2015-2020 and prolonged until 2024) first important practical steps will not be taken before 2022. On 7 pilot sites, restoration measures are implemented with the aims of improving the river’s ecological state as required by the EU’s Water Framework Directive while also keeping in mind the principles and best practices of the flood risk management in the EU Floods Directive. The measures include the restoration of river side channels and the river bed itself and aim to improve lateral connectivity, and to improve flood retention in the current floodplains – without endangering the safety of the existing flood protection system.

These are the **expected results** of river restoration measures within the DRAVA LIFE project:

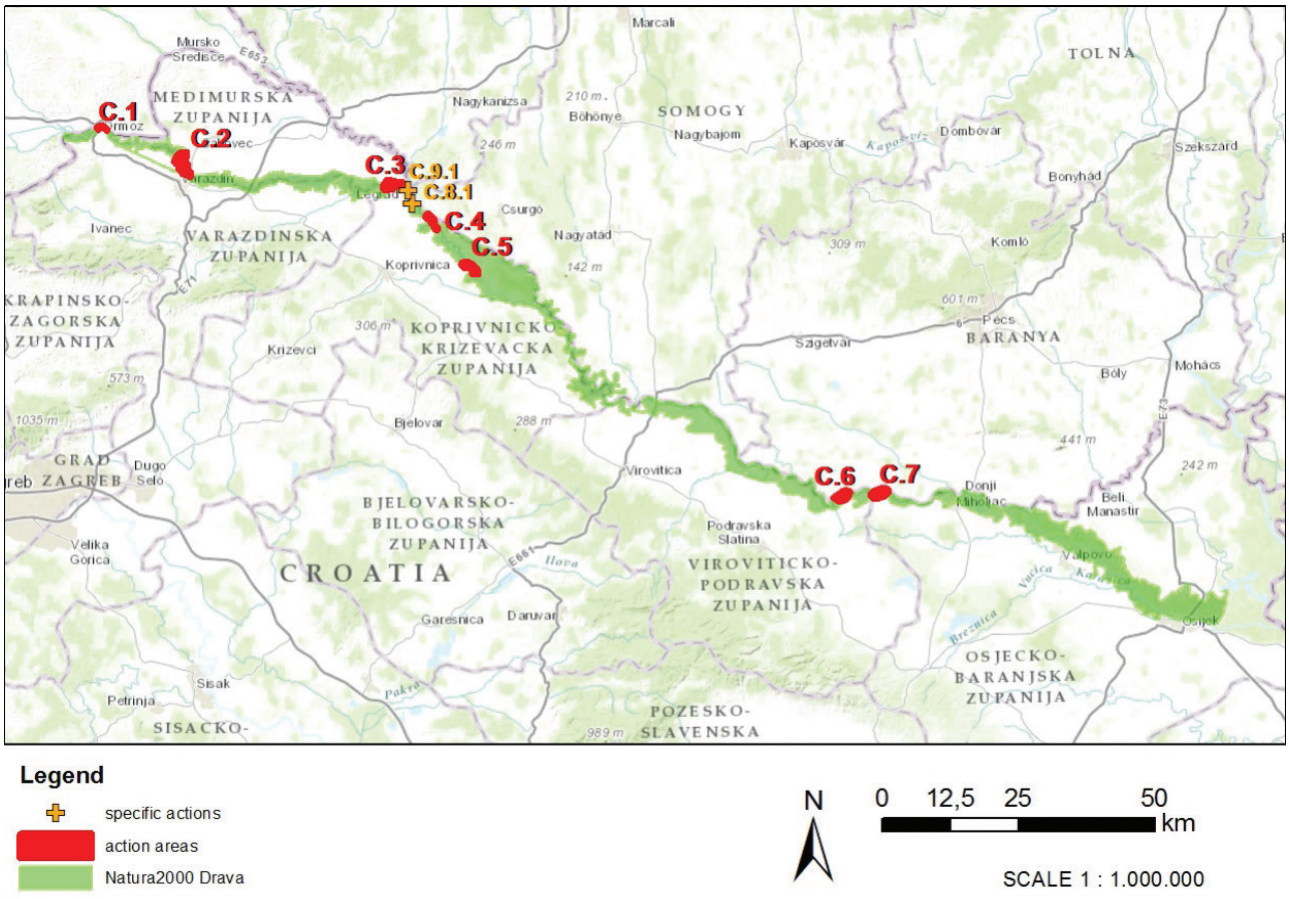
1 km of dynamic river banks restored and preserved

13 ha of new dynamic river zones with gravel, sand and muddy banks created

14,5 km of side branches restored or newly created

300 ha of floodplain forests improved

The experiences gathered on these 7 pilot sites at the Drava river should contribute to the ecological benefit, to long-term cross-sectoral cooperation. They should also become a precedent in Croatia for integrative water management practices and further restoration measures, leading to an overall shift towards ecological thinking in water management practices.



A map with the 7 proposed locations: 1. Otok Virje (312 – 314,3 rkm), 2. Stara Drava Varaždin (289,3 – 292 rkm), 3. Donja Dubrava – Legrad (240 – 241,45 rkm), 4. Most Botovo (226,6 – 227,9 rkm), 5. Novačka (214 – 217 rkm), 6. Miholjački Martinci (104 – 106 rkm), 7. Podravska Moslavina (96 – 98 rkm)

(Source: DRAVA LIFE: River restoration for nature and people Factsheet)

Example 2: MURA

Within the lifelineMDD and other EU-funded projects a part of the Mura river near Bad Radkersburg/Gornja Radgona on the border between Austria and Slovenia is being restored; several other EU projects have been contributing to the Mura river’s restoration over the last 20 years. The once wild, up to 1,2 km wide Mura had been forced into a narrow “channel” to prevent the region from floods. But the negative consequences of these changes were obvious: sinking groundwater level, disappearing gravel banks, alluvial forests falling dry, extinction of rare plant and animal species.

Mura river restoration near Gosdorf on the Austrian side of river Mura, seen from the Murturm observation tower © Office of the Styrian Government, Tanja Schriebl

Results of these restoration measurements:

1. The Mura river got its space back and widened its riverbed
2. Channels were recreated
3. Artificial river bank stabilization was removed
4. Steep banks (cut bank) and flat banks (slip-off slope) appeared again
5. Sediments as bedloads were added to stabilize the river bed
6. Gravel banks, pools and fords appeared again
7. The Mura river gained back its dynamics
8. Revitalisation of 45 km of tributary rivers as important habitats
9. Sand martin and little ringed plover came back to nest here
10. Common nase and common barbel got back their spawning grounds under gravel banks

Results of the restoration measurements on the Mura river (information board on the Austrian bank of River Mura between Mureck and Bad Radkersburg) © Alice Thinschmidt

Example 3: DANUBE

Within the lifelineMDD project restoration actions that help improve water levels in oxbows and groundwater tables in floodplain areas along the Danube section in Serbia, will be performed. Experts are working to find possibilities for improving the water inflow into various old branches while dealing with the problem of continuous sedimentation in floodplain areas. The pilot action of drainage and connection of water habitats with rivers will be done at Lovrenac channel in the Special Nature Reserve „Karađorđevo“.

Besides the mentioned ongoing project, there have been other restoration measures in the region in the past, including:

- Liberty Islands along the Danube in Hungary: A riverine habitat restoration that showed positive results in protection and restoration of the available rare biotopes, with silt removal from the side channel.

- Oxbow lake restoration at Široki Rit in the Bačko Podunavlje Biosphere Reserve: The focus was on restoration and maintenance of water levels in the oxbow lake by widening and deepening the existing water supply channel and by slightly dredging the oxbow lake.

Benefits for all of us

River restoration contributes to the long-term survival of the natural habitats and the native species in the rivers. There are numerous additional positive effects:

- Biodiversity is improving in general
- Rare, endangered bird species are coming back
- Rare, nearly extinct fish species are coming back
- Excellent fish grounds are maintained/guaranteed
- Migration of animals is happening again: the 3 rivers are an important migration corridor
- Flood protection following modern standards and EU directives
- Increased river water infiltration into the groundwater lifts or stabilizes ground water level
- Better water purification for drinking water supply
- Stabilized ground water conditions for forests and agriculture: not depending on rain in the region, but benefit from all the precipitation upstream
- Making floodplain ecosystems more resilient to negative impacts of climate change
- Establish long-term sustainability in the region
- Safeguarding ecosystem services
- Further degradation of the river bed and floodplain is stopped

WWW.

www.riverwatch
www.restorerivers.eu
www.icpdr.org
https://www.drava-life.hr/en/home/
https://wwf.hu/wisedrava/?/en/kezdooldal
https://lifeprogramhrvatska.hr/en/projects/wisedravalife-wise-water-management-for-the-conservation-of-river-and-flood-habitats-along-the-drava-river-life17-nat-hu-000577/
http://szabadsagsziget.hu/index.php?l=_en

3.5. Living minds

All these efforts would not be possible without the people taking them. People with living minds, including local people, environmentalists, decision-makers, scientists and many more, achieved what seemed impossible. Raising awareness is one of the main goals of river restoration actions.

You are part of this story. When you work with children or visitors, you give the TBR MDD a face - yours. Participants will remember you and connect you with the river. Your passion and your enthusiasm will open the minds of the ones that listen to you.

The location where you do your tours also matters. River'Scools with their indoor and outdoor classrooms are a great concept that aims to open people's minds and hearts all over the TBR MDD. They are places for direct contact with nature which has always had a profound impact on people.

Like a river we should always stay dynamic and flexible when it comes to moving ahead, learning and teaching. Our didactic methods in this handbook want to play with the water and sediments as the river plays with them as well. Our focus is on practical work and direct, personal experiences to feel and understand the dynamic of the rivers at first hand.

Let the living rivers touch us and lead us to living minds!

3.6. Rainbow flow with activities

1. Create a good group atmosphere!

The longest river

Age: 5+
No. of participants: 16-40
Duration: 10 min

Goal: Introduction into the topic and a funny welcome energizer.

Method: Divide the group in teams of 8, 9 or 10 people, but each team must have the same number of members. Their task is to create the longest river using either participants' own bodies and/or any clothing or items they have with them. Participants are not allowed to collect and use other things than what was chosen by the facilitator. A time limit of 2 or 3 minutes spices the action up. The team with the longest river is the winner. The three longest rivers can be named according to their length: the longest is Danube (2875 km), then comes Drava (749 km) and then Mura (453 km).

Material: None (people and their clothes).

Barrier-free: great for everybody, in case you have blind and visually impaired people in the group get them assistance (one member of the group), and for wheelchair users make sure to pick the appropriate terrain.

2. Experience nature with all your senses!

Blind River trail

Age: 7+
No. of participants: 5-30
Duration: 20 min or more

Goal: Use more senses than your eyes, get to know river sediments.

Method: This activity needs a bit of preparation before the group arrives or while a partner does the first activities with them. The blind trail is a thick, long rope (like a climbing rope) that is fixed in shoulder height around trees or other vertical elements, but can also lead a bit up or down sometimes to make it more exciting. The terrain should be a bit up and down as well, diverse in covering (sandy, pebbles, vegetation, shallow water, forest ground...), but not too challenging as the participants will be blindfolded. Remove therefore too big branches or twigs that could make participants stumble and fall or stick into their face — safety is important! Fill the cotton bags with sediments of different grain from bigger stone to gravel, sand and clay and maybe also artificial sediments (bricks parts, plastic...) you find at the spot or bring with you. Hang them on the rope according to their grain size from big to small in such a distance that the bags are well distributed on the trail from the start till the end.

It gets more exciting when the participants don‘t see the beginning of the rope before they get blindfolded. Therefore it‘s best that the participants go in pairs: one is blind, the other one takes care in case it is needed, like leading the partner to the beginning of the trail. The blindfolded participants put one hand on the rope and one in front of the head to protect themselves and start the journey down the river, carefully step by step. Once they feel a bag hanging on the rope they reach into it, try to guess the content and memorize it. When they get to the end of the Blind River trail they can take off their blindfolds and the pair takes turn. Older participants or adults can also go alone, in that case the facilitator needs some helpers to lead blindfolded participants to the rope and look over the safety of those who are following the trail simultaneously. Helpers are also useful when there is a “traffic jam” on the Blind River trail to make people wait.

When all participants who wanted have done the trail they come together again. Continue with the following activity “River sediment picture”.

Material: Thick long rope or climbing rope (30 m or longer), 8-10 cotton bags, blindfolds, natural materials (sediments) to fill the bags (edgy stones, pebbles in all dimensions, sand, clay, artificial sediments like bricks parts or plastic etc.)

Barrier-free: This is a great activity if there are blind people in a group, they could feel like

heroes. If the group has members in wheelchairs, set the trail on easy, flat terrain with the rope a bit lowered and put emphasis more on the bags and their content.

3. Calm down and focus your attention!

River sediment picture

Age: 7+
No. of participants: 5-30
Duration: 20 min or more

Goal: Share your findings in an attentive, creative way.

Method: The facilitator invites the group to talk about what they touched in the bags when doing the previous activity “Blind River Trail”. The materials can be taken out of the bags now, shown around, touched again or layed on the floor like sediments in a river. Start with the biggest edgy stones, then continue with pebbles (gravel), artificial sediments etc. End with sand and clay or with the water which can be for instance poured on the stones. A river sediment picture is decorating the middle of the sitting circle. This gives the facilitator a wonderful opportunity to focus attention on sediments and where they come from or go downstream.

Another way is to lay the items like a mandala or in any other nice pattern.

Material: 8-10 bags from the previous activity “Blind River Trail” with content.

Barrier-free: Suitable for everybody, if blind or visually impaired participants get the chance to touch the items that you are talking about. Since it is also exciting for everybody, let all participants at the end “see” the picture with closed eyes, only by touching.

4. Trigger curiosity!

Three species – one secret

Age: 7+
No. of participants: 5-15
Duration: 5 min

Goal: Drag the participant´s attention to the subject of river dynamics and its role for different species.

Method: The facilitator shows the three A5-pictures to the participants and lets them guess what these species have in common. All three animals need dynamic rivers and can´t live in other circumstances than free flowing, natural “wild” rivers. The little Tern lays its eggs on gravel islands, the fish uses gravel as a spawning ground and the Danube crested newt uses gravel pools during the spawning season.

Participants learn that these species may go extinct when rivers are tamed and regulated. They learn that in the TBR MDD the rivers are still in good shape and will be restored so that these three species will still be here tomorrow.

Material: A5 cards with pictures of bird species (little tern), fish species (common barbel) and amphibian species (Danube crested newt) - for longer use laminate them (see Supplementary materials).

Barrier-free: Blind or visually impaired participants can participate, if they know what species are shown on the pictures (not the exact species but “little bird” “little fish” “little amphibian”). Alternatively small plastic models can be used or even modelling with clay on the spot.

5. Actively explore nature!

Rivers need space

Age: 7+
No. of participants: 5-30
Duration: 30 min

Goal: Experience what factors have an influence on floods.

Method: The experiments can be demonstrated by the facilitator or can be carried out by the participants themselves after getting instructions.

Experiment 1 / Two full watering cans (or buckets) are emptied simultaneously onto a natural surface where water can seep away. One watering can is emptied very quickly, the other one very slowly. Where the watering can was emptied quickly, a smaller or bigger flood can be observed. In contrast, the very slowly emptied water from the other can has time to enter the ground and seep away without flooding the area. Participants see that if water can be held back and the runoff can be slowed down, floods tend to be less severe – and remain as precious, filtered groundwater for drinking or agriculture.

Experiment 2 / Two more watering cans are emptied at the same speed, either simultaneously, or one after the other. One in an open, slightly sloped area without any barriers, the other one on the same sloped spot, but with narrowed space, for example a channel limited by two wooden, slightly dug into the ground planks, downhill. If more time is available these “channeling structures” can be also made by clay, stones, lego bricks etc. It can be seen that where the water has space to flow it spreads out, thus losing speed and the water level is much lower. The same amount of water in a narrower place leads to a higher water level and the velocity of the “river” increases. By measuring the time with stop watch the participants see that flood waves arrive more quickly in channeled rivers and water levels and damage are more severe.

Both experiments should lead into an open discussion where rivers can spread out without causing damage.

Material: 2 watering cans (or buckets) full of river water, 2 (wooden) planks (minimum length 1 m), alternatively clay, stones, lego bricks etc., stop watch (mobile phone)

Barrier-free: As there are different tasks to do when preparing or executing the experiments, all participants should be able to take part. To avoid exclusion of participants they can also be carried out by the facilitator.

Sponge competition

Age: 9+
No. of participants: 5-20
Duration: 45 min

Goal: Get to know how wetlands like floodplains act as water retention areas and store water, thus helping to minimize the damage of floods.

Method: The group is divided into smaller groups of five, who receive a “floodplain box” each. The teams are assigned to collect fillings for their box that will have a maximum water retainment capacity. That can be any natural material like soil, sand, clay, pebbles, organic material like grass, leaves, straw, moss - the teams are to find that out by themselves. Plastic or any other artificial materials are not allowed. They shall build a “floodplain”, which holds back as much water as possible. If the groups decorate it and add plants like in an alluvial forest or not is up to them. After a limited time of app. 30 minutes the filled floodplain boxes are placed on the rims of two chairs each. A big plastic bowl is arranged below each box so that water can drip into the bowl. By call of the facilitator a given amount of water is poured into each “floodplain”. After some time (app. 2 minutes) the amount of water which passed through the different “floodplains” is compared. The group with the least quantity of water having passed through will be stated as the winner. They receive the title “Best water retention floodplain of the year”.

After the competition the capacities for water retention of different materials and their interactions will be discussed after the teams revealed their fillings and secrets. The facilitator passes on the message that ecosystems like floodplains and alluvial forests near rivers provide us with services like water retention, water purification, ground water storage etc.

Note that this activity needs a lot of preparation and also quite specific materials.

Material: 2 to 4 “floodplain boxes” of 50 x 50 x 20 cm (or smaller 25 x 25 x 15 cm) - one for each team, with 4 wooden sides and bottom shut with a metal grid with a width of 1 cm maximum (fence for rabbits or similar); 2 to 4 large plastic bowls in similar size 50 x 50 cm (25 x 25 cm), 3 – 5 chairs or similar structures; natural materials found on the spot like soil, sand, clay, pebbles, organic material like grass, leaves, straw, moss etc., bucket, watch showing seconds, maybe a reward for the winning team.

Barrier-free: As there are different tasks to do within the teams when preparing or executing the experiments, all participants should be able to take part.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6. Repeat and process information!

Create your own river

Age: 7+
No. of participants: 5-20
Duration: 60 min or more

Goal: Repeating characteristics of living rivers.

Method: Participants work in teams of four or five. They can be named after local rivers (Mura, Drava, Danube and their tributaries). After having already heard a lot about sediments and species on the river the facilitator gives a short introduction/repetition about the different river courses - for instance drawing them with a stick into the sand or mud. Each team gets a deck of A6 cards with elements like e.g. gravel island and a species that lives there like e.g. little tern. Their task is to build a wild, natural, free flowing river “in miniature” with only natural materials (sand, stones, water, leaves...). It should include most of the elements on the cards, if not all, and like this becomes as diverse as possible. Give them enough time to build, dig, pile up hills etc. At the end all participants go together on a visiting tour from river to river and congratulate the other teams for their biodiversity. By repeating the elements when comparing the rivers participants will know them by heart at the end.

Material: shovels, buckets like sand toys, deck of A6 cards with all characteristic elements of living rivers with their typical species (one deck for each team), for longer use laminate them (see Supplementary materials).

Barrier-free: As there are different tasks to do within the teams when building the rivers, all participants should be able to take part. If you have participants in wheelchairs choose a flat, easy terrain for the mini-rivers.

7. See things at a larger scale!

Upstream and downstream

Age: 10+
No. of participants: 10-30
Duration: 50 min

Goal: Experience the region as a whole and one of many different factors as an example for connections that rivers constitute (water pollution).

Method: The participants get 3 preferably blue ropes that represent Mura, Drava and Danube rivers.

1. In a first step the group is asked to lay the blue ropes on the ground according to their memory. This may lead to funny discussions and interactions about the geographical situation. Then give them the map of the TBR MDD, so that the Amazon of Europe can be created nicely. Mura is tied to Drava rope, and Drava rope is tied to Danube rope that is flowing into the Black

Sea. When the “rivers” are set on the ground the second step follows.

2. The participants draw papers with geographical terms on them (see list below) and position themselves according to the information on them. The papers can be fixed on chests with masking tape if wanted. Together the group can discuss the position of countries, where there are common borders e.g. along rivers, connections and distances. The focus is not on proper geographic knowledge but on interactive doing and discussing. At the end everybody should be in his/her geographical position and hold the blue rope (all together).

3. Suddenly an accident is happening in e.g. Austria. Poisonous substances are entering the river Mura and flowing downstream. A symbol of toxic waste is being passed on from hand to hand. It should be something slimy, muddy, ugly, maybe smelly that you wouldn‘t like to touch. The facilitator enters the “pollutant” somewhere upstream on Austrian Mura (or chooses another spot) and passes it on to the next participant who does the same... all the way downstream the “pollutant” is going from hand to hand, from river to river. This is an ideal time to emphasize the importance of international collaboration and protection on rivers. The “pollutant” ends up in the Black Sea. The facilitator can start a second “pollution chain” on the Danube – it ends up in the Black Sea as well. Like this it gets clear and visible that the pollution of oceans has got a causal connection to all countries, also the ones without access to the sea like Austria or Serbia.

4. We end our simulation with a hopeful message: a water drop needs 4 weeks from the springs in Germany down the whole Danube River to the Black Sea. There is always fresh and clean water coming from the springs. If we stop polluting, the rivers will be clean soon and also the Black Sea can recover. An advantage for all of us.

Adapt the activity to your needs, shorten it or add aspects you consider important. The key element is storytelling.

Material: 1 (preferably blue) rope of min. 10 meters (Mura), 2 (preferably blue) ropes of min. 20 meters (Drava and Danube), at least 1 map of the TBR MDD region (better 2-3), A4 or A5-papers with geographical names, printed in big letters (one per page and person, feel free to add or change some), masking tape, a symbol for toxic substances (e.g. “slime” from toy shop).

Geographical names: Mura, Drava, Danube, Osijek, Bački Monoštor, Kopački Rit Nature Park, Balaton-felvidéki Nemzeti Park, Gornje Podunavlje Special Nature Reserve, Danube-Drava National Park, Varaždin, Bad Radkersburg, Iron gates dam, Austria, Hungary, Slovenia, Croatia, Serbia, Black Sea ... (see the list in the Supplementary materials).

Barrier-free: With some “translation” everybody should be able to take part in this activity. Blind or visually impaired participants will need help in point 3. and 4.

8. Imagine solutions and prepare to get active!

River reporter

Age: 9+
No. of participants: 5-30
Duration: 30 min or more

Goal: Talk with people about rivers and their relation to them.

Method: Each participant makes interviews about the question: “What is a river to you?”. The interviewed persons can be other members of the group at the very same day or later on as a follow-up parents, neighbours, grandparents, friends or whoever else. Those persons are asked to make a drawing of their favourite spot on their favourite river. The drawing doesn‘t have to fulfill any criteria but to show the “picture of a river” of the drawing person. All participants fill out the templates and the drawings and share their experiences within the group (hanging the drawings on a wall like an exhibition, presenting them, etc.).

A discussion and reflection about the gap between natural rivers and real situations is welcome.

Material: River Reporter template with questions (see Supplementary materials) (name of the river, location, time, what is so special there, why do you like it, is the place still like in your memory, is there something you would like to do/make better, ...)

Barrier-free: As this activity may be carried out also later on it can be adjusted to the needs of the participants. Instead of filling the templates participants can also use recording apps on their smartphones.

9. Goodbye!

The Goodbye-Stone

Age: 5+
No. of participants: 5-40
Duration: 10 min

Goal: Closing ceremony, participants get the chance to give feedback or share a message to all.

Method: The participants are asked to bring one pebble stone they like or find interesting from the shore. Before throwing the stones back into the water in a last common action each of them can have a say about the day/about their river/a wish for the group/a wish for the river/a heartfelt message to other people in the TBR MDD or similar.

Material: stones or pebbles collected at the river shore.

Barrier-free: If the group has members with difficulties in mobility or visually impaired participants the pebble stones can be collected by the facilitator in advance and handed out.

4. River branch "Fly with the birds!"

The Amazon of Europe is a paradise for birds. Is that right? It is, when you compare it to other rivers. But especially breeding birds would say: "There are many things to improve!"

The plains south-east of the Alps are also a very important migration area for birds. More than 250.000 migratory waterfowl are resting and feeding here on their trips to north or to south. This is another good reason to call our TBR MDD a bird-hotspot or a bird paradise. Our region provides habitats for species that are listed in the Habitats Directive and Birds Directive of the European Union or the national Red Lists.

4.1. River birds as indicator group of dynamic river processes

This is actually no surprise: Natural riverine systems with high dynamics are among the richest ecosystems - in niches and in species. That's why river restoration and conservation of bird species are just like the two sides of the same coin.

Steep banks and sand or gravel banks and islands are the favourite breeding areas for a specific group of birds. They need exactly these kinds of places and don't build nests somewhere else – and may therefore serve as an indicator group for a dynamic, intact riverine system. If there are many of them, the river is in "good shape" – meaning that it's a free flowing river that may change, destroy and rebuild its beds and banks. If their numbers are decreasing, the river has lost its dynamic and strength. But don´t forget that gravel banks and islands are not only important for breeding. They are also important resting places for other bird species like ducks, herons, gulls, shanks and tattlers.

In the last 100 to 150 years rivers in our region have seen a lot of changes like almost everywhere in Europe. Hydropower dams disturbed or completely stopped their natural dynamics. Navigation improvements straightened their courses and deepened their beds. Flood protection levelled their waters and minimized their surface by narrowing their beds. As a result of all this approximately 70% of gravel and sand banks or islands and around 50% of natural river banks in TBR MDD are lost[18]. Only 21% of the steep Mura and Drava banks between Mursko Središče (Slovenia) and Osijek (Croatia) remained unspoiled, that is, almost 80% of the banks were stabilized by artificial protection infrastructure. And with this loss of natural, uncovered banks comes along the loss of river birds that are bound to these special habitats.

18 Retrieved from Action Plan A.7, *Action Plan for River birds*, page 7.

Grey heron standing on a tree
©WWF Adria/Ante Gugić

Little ringed plover on a gravel bank
©WWF Adria/Ante Gugić

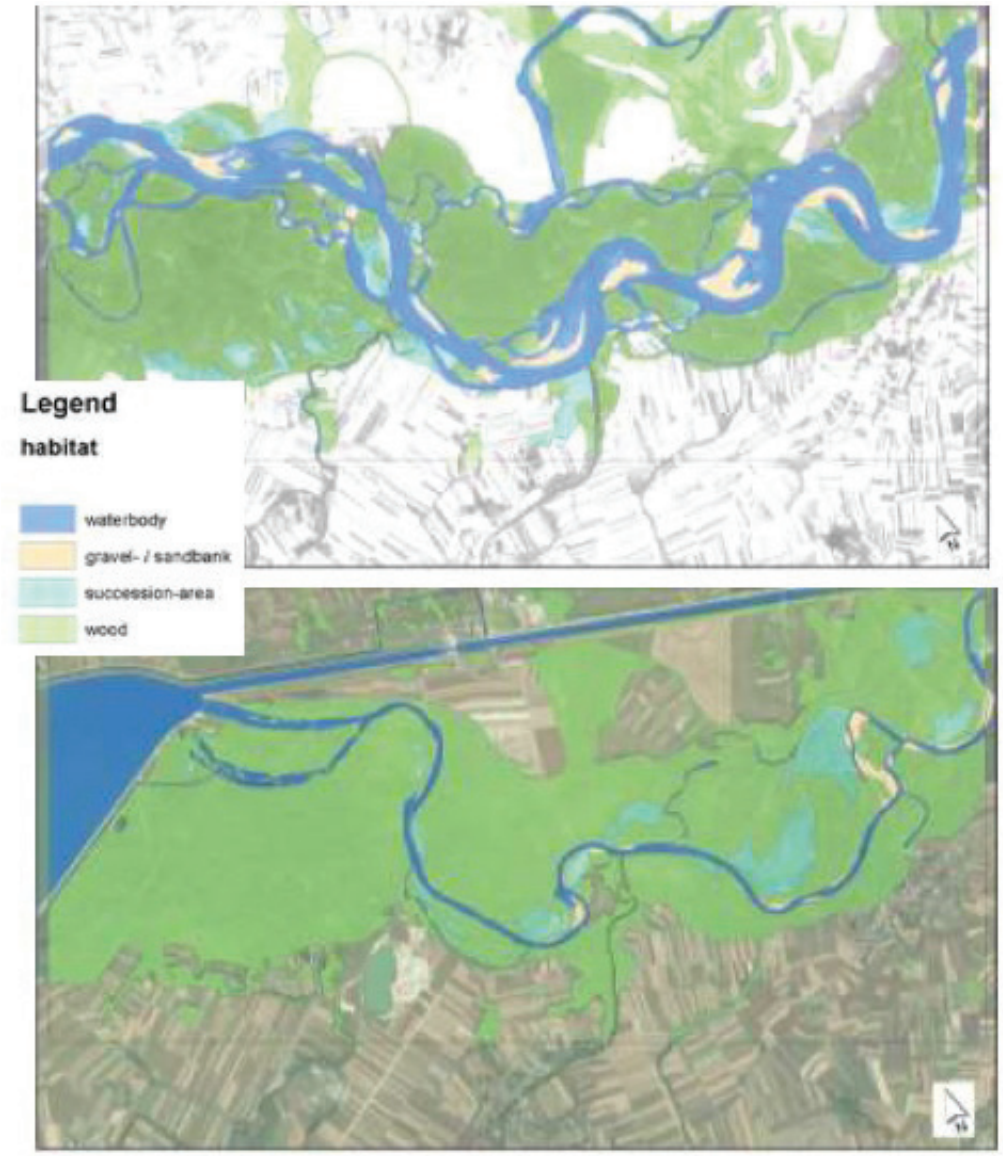
The Mura river with its gravel bars
©Monika Podgorelec

Confluence of the Mura and Drava rivers
©WWF Adria/Ante Gugić

Some bird species adapted slightly to similar breeding places like pebble shores on artificial lakes, or steep banks on abandoned gravel pits, but this can´t be enough to compensate for the loss in numbers.

The changes rivers have been facing in the past have a strong impact on the remaining free flowing parts as well. Sediments are limited, there is no more natural supply of stones and sand coming down from upstream stretches due to dams of hydropower plants. The result is a constant degradation and deepening of the downstream river bed. Tributaries bring some sediments, but besides that the bed load input consists only of the materials from the lateral erosion of the river. Without sediment there is less “dynamic building”, and the river deepening changes conditions. This is not only impacting birds but also fish population (see river branch “Swim like a fish!”).

To see what really happened to rivers in the last decades, it is very impressive to compare two satellite images from back then and from today.



Between 1968 and 2011/2014 this 7 km long part of the Drava river upstream of Donja Dubrava changed fundamentally. A massive habitat loss is the consequence of the hydropower plant Dubrava. Gravel breeders now find more than 70% less gravel- and sandbanks to build their nests on. Only the “Stara Drava” (Old Drava) offers some proper breeding habitats for species like common sandpiper and little ringed plover. Also, the total area of all side branches speaks volumes: it decreased from 198 ha to 52 ha today - a loss of 74%.[19]

But there is hope. Various international examples have shown that restored rivers have a big regeneration capacity. It sometimes happens more quickly than expected.

19 Retrieved from: Action A.7, *Action Plan for River birds*, LIFE14 NAT/HR/000115 – DRAVA LIFE, 2019, page 32.

The summer of 1995

It happened only six years after the new hydropower plant was built. The dam Donja Dubrava (see satellite photo above) had to be maintained due to a water spill. The huge reservoir stayed empty for several months until the dam was repaired. Over spring and summer of 1995, the Drava was the old Drava again. Or better to say: it reappeared with its many branches, abundant gravel and sand banks and islands. Without any flood events the Drava regained its former dynamics: The riverbed shifted laterally by over a hundred metres, thereby creating new open sand and gravel surfaces. Silver and Black Poplar, the typical softwood gallery forest species, grew two metres high within one summer. The unexpectedly recreated bird paradise drew many different species that had disappeared with the construction of the dam. Ornithologists and locals observed 25-30 breeding pairs of common tern and 12-15 pairs of little terns colonizing the new gravel bars and even a few individuals of stone curlew joined them. Over 100 breeding pairs of little ringed plover and several pairs of common sandpiper were observed in the area. Even long-disappeared bird species, such as the ferruginous duck, and the red-crested pochard were spotted. The end of the summer brought a colony of 700 common sandpipers that used the gravel bars as a resting place. Over 200 common terns used the area to hunt and more than 600 wood sandpipers and 300 common snipes used the muddy wetlands and braided structure of the old river as a resting and feeding place. An osprey used the same area as a hunting ground. The event’s described effects offer a clue to the biodiversity likely typical to this area before economic development began leaving its marks on the river. This is very reassuring and comforting: nature can come back.

This is, if you like, another proof of the strength and power of life and free flowing rivers. River restoration is one of our main topics in this handbook (see river branch “Let the rivers run free!”). An important goal of river restoration activities is the reduction of human disturbances on river birds.

Let‘s go to the beach!?

River birds depend on an intact and dynamic natural landscape, and “natural” means little to no human disturbances. Tourist activities on a river do have an impact on flora and fauna. When canoers and campers rest on gravel banks, pull their boats there, light a fire and roll out their sleeping bags, then birds like little tern or little ringed plover leave their nests and the embryos in their eggs sometimes go hypothermic. Adults might even give up their nests completely, eggs are destroyed, or hatched chicks are harmed, in the worst case. Even swimmers, that come only for a day, cause a lot of damage when they step on “deserted” river islands. Most of this happens unwittingly, without people knowing and noticing. Even more as eggs of gravel breeders are well camouflaged and resemble stones in colours, size and shape.

Common tern (Sterna hirundo) eggs in a nest © Ola Jennersten/WWF-Sweden

Other birds are disturbed not because their eggs are in danger, but simply because of human presence around their breeding sites. Those birds like black stork or white-tailed eagle, as well as colony breeders like herons, build their nests in places where no humans ever get to: high on top of trees or in thick branches. Nevertheless, these birds need silence and peace, and this also concerns “soft” tourism like hikers, bikers and walking-by people. Tourism and recreational activities of local people are therefore a potential danger for these bird species. Not only noise and physical presence on sensitive sites are concerning environmentalists, but also pollution or barriers for wildlife, such as roads.

Does it mean no more swimming, picnicking and boating in the Amazon of Europe? Not at all! But there must be rules that assign places for people and places for wildlife. Stakeholders have been trying to find solutions for this interest conflict – and a Biosphere Reserve, where all relevant sectors participate in the discussion – is one ideal base and partnership to reach this goal.

In a Biosphere Reserve strict zonation is characteristic. Core zones, buffer zones and transition zones indicate the main use of river stretches and take care of a balance on a large scale. But on a smaller scale there is a need for a “buffer” that protects single breeding sites of river birds. Some birds need a 100 meters buffer around their nests to successfully raise their youngsters, other species can only bring up their chicks when there is 500 meters around them without any disturbance. To make this possible, so-called “No-go zones” have to be declared, for instance in the Natura 2000 areas, to regulate the use of beaches, banks and islands to protect river birds´ nests. These highly sensitive and ecologically important spots have to be defined together and kept free of infrastructure projects in the future.

River birds are facing many threats, and these are the main ones:

1. Lack of transboundary cooperation and harmonisation

A river doesn‘t know borders – although many serve as administrative borders like the Mura between Austria and Slovenia, the Drava between Hungary and Croatia, the Danube between Croatia and Serbia. If anyone wants to reach any goal concerning a river, cooperation between all “up- and down streamers” is not only advisable but simply logical. Nearly all big rivers are international rivers – among them the most international river on the Earth, the Danube. Without cooperation and harmonisation of measures, action plans won‘t be successful.

2. Hydropower plants

There are still enough plans for new hydropower plants that put the remaining free flowing rivers in peril. The already existing chain of dams causes serious problems such as interrupted sediment transport and hydropeaking: sudden water level rise or fall has a big impact on animals in the river and on its banks. Water diversion for reservoirs influences and decreases the remaining dynamics.

3. River regulation

Straighter, deeper, narrower and with artificial banks at its sides - regulated, trained rivers look quite the same everywhere. They are disconnected from their old side branches, which become still waters and a cut off. The river is not a system anymore, but a channel. This habitat degradation, or even destruction, is one of the main reasons for the decreasing number of river birds.

4. Recreational use

Boating, swimming, canoeing or fishing – people love their rivers. The problem is that the rivers are not in the best shape and only small parts remain free and wild - the parts people love the most. In other words, we have to share these parts we all love. A growing number of tourists is not only predicted but also hoped for in the region. Tourism potential

is high and finds support in the society. The goals are to harmonize the existing recreational and/or touristic uses with the needs of nature and nature conservation concepts. This is all to reduce existing or avoid future conflicts and bring benefits for visitors and for nature conservation.


© A. Mohl

5. Land use and agriculture

Additionally, there are some minor threats that can nevertheless have severe consequences for birds. First of all, pesticides have to be reduced. They are applied, for instance, against mosquitos and their larvae, a basic nutrition for a lot of birds. Spraying against them has a direct impact on biomass and therefore influences food chains in riverine systems. Anyway, the biomass of insects is decreasing worldwide, not only in wetlands. Meadows alongside rivers are well known for their rich diversity of insects. Extensive meadows are cut only once or twice a year and are especially rich in plant species and therefore also in insects. Intensive agriculture or giving up traditional, extensive land use decreases their number. Many birds feed on insects, especially during the breeding season when parents bring their chicks up with this protein-rich food.[20]

The “Action plan for river birds” of the “DRAVA LIFE – Integrated River Management” in our five-country Biosphere Reserve “Mura-Drava-Danube” is the groundwork for further actions in river restoration, for management plans in Natura 2000 areas and serves as a conservation tool to carry out hydraulic engineering projects. It is the first step. All efforts need to contribute to one goal: ensuring the survival of these species. It can happen only at an international level. Seven species can be looked upon as indicator birds for natural, dynamic rivers.

20 Retrieved from: Action A.7, *Action Plan for River birds,* LIFE14 NAT/HR/000115 – DRAVA LIFE, 2019, pages 53 to 59.

4.2. We proudly present: The 7 indicator bird species

The choice of the indicator bird species selected through the lifelineMDD project, with their unique habitats and ecology, mirrors the state of the rivers perfectly. That is why they were chosen as indicator species. Their numbers show the situation in detail[21]. These are the results of the joint and outstanding monitoring work of our many river enthusiasts, local ornithologists, birdwatchers, scientists and environmentalists.

The 7 key bird species in our ‘Amazon of Europe’ can be sorted into the following two groups:

1. Gravel and sand bank breeders

Common sandpiper (*Actitis hypoleucos*)
Little ringed plover (*Charadrius dubius*)
Little tern (*Sternula albifrons*)
Common tern (*Sterna hirundo*)

2. Steep bank breeders

Sand martin (*Riparia riparia*)
Common kingfisher (*Alcedo atthis*)
European bee-eater (*Merops apiaster*)

You will find the detailed description of each of these bird species, as well as other 3 additionally selected, in the separately prepared PowerPoint presentation (TBR MDD Bird and Fish Species Descriptions), but also on the bird cards that you will need for some of the activities. Both materials (PowerPoint presentation and bird cards) are open to be adjusted, extended, and continued by you, according to your needs.

21 For more information: Action A.7, *Action Plan for River birds*, LIFE14 NAT/HR/000115 – DRAVA LIFE, 2019, page 50.

4.3. Becoming a birdwatcher

Binoculars are an important tool when you want to observe and determine birds. First, because of their large flight distances. Second, binoculars also keep us humans at a distance. Participants should be reminded that birds or nests are not to be approached, particularly in the breeding season.

It takes some time to get acquainted with the use of binoculars, especially for children. For that reason, they should have enough time to practice and should feel free and safe enough to ask for help in case they don‘t see well. It is not easy for beginners to adapt the focus to their eyes. Facilitators should ask repeatedly if the participants have any problems, as some children or even adults tend to be too shy to ask for help. Try to make the observation an exciting and comfortable experience for all!

If you have a spotting telescope on a tripod: the better! But the telescope might be even harder for use by beginners. For a group of around 20 participants it would be good to have two or three telescopes available. Its magnification exceeds the binoculars by far, but it needs a stable tripod, otherwise it‘s too shaky. The height has to be adapted to the shortest participant.

For determination, or to show the birds and explain details or differences, bird guides are very helpful, but usually not available in all languages or in enough copies for the whole group. Applications for smartphones can be very handy here. When it comes to recognizing a bird by its song, there is definitely no better way than to use an application. Facilitators can use their own devices for this purpose, but also invite participants to install free ones on their phones or tablets. The app BirdNET makes it very easy to determine birds by their singing - if there is no internet connection on the spot - the application offers the possibility to record songs and determine them later.

It takes some time for children to become acquainted with using binoculars, © WWF Adria/Milena Dragović

4.4. Rainbow flow with activities

1. Create a good group atmosphere!

Welcome, birds!

Age: 7+
No. of participants: 5-40
Duration: 10 min

Goal: Introduction to the topic and a funny welcome energizer. Have some fun, move and dissipate excess energy, get into the mood of “birds”.

Method: The group stands in a circle. Each participant chooses another person from the group without letting anyone else know who it is.

Level 1: When the facilitator gives the signal to start, all participants try to “fly” (run) around the person they have chosen three times – the target person will still not know and is running himself/herself. Once each participant has orbited the selected person three times, everyone stops.

Level 2: Each participant chooses two persons and tries to run around both in one big circle – again three times. They may begin when the facilitator gives the signal to start. Once the goal is accomplished, the participants stop running and form a circle again. The mixture of chaos and order is very funny.

Level 3: Finally, each participant chooses three other persons and tries to run around all of them in one big circle – of course three times.

Material: none.

Barrier-free: Persons with limited mobility and visually impaired persons may need help from other participants. Watch out for the terrain and make sure that they are feeling comfortable. Arrange the game in groups if needed.

2. Experience nature with all your senses!

Song Contest

Age: 7+
No. of participants: 5-20
Duration: 10 min

Goal: Nature sensitization with focus on the sense of hearing.

Method: Define 4 spots (trees, board, benches, corners of a room...) as different bird nests, some 5-10 m away from each other. Make sure that all participants know which nest is located at which spot – maybe by fixing a bird card there. Then play the bird songs from a smartphone and link them to the 4 nests – everyone should know all the songs after some training.

Now the participants fly around between the 4 spots. Once a bird song is played, they have to fly to the right “nest” – first slowly, one after the other, then more and more quickly. If the game goes well, you can spontaneously add another nest or two. The game can also become a kind of competition for ambitious groups: A mistake or being too slow means the game is over. Less and less participants are flying between the nests.

Material: smartphone with river birds’ songs, maybe loudspeakers, 4 bird cards (indicator bird species or others), masking tape.

Barrier-free: Activity has to be adjusted if you have participants with physical or visual disabilities. Terrain has to be open space. Visually impaired participants can recognise bird songs, but since it would be hard for them to find the “nest”, it would be better if activity is done in pairs and without competition. For participants with physical disabilities, all the bird cards can be on one spot so that participants don‘t have to move around a lot. They indicate for instance with their fingers which card a song belongs to (first one, second one from the left etc.).

3. Calm down and focus your attention!

Find your chick!

Age: 7+
No. of participants: 10-30
Duration: 20 min

Goal: Introduce colony breeding bird species, have fun.

Method: Print bird cards of colony breeders in two copies and hand them out to the participants. The participants look at the card and try to find a partner with the same bird. The facilitator plays some bird songs or noises of the birds (from the cards or other species) and lets the participants practice a bit to imitate them, just to get into the mood of birds. Then the pairs secretly agree on a “bird noise” – it doesn´t need to be a real bird song but can only be a “peep peep”. One of the pairs is the chick and the other one the mum or dad bird that gets blindfolded. So, choose a plain, easy terrain without any obstacles or dangers for the “blind ones”. The chick looks for a place apart from the other chicks and sits down. The parents are led to a starting point. On a command, all the chicks start making their noises simultaneously and the parents start looking for them. Not being able to see, they have to rely only on their ears. Once all pairs are together again, they swap roles and do a second round.

Material: selection of bird cards - one per participant (colony breeders like grey heron, European bee-eater, sand martin, but also black-headed gull) (see Supplementary materials), blindfolds, maybe app with bird sounds (from the cards or other species).

Barrier-free: This activity is great for the visually impaired. It is only needed that someone explains a bird card to these participants. Avoid it if there are deaf children in the group. Participants with limited mobility can easily take over the role of a chick, but there should not be a second round with swapping roles, the pairs only change their “song” and try again.

Stalking

Age: 7+
No. of participants: 10-30
Duration: 20 min

Goal: Introduce gravel breeder´s challenges, calm down a group.

Method: Select a volunteer who will be the little tern or little ringed plover or any other bird which breeds on gravel banks. The volunteer will be blindfolded and sits in the middle of a big circle created by other participants. He/she guards the eggs in front of him/her, in this case some stones. The facilitator is part of the circle and indicates one participant by pointing silently. The chosen participant tries to reach the bird in the middle by stalking slowly without making any noise. The bird in the middle tries to detect the intruder. If he/she hears something suspicious, he/she points in that direction. The facilitator silently decides if the stalker has to go back, when caught, or may continue. Once a stalking participant reaches the eggs and touches them, he/she is the next one to be a gravel breeding bird in the middle. Later on, the facilitator may nominate two or three stalkers at the same time. Play the game on different grounds, such as grass, sand or stones, to challenge the participants' stalking abilities.

As a follow up, the facilitator tells the group that some birds such as little tern prefer gravel islands before gravel banks because they are safer from stalking predators like foxes etc.

Material: one blindfold, bird card of some gravel breeders (little tern, little ringed plover, common tern, common sandpiper) (see Supplementary materials).

Barrier-free: Mind that in this activity participants with different disabilities can have different roles. The bird in the middle can be in a wheelchair or be visually impaired, the stalker can have hearing disabilities.

4. Trigger curiosity!

Egg hunt

Age: 7+
No. of participants: 5-15
Duration: 30 min

Goal: Getting familiar with sand and gravel breeding birds´ eggs.

Method: Gravel or sand bank breeders have eggs that are perfectly camouflaged. They can‘t be seen even when you stand in front of them. That‘s why it is easy to destroy nests when walking along river banks.

Divide the group into two or more teams that compete against each other. Each team gets a field of several square meters marked with ropes or wooden sticks, and a set of “eggs” – 5 to 10 stones from the river bank. Alternatively, you can crumple up papers into egg-shaped forms. All teams get the same number of “eggs”. Their task is to paint the eggs (stones or crumpled up paper) to make them almost “invisible” when laid openly into their fields. It is not allowed to cover the eggs with grass or sticks. The results get more interesting if the fields' ground is

different, e.g., stones, grass, sand, etc.

Afterwards, the teams secretly place their eggs in their fields. It is important that other teams don’t look. Then the teams visit other teams’ fields. The facilitator gives the start signal and the “visitors” try to spot the eggs without entering the fields. When participants want to guess, they point to where it might be. If one is right, the egg is taken out and the team gets a point.

In a second round the teams get new places and new “eggs” – and a second chance to do their best to disguise them. At the end the winner is announced and the participants can share their findings and experiences. But the real winners in making invisible eggs are birds such as little ringed plover or little tern. The facilitator can now show the participants photos of gravel bank breeders and make them familiar with the management actions of the TBR MDD, that aim to protect gravel or sand banks and islands during the breeding season.

Material: picked up stones, blank papers, coloured pencils, watercolours, brushes, 2 ropes of 10 m, bird cards of gravel breeders (with photos of eggs and nests, see Supplementary materials), stopwatch (smartphone).

Barrier-free: Since this is a team activity everybody should participate, but make sure that participants have roles they can accomplish.

5. Actively explore nature!

Bird monitoring

Age: 7+
No. of participants: 10-30
Duration: 45-60 min

Goal: *Learning by doing* about the bird diversity.

Method: The facilitator invites the group to help with an inventory of bird species in the TBR MDD as many ornithologists did when they collected data, wanting to know where the birds live and how many of them. Monitoring is an essential, important part of the management plans within the Amazon of Europe and the protected areas in all 5 countries. The facilitator may give the participants the feeling that they are contributing to this or at least that they are doing the same as ornithologists in all 5 countries of the TBR MDD.

Participants work best in pairs or teams of three. Each team gets a stock of “official” monitoring checklists and starts the exploration. The teams try to find as many different bird species as possible within a given time and may choose the best observation spots by themselves - if there are no other rules for the place. Binoculars are useful but not 100% necessary. Smartphone applications installed on the participants‘ devices (if they want) may also be helpful. They may take photos with their smartphones or drawings and can always come back to the River’Scool “base camp” to check the bird cards hanging there like a “bird lexicon” or bird books (if available). If they are sure they really found and determined a species correctly, they fill in a monitoring sheet.

It is not important that all the species they find are “correct”. The focus is on discovering and distinguishing different species and learning that birds have diverse demands and needs. The activity should have a “scientific“ taste, and the participants should feel like explorers and contributors to the Biosphere reserve „Mura-Drava-Danube“ in five countries.

Note that birds are very active in the morning and less around noon and in the afternoon.

Material: binoculars (best one for each team), worksheet “Bird monitoring” (see Supplementary materials), bird cards, bird books or guides, if possible, rope, clothes pegs, pens, clipboards, smartphones (apps, camera, GPS).

Barrier-free: If you want to integrate blind or visually impaired participants, make teams or mixed pairs and add the sounds of birds as a task for the observation. If you have participants with limited mobility, each team should have a defined spot from where they do the observation - just like real ornithologists do when stay in a “hide”.

6. Repeat and process information!

Owls and crows

Age: 8+
No. of participants: 10-40
Duration: 20 min

Goal: Revision of the subjects learnt before by having much fun at the same time in a game of catch.

Method: Define a big rectangular playing field like a tennis court and mark it with long ropes (or rucksacks, wooden sticks etc.). Participants are divided into two equal groups, the owls and the crows. Owls are often considered to be wise and crows to be insidious birds. The two groups stand in the playing field facing each other right and left from the centre line. The facilitator now makes a statement about something the participants have learnt and seen that day, for instance:

“The black stork is very easy to spot on the river.”

If the statement is (like this one) false, the crows attempt to catch the owls, who run to their end of the playing field, where they are safe only behind the rope. If a statement is true like „The eggs of the little tern resemble stones “, the owls attempt to catch the crows. Participants who have been caught transfer to the other group. Before making a new statement the previous one is briefly explained and discussed. Note that it is not easy to decide quickly in which direction to run, even if you know the correct answer, but it is much fun. Do not reproach anybody if they are wrong. It is important that all participants repeat what they learned.

Use the facts in your statements that the participants learned on the same day, not the general ones or from books or classes before.

Possible examples for statements in the owls and crows game:

“The little tern builds its nest on steep banks” FALSE

“The breeding season of gravel breeders lasts from July till October” FALSE
“Kingfishers have their nests in steep banks.” RIGHT
“Black storks nest in colonies.” FALSE
“Grey herons build their nests on gravel islands.” FALSE
This activity is also very nice for closing a day.

Material: long ropes to mark the playing fields (or rucksacks, wooden sticks, etc.).

Barrier-free: If you have participants with limited mobility, just let them stand in two lines (owls and crows) facing each other. The participants simply make a predefined sign (like raising the right hand for “TRUE” and not raising or raising the left hand for “FALSE”) on a quick command (all at the same time, do not give them too much time to think). Who is wrong, changes the group. It is also suitable for wheelchair users.

7. See things at a larger scale!

Steppings stones

Age: 7+
No. of participants: 10-30
Duration: 30-45 min

Goal: Learning about habitat networks and their important role as stepping stones, using the example of migratory birds.

Method: Define a large, more or less rectangular playing field and mark it with long ropes (or rucksacks etc.). Arrange “protected areas” such as the Amazon of Europe and other wetlands all over the field – mark these small “safe spaces” with shorter ropes, hula hoops, camping mats etc. Mark trees or any other elements on both sides of the big playing field with a signboard EUROPE and a signboard AFRICA.

Round 1: The group should stand at the EUROPE-end of the playing field. All participants are black storks (or chose other migratory species). The facilitator tells a story about the animal’s life cycle and habits, what they feed on, etc. While listening, smaller children might want to act as storks and identify themselves with their role by playing (building nests, laying eggs, breeding, feeding the young ones and so on) – make them feel as if they were the storks. Tell the participants that the time has come and black storks must fly from here (Amazon of Europe) to the other end of the playing field (Africa) before winter. Make clear that the coming migration is a long, tiring and dangerous journey that takes two or three months. The facilitator can also add some information about their way of flying: gliding. Along the way, the storks have to take rests, feed and gather their strength for the next part of the journey. For this they choose attractive protected areas (ecosystems) – the `safe spaces´. Between these marked areas that promise food, peace and shelter, the birds are threatened by many dangers – these dangers are represented in the game by `catchers´, who will try to catch all the birds that are not standing on a protected area (ecosystem). The dangers (catchers) can also be named like

“hunger”, “hunting”, “collision with power lines”. Participants that are touched by a catcher have to leave the playing field, because they have starved, are shot dead, etc. The remaining birds arrive at the other (safe) end of the field. To visualize their journey, the facilitator can show photos of black storks flying on their migration routes or from Africa. Use them also to tell the participants some stories about the black storks’ life cycle and habitat in Africa.

Round 2: One or two protected areas (ecosystems) are removed, the facilitator tells a story why this has happened (they are no longer protected by law, or they were replaced by tourist infrastructure, or growing cities swallowed them up, roads have been built, hydropower plants changed the landscape...). The group of storks should then try to get back to EUROPE (the other end of the field) without getting caught by a catcher, which is certainly more difficult than before.

Round 3: Again, one or two protected areas are removed, again there is a story about why this has happened (giving different reasons than before). The group of remaining storks should try to reach the other end of the field, AFRICA once again. Play the game for a certain amount of time or until none of the participants are left on the field.

This activity helps people to understand that nature protection doesn‘t make sense without national and international collaboration. Participants physically experience the difficulties that migrating species face in our artificial landscapes.

It becomes even more clear when the Mediterranean Sea is introduced in the middle of the playing field – an area the big birds don‘t cross because their gliding does not work above water, but only above land surface with its thermal lift. So, there are only two narrow gateways right and left, Gibraltar and the Middle East: that makes it easier for the catcher.

Material: one A4 paper with EUROPE written on it, one with AFRICA (as a signboard), masking tape (to fix signboards), ropes, camping mats, hula hoop or similar materials (for marking the protected areas as `safe spaces´), a long rope (may be helpful to mark the boundaries of the playing field), photos of migratory birds in other countries (Africa), if possible.

Barrier-free: If you have participants with disabilities, arrange the activity so that you have an “audience“ and only three to five running participants who volunteer for that. They represent migratory birds. The audience is mixed (disabilities and no disabilities) and they do not only watch the activity but also choose which resting place will be taken out in the next round. If you don‘t have participants with disabilities, make sure everybody participates in the migration and acts as a bird or catcher.

Let’s have some fun at the beach

Age: 7+
No. of participants: 10-30
Duration: 60 min or more

Goal: Start thinking about different interests of birds and humans on rivers by using theatre pedagogy.

Method: The facilitator asks the whole group about their favourite leisure and tourist activities

connected to rivers. While brainstorming in a nice, relaxed “beachy” atmosphere, the facilitator writes the mentioned activities on A5 papers (one per paper). To make the list of activities similar to the real lives of participants, the facilitator should add some not yet suggested activities and steer the brainstorming to not yet covered topics. This set of human activities will serve as a pool of ideas from which the theatre teams can pick and use in their stories. In that way the activities cannot be used twice and each team will have different content. Show the bird cards and repeat information about specific needs and “No-Go-areas” around their breeding places if necessary.

The participants are divided into teams of 5 to 7. Their task is to develop and perform a short theatre play. There should be bird characters, and maybe human, and a story needs to be about human activities versus bird´s needs. After 30 minutes, each team performs their play in front of other teams. Encourage the teams to look for the most suitable locations for their story - the audience will follow from spot to spot. Main focus is on “becoming a bird” and having fun, both in playing and in watching. Whether you encourage them to use disguise, requisites or theatre make-up, depends also on the time you have. These things usually help people a lot to get into their roles and “become” a bird. Things found in nature can also be taken and used. During the preparation phase, the facilitator, and ideally some helpers, visit and support the teams to make sure that nobody gets harmed or feels uncomfortable, that the instructions were clearly understood, but also to give some advice, stimuli and helpful remarks like a dramaturg in the theatre.

Some simple rules have to be obeyed:

- Each team member has to have a role in the play (if they feel uncomfortable to speak they can be a tree, reed etc.);
- The story has to have a clear beginning and a clear end;
- There have to be bird actors in any case, human actors are optional.

This activity can also serve as a nice ending to a day. If parents come to pick up their children, this activity may also be a nice surprise for them to show what the group has learnt that day.

Possible human activities: swimming, angling, fishing, rafting, kayaking, canoeing, rubber boating, motor boating, paddling, horseback riding, kite surfing, cycling, hiking, picnicking, barbecuing, riding motorbikes or quads, weekend huts, fishing huts, ferry terminal, viewpoint/watchtower, cafe, restaurant, accommodation, supermarket/kiosk, WC, roads, info boards, educational paths, churches/monasteries...

Material: one set of bird cards for each team (7 indicator bird species with indicated size of buffer zones needed around nests plus white-tailed eagle, black stork, grey heron colony) (see Supplementary materials), maybe disguise, requisites and theatre make-up, A5 papers, marker.

Barrier-free: It‘s teamwork, so all the participants can have different roles. Make sure everybody contributes to the tasks and feels good in their roles.

8. Imagine solutions and prepare to get active!

Our Action plan for birds

Age: 7+
No. of participants: 5-30
Duration: 60 min

Goal: Take action for endangered river birds in your region.

Method: Participants have already learned a lot about birds. They identified some species on their river spot and are aware of the threats to specific birds in the Amazon of Europe. The facilitator mentions the “Action plan for river birds” in the TBR MDD. Participants are invited to brainstorm ideas that could help to contribute to “Reducing the impact of human disturbance due to recreational activities along the river” - one of its main objectives.

The participants can take action within the school project framework. This is a wonderful way to experience active citizenship, enjoy teamwork and gather self-confidence. Participants should have the feeling of “*We are doing something important for the birds in our region!*”.

Some ideas:

- Design leaflets about breeding birds on gravel banks and distribute them on next school/local festival;
- Contest “Birds in danger” and exhibition (art, literature, dance etc.);
- Make small boards with messages for potential visitors: prepare them and set them up on gravel banks before breeding season starts;
- Children give radio interviews on local radio stations to raise awareness in the local community;
- Write and perform a theatre play in front of local community;
- Invite local TV to school and let the school children explain the problem;
- ...

Material: paper and pen to make notes, the rest depends on the action.

Barrier-free: This activity can be adjusted to the needs of all the participants because it can also be done later in some other environment.

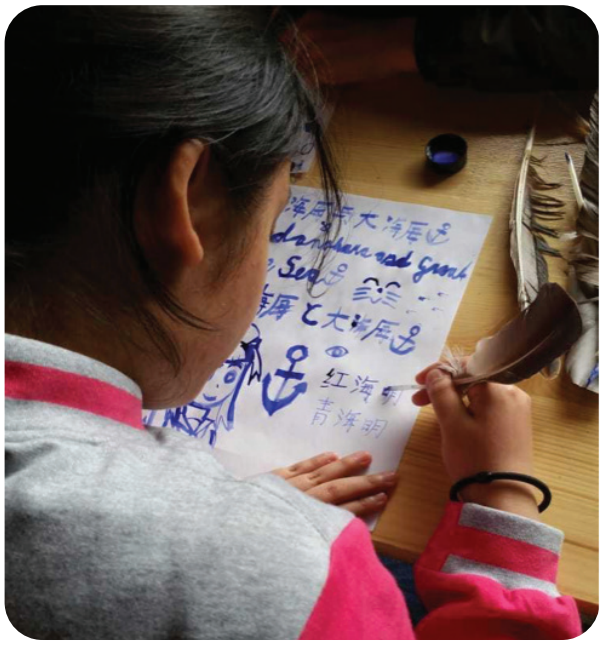
9. Goodbye!

Write with a quill pen

Age: 7+
No. of participants: 5-30
Duration: 10 min or more

Goal: Say some last words, get in touch with historic writing tools connected to birds.

Method: In former times people wrote with quill pens. These are strong, big flight feathers preferably from goose or any other large bird (swan, eagle, hawk, crow, owl…), with a thick, strong, hollow shaft. Its tip has to be cut into a nib using a pen knife or any other sharp knife or scissors. The hollow shaft of the feather serves as an ink reservoir, once being dipped into a bottle of ink. It flows to the tip through the slit by capillary action.



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The participants are invited to put their ideas into words and either

- write a message to all birds of the TBR MDD (“What I have always wanted to tell them”);
- write a letter to yourself;
- write an imaginative story (“If I was a bird, I…”);
- write a letter to somebody you like;
- write a letter to a bird you saw or heard about today and you liked it;
- make a drawing of a bird you like the most;
- … any other idea is welcome.

Be aware that the ink needs some time to dry before participants can fold the paper and put it into their bags or rucksacks. It is also important to wash their hands afterwards or use hand sanitizer.

Material: picked-up flight feathers from goose or any other big bird (swan, eagle, hawk, crow, owl...), scissors or sharp knife (adults cut the feathers), bottled ink, A4 or A5 paper.

Barrier-free: Very good experience for autistic children. They like to concentrate and do things carefully, exactly how one has to use the feathers.

Birds of the Amazon of Europe

See the activity “Fish of the Amazon of Europe” (see river branch “Swim like a fish!”). It can be adapted for the “birds” topic.

5. River branch "Swim like a fish!"

The rivers pass by us and remind us of our transience.

The Mura and Drava belong to the Alpine rivers, their springs are in the Alps and at their beginnings, they bear the features of the mountain rivers. Only a few fish species have adapted to the adverse conditions there: low temperatures, strong streamflow, and sediment transport - so they can live permanently in the highest fish-bearing streams of the Alps. Downstream conditions become milder, and the number of fish species increases.

The Danube itself flows outside of the Alps and only touches the eastern Alpine fringe for a few kilometres near Vienna. Large part of the Alpine waters actually flows into the Danube, which affects the character of the Danube itself.

These are the rivers of the Black Sea basin. Ichthyology wise, the Black Sea basin is the richest basin in Europe, with 103 fish species.[22] Fish are special travellers - they are born in one place, in another they grow and feed, in the third they spawn. Some of them travel thousands of kilometres on their paths from oceans, seas to rivers, and back. Certain species find only narrow stretches of a single river with a specific bottom as a suitable habitat.

5.1. Pre-conditions for successful reproduction of fish species

Physical factors	Chemical factors
Temperature	**Oxygen levels**
Water depth	**Dissolved minerals**
Current	
Waves	
Bottom types	
Cover	

Fish need a healthy living space so they can grow and thrive. Their habitats hold specific and different physical and chemical factors.

The life cycle of a fish has different stages: egg, larvae, juvenile, and adult stage. For each of these stages, fish need suitable habitats. The quality and quantity of habitat directly

22 Retrieved from: DRAVA LIFE book, in press

affect fish populations.

As early as the nineteenth century, biologists noticed that certain species of fish were retained in parts of rivers where the water temperature, depth, or other habitat factors were more suitable for them. They divided the rivers into zones which are named according to the dominant species in that habitat. Later, biologists added specific abiotic parameters to the system of fish ecological zonation: the most important being bed slope and river width.[23]

Along with the longitudinal profiles of rivers, ranging from the source to the mouth, there are the ***trout***, the ***grayling***, the ***barbel***, and the ***beam*** zone. The trout zone is least represented in the TBR MDD. The grayling zone transitions from a strong current, rich in oxygen water, which belongs to the trout zone, towards the middle course. The temperature is slightly higher. Fish species in this zone lay adhesive eggs. Characteristic fish species are grayling, chub, dace, minnow.

In the lowland part of the rivers, the water has less dissolved oxygen and this zone belongs to barbel. Temperature and water flow are moderate. The mixed substrate of silt, sand, and gravel in the river bed is suitable for plants to grow roots. Vegetation on the river bed is the perfect place for fish to lay their eggs. Thanks to the photosynthesis in the plants, they are a comfortable protection with enough supplies of oxygen for barbel, roach, rudd, European perch, pike, and eel.

Of course, the boundaries of these zones change with seasons, and many species migrate between them in search of favourable habitats according to their needs. Because of this, in the barbel zone, we can also find chub, common nase, ide, asp, and others. The bream zone is in the lower course of the river with a muddy bed. Water is slow flowing, and temperature is very variable. There is a lot of aquatic vegetation. It is suitable for adhesive eggs. This is a perfect habitat for carp, catfish, pike, and tench.[24]

Fish are part of the food web within aquatic ecosystems and are the link of the food chain between aquatic and terrestrial ecosystems. Their distinctive features give them character and that‘s why they are interesting for learning activities.

23 Unfer, G., Meraner, A. & Pont, D. (2019). Fish - Endangered aquatic biodiversity at the heart of Europe. In: Rivers of the Alps: Diversity in Nature and Culture, Haupt Verlag, Bern. pp.126-145.

24 DRAVA LIFE book, in press

5.2. Meet the families of fish

In the TBR MDD there are diverse fish families. Among all existing species within different families, we have chosen some species with unique biology, ecology and habitat preference, to present to you. There is a detailed description of each of the following species in the additionally prepared PowerPoint presentation TBR MDD Bird and Fish Species Descriptions.

The oldest family - The Sturgeons (family Acipenseridae)

Sturgeons represent a natural heritage of the Danube River basin. Most species live in the seas and migrate to rivers to spawn, a few others are confined to freshwater. They migrate to spawn in spring or early summer, and during the winter they are rather inactive.

Several species provide caviar from eggs, which is one of the reasons for their overexploitation in the past. Most species are considered to be critically endangered.

They are living dinosaurs, with fossils dating from Middle Jurassic (174 million to 163 million years ago). They have bony plates (scutes) along the cylindrical body. On the underside of the snout, they have a toothless mouth with sensitive tactile barbels that the fish drags over the bottom in search of food (small fishes or invertebrates).

- **The sterlet (*Acipenser ruthenus*): the smallest sturgeon that permanently inhabits freshwaters.**
- **The beluga (*Huso huso*): the largest sturgeon and the biggest freshwater fish in the world.**

The family with homing behaviour - The Salmonids (family Salmonidae)

Salmonids have a relatively primitive appearance among the ray-finned fish, with the pelvic fins being placed far back, and an adipose fin towards the rear of the back. They are slender fish, with rounded scales and forked tails. Their mouths contain a single row of sharp teeth.

This family includes salmon, trout, char, freshwater whitefish, and grayling.

As adults, they return to their place of birth when they are ready to spawn. As fish grow, they usually migrate downstream to find larger habitats and more abundant food sources. As spawners, however, they want to return to the place of their birth to lay their eggs there. This behaviour guarantees the best possible reproductive success, as the spawning sites that their parents chose and that they emerged from will also guarantee optimal conditions for their offspring. Therefore, they need free-flowing river stretches, open for migrations.

- **The huchen or Danube salmon (*Hucho hucho*): endemic to the Danube basin.**

The biggest family in varieties and numbers - The Carp or a Minnow family (Cyprinidae)

Cyprinidae is the largest and most diverse fish family, with about 3.000 species. It includes the carps, the true minnows, and their relatives like the barbs and barbels. In the TBR MDD river basin the number of cyprinids increases in the downstream direction.

They are stomachless fish with toothless jaws. Even so, food can be effectively chewed by the gill rakers of the specialized last gill bow. These teeth (pharyngeal, because they are in a pharyngeal arch, in the back of the throat) are unique to each species and are used by scientists to identify species. Strong pharyngeal teeth allow fish such as the common carp to eat hard baits such as snails and bivalves.

- **The common bleak (*Alburnus alburnus*): small fish that lives in great schools.**
- **The cactus roach (*Rutilus virgo*): endemic to the Danube catchment.**
- **The emerald gudgeon (*Romanogobio skywalkeri*) - new species, found in the Mura river.**

The family of ray-finned fish - The Percoids (family Percidae)

Their fins are webs of skin supported by bony or horny spines (rays). Their dorsal fin is split in two. Most of the species are small. As freshwater, temperate species, the family includes both predator and prey species and is thus of great importance within the aquatic food web. Some of the well-known species of this family are the walleye, sauger, ruffe, darters and three species of perch. Most of them are carnivorous, and so are the two little predators endemic to the Danube basin that are regionally and nationally red-listed as critically endangered:

- **The schraetzer or striped ruffe (*Gymnocephalus schraetser*)**
- **The zingel (*Zingel zingel*)**

The life path of a fish is not easy. For a small egg, the development completely depends on the habitat conditions: whether the substrate, temperature, and water fluency is suitable. For juveniles, the availability of food and the ability to hide among river plants are among the greatest conditions for survival. Are there any insects that fish feed on and is the area rich with vegetation? Is the water clean enough without the pesticides and chemical waste, so that plants, fish, and insects can survive all together?

5.3. Threats to riverine fish population and how to overcome them

Riverine fish populations are declining fast due to various reasons. All current major problems which act upon our fish stocks are caused by human impact.

The question is which threats are causing more rapid population declines for the riverine fish populations. Major threats in order of severity are:[25]

1. Over-abstraction of water for irrigation - water scarcity and reduced river flow, the drying up of wetlands, and decrease in water levels - impact fish distribution and reduce their habitat.

2. Non-native (alien) species - native fish species (very often the endemic ones) are being threatened with species introduced for recreational fisheries or other economic purposes.

3. Hydropower and water control dams - changes in the width or depth of a river reduce flow rates and interrupt natural sediment transportation as well as the migration routes of many fish species. The hydropeaking (the discontinuous release of water) can also directly cause habitat destruction. Suitable spawning sites are destroyed because of the newly formed water reservoirs.

4. Pollution - domestic, agricultural and industrial pollution harm fish and can sometimes cause mass mortalities in the water body. Oxygen depletion is one of the most common causes for fish kill (coupled with droughts, algal blooms, thermal pollution etc).

5. Climate change - rises in temperature and acidification impact fish spawning, food supply, oxygen levels in the water, decreased precipitation and snowmelt runoff. These changes can cause fewer offspring, limited growth and reproduction rates and even in some cases of extreme weather events - death.

Fish need adequate sediment for their in-river spawning, and lateral connectivity to reach floodplain spawning sites. As an example, a large floodplain area lies at the confluence of the Drava and the Danube rivers, providing favourable living conditions for over 55 fish species.[26]

The first hydroelectric power plants built on mighty rivers were a boon to the human race and the use of natural energy resources. They represented the strength of the man who tamed the river. On the other hand, they completely closed the way for the inhabitants of the rivers - fish and other freshwater organisms. For instance, a total of 59 dams have been built in the upper part of the Danube, which means that at every 16 km on average the fish encounter an obstacle.

Conservation actions include actions toward the environment, animals, and humans. They help protect natural and cultural heritage. There are different kinds of actions, for example, the IUCN Red List combats extinction pressures on fish species. Many actions are mentioned

25 Freyhof, J., Brooks, E. (2011). European Red List of Freshwater Fishes, Luxemburg, Publication Office of the European Union

26 https://www.icpdr.org/main/danube-basin/drava-basin

in previous chapters related to the river restoration and birds as indicator groups. In addition, it is crucial to drastically improve water quality in freshwater ecosystems, prevent and control invasions by non-native species, remove obsolete dams and let rivers flow free.

These conservation actions directly help us to preserve the natural flow and biodiversity of rivers. If we are implementing them, we are also helping ourselves to overcome our own transience - we are actually giving it a meaning.

5.4. Rainbow flow with activities

1. Create a good group atmosphere!

I am a fish!

Age: 5+
No. of participants: 5-40
Duration: 20 min

Goal: Introduction to the topic in a funny way.

Method: The facilitator asks the participants where they are. By the river? Who lives in the river, what kind of animal? ...Fish? How do the fish greet one another? Do they talk? Imagine that you are a fish and that you are swimming through our rivers Mura, Drava, and the Danube. How would you say hello in a “fishy” way? When the facilitator gives a sign or makes a sound they start moving around like fish (hands on ears, waving, mouth opening, no sounds).

Material: None.

Barrier-free: For blind and visually impaired participants you must describe the space and the movements of a fish to help them explore the area. Participants with limited mobility can join the activity impersonating the fish without movements of the whole body.

2. Experience nature with all your senses!

Feel the river

Age: 5+
No. of participants: 5-40
Duration: 30 min

Goal: Sensitization for nature.

Method: Feel the river. With their hands, or even better with their bare feet, participants have to “feel the river”. They are trying to walk in it, to feel what kind of river bed it is, what the water temperature is, what the current is like (of what speed). How do they think fish feel in that river? Imagine and tell us - if you were the fish how would you feel? Every participant should explain how the fish feel in the water.

Material: None.

Barrier-free: This activity can be adjusted to everybody. It is important that participants feel relaxed in a natural environment.

3. Calm down and focus your attention!

Silence of a fish

Age: 6+
No. of participants: 5-40
Duration: 20 min

Goal: Use your senses and self-regulation while learning about the life cycle of fish.

Method: Play a silent game. Every participant takes their place and sits down trying to be attached to the ground as an egg of the fish. One of them is a Beluga, looking for food, going around them, ready to hunt its prey. Whoever moves or makes a sound, Beluga catches them (just touch to the shoulder will be enough). The participant that is “eaten” has to get up and leave the area of the game, standing by the side. The game ends when “every egg is eaten”.

Material: None.

Barrier-free: It is suitable for everyone, just make sure they understand the rules of game. Wheelchair users can be helped by Beluga to leave the area of the game when caught.

4. Trigger curiosity!

Story of a skywalker

Age: 8+
No. of participants: 5-30
Duration: 40 min

Goal: Raise curiosity while exploring a habitat for a new species.

Method: The facilitator tells a story about a newly discovered species - the emerald gudgeon. He/she explains what it means for a scientist to find a new species in a territory scientifically observed many times, and how important it is to preserve the habitat of that species. He/she also gives them important information about the species habitat and ecology. Participants have 20 minutes to go along the river and find the best suitable habitat for the emerald gudgeon. Everyone has to explain why their habitat is the best place. Then the whole group stands in a circle and tries to make a habitat for emerald gudgeon with the natural elements (they do not need to be taken from water).

Material: Natural material picked from the ground.

Barrier-free: If there are participants with limited mobility or the blind and visually impaired, activity can be organized in pairs, so they get the help from other participants on the terrain.

5. Actively explore nature!

Habitat exploration

Age: 8+
No. of participants: 5-30
Duration: 60 min

Goal: Opening eyes to an unknown hidden world, such as underwater life.

Method: Divide large groups into several smaller ones so that all participants can be actively involved. The facilitator gives participants an explanation about importance of habitat for fish feeding. For fish, finding food is a treasure. “Let‘s imagine that you are a fish and you are looking for food.” Every participant gets a long plastic transparent tube to observe deeper parts of the river, or a water-filled container with a brush. Give the participants a short introduction about how to use the equipment. Call participants‘ attention to the fact that they are dealing with living creatures and make sure that at no time animals may be harmed or killed and that all species are put back carefully into their natural habitat after observing them. They spend some time catching water insects or other small creatures with small nets, using a brush to place them into water-filled containers. After approximately 30 minutes summon the participants together to examine the species they have collected in their mini aquariums. Found treasure is not only fish food, but food for other animals as well. The participants should understand why these little invertebrates are so important for other species.

Material: Small nets (normally used at aquariums) or kitchen strainers, brushes (for removing the small animals carefully from the nets or strainers into the mini-aquariums): one for every 1 or 2 students; long plastic tubes for observing deeper in the river, shallow white watertight containers (mini-aquariums to temporarily host the animals): 3 to 5 for the whole group; magnifying cups and books or pictures with the most common water animals; identification key of invertebrates (see Supplementary materials).

Barrier-free: Blind and visually impaired participants will need an assistant to describe the space and conditions to help them explore the area. Educational materials can be prepared in advance, such as relief images, large images with high contrast on non-reflecting paper, or small models of animals and plants. For participants with limited mobility and wheelchair-users, an assistant is needed to pay special attention to safety. If possible, they can sit or lie on the ground during the activity.

6. Repeat and process information!

If fish could talk

Age: 7+
No. of participants: 5-30
Duration: 30 min

Goal: Recognizing the needs of other living beings, meeting the characteristics of fish life through the role-play and development of imagination.

Method: Participants form a circle. The facilitator introduces them with the characteristics of fish in that area. Participants can choose which fish they will play the part of (imagine to be). After they choose, they get a question” What would you say to us on behalf of the fish you play?” For example: “I can speak on behalf of a Beluga named Marry, who is looking for a nice place for her eggs and is afraid of fishermen...”

Material: The activity can be done with fish cards (see Supplementary materials), or without.

Barrier-free: If you have participants with impaired hearing, or with speech problems, this activity would not be suitable because it could make them feel less confident instead of just enjoying the learning process.

7. See things at a larger scale!

Save the Sturgeon game

Age: 9+
No. of participants: 10-20
Duration: 60 min or more

Goal: To understand the main characteristics of migrating fish, define the main stages in the beluga‘s life cycle and identify threats.

Method: This is a role play type of game. There is a lot of introduction at the beginning. Layout the rope that represents the Mura, Drava, and Danube rivers connected (that could be three ropes that participants have to tie together to look like rivers or one rope they will lay out in the form of three rivers, to check out in which scale they remember the map). At the end, they are forming the Black Sea (with a big multiple knot, or a pot full of water). Put the chairs or other objects that will symbolize the obstacles next to this “TBR MDD” area. They will be used in the second round of the game.

Somewhere along the blue rope, spread some gravel or pebbles representing spawning locations, for example at the river stretch where Vienna is. Start the game with questions to remind the participants about the biggest freshwater fish in the world. Remind them of the Beluga and the main features of this sturgeon.

Round I: Presenting the life of sturgeons before human impacts and threats.

At the beginning of the game, all participants have to get roles because in this round they

will see how it was for beluga to live before people put different pressures on their habitats and population. It’s the version of the polygon “without threats” so here we only speak about their biology and ecology.

Roles for participants: belugas (put moustaches on them).

Roles for just two participants: 2 fishermen (one equipped with a fishnet and another with a fishing rod).

Place all the belugas on the side of the rope where the pot with water is because belugas live in the Black Sea. Fishermen are set somewhere upstream of the Danube (and are holding the rods but are not doing anything at the beginning). Juveniles are growing, they live in the sea, feed (give them a gummy worm to represent food) and as they are growing you can give them one goldfish snack (or whichever other animal snack you found) because they reached maturity and now they are ready to go into the Danube upstream to fall in love. So, they migrate to make family and offspring upstream. Belugas are moving upstream and the facilitator is telling a story about how they mostly move close to the riverbed and they leave the Black Sea in March or September. Migration can be explained through the situation we have in the area: a lot of members of their family and people from villages that moved to some city. Vienna is the location beluga would reach swimming upstream before the threats (hydropower plants) were introduced. At this stage, the Belugas should be in the area of the Danube where you have laid out gravel/pebbles (for example Vienna). Along the Danube, they will reach Vienna where you can treat them with something like black brownies to symbolize Sacher cake, or something else symbolizing they reached all the way there.

Next, tell them that next year in May they have to make babies in Vienna and in order to do that they have to lay eggs at the spawning site. Give sturgeons some raisins that will symbolize eggs and ask them to pour it over the gravel. Stay here for a bit and explain that for a very, very long time the fish were very strong, bigger in numbers and greater in size. Now start moving them downstream to the Black Sea. Two fishermen along the Danube should catch one or two Belugas on their way down to the Black Sea. Facilitator can show that it didn’t affect the stability of the population. Dead sturgeon fish have to lie on the ground and wait. Tell them that while the fish were strong, the fishermen were able to feed their families and provide for them by using sturgeon’s eggs as caviar and meat. But that story didn’t unfold in a nice way and now we will see how.

Round II: Go through the polygon again, this time with threats.

Roles for participants: belugas.

A role for 2 participants: 2 fishermen (one equipped with a fishnet and another with a fishing rod), roles for a few more participants (optional): people doing gravel extraction, people polluting the river, or any other threat you want to talk about.

We start from the Black Sea again. Juveniles hatched from eggs and they migrate to the sea during their first summer and remain there until maturity. Move Belugas upstream again and give them some sweets as food.

Obstacles/threats:

First threat – overfishing and poaching: Now, fishermen should fish a lot of belugas (use the fishing rods to chase around the kids and fish them). The ones that got caught should sit down on the grass and wait. This is the time to talk about poaching and the use of caviar, tell them when it became forbidden to fish belugas and why. Poaching is done in spring and autumn. Ask them if they know or heard of anyone who used to fish beluga. Do they know any stories? These fish become mature late, and they also don’t spawn every year which makes them even more threatened.

Second threat – the Iron Gates dam: now put the big object over the blue rope to represent the Iron Gates. Move the rest of the kids who did not get caught by fishing towards the dam which blocked their migratory route and tell them that fish are not able to overcome this obstacle.

Third threat – exploitation of gravel: Belugas are stuck in the area under the dam or somewhere along the river course and they start laying their eggs in the river bed but exploitation of gravel is destroying their spawning site. This is where the participants that play the role of gravel exploiters should pick up the gravel and roe from the river.

Fourth threat – pollution: There is a big chemical plant that is releasing pollution into the Danube river. All other types of pollution that people cause to the rivers should be mentioned because they are especially lethal to the juvenile fish which need a lot of oxygen to grow. At this point, the people who are conducting the game can pretend to be poisoned and faint and fall to demonstrate they will be dead from pollution.

Material: 1 big blue rope 50 m long, or 3 (to represent the rivers), Optional: 1 pot of water, 2 fishnets, 2 fishing rods (kids toys or real ones), some big object (can be a chair or a box) that will symbolize the river dam, paper moustaches for kids that will play beluga - at least 20 pieces, food for the fish: gummy worms, goldfish snacks in a pack, some other sweet or salty animal food that is eaten by sturgeons, small amount of gravel or pebbles to represent spawning sites, raisins to represent roe.

IMPORTANT!!! Check with the kids and/or parents if someone has a food allergy, especially for nuts!! They can provoke a very strong allergic reaction. BE CAREFUL with food in activities with kids! And with adults as well, not that they are less important.

Barrier-free: Depending on the disability, the participants can have different roles in this game.

Kids that participated in this activity decided to play the role of caught sturgeons as they were waiting to be “barbecued”, © WWF Adria

8. Imagine solutions and prepare to get active!

Protect beluga!

Age: 9+
No. of participants: 10-20
Duration: 30 min

Goal: Evaluating and encouraging responsible behaviour, recognizing personal contributions.

Method: Relying on the previous game, ask participants to name conservation actions and main activities to protect beluga and other sturgeons. Let them share their ideas. The facilitator writes them down on a big piece of paper. Then they vote for one (or two if they are connected) which they will develop as an idea for conservation action. How can they see their activity connected to the endangered fish species?

The facilitator can explain the project with 7.000 Belugas, and legal regulations to protect sturgeons (PowerPoint presentation (TBR MDD Bird and Fish Species Descriptions, see PPT in Supplementary materials)).

Material: Big thick paper, markers.

Barrier-free: Everybody should participate. If you have participants that cannot share ideas out loud, you can give them papers to write it down.

9. Goodbye!

Fish of the Amazon of Europe

Age: 9+
No. of participants: 10-20
Duration: 20 min

Goal: Say goodbye, take home messages and giveaways.

Method: There are two piles with cards. One pile is with a “goodbye” greeting in all languages from the TBR MDD region, the other pile is with fish and their common names from every country. Participants pull out a card with “goodbye”, and then the card with the fish. They have to find the name of the fish in the same language as the other card that they pulled out and say it out loud. It is supposed to be funny; it is not important that they pronounce the words correctly.

Material: Cards with “goodbye” in 5 languages: they have a flag, name of the country and hello and goodbye greetings written; 10 fish cards with common names in all five languages, indicated by a flag on the backside (see Supplementary materials).

Barrier-free: If the group is with participants with speech difficulties, this game can be played as pantomime to explain only fish species.

6. River branch
"Climate change affects us all!"

Climate change is here.

And it changes everything: climate change is affecting everything and everyone around us, plants and animals and people. The consequences are being felt all over our planet and its ecosystems. Well-being and human safety are threatened. This change is accelerated by human activities and it refers to the **long-term changes** in weather averages, weather extremes, and climate variability.

Climate change reminds us that we are still completely dependent on natural resources and natural cycles, despite the rapid technological development.

Thanks to the excessive use of rivers, freshwater ecosystems are being degraded by pollution, overfishing, but also by extracting increasing amounts of irrigation water, which can all be exacerbated in the following years, due to changes in climate.

In the "Climate change adaptation strategy" by ICPDR (*International Commission for the Protection of the Danube River*) we can find what are the *Particular trends* in Climate change in the Danube River Basin (DRB):

- Wet regions tend to become wetter and dry regions drier
- Strong precipitation gradient: northwest (increasing, with more rains) southeast (decreasing, with more droughts)
- Highly certain significant changes in seasonality = wetter winters, drier summers

Extreme weather events as a result of climate change are happening every day. Floods and landslides caused by heavy rains, droughts and wildfires caused by heat waves, strong winds or heavy snowfalls, all those extremes are affecting everything around us. Rethinking about the possibilities, planning ahead how to prevent these changes is part of obligated human activities. Not doing anything about it, runs the risk of a catastrophic scenario. In that case we panic and we are running around trying to put the bucket under the leaking roof. But the bucket won´t help.

The basic terms related to climate change

It is difficult to talk about climate change. Climate change discussions are often burdened with abstract concepts and technical terms that can be difficult to relate to. There is also trouble with conflicting information about what the problem is and the causes behind it.

The most important terms:

- **Atmosphere** - the air surrounding Earth, described as a series of layers of different characteristics. The atmosphere, composed mainly of nitrogen and oxygen with traces of carbon dioxide, water vapour, and other gases, acts as a buffer between Earth and the Sun.
- **Weather** - state of the atmosphere at a particular place and time. Refers to what we experience over a period of hours or days in terms of temperature, precipitation, wind speed, cloud cover, dryness, sunshine, etc.
- **Weather extremes** - a meteorological event that falls outside the realm of normal patterns.
- **Climate** - the weather conditions prevailing in an area over a longer period of time. The classical period used for describing a climate is 30 years, as defined by the World Meteorological Organization (WMO).
- **Climate variability** - the yearly fluctuation above or below an average value for temperature, precipitation, and other climate variables caused by short-term changes in the ocean and atmosphere. Climate variability occurs naturally and both natural systems and people have adapted to those variations.
- **Greenhouse gases** - gases that are warming the atmosphere and contributing to global warming: carbon dioxide, methane, nitrous oxide, chlorofluorocarbons, water vapour.
- **Global warming** - is the rise in global average temperatures due to increasing greenhouse gases in the atmosphere caused by human activities (deforestation, air pollution, burning fossil fuels).
- **Mitigation** - human interventions to reduce the emissions of greenhouse gases at source, or enhance their removal from the atmosphere by forests, vegetation, or soils that can re-absorb CO2.
- **Adaptation** - is the process by which strategies to moderate, cope with, and take advantage of the consequences of climate change are enhanced, developed, and implemented. Adaptation has the potential to reduce adverse effects of climate change and can produce ancillary benefits but cannot prevent all damages. Therefore, preserved nature and healthy ecosystems are of great importance.

6.1. Climate change impact on biodiversity and freshwater ecosystems

Besides extreme weather conditions, global climate changes, such as changes in temperature and humidity, increased levels of UV-B radiation or acid rain, have many impacts on different species and are often indirect. Some species will need to adapt by changing their habitats, shifting their range to track a suitable climate. For example, in the TBR MDD, fish species that need colder water temperatures will be moving upstream. The suitable temperature of the water is very important for their in-river spawning.

Changes in water temperature also affect the phenological cycles of plants and animals.

Some species will change the time of reproduction because the seasonal events have changed. At the time of reproduction, species usually need more food. Habitats might not be able to provide enough nutrients during shifted reproduction.

But the problem is not simply the disappearance of some species, animals or plants, the problem is in the profound changes in the ecosystem that provides vital services to millions of organisms, including people who live in those regions.

6.2. How will climate change impact our future and how will we shape our own environment?

This is a question that we are supposed to ask ourselves. To understand how climate is changing and to predict the future climate - scientists use climate models. They are an important tool for the consideration of possibilities of climate behaviour on seasonal, annual, decadal and centennial time scales.

In the Upper Danube river basin, it is expected that water stress will increase by the end of the 21st century. Water availability will be in danger.[27] Mean annual potential evaporation will increase due to warmer temperatures in all regions of the Danube. It is highly uncertain to predict future floods, but there is a consensus that extreme hydrological events will occur more often and will be more intense. Alpine head watersheds are important because of the amount of water that flows downstream during drought periods. Nevertheless, floods are more likely to occur in late winter/spring because of the snow storage and changes in winter

27 ICPDR (2019). *Climate change adaptation strategy*. Climate-ADAPT Oct 06 2020.

precipitation. Since summers will be drier and warmer in the middle Danube river basin, there is a possibility of the pests and diseases development because water demand for livestock and irrigation can become higher. This will affect the entire agricultural sector. In the end, scientists are recognizing that water balance has to be improved for the Danube river basin.

Following the future increase in air temperature, the water temperature will most likely also rise. Certainly, the quality of water and its availability are changing as well. Climate change is causing impacts to different sectors on a transboundary scale.

6.3. Mitigation and adaptation measures

We deplete and destroy ecosystems faster than they are able to regenerate. We are part of our planet’s ecosystem, which means that if there is a biodiversity crisis, our health and livelihoods will also be in danger.

Ecosystems still have the capacity to mitigate our negative effects, but it is obvious that this capacity is declining and that we are already feeling the drastic economic and social consequences. If we stop with the degradation of ecosystems, they will recover, become stronger and will be able to reduce the effects of climate change.

Nature-based solutions might be an answer, but we must first repair our broken relationship with nature to be able to apply these solutions to modern day problems. Such measures include a spectrum of activities and actions to protect and restore natural or modified ecosystems. Some of them are: re/afforestation and forest conservation, reconnecting rivers to floodplains, wetlands restoration/conservation, green spaces (bioretention and infiltration), establishing flood bypasses.[28]

Due to the transboundary character of water in freshwater ecosystems, and its relevance for biodiversity and the ecosystems, but also energy, transportation and agriculture, the only solution is integrative and coordinated action.

28 WWF & AB InBev. (2019). *Climate change & water - Why valuing rivers is critical to adaptation.*

6.4. Rainbow flow with activities

1. Create a good group atmosphere!

Weather is changing!

Age: 3+
No. of participants: 5-40
Duration: 15 min

Goal: Introduction to the topic in a funny way. Understanding the difference between the weather and climate change.

Method: Everybody stands in a circle. They have an instruction to “make the rain”. Using dramatization - giving importance to the word rain to sound “strong”.

The facilitator starts and “sends the sound” in the circle. Participants join “the sound” one by one so that it gets louder and louder. When it comes back to the facilitator, he starts with the next one. Participants continue to make the old sound until the new one comes around to them. Every sound is travelling through the circle for not more than a minute.

1. first, just one finger strikes the palm (quiet sound of a raindrop),
2. then two fingers (louder raindrops)
3. then three fingers, not simultaneously (beginning of the rain),
4. then four, simultaneously
5. then snapping fingers hard (rain becomes heavy),
6. then tapping the knees,
7. stamping the ground harder and harder
8. and lastly yelling like a storm (participants should feel free to yell strongly on this point)

...for a minute...

9. and step by step in reverse going back to the quiet raindrop again.

The same steps are taken when the rain is calming down - circles in which the facilitator always changes the sound in a quieter one. After finishing the activity, start a discussion by asking the following questions: Is the rain a natural phenomenon? What is causing the rain? How is the rain connected with climate change?

Material: None.

Barrier-free: If there are participants with impaired hearing in the group, don‘t focus on the sound of the rain but rather on the feeling of the rain they have on their skin. For the visually impaired, participants standing next to them in a circle can lean toward them or give them a sign that it is time for them to participate.

2. Experience nature with all your senses!

Our rivers are flowing

Age: 3+
No. of participants: 5-35
Duration: 20 min

Goal: Energizing a group that feels a bit tired.

Method: Invite the group to stand in a line. The facilitator should explain: “We have three rivers in our biosphere reserve. They are connected and we are now forming the line of those rivers...stand up so that everyone is holding the person in front of him/her by their shoulders. Those rivers have different speed of flow. Every river has an upper, middle and lower river flow. The upper is the quickest one, the middle is calm but moving, and the lower is moving really slowly. Now, let’s start to move together and whenever I clap my hands you are changing the flow and moving really quickly, walking calmly or walking really slowly... I‘ll clap once for the upper, twice for middle and three times for lower river flow...”.

Material: None or a large map of the Amazon of Europe, if possible - so that participants can observe the connection of three rivers (see Supplementary materials).

Barrier-free: If there are wheelchair users or participants with limited mobility, it is important to choose flat terrain and to set them in line with an assistant who will monitor their moves. For participants with impaired hearing you can arrange activity so that the participants who hold them by their shoulders know how to give the sign “the flow is changing” (e.g. “squeeze” them once for the upper, twice for middle and three times for lower river flow...).

3. Calm down and focus your attention!

Where have all the stones disappeared?

Age: 5+
No. of participants: 10-20
Duration: 30 min

Goal: Focus a group’s attention and understand the connectivity of human action in nature.

Method: A small pile of stones, approximately 20 per team, is placed in front of the group. The group is divided into teams of four participants. They have an assignment to build a high tower of stones, but one team member can take only one stone when approaching the pile. Before the next team member goes to take another stone, they have to use the previous one to build the tower. Everyone can approach, no matter if someone from the team has already taken a stone. In a brief moment, all stones will be gone. The game should introduce them to the discussion of how much we use the resources around us without thinking about whether there will be enough resources for everybody.

Material: Pile of stones, approximately 20 per team

Barrier-free: Participants with limited mobility and the visually impaired can have a special assignment - only to build the tower and order a new stone.

4. Trigger curiosity!

Deforestation

Age: 7+
No. of participants: 5-20
Duration: 20 min

Goal: Storytelling and simultaneously visualizing the story.

Method: The group is sitting in a circle. The facilitator starts his/her storytelling with the historic fact that people have always been attracted by rivers and the first settlements were located on river banks.

“To imagine how those first settlements looked like, we need forest around.”

Each participant sticks one or more twig/branch in the ground – all together they create a dense primeval forest.

”Let’s build a small village on the river bank and give it a name!”

The whole village has got five or six houses, made from stacked stones and wood.

“Who lives here? Give names to the people in the village!”

Participants create a little world and by naming its elements and inhabitants it becomes their own.

“We need a school, a doctor and we need to tame the rivers and cultivate fertile land.”

Since the village is growing, they have to use more and more wood and the forest thus becomes smaller and smaller.

“One day a heavy storm came and the rain didn’t stop for a long time.”

A bucket full of water flushes away everything.

“What is happening now in the village?”

A discussion about if and how people are changing nature around them is initiated. Was the forest a home also for some animals and what happened to them?

Material: Natural materials like stones, twigs or branches and a bucket full of water.

Barrier-free: Everybody can participate.

5. Actively explore nature!

The hottest and the coolest place

Age: 7+
No. of participants: 5-30
Duration: 40 min

Goal: Exploring the place via temperature changes.

Method: Before they start the quest, they have to sit in the circle to meditate and think about where the hot and the cool places are in nature. Participants are to team up in groups of five. Every team gets a little thermometer, a map of their River’Scool’s surrounding and a marker. If there is no map that can be used, the facilitator can sketch the surrounding on a big paper to be displayed for everybody and the teams can sketch their own maps. The assignment is to visit places on the map, measure temperature, write it down on that spot and try to find the hottest and the coolest place. Every team has the right to check out 5 places, then they get together again. Each participant or each team shows the results of their maps. The facilitator may decide on the order and length of statements. Every team should explain why they thought those places would be hot or cool. How does the ambient affect the temperature?

Material: 5-6 thermometers for air, water, and for soil, printed maps of the River’Scool’s surrounding (or just sketched environment on papers), pencils, markers.

Barrier-free: Participants with limited mobility could measure temperature in the nearest place possible. This activity is not recommended if blind or visually impaired participants are involved.

6. Repeat and process information!

Web of Life in times of climate change

Age: 7+
No. of participants: 10-30
Duration: 30 min

Goal: Repeating names of the species and learning about the relations among them; the activity helps participants understand that each plant/animal has its place in a “web” and is important for other species.

Method: Sit together and revise the species from the TBR MDD ecosystem. The facilitator should include a large variety of species. Invite the group to form a circle. Someone starts the activity by saying, for example, “I am a kingfisher and I eat fish”; they then throw a woollen ball to a person representing the “fish“ but continue to hold the end of the string. The person representing the fish catches the wool and continues “I am a fish and I like to eat tadpoles”, and then throws the woollen ball to a participant representing the tadpole while also continuing

to hold the string. The web is growing. The participant representing the tadpole could say “I am a tadpole and dragonfly larvae like to eat me”, and so on. Do not forget to include some plants or birds, or even humans, so that the web includes a large variety of species. At the end, when everyone has become part of the web and is holding the string (in several places if they have been addressed more than once), the group may lean back, holding only the string of wool in their hands. This can have a surprising effect: an ecosystem is like a strong web, each member counts. Now is the time for the facilitator to introduce an endangering factor- climate change. He/she explains that disappearance of one or two species can cause serious damage (for example because of the changed temperature of water in the river some tadpoles are gone, and some fish that feed on them are also gone...). The participants that represent mentioned species should let go of the string. The group should try to lean back again. The web has lost its strength and some of the participants may even fall backward because the string is loose. Facilitator explains that this is an example of how climate change can lead to the collapse of the whole ecosystem.

Material: Tear-proof ball of wool, paper and pens, masking tape.

Barrier-free: For blind and visually impaired participants, an assistant or another child in the group should catch and pass them the woollen ball and describe the species mentioned during the activity. The next participant to whom the ball is passed should give a vocal signal to make it clear in which direction the ball should be thrown by the blind or visually impaired participant. For deaf or hearing-impaired children, a sign language translator is recommended.

7. See things at a larger scale!

Letter to the past

Age: 10+
No. of participants: 20-30
Duration: 30 min

Goal: To understand how everything we do today affects next generations.

Method: Ask participants to put themselves into the role of present-day young people. They circulate around the area and talk to each other asking the question “In what ways have previous generations improved the lives of their generation, and in what ways have they reduced the quality of life?” After a while, they have an assignment to write a note to the generations before: to someone living in 1990. What would they tell them to do differently? This can be a powerful, emotional experience. It is best not to debrief the activity but just let it stand as an experience.

Material: One big thick paper where they can write notes together for generations of the 1990’s, coloured pencils.

Barrier-free: Participants with limited mobility don’t have to circulate, they can wait in one spot and others can approach them. Participants with speech and voice difficulties can be

active, just make sure that other participants have time to listen to them. If that is the only way, they can write down their ideas on a piece of paper and present them while walking around.

8. Imagine solutions and prepare to get active!

Repairing the future

Age: 10+
No. of participants: 20-30
Duration: 30 min

Goal: Evaluating and encouraging responsible behaviour considering climate change, recognizing personal contributions.

Method: Relate to the previous activity. At the beginning of the activity the whole group has a conversation about the importance of preventing further climate change. They should discuss what to do in order not to receive a letter from the future generations like the one they sent in the past (note that tells us what we could have done to mitigate climate change). The facilitator lets the group explain what they know already. After that the group is divided into four teams. They get the questions printed on papers.

What is happening right now on the rivers that is a consequence of climate change?	**To whom can I speak about the problem, who should I contact?**
How should I explain the importance of action to others?	**What can I do to make a change?**

After 15 minutes each group should present their conclusions. The facilitator has to recognize differences in their ideas and emphasize them in discussion afterwards. Encourage them to talk about it with their families, friends, neighbours when they get back to their communities.

Material: printed papers with questions

Barrier-free: Since this is a team activity, everybody can participate if the teams are created according to disabilities and other participants are instructed how to help them.

9. Goodbye!

We have learned something important

Age: 5+
No. of participants: 20-30
Duration: 10 min

Goal: Say goodbye, take-away messages.

Method: Everybody sits in the circle and thinks about what they learned about this big problem all humanity has to fight against. At the same time, they have to invent a secret handshake. This handshake will be their sign when they meet in school, at work, in their neighbourhood. Without uttering a single word, just placing importance on their greeting because it carries very important information from this gathering. They begin to shake each other‘s hands (or whatever they come up with as an idea to greet each other). They move around and whenever they meet someone, they shake hands. It is a simple game in which each participant has to shake hands with everyone in the group and tries to remember this greeting next time they see each other (not to forget what they have learned in the River’Scool that day).

Material: None.

Barrier-free: This activity can be adapted so that every person can participate.

7. The Mouth

In the lower course a living river meanders extensively like the mind of people does sometimes. Meanders eventually get disconnected from the main flow just as ideas get abandoned or learning processes are interrupted. As a result, an oxbow lake is left behind, just like some ideas that weren't thought through to the end. And one day they might be flushed again, reconnected with the river flow, and old conceptions begin to live once more. Learning is rarely a steady, straight process.

Close to the mouth a river occupies more space on both sides and blesses large land areas with its waters. It is not only our ideas that are flowing into a big ocean of wisdom. Other waters, too, coming from other regions and other countries, carry new methods and approaches. All these waters mingle, and ocean currents transport the knowledge to distant shores. One drop of enthusiasm from somewhere upstream can become the raindrop somewhere else that helps new ideas grow.

With a strong source and many tributary inputs our knowledge base is set. We are ready to bring our waters to the people. We are ready for action, in our schools, neighbourhoods, communities and wherever in the world our lives take us to.

Dive into our ocean of wisdom from different sources, authors and countries. We invite you to let it inspire you as it inspired us.

WWF Adapt - online training tools for Climate change

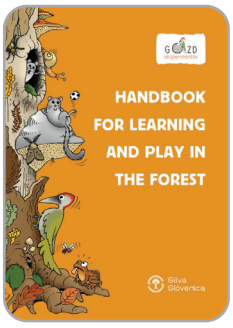
https://wwfadapt.org/

Interactive and entertaining online courses that can be done within school (for now available in English and Serbian). After going through all 4 parts, students know a lot about climate change but also start to think about its consequences. You can find more online courses on this site (Happy Village, etc.). "The collection of resources continues to grow, so please visit the site regularly!" ... says Shaun Martin from WWF-US.

Nature's services – A guide for primary schools on ecosystem services

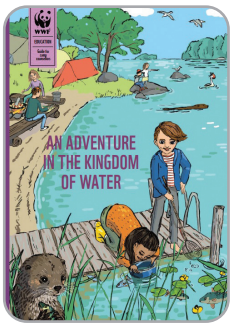
A very useful and practical handbook for primary schools, published in 2013 by WWF Sweden, available also in English. The somehow unusual concept of Ecosystem Services will be 100% clear to you - and you will be happy with plenty of materials, methods and suggestions!

Handbook for Learning and Play in the Forest



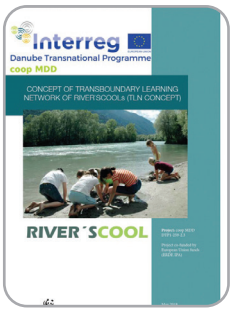
This wonderful handbook from the Slovenian Forestry Institute is covering four main topics: trees, forest animals, water and genetic diversity. The authors have greatly matched the concept of forest pedagogy and Joseph Cornell's old flow learning concept. Available for download in English since 2017.

An adventure in the kingdom of water - guide for camp counsellors



In this handbook by WWF Finland (2019) you will find different methods you can do with young people on both day trips and camps as it offers model day programs from morning till night. "Water and water systems are fascinating objects of study" - we agree with the authors!

River´Scools - Concept of transboundary learning network



Throughout the RIVER`SCOOLs, the TBR MDD is promoted as a unique river system of international importance. Children, pupils, students, adults and families can come to the sites of the RIVER`SCOOLs and learn about the TBR MDD and nature in a living laboratory.

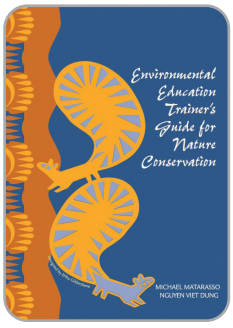
MOOC (Massive Open Online Course) - Climate Change, Risks and Challenges

Free and open online course on climate change with renowned climate scientists, available since 2017. Aim of this course is to make fact-based knowledge available for everyone and to guide the transformation process towards a sustainable future. With repeatable exams and a certificate at the end. Available in English, Serbian and German.

For German version: oncampus.de » Type in: #ClimateCourse » Suchen » Choose: Climate Change, Risks and Challenges

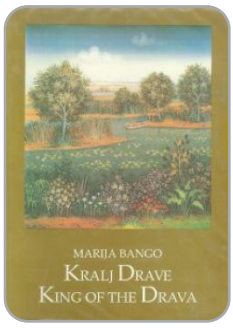
For Serbian version: Go to: https://iversity.org/en/courses/klimatske-promene-rizici-i-izazovi or https://iversity.org/en/courses/klimatske-promene-rizici-i-izazovi-kraca-verzija-kursa

Environmental Education Trainer‘s Guide to Nature Conservation



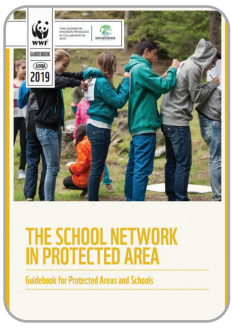
Developed by WWF-Greater Mekong the handbook has been available since 2002 in Vietnamese and English. It gives a profound pedagogical base for conducting outdoor programs and has also widely inspired our handbook. It‘s a treasure not only for teachers, but also for rangers in protected areas. Moreover, it gives some advice about founding a green club. At the end you find a great collection of energizers and group dynamic games.

King of the Drava - A children‘s book



“King of the Drava! – this is how the local people used to call him. Everyone who lived near the river Drava more than a hundred years ago knew who he was. Many saw him on the river banks, the meanders, islands, in the cold waves and eddies. Even the children heard all sorts of tales about him from their earliest childhood: He was large, strong, overgrown with hair from his head to his toes....” - that‘s how the story begins. See for yourself where and who this King is - in Croatian and English.

School network in Protected areas - guidebook for schools and protected areas



A close collaboration between protected areas and schools is a key factor for the successful environmental education and sustainable development. It makes local future inhabitants and their families understand and appreciate the values of their natural and cultural heritage. It also contains a diverse collection of activities following the rainbow flow.

A collection of good ideas from the River´Scool Koprivnica-Križevci (CRO) - many more ideas

This study was conducted in 2019 and collected a lot of interesting topics, worksheets, stories and inspiration for educational activities on the Mura and Drava rivers. There are parts which are bilingual - Croatian and English. Don't miss to check it out, the authors used school-based curriculum in respect to the proposed themes.

Celebrate environmental days together with people from all over the world!

Here are some important international days when people around the globe take action. Maybe you want to join?

World Water Day (March 22)
Danube Day (June 29)
International Day of Drava River/Drava River Day (September 23)
Amazon of Europe Day (July 14)
World Wetlands Day (February 2)
World Nature Conservation Day (July 28)
World Wildlife Day (March 3)
World Fish Migration Day May 16)
Earth Hour Day (March 26)
Earth Day (Third week in April, usually April 22)
World Migratory Bird Day (Second weekend in May and October)
World Environment Day (June 5)
World Habitat Day (First Monday in October)