Dviete river restoration

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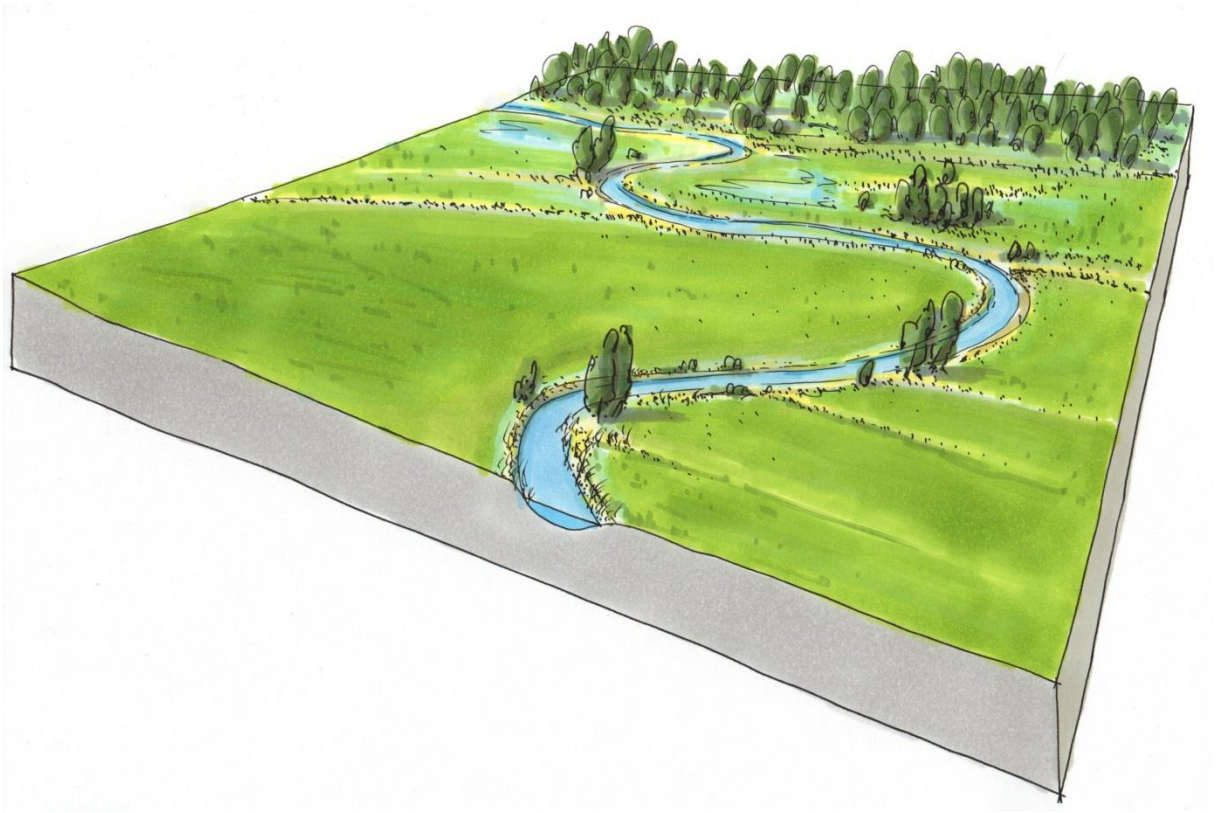

Summary

Open grasslands with breeding Corncrakes form an important part of the Natura 2000 site Dviete floodplain in Latvia. Nevertheless, nature quality has declined due to hydrological changes (drainage measures for agriculture). The goal of this LIFE+ funded project is to improve the habitat quality of wet grasslands. This will amongst other actions be achieved by restoring part of the meandering course of the Dviete river. While restoring small streams (the so called re-meandering), there are a number of possibilities in restoration: with patience, by digging a new bed or by restoring the old bed; whereby the choice for one of these options depends on the local situation. The design for the Dviete is based on the original course of the river, which is still recognizable in the landscape. By restoring the natural curves and blocking the drainage channels, water will remain longer in the system, restoring the hydrology. Reviving natural processes like falling trees, beaver activity and herbivore grazing will complete the work.

Introduction to the Dviete river and its flood plain

The Dviete floodplain lies in the southeastern part of Latvia, on the west bank of the Daugava river. The valley is more than 20 km long, 500-750 meters wide and has a small gradient; see figures 1 and 2.

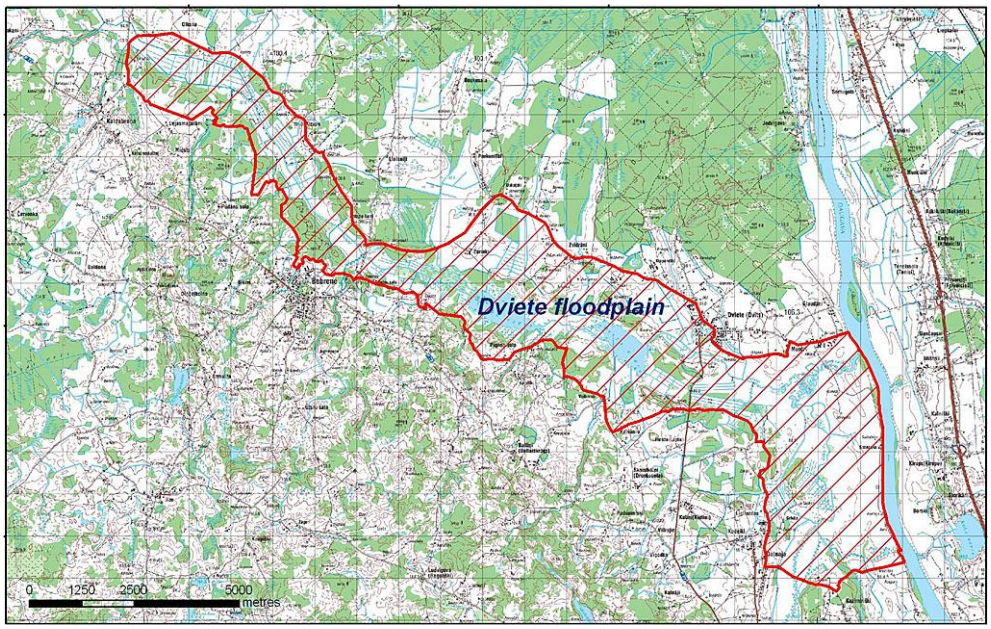

Figure 1: The boundaries of the Dviete floodplain within the Life+ project (Natura 2000)

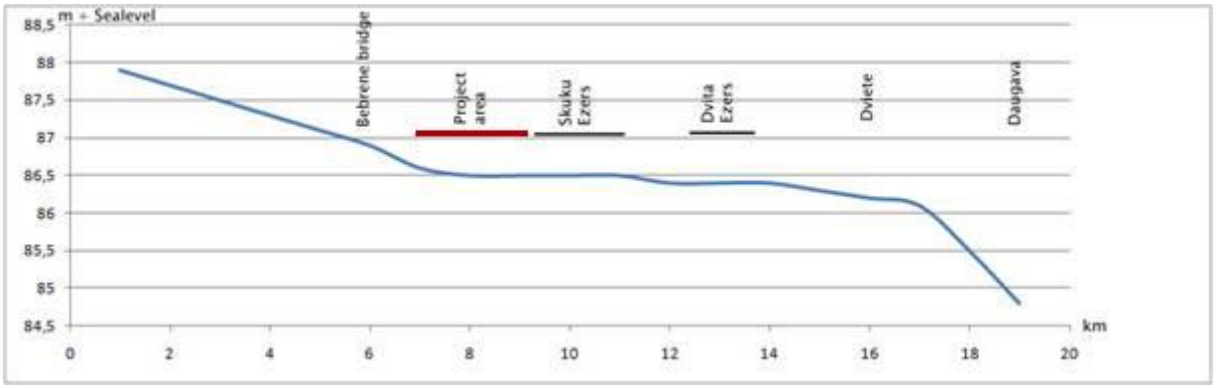

Figure 2: Longitudinal profile of the Dviete river. The project area lays just in front of the Skuku lake, in a part of the profile where the gradient is very small..

In this valley flows the Dviete, with a length of 25 km and a width of 2-3 meters wide a small stream, draining an area of app. 300 km^2. The average discharge of is 0,300 m^3/sec, but during periods with heavy rainfall peak discharge can reach up to 2 m^3/sec.

The valley is covered with ditches to drain the area into the Dviete. Dviete, May 2011

Natural processes as erosion and sedimentation still take place, especially in the upper part of the course. From the hills in the south several small streams with a high gradient flow into the valley, transporting fine sandy sediment into Dviete river. Every year in early spring, the Dviete valley is entirely flooded by water of the Daugava river, inundating the valley from downstream. The flooding lasts for at least a month and after that the soil keeps moist, because of high groundwater levels, till the beginning of summer.

Sand from side streams is used to build sand bars in the upstream parts of Dviete and helps the re-meandering process.

The project area lies near Bebrene, directly upstream from Skuku lake, and has a length of approximately 2 km. In the height gradient a discontinuity is visible in this area: in the first kilometer upstream the lake, the water level is similar to the lake with hardly any gradient, while about 1 km upstream a steeper section starts, with a gradient up to 20 cm/km. Due to this difference in slope, the river will sooner en faster re-meander in the upstream part than in parts just upstream of Skuku lake (see figure 3).

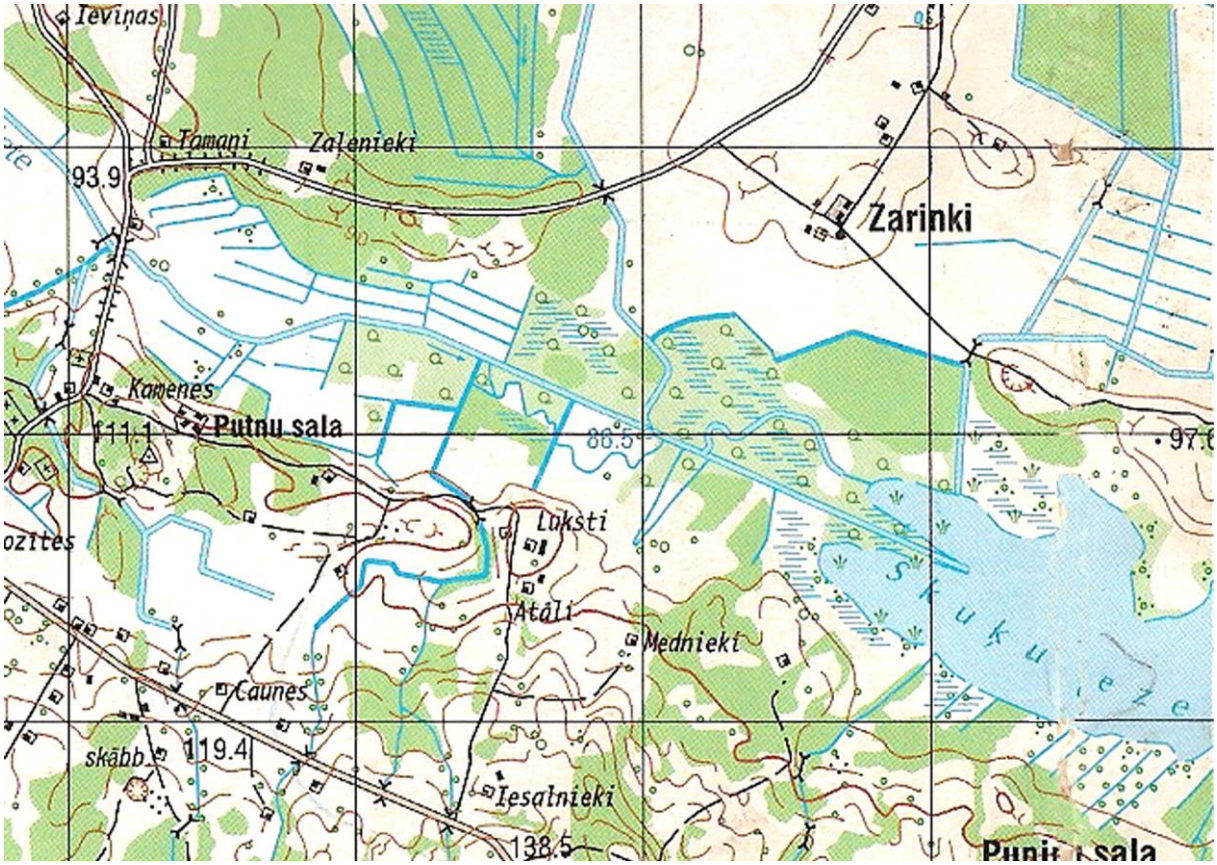

Figure 3: The current situation of the river Dviete in the project area.

During the canalization of Dviete in 1930, the stream has been straightened and deepened to drain the surrounding fields. This could not avoid the yearly inundations, but made possible an intensified agricultural use. Nevertheless, since the independence of Latvia agricultural use of a large part of the grounds has stopped, causing forestation of the abandoned fields. Also the maintenance of Dviete river has diminished and water plants and reed have overgrown the riverbed.

Methods for river restoration

While restoring small streams, there are a number of possibilities in restoration measurements.

A. With patience, by letting the river do the work. Depending on the longitudinal profile, the discharge and the type of soil of the riverbed, a canalized stream will in time start re-meandering by itself. Obstacles in the streambed like beaver dams and burrows,

fallen trees and curves will stimulate this process. To allow this natural process to take place, artificial riverbank protection has to be removed. Burrow activities of mammals like beaver weaken the riverbank and increase erosion. In a meandering riverbed, places with fast flowing water alternate with slow flowing areas. Vegetation growing in the slow flowing areas, forces the stream to curve even more and raises the water level and because of that the buffer capacity. Fallen trees play an important role in this process as well; to speed up meandering, trees can be placed into the riverbed to force this.

A tree fallen into the stream forces the flow through a narrow gap between the uplifted roots and the remaining riverbank; this causes quick erosion. Worm, Netherland, October 2003.

B. By restoring the old riverbed. Redirecting the canalized stream into old meanders (when still present) is another way of restoration. This is realized by blocking the artificial stream; redirected flowing water will search its own path, and erosion en sedimentation will soon give a natural result. To start these processes, it might be necessary to remove fresh sediment or vegetation overgrowing the historical riverbed, or even dig out the curves of the original river course. This removed material can be used to fill and block the canalized streambed and the draining ditches in the floodplain. To maximize ground water level rise, both ends of the artificial channel should be blocked.

During the yearly floods, old meanders of the Dviete become visible in the landscape again.

C. Digging a new river bed. If the old streambed is not visible anymore in the landscape, or if it has turned into a high value oxbow lake, it might be the best solution to dig a completely new meandering riverbed. In this case, the natural low-lying places in the floodplain will guide the design, leading the new river through natural depressions in the floodplain.

In the Netherlands there is a lot of experience with restoration of rivers and smaller streams. Since the nineties of the last century the water boards in especially the eastern and southern part of the country have made large efforts to restore the natural courses of hundreds of smaller streams. In most cases the old bed was not visible anymore in the field and new beds had to be made. An example of this type of restoration is the Roode Beek near Schinveld in Limburg (figure 4). To activate natural processes a broad shallow bed was excavated with enough room for the stream to make its own bed.

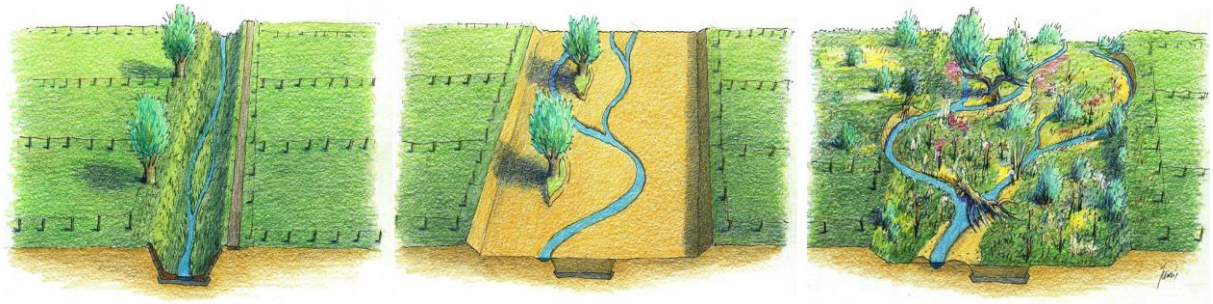

Figure 4. The Roode Beek in Limburg, an example of a new excavated bed in which the stream could find its own course.

In the more elevated part of the Netherlands there are some examples of streams where digging isn't necessary and only the artificial riverbank protection has to be removed. Due to

the strong currents the stream will start to erode the banks and to form new meanders. In this case measurements are not necessary, since the stream has enough strength to restore itself (see figure 5).

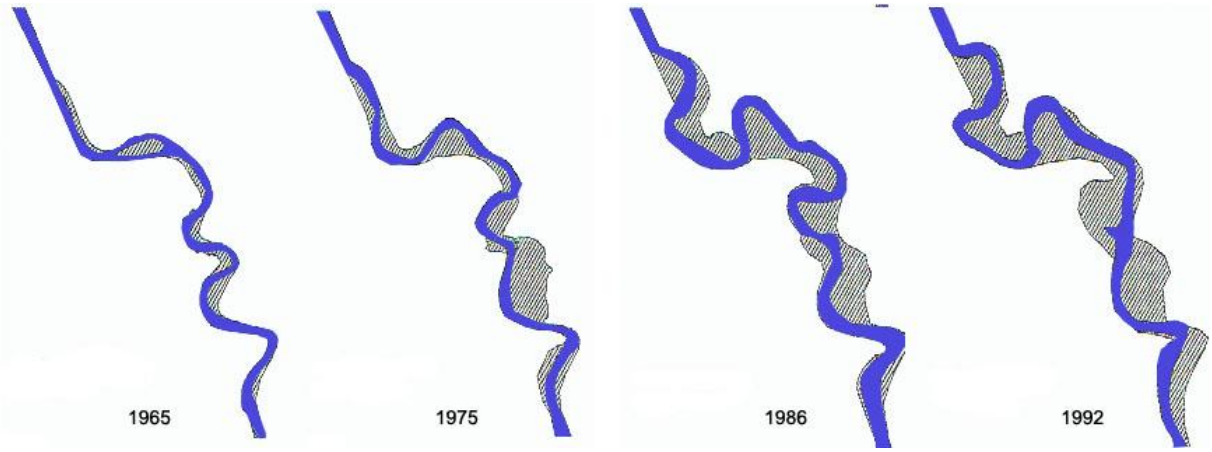

Figure 5. History of the meandering of the Geul in Limburg (blue is the streambed, grey the eroded valley). The Geul is an example of a small river with a high gradient. Since the maintenance of the banks stopped (already in 1970), natural processes became active again and the river made several new meanders and enlarged its valley.

Restoration of the Dviete river

In the Dviete restoration project, both the first and second measurement is used. Therefore, the area is divided into three sections (see figure 6):

1. The upper part (part 1 in figure 6) with some gradient, where one barely visible historical meanders can be restored by digging out the old bed and using this material to block the artificial channel. In the field the most appropriate course has been determined, by following the lowest parts.
2. The middle part (part 2) with almost zero gradient, where the old meanders are still recognizable in the landscape and can be restored quite easily. The former bed is however partly filled up with sand and silt which has to be removed. This material will be used to fill up the present canalized channel. Due to the moist and muddy soil no heavy equipment can be used to dredge the former channel and transport of the mud to the present channel will be difficult. Therefore most of the mud will be spread over the area next to the new channel and only a small part will be used to block the present channel in two places. We expect that the present channel will thereafter slowly fill up by natural sedimentation. To maintain the accessibility of the land for the farmers a fort will be made where they can pass.
3. The lower part without gradient (part 3) where the old meanders are still recognizable but are overgrown with reed and water plants. Here, the former riverbed can be restored by blocking the present canalized riverbed on the spot of a natural sandy high ridge, thus forcing the Dviete to flow around it, eroding his own historical river bed again. The reed beds in the delta will remain intact, in order to slow down the outflow of the Dviete into the lake and therefore maximize (ground)water levels in

the project area.

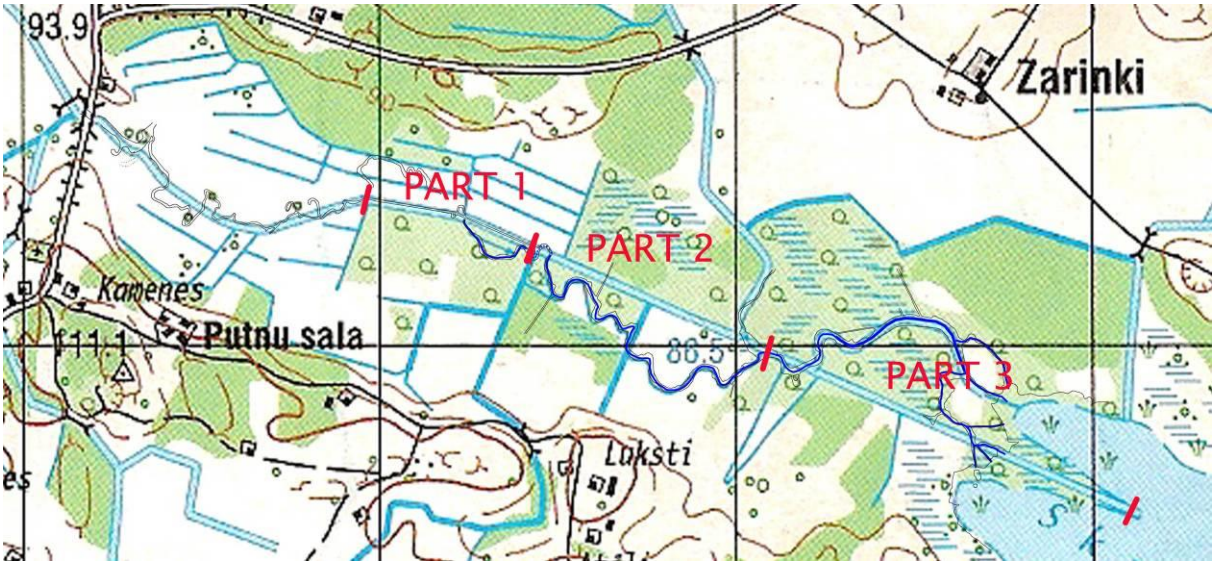

Figure 6: Subdivision of the Dviete valley in three sections

The new river bed will have a depth of approximately 1 meter and a width of 2 to 3 meter, with partly steep and partly gradual slopes, corresponding the historical situation. After the digging of the new channel maintenance of the riverbed will be absent and natural processes will take over again. Care was taken not to raise the water levels too much, as fields still in agricultural use (esp. in part 1) have to remain sufficiently drained.

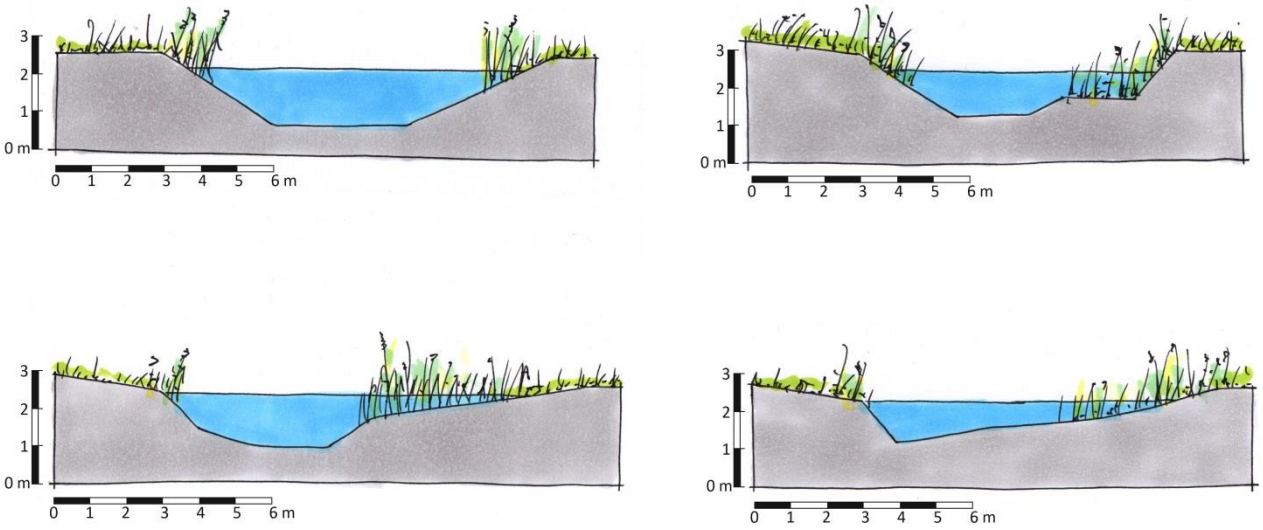

Figure 7: Cross sections of four profiles of the Dviete river

Mammals have a large influence on the Dviete river system as well. By building dams, eating barks and cutting trees, beavers have the largest impact. The restoration plan has to assure its survival, by not removing all trees and bushes but leaving a wooded stretch next to the stream. Large herbivores like moose, wild cattle and Tarpan will assist the Beaver in keeping the area open en delaying the reappearance of bushes for a prolonged period. Large herbivores can turn reed beds into a more open mosaic of flowers and grasses, preferred by Corncrakes. Beavers and large herbivores need a complete landscape to survive and vice versa. The ecosystem is not complete without large grazing animals.

Moose can help in keeping the wet areas open by consuming branches and leaves

Due to the presented restoration plan, the surface (river) and ground water levels will raise. As the water level rises above ground and below, old trees will start to die, giving place to wet grasslands. From cutting trees and mowing, the management can shift towards nature management, i.e. management of the herds of wild cattle and Tarpan. This will result in a more diverse and more natural area, giving place to many breeding pairs of Corncrake.

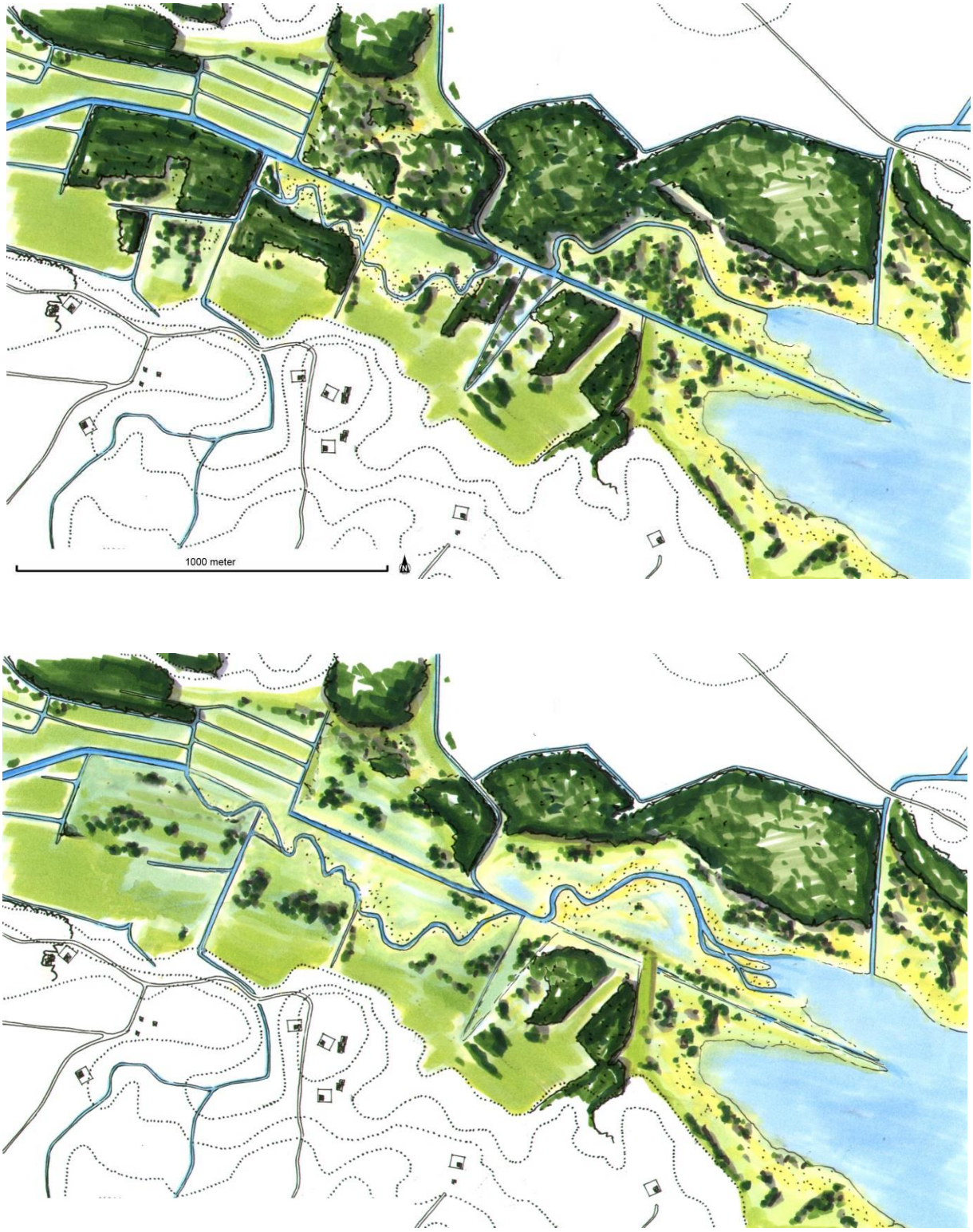

Figure 8: Current situation, and new situation after Dviete restoration in the project area

Lessons learned and leads for future river restoration projects

Decision-making on restoration options

As stated, there are three ways to restore a river. Which option suits your situation, depends on the natural characteristics of the stream and the social and political needs.

If natural re-meandering is possible, depends on the longitudinal profile, the discharge and

the type of soil of the riverbed. But it depends as well on the amount of time you were given to realize measurable results.
To decide whether you choose for digging out the old river course or realize an entirely new direction, depends for example on the information available and the ground positions. If you would like to restore an old river course, you depend on the needed information: are the historical meanders still visible in the landscape and/or on historical maps? Moreover you will have to be able to use the needed land: are the landowners willing to cooperate?

A sound project process is as important as a sound design

Like explained in this brochure, river restoration starts with a sound design, based on an analysis of the current and natural situation. This includes hydrological calculations to estimate the effects of the restoration plan.
Nevertheless, there is a lot more to be achieved before restoration can be realized in the field. For example, formal permissions are to be received, public support is to be gained and agreements with the landowners are to be achieved. When landowners are not willing to participate, the plan might be adapted to avoid the use of their land.

All these aspects have to be taken into account from the very start of the project. Involved parties have to be informed and included in the entire process of planning and decision making, to avoid their obstruction later on. To assure the commitment of indispensable stakeholders, an official counsel can be helpful, as can be regular information meetings with local parties and interested persons.

An integral system approach is the most effective way of restoring

It is impossible to restore a river system by restoring only part of it. All upstream and downstream river stretches are interdependent, while the river flow depends on the land use in the surrounding areas and vice versa. Surface waters and ground water levels interfere over very large distances.
Therefore, a river restoration project ideally starts with an integral vision for the entire floodplain. In this way, the most effective and efficient measures can be distinguished. In the execution phase, this integral vision or master plan might be divided into sub-projects, to make the realization workable.
In the Dviete case, there are several actions needed to restore the hydraulic system. Beside the measurements within the Dviete project area, two of them lie outside the project area. Restoring the outflow threshold of the Skuķu lake would squeeze the outflow of the lake, thus retaining the lake's water during summer time. This will prevent the lake to dry out, and would help to raise ground water and river water levels upstream. Restoration of the thresholds is cheap and effective and contributes significantly to restore the hydrological situation for the Corncrake. Of course these actions can only be executed in agreement with the land owners, and therefore have to be undertaken in a new project to be defined.

In the area upstream of Bebrene bridge (on the left in figure 4), it will be sufficient to leave the Dviete river to re-meander itself. To speed up this process, disturbances can be added to the riverbed and draining ditches, such as big tree roots placed near one of the banks. Ditches bringing in water and sediment from outside the Dviete valley can be blocked partly

or entirely, forcing the water to run over the floodplain, eroding new shallow waterways and bringing fresh sediment to the Dviete.

Summary in Latvian (to be prepared by LFN)

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