Žuvintas Biosphere Reserve Action Plan

Baltic Environmental Forum Lithuania
Elvyra Mikšytė, Justas Gulbinas, Audronė Alijošiutė - Paulauskienė

1. Case Area Description

The Dovinė River Catchment covers an area of approximately 588.7 km^2 and is located in the southern part of Lithuania (see Figure 1). The basin is one of the small catchment areas of the larger Neman river basin, which covers around 75% of the territory of Lithuania and is the 4th river basin in size in the whole Baltic Sea Region.

Figure 1. Location of Dovinė Catchment area.
Source: Nature Heritage Fund

The Dovinė river catchment is located in the southern Lithuania (see Figure 2) and consists of a network of rivers and water bodies formed by five big lakes (Dusia 23,3 km^2, Zuvintas 9,3 km^2, Simnas 2,4 km^2, Giluitis 2,4 km^2, Amalvas 1,9 km^2) and a number of rivulets and small lakes (see Annex 1).

Within the borders of the basin lies one of the oldest and most unique protected areas of Lithuania – Žuvintas Biosphere Reserve. The reserve lies in the junction of three municipalities (Alytus district municipality, Lazdijai district municipality and Marijampolė municipality). This one of the most valuable Natura 2000 territories in the country hosts valuable habitats for biodiversity, breeding and feeding areas for protected species, especially migratory birds (see Figure 2).

Figure 2. A gaggle of geese flocking in Žuvintas Biosphere Reserve during migration.
Source: Žuvintas Biosphere Reserve Directorate

A lot of species found in the area are listed in the Birds Directive Annex 1 and the Habitats Directive Annex 1 and 2. A part of the reserve has been protected by the Ramsar Convention on Wetlands of International Importance Especially as Waterfowl Habitat since 1993 and in 2011 the reserve was enlisted into UNESCO's Man and the Biosphere Programme.

Since the water in the Dovinė Catchment flows from other water bodies towards Žuvintas Biosphere Reserve, there is a risk that in addition to the pollution generated in Žuvintas sub-catchment, it can travel from other water bodies and sub-catchments. Moreover, if a significant amount of pollution occurs in the reserve territory it can do a lot of damage to protected and sensitive habitats and species.

2. Key Case Area Challenges

2.1. Water Quality and Hydrology

In the 19th and 20th century, land reclamation and wetland drainage projects were carried out in the case area in order to expand agricultural lands and make use of fertile lands in the Dovinė river catchment. Hence, the natural hydrological cycle was interrupted, many wetlands were drained and ameliorated to provide space for agricultural lands. Later, different nature management projects have attempted to improve the cycle and environmental state of the area by installing sluices and spill weirs. However, these efforts did not fully solve the issues of the area.

Figure 3. One of the spill-weirs in Metelytė (between Dusia lake and Simnas Fishery Ponds). Due to hydrological drought the water level is becoming dangerously low and at risk of not flowing through the weirs.

The Environmental Protection Agency (EPA) has carried out an *Assessment of the Risk of Lakes and Ponds not to Achieve Good Quality Status*, where lakes of Žuvintas Biosphere Reserve (Žuvintas, Amalvas and Dusia lakes) were listed as being at *Potential Risk* for diffuse pollution, while lakes of remaining Dovinė catchment such as Rimietis and Simnas lake (currently evaluated as being at very bad ecological state) is listed as having *At Risk* status due to diffuse pollution (see Table 1). Simnas lake aslo faces point-source pollution, one of the pollution sources being Simnas fishery ponds.

Table 1. Risk Assessment of Lakes in Dovinė catchment

Name of Lake	Ecological	Risk Status	Potential Sources of Pollution

	Condition		
Giluitis	Medium	Potential Risk	1. Diffuse pollution 2. Point-source pollution
Rimietis	Bad	At Risk	1. Diffuse pollution
Žaltytis	Medium	Potential Risk	1. Diffuse pollution
Dusia	Good	Potential Risk	1. Diffuse pollution 2. Point-source pollution
Simno ežeras	Very bad	At Risk	1. Diffuse pollution 2. Point-source pollution 3. Potentially internal pollution
Žuvintas	Good	Potential Risk	1. Diffuse pollution
Amalvas	Bad	Potential Risk	1. Diffuse pollution

Source: Assessment of the Risk of Lakes and Ponds not to Achieve Good Quality Status, Environmental Protection Agency, 2020

Although the national assessment of water quality by EPA identified water quality challenges on the national level, during the project work in the case area it turned out that there is no understanding among stakeholders regarding the local water quality situation. Even though the national assessment pinned down potential pollution sources in the case study area, the pollutants and their levels in the local water bodies was not clear. This is why the local water quality monitoring was started in the case area by the project. Even though the local monitoring is comparably short-term, it has already indicated potential concerns in the area.

The main findings during short-term monitoring:

1. Disrupted hydrological regime which together with built water control infrastructure (weirs), exacerbated by climate change and fishery pond impacts (a lot of water is used to fill up the ponds and a lot of water is lost due to evaporation) result in lower water levels and therefore less water reaching Žuvintas lake. It was estimated that compared to the natural hydrological regime in 1970 which is now disrupted, Žuvintas lake potentially loses up to 50% of water, which results in higher pollutant concentrations and faster eutrophication processes.
2. During the water discharge from Simnas fishery ponds, the Biochemical Oxygen Demand (BOD7) in Spernia indicates bad condition and the indicator is substantially higher compared to other months during the year.
3. The water quality of a tributary flowing to Dusia lake is in bad or very bad condition in terms of dissolved oxygen amounts. This shows that Dusia potentially receives water with pollutants from agriculture.
4. In Spernia, Sūrava and Kiaulyčia catchments the water quality is in bad condition in terms of phosphorus amounts and that is potentially due to agricultural pollution.

5. In 2019-2020 the amount of nitrogen run-off in the Žuvintas Basin suggests that the levels are similar to the run-off in areas of intensive agriculture. In Spernia catchment the phosphorus amounts are high also potentially due to agricultural impacts.

The water quality measurements will be continued during the first-half of 2021. However, it is obvious that in order to have a better view of the local case area challenges and more reliable data, the monitoring of the water quality should be continued after the end of the project.

2.2. Stakeholder Participation and Awareness

As mentioned in previous sections, the awareness of local stakeholders about the local water quality situation as well as about the overall environmental situation is very low and there is a lack of information flow from local actors to the decision-making stakeholders and vice versa.

There is no active local water management and no local water-related knowledge provider, i.e. none of the actors work towards the collection of water quality related data and issues on the local level nor work towards addressing them. There is a lack of actors who would have a good understanding of local ecosystems and environmental, especially water related challenges as well as possible solutions. A potential candidate could be the directorate of Žuvintas Biosphere Reserve, but currently the directorate is not taking leadership.

Moreover, there are no known active communities or leaders in the region, who would be motivated to change the situation and work towards addressing water management issues. Farmers usually do not believe that they are significantly impacting water quality or that there are any issues with water quality at all.

All three municipalities have local action groups, i.e. a local collective of different small businesses and organisations that are eligible for LEADER programme funding when the project idea goes in line with local action group strategy. The strategies however mostly focus on the issues that are understood and experienced better by local people such as social, demographic and economic challenges. The environment or water related challenges are seldom mentioned, limited to very general goals and not given adequate focus.

2.3. Policy and measures

2.3.1. Agri-environmental measures

The water protection related policies usually are defined in Rural Development Programme (RDP) through agri-environmental compensation measures (AECM). There is a list of measures available for farmers directly or indirectly connected to water protection.

However, according to data from the 2020 plot declaration, many AECM are not popular enough among farmers, hence, their overall effectiveness is low. Out of all nationally declared land (2 937 302,7 hectares), only a few percent are declared within agri-environment measures relevant for water quality conservation:

- 0,0003% (7,36 ha) of declared area apply *Water Protection from Pollution and Soil Erosion in Arable Land* (Buffer Strips in Arable Plots), 221 eur/ha;
- 0,21% (6 219,11 ha) of declared area apply Lands Use Conversion From Arable to Grasslands, 232 eur/ha;
- 1,16 % (34 111,51 ha) of declared area apply Stubble Fields measure (leaving stubble fields during winter season), 99 eur/ha;
- 0,96% (28 225,68 ha) of declared area apply Catch Crop measure, 134 eur/ha.

For instance, the most unpopular and ineffective measure was *Water Protection from Pollution and Soil Erosion in Arable Land* that is planned to be discontinued for the next CAP period. This measure entails widening legally defined buffer strips. However, one issue with it is that the measure is simply ineffective because it is voluntary. It results in fragmented application of buffer strips along the same river as not all farmers along the river are applying the measure. As a consequence, the overall environmental impact of these strips is minimal. Also, despite the fact that the payment was the highest from all water protection measures (221eur/ha), the total declared area in Lithuania for this measure was only around 7,36 ha.

According to the declaration data from 2020, the declaration for catch crops and stubble fields which could significantly decrease leaching of nutrients from arable lands to water bodies in Dovine catchment was minimal:

- 15 plots, summing up to 70 ha of catch crops were declared in 2020 in the area, whereas the potential for declaring in the area is 6194 plots, which sums up to 16 225 ha. The declared are makes up 0,43% of the total potential;
- 27 plots, summing up to 85 ha of stubble fields were declared in 2020 in the area, whereas the potential for declaring in the area is 5797 plots, which sums up to 15 687 ha. The declared plot makes up 0,54% of the total potential;

Of course, it has to be mentioned, that both potentials cover mostly the same plots. The total potential in the area for both of these measures is 16 273 ha, while the total sum declared over both measures is 155 ha. This makes up 0,95% of the total potential (see Annex 2).

Regarding other AECM's declared in the case study area, the results are as follow:

- 11 ha were declared for measure *Management of specific meadows;*
- 178 ha were declared for measure *Extensive management of meadows by grazing animals;*
- 267 ha were declared for measure *Extensive management of wetlands;*
- 178 ha were declared for measure *Conservation of the population of Aquatic Warbler in wetlands.*

During the discussions with farmers it was identified that the AECM are unpopular because some requirements are irrational for the farmers' needs, the payment is not economically rational to justify implementation of the requirements and overall there is a lack of understanding on the benefits or in general lack of benefits for the farmer to change their

practice according to the requirements. However, the measures of stubble fields and catch crops were valued favourably.

2.3.2. Water framework directive (WFD)

Lithuanian 2nd RBMP's & Water development program 2017-2023 identified drivers and measures, though there is a delay in implementation of policies in the water management sector. The strategic documents suggest that local authorities, other related legal entities and natural persons should participate in the implementation of the actions, though this is not happening on a local level. In the context of the WFD, public participation is viewed as a means of improving water management through better planning and more informed decision-making. The active involvement requires certain institutional setup and knowledge and facilitation and that is lacking in the case study area (as well as in overall Lithuania). The local level participation in RMBP's development and implementation is very weak and inconvincible as river basin advisory councils are established only formally at national level and not functioning effectively in reality.The consultation with stakeholders, including the local communities should be implemented through the establishment of river basin district advisory councils, and following the dissemination of documents and information, outlining significant issues for meetings the WFD's environmental objectives

2.3.3. Farming practices and challenges for on-farm measures

Unsustainable practices driven by lack of awareness, chasing of higher productivity and lack of regulation result in intensive and irrational chemical fertiliser, pesticide and herbicide use which affects the quality of the water bodies. Also, the farmers are used to leaving fallow land as it is believed that it increases soil fertility and even is supported by the government. In fact, it really does more harm than good because it is leaking nutrients and leaves soil prone to water and wind erosion. In 2020 there was almost 60 000 ha of fallow land declared in Lithuania, out of which 513 ha were in the Dovinė river catchment area (see Annex 3).

Soil testing and fertilisation plan is one of win-win measures for farmers and the environment. However, currently they are not mandatory for mineral fertilisers. There are some discussions about potentially gradually making them obligatory, especially for bigger farms but the discussion and processes are slow to progress, e.g. processes are getting stuck with tenders on developing national methodologies.

Among a number of other measures, farmers could achieve effective water protection and win-win solutions by adjusting their practices to sustainable alternatives which would be relevant for local conditions and reflect farmers' needs. However, there is a lack of knowledge among farmers about these practices and lack of understanding about the need for them and the benefits they bring to the farmer.

Regarding other infrastructural on-farm water protection measures such as constructed wetlands, sedimentary ponds or bioreactors, just like with farming practices, there is a lack of understanding among farmers on benefits for the farmer to install it and maintain these measures in the long run, therefore, there is no motivation to take these measures even if costs were covered for installation. Some farmers said that if one knew how to install wetlands which would allow irrigation of fields during dry periods, then they would consider such an option. However, there is a lack of strong experts who would work with farmers and make sure such a result is achieved. Also, they said that if the government would cover the costs for construction, maintenance and make sure that the support given adequately reflects the value of public goods generated, they would consider installing some of these measures.

A lot of issues discussed above could be addressed with education and high-quality individual consultation. However, current agricultural advisory is insufficient for in-depth improvements, since the consultations they provide are standardised and mostly oriented to resource efficiency, economic gain, productivity or pest control. While the experts in local authority divisions usually are not motivated and lack capacity to work with encouraging farmers to use agri-environmental measures or transition to environmentally friendly farming practices.

Another challenge relates to old drainage systems. During soviet period massive drainage projects were implemented across the whole country, hence, currently the drainage systems are very old and in some areas the condition of them is bad and requires restoration (see Figure 5). The issues occur regarding insufficient funding and responsibility for restoration and maintenance of the drainage systems. Some drainage channels belong to the state and sometimes the drainage system goes through the fields of several farmers. Even though the farmers are farming in the drained fields, they often do not want to take responsibility and invest into states' drainage systems or have difficulties to cooperate and unanimously agree to invest in necessary renovations. Also, they do not want to take the ownership of unrenovated and faulty systems. Currently there is some financial support given for drainage restoration projects, but the projects that need to be implemented are large scale and farmers are reluctant or incapable to cover even a portion of the whole project costs. Moreover, according to the local amelioration expert, there is a heavy administrative burden regarding renovation of drainage systems in protected territories, because farmers need to get approvals and permissions for construction and some farmers avoid the trouble.

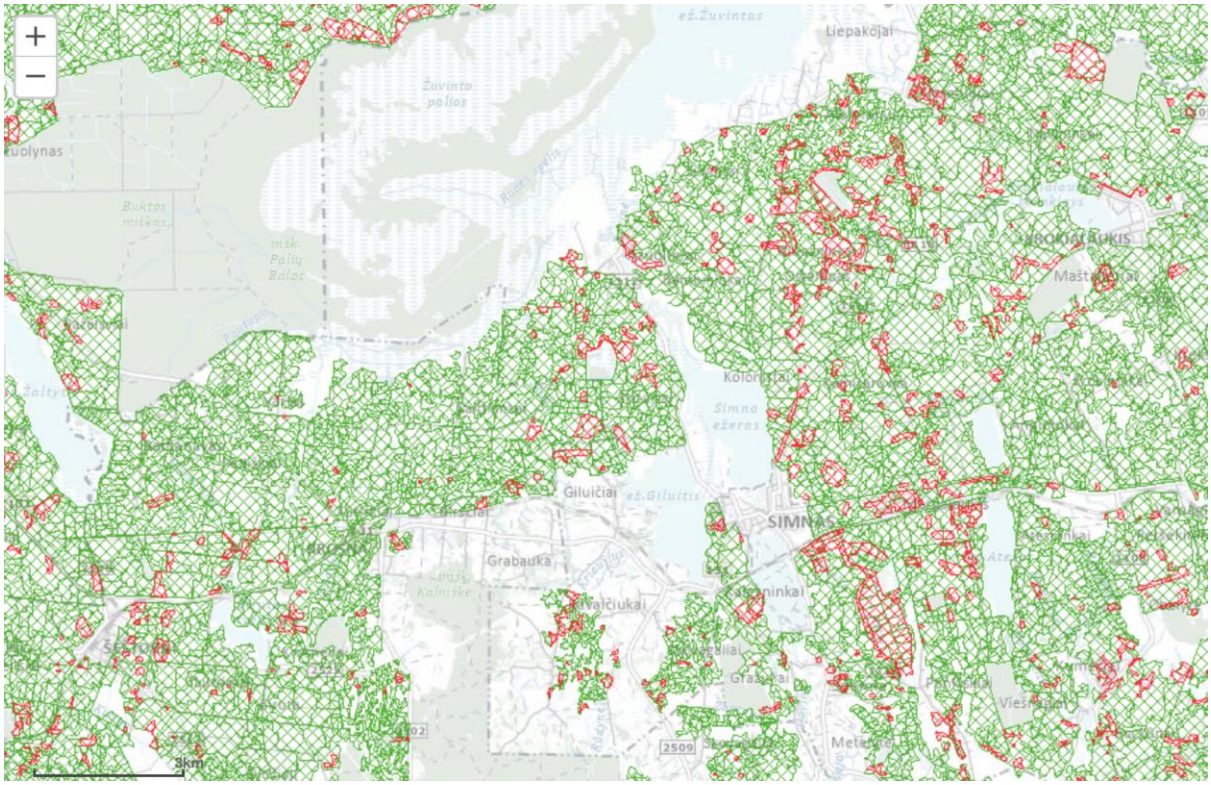


Figure 5. Case area and amelioration systems marked in green those which are in bad condition, marked in red. *Source: Geoportal.lt*

Controlled drainage is usually positively seen by farmers and its benefits are well understood by them. This measure could address the nutrient run-off problem and encourage farmers to invest in replacing old drainage systems because it is not only effective on water pollution reduction but also financially adequate as it often has a fast payback for farmers due to increased productivity. However, according to controlled drainage experts, this measure is not feasible in the case area due to hilly landscape which would need a lot of investment and would result in slow payback.

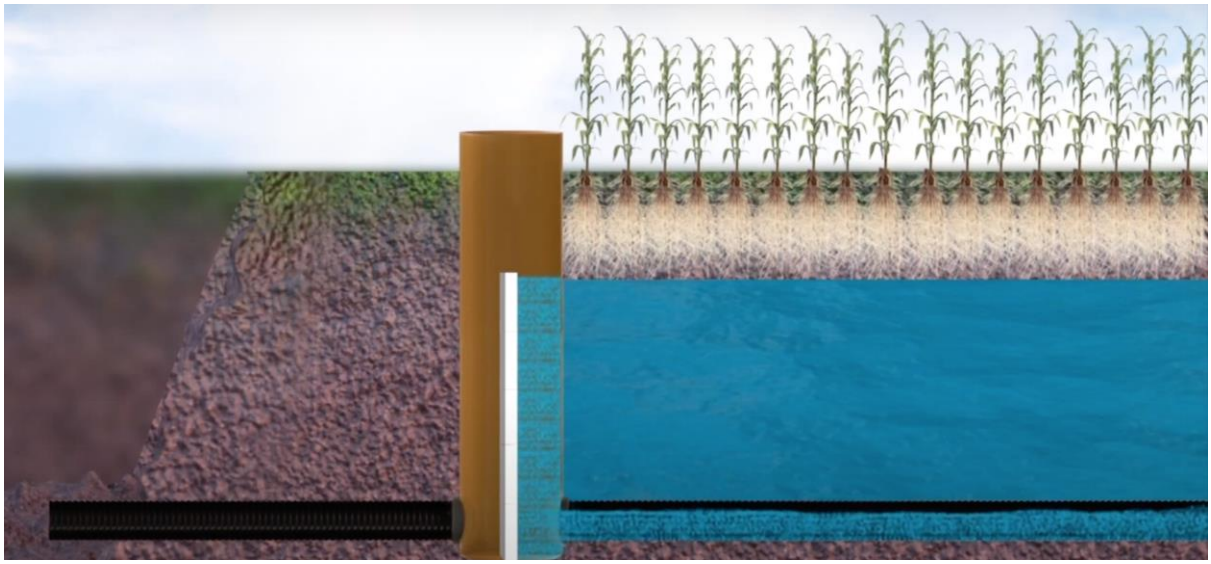


Figure 6. Visualisation of the controlled drainage system. *Source: Ekodrena.lt*

2.3.4. Data

There are some data related challenges limiting decision-making and water protection initiatives. For instance, there is a lack of trustworthy database for actual fertiliser use by fertiliser active components. Such data is not collected and tracked in Lithuania and fertiliser use is only being estimated based on fertiliser sales data. Also, there is no database or data collected for pesticide use in Lithuania. Therefore, the impact of agricultural activities on water cannot be accurately assessed and effective agri-environmental policy and decision-making is difficult.

Moreover, even though the EPA carries out the national environmental quality monitoring programme, it has some flaws. For instance, it does not have a specific focus on water quality monitoring in protected territories such as Žuvintas Biosphere Reserve which results in lack of local knowledge and capabilities to address water quality issues and ensure protection of sensitive habitats and species. Also, hydrology experts highlight that the national water quality monitoring system is ineffective. Water sampling needs to be done way more frequently, the monitoring point network has to be denser and the monitoring data needs proper interpretation in order to identify the pollution sources and reasons for fluctuations in water quality parameters. Current system fails at achieving this and a lot of investments are needed to improve it so that the monitoring data would start giving valuable information.

3. Recommendations for Further Action in the Case Area

3.1. Foster the Improvement of Farming Practices

Target stakeholders for implementation:

Leadership: *Žuvintas Biosphere Reserve Directorate*

Supporting stakeholders: *environmental NGOs, local departments of Agricultural Advisory Service, local municipalities and elderships.*

One of the ways forward would be to work closely with local farmers, educate and help them address unsustainable farming practices resulting in nutrient and chemical toxin run-off from fields into water bodies.

First of all, it would be important to address the problem of degradation of humus in soils and increasing mineral fertiliser use, which occurs due to possibly imbalanced agricultural sectors (decreasing livestock farming and increasing crop farming tendencies). The problem could be addressed by encouraging sustainable restoration of organic matter in soils following principles of circular economy (e.g. sustainable use of manure, hay, food waste, compost, etc.). It would be important to introduce training and encourage agricultural advisors to work closely with farmers to educate and teach them to reintroduce organic matter to the soils via sustainable methods such as agro-ecological practices or regenerative agriculture principles.

Second of all, there is a strong need to progress with mainstreaming the use of soil testing and fertilisation plans and encouraging intensive farmers to use precision farming technologies to optimise fertiliser use.

Moreover, the data gaps should be addressed. While closely working with farmers one could collect data into a case area database on fertilization, pesticide and other hazardous chemical use in farms. Such a trustworthy database would enable identification of potential hotspots for water quality issues and apply more targeted measures. Collaboration with the ministry of environment and ministry of agriculture is needed to support policy-making and development of a national database.

Furthermore, it would be important to terminate practices leaving open soil such as fallow land and minimise arable land areas in the sensitive zones. There should be a targeted promotion of agri-environmental schemes, especially catch crop and stubble fields over winter and extensive management of meadows and wetlands. The locations where efforts need to be made are currently known (see Annex 2 and Annex 3) and various stakeholders can be encouraged to communicate with local farmers, advise them and help implement necessary farming practices and declare their plots for support.

3.2. Enable Local Water Management Action

Target stakeholders for implementation:

Leadership: *Žuvintas Biosphere Reserve Directorate*

Supporting stakeholders: *Meteliai Regional Park Directorate, environmental NGOs, Alytus District Municipality, Lazdijai District Municipality, Marijampolė Municipality, Simnas fishery ponds*

During the work in the case area it turned out that there is very little understanding about the local (catchment-level) water quality situation. For effective water management, local action is very important to collect data and apply targeted measures. Therefore, regional water management agreement could be made based on the Dovinė catchment level among stakeholders such as all three municipalities and protected territory directorates (e.g. Žuvintas Biosphere Reserve Directorate, Meteliai Regional Park Directorate). The assigned stakeholders could divide responsibility (or it could be assigned to one competent stakeholder) for data collection and analysis, developing strategies for improving water management, foreseeing pollution prevention or reduction measures and attracting or allocating funding.

Municipalities (potentially collectively on the catchment level) should procure high quality local water data collection, problem assessments and mapping to identify the locations for targeted measures, e.g. where wetland restoration, constructed wetlands or sedimentation ponds are most needed and would be most effective. Dialogue should be started with the municipality association for adequate funding.

Effective local water management in the case area could be achieved through establishing a specific expert position within the protected territory, catchment or municipality such as Catchment Officers in Denmark. The Catchments Officer could carry out the following responsibilities for successful local water management:

- Collect and analyse local water quality and land-use data
- Map water-related issues, identify pollution sources and targeted measures to improve water quality and hydrological conditions
- Educate, engage and closely collaborate with local communities, businesses and farmers to exchange local knowledge, reduce pollution sources and implement water quality measures
- Search and apply for funding for implementation of water quality measures

Moreover, it is important to empower and engage local communities and local action groups in water management and protection but for their successful participation it is important that they have a certain level of environmental and local knowledge on condition of and threats to local water bodies. Thus in parallel to above mentioned solutions, it is important to carry out environmental education of locals. The education should be adapted to local contexts, cover concepts of ecosystems, ecosystem services, biodiversity and local threats. Education should develop abilities to recognise signs of environmental degradation and understand complex environmental problems through systems thinking. Such environmental education can be effectively carried out through collaboration with schools, environmental NGOs and directorates of protected areas. Such actions may lead to the establishment of a local river basin district advisory council and may contribute to the implementation of WFD.

3.3. Further research and discussions

The complexity of the case area and lack of water quality monitoring data and management suggests that the research of the hydrology, water quality and impacts should be consecutively continued further and it is important that in addition to water quality data collection, proper analysis and interpretation is done in order to identify pollution sources, other issues and necessary measures. During the case study work in the Dovinė catchment, the main research directions were identified and outlined below.

3.3.1. Hydrological Conditions and Water Quality

Target stakeholders for implementation:

Leadership: *Žuvintas Biosphere Reserve Directorate*

Supporting stakeholders: *Vytautas Magnus University Agriculture Academy, Kaunas Technology University and other education institutions, Meteliai Regional Park Directorate, environmental NGOs, Alytus District Municipality, Lazdijai District Municipality, Marijampolė Municipality, Simnas fishery ponds*

According to a hydrology expert, current short-term monitoring indicates low water levels and therefore less water reaching Žuvintas lake potentially due to hydrological infrastructure (weirs) and climate change impacts. This can substantially affect the condition of Žuvintas lake and its ecosystems resulting in faster eutrophication processes. However, in order to better understand actual impacts of reduced water amounts one needs to carry out a specific assessment. It is highly recommended to procure or in collaboration with universities carry out a study on impacts of climate change and hydrological system transformations for the runoff of the Žuvintas basin and the impact on the water balance on lake Žuvintas.

Furthermore, research and discussions with experts and stakeholders are needed on possibilities for further restoration and renaturalisation of the hydrological cycle. One of the topics discussed and assessed could be the renovation of spill weirs to pass through more water. For instance, reshape weirs that are currently horizontal barriers into a "V" form to mimic the shape of the riverbed and let more water flow through.

Moreover, the monitoring data shows exceptionally high nutrient levels in collected precipitation samples. Such a result could occur due to various reasons, for instance, faults in maintenance and collection of samples from the rain gauge or nutrient particles travelling through aerosols in the atmosphere. It is possible that pollution comes not only from farms or other pollution sources but also high levels of nutrients are coming in through precipitation. Therefore, it is strongly recommended to carry out a study on nutrient levels in precipitation in the Žuvintas Biosphere Reserve and Meteliai Regional Park. This can also be done in collaboration with researchers and universities. If the nutrient levels in precipitation are indeed high, potential solutions could be explored such as rainwater harvesting for irrigation of fields which would help to adapt to droughts due to climate change and potentially reduce fertiliser needs.

3.3.2. Impacts of Simnas Fishery Ponds

Target stakeholders for implementation:

Leadership: *Žuvintas Biosphere Reserve Directorate*

Supporting stakeholders: *Hydrology experts, universities or research centres, Alytus District Municipality, Environmental Protection Agency, Simnas fishery ponds*

Our short-term monitoring detected that discharge water from fishery ponds affects water quality and potentially could affect water ecosystems due to water being discharged in bursts. Also, just like with overall national water quality monitoring, the water quality data is being collected but there is a lack of analysis and interpretation of data to evaluate impacts on water quality of the water bodies. Therefore, it is highly recommended to optimize the water quality monitoring program to assess impacts of water intake and discharge from the ponds to evaluate the impacts on water quality and ecosystems of the Sperna (Bambena) river, Simnas and Žuvintas lakes and ensure more sustainable functioning of Simnas - Žuvintas lake water system.

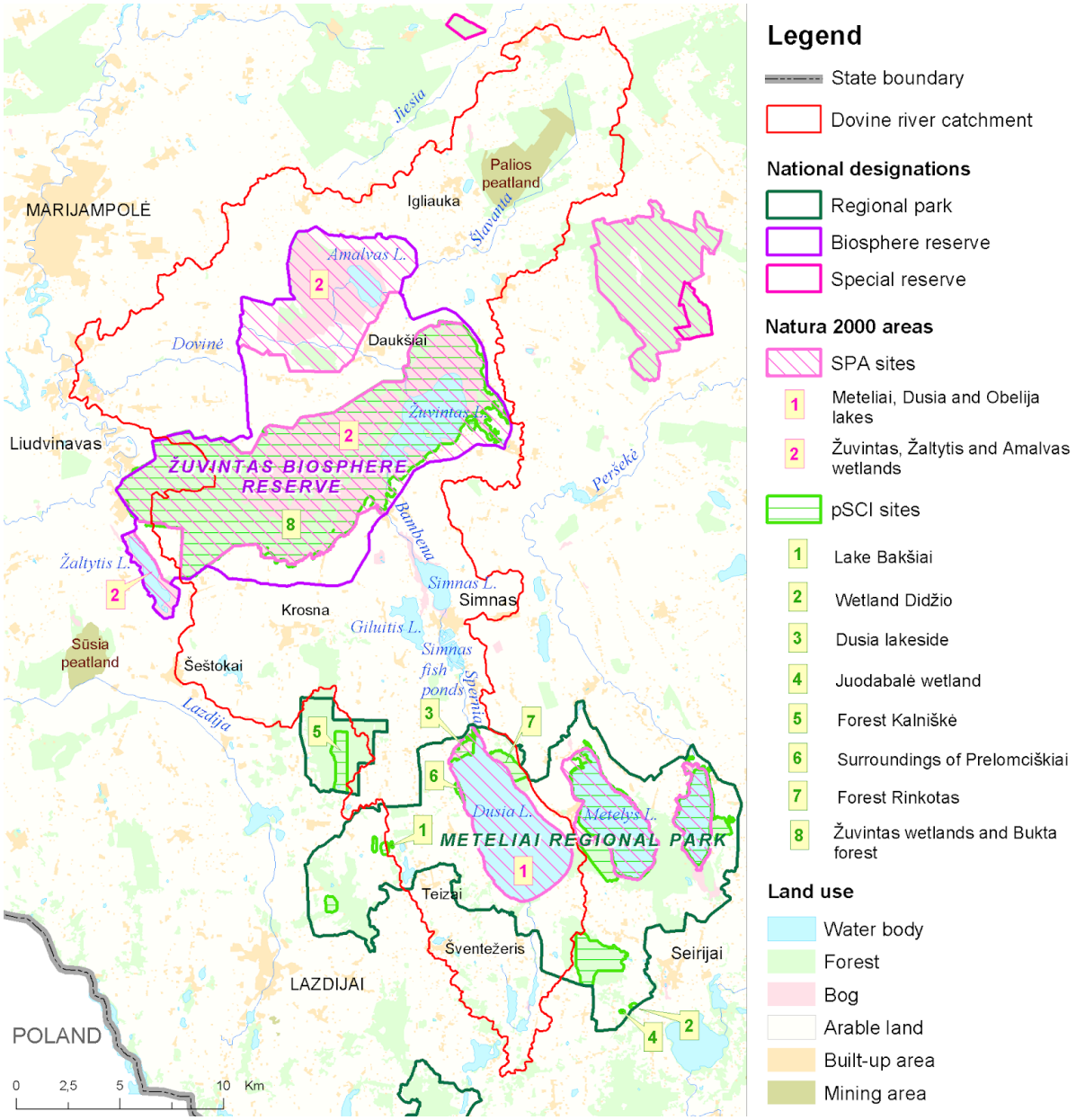
References

1. Environmental Protection Agency (2020). *Assessment of the Risk of Lakes and Ponds not to Achieve Good Quality Status*

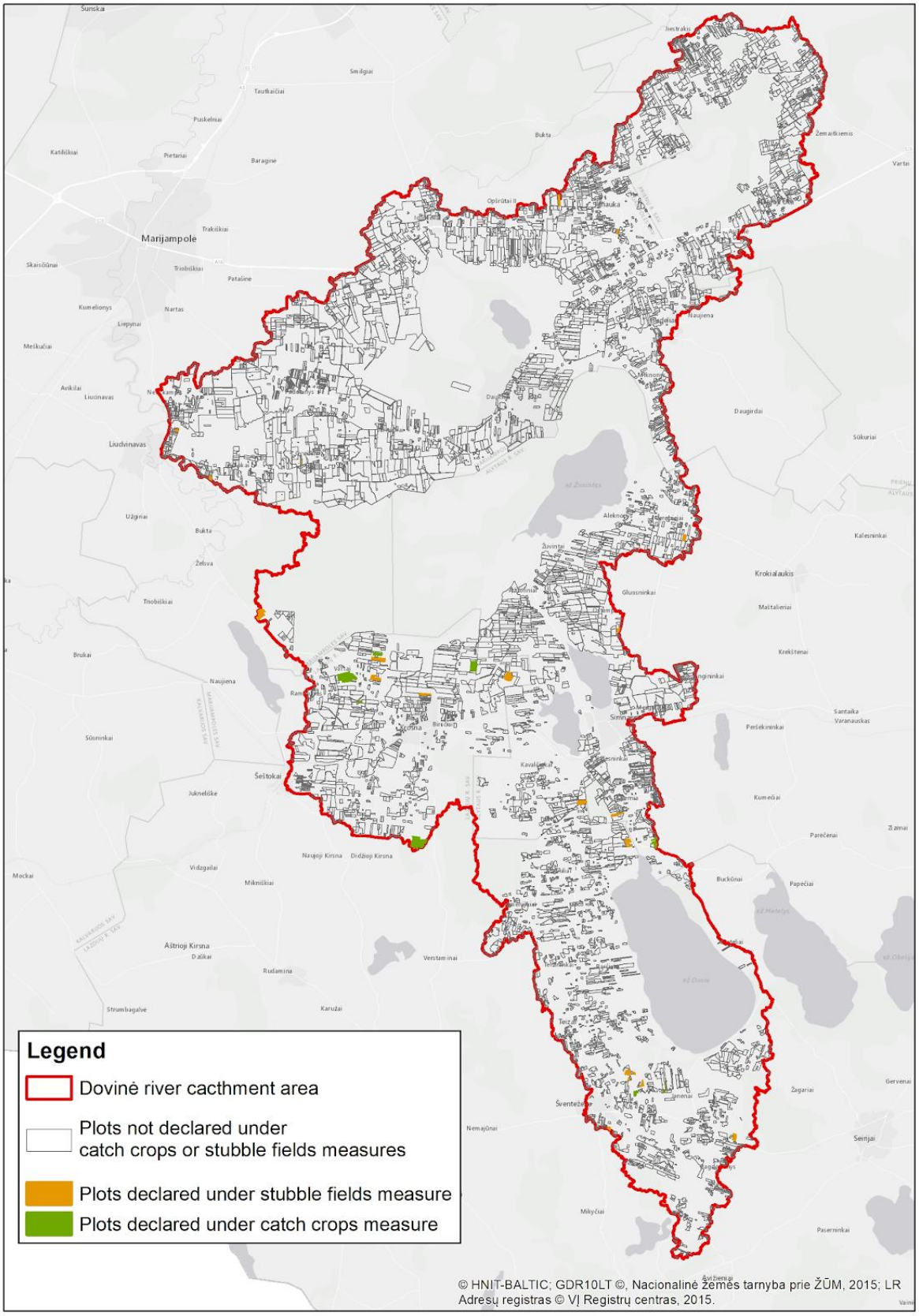
   http://vanduo.gamta.lt/files/Ezeru_rizikos_apzvalga21606810604295.html

2. Nature Heritage Fund (2006). *Management and Restoration of Natura 2000 sites in the Dovinė River Basin*
3. Žuvintas Biosphere Reserve Directorate. www.zuvintas.lt

Annex 1. Map of water bodies and protected territories in Dovinė Catchment.



Annex 2. Declared plots for stubble field and catch crop measures and potential to declare outlined in black



Annex 3. Locations where fallow land measure is declared and should be addressed