Adaptation plan/design of interventions/pilot interventions on Nature Park Vransko Jezero

Final Version of 30/11/2021

Deliverable Number D.5.4.2.

Project Acronym	CHANGE WE CARE
Project ID Number	10043385
Project Title	Climate cHallenges on coAstal and traNsitional chanGing arEas: WEaving a Cross-Adriatic REsponse
Priority Axis	2
Specific objective	2.1
Work Package Number	5
Work Package Title	Pilot Sites: adaptation strategies and measures for increasing resilience to climate change
Activity Number	5.4
Activity Title	Adaptation plan/design of interventions/pilot interventions on Nature Park Vransko Jezero
Partner in Charge	Emilia-Romagna Region
Partners involved	Public institution Vransko lake Nature park
Status	Final
Distribution	Public

Table of contents

1. Foreword

This document has been produced in the framework of the INTERREG Italy – Croatia CHANGE WE CARE Project. CHANGE WE CARE fosters concerted and coordinated climate adaptation actions at transboundary level, tested in specific and representative pilot sites, exploring climate risks faced by coastal and transitional areas contributing to a better understanding of the impact of climate variability and change on water regimes, salt intrusion, tourism, biodiversity and agro-ecosystems affecting the cooperation area. The main goal of the Project is to deliver integrated, ecosystem-based and shared planning options for different problems related to climate change (CC), together with adaptation measures for vulnerable areas, to decision makers and coastal communities. Additional information and updates on the CHANGE WE CARE can be found at https://www.italy-croatia.eu/web/changewecare.

2. Aims and content of the document

This document is the final Adaptation plan in the Vransko jezero Nature park Pilot Area and corresponds to the Deliverable 5.4.2. indicated in the Application Form. It represents the synthesis of Adaptation/management Plans for the Pilot Sites, where the shared knowledge base on the present and expected dynamics of coastal systems in the cooperation area and Pilot sites, built in WP3 and WP4, is conveyed.

The definition of such Plans is foreseen to be pursued by means of participatory processes (see Deliverable 5.4.1) determined in order to get all information available, shared decision and consensus by the stakeholders to make the Plan effectively implementable in a collaborative way by all subjects and decision makers involved.

Starting from a “preliminary document” concerning the knowledge framework, threats and opportunities, prepared by each Partner responsible for the Pilot Area to feed the start of the Participatory Process, the Adaptation Plans will be developed taking into account outcomes of WP3, WP4 and of the Participatory process itself, including shared vision, objectives, measures/ actions/ interventions, possible resources/financing, roles and commitments for its implementation beyond the end of CWC project.

3. CHANGE WE CARE project and the objectives of WP5

CHANGE WE CARE fosters concerted and coordinated climate adaptation actions both at Pilot Sites and transboundary level. The project explores climate risks faced by coastal and transition areas contributing to a better understanding of the impact of climate variability and change on water regimes, salt intrusion, tourism, biodiversity and agro-ecosystems affecting the cooperation area.

WP5 main objective is the preparation of climate change Adaptation Plans in Pilot Site, containing the assessment of present state and of foreseen scenarios, the jurisdictional references, the indication of measures and intervention priorities, conforming to the local environmental and socio-economical needs, monitoring strategies on key parameters and on the efficacy of the Plan.

The Planning options presented are the result of participated processes involving local authorities and stakeholders. The Adaptation Plans include actions and interventions, where appropriate, indicating the timeline and the financial strategy for the implementation of the envisaged activities and Monitoring Plans (taking stock also of WP4 indications) for observing and ensuring the durability of the project outcomes and of the implementation of the Plan.

4. Description of the Pilot Area, Knowledge Framework and Scenarios

4.1 Characteristics of the pilot area

Vransko lake is a shallow karst lake, separated from the sea by a merely 1 km wide limestone ridge (Figure 1). Because of its rare natural habitats, fresh water springs and biodiversity, Vransko Lake and its surroundings have been declared a Nature Park on July 21st, 1999. The Park borders are between villages Pirovac and Pakoštane. It stretches across 57 km², 30,02km² of that being the lake area itself, which stretches in direction north-west to the south-east, parallel with the sea coast.

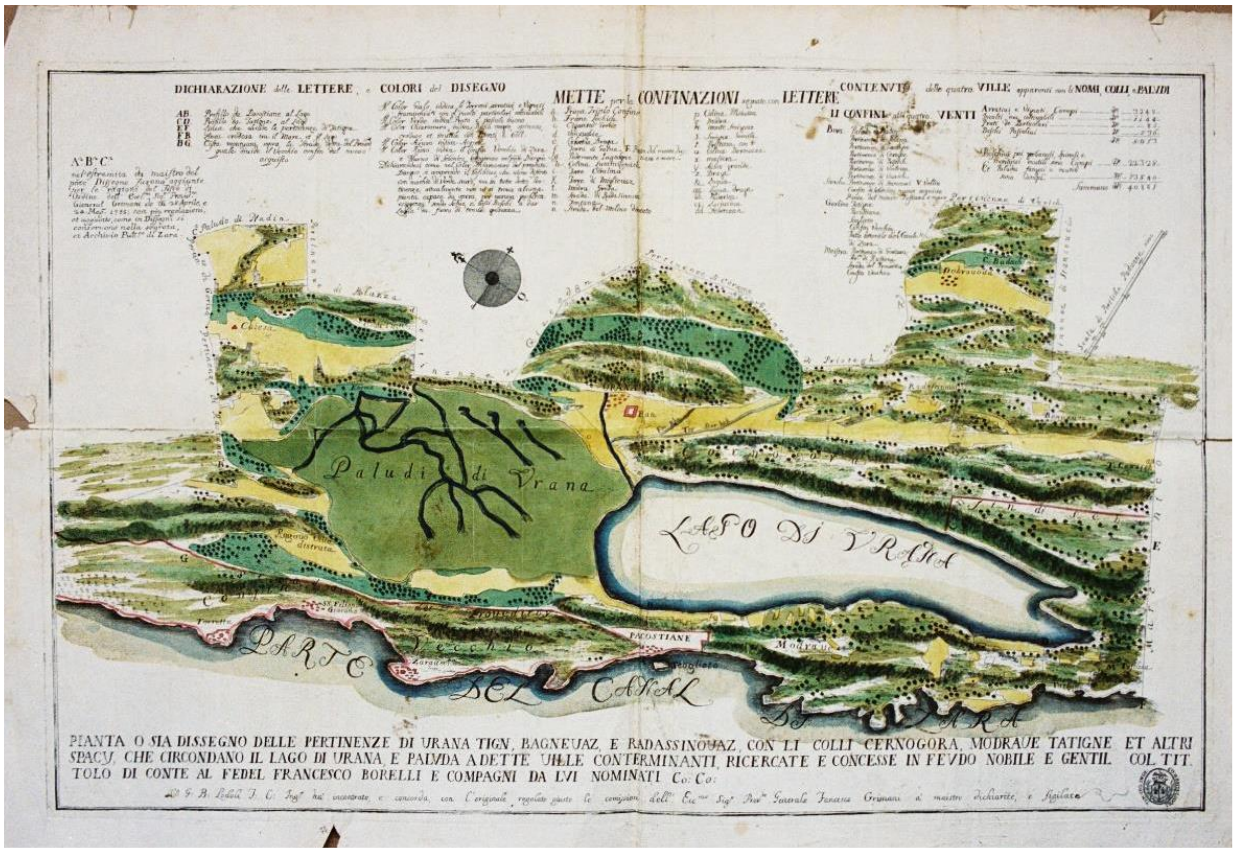


Figure 1. The situation of Vransko Lake and the wetland area of the present Vransko field before the digging of the Prosika canal from 1746. (photo of the map from the State archives of the Borelli family)

The lake constitutes a complex hydrological system in dynamic balance with the sea. The lake is a wetland area supporting habitat types that are rare in the Mediterranean and recognized as Natura 2000 habitats. The Jasen area is a biologically important area and is part of the ecological network Natura 2000 Vransko jezero i Jasen.

In the area of Vransko Lake and its basin in the last 200 years a modern melioration system was built, which began with the construction of the Prosika canal in 1770, and continued with

the construction of a melioration network, as well as deepening of the Prosika canal in the first half of the 20th century, further draining the Jasen area and Vransko field. (Figure 2.)

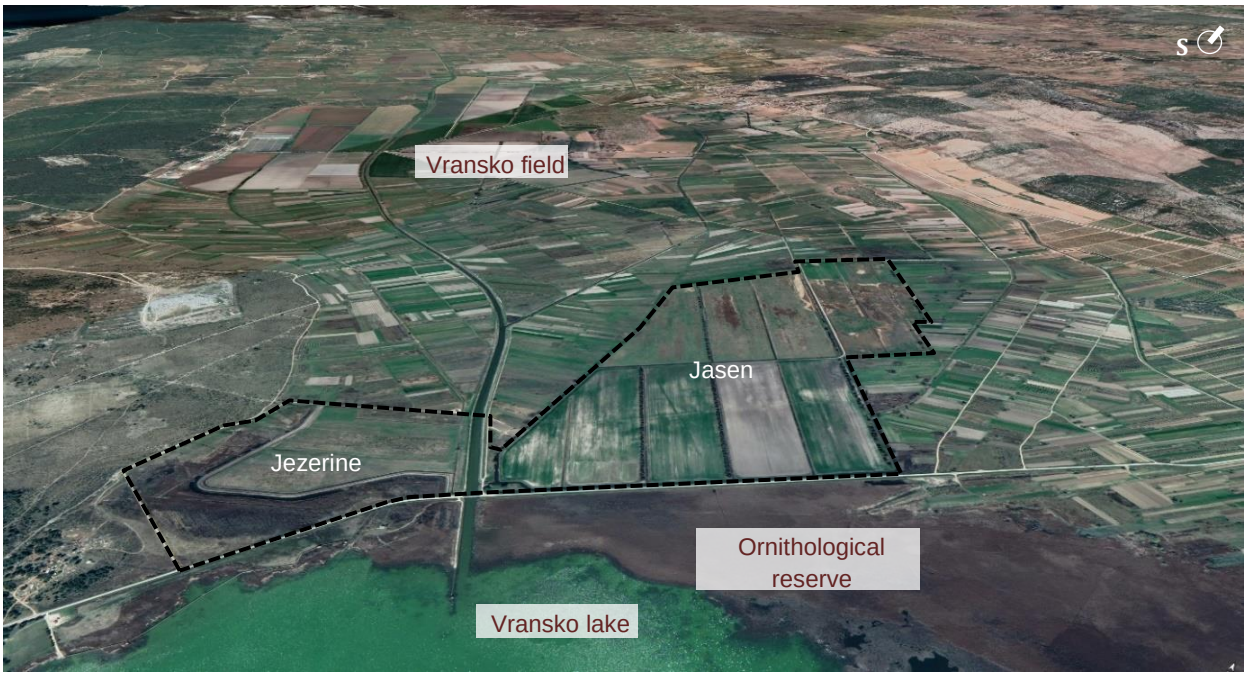


Figure 2. Overview of the Jasen and the Jezerina area in relation to Vransko filed and Vransko lake. (Source: Google Earth Image Landsat / Copernicus © Maxar Technologies)

Vransko Lake, with all its hydrological, biological, landscape and recreational values, during the recent long dry periods, is directly endangered by reduced freshwater inflows and consequent penetration of sea water into the lake system. The effects are documented and monitored. Climate change is causing biodiversity loss due to lower water quality and eutrophication. Agriculture is one of the most important users of space in the area along and around the lake. The use of chemicals for intensive agriculture (mineral fertilizers and pesticides) significantly affect water quality and reduce biological diversity.

Threat from agriculture

The area of Vransko field is in the categories of low and medium natural vulnerability of aquifers. Most of the field is located in the area of low aquifer vulnerability, and the area around the lake and the lake itself, given its geological background, belongs to the category of medium aquifer vulnerability (Biondić et al., 2011). The freshwater ecosystem of Vransko Lake is extremely sensitive, and is additionally endangered due to climate change and increased needs for the use of water from the basin and the consequent intensification of eutrophication (Katičin et al., 2017). Agricultural production is one of the most serious threats to the quantity and quality of water in Vransko Lake, but also in the entire basin. Nutrients from mineral and organic fertilizers regularly used by agricultural producers along Vransko Lake are the main cause of the increased content of nitrogen and phosphorus in water. Current irrigation system in the basin takes away part of the water balance and increases the risk of salinization of the lake system.

Plans to expand irrigation

Currently, there is a well-developed irrigation system in Vransko field. The most popular method of irrigation is "drip" and the use of movable rain wings. Zadar County plans to modernize and expand the existing irrigation system and in this regard, very concrete steps have been taken. The planned new irrigation system on Vransko field will occupy 4,449 ha, and its construction will be carried out in three phases. Preparatory works are underway for the implementation of the first phase of construction of the system, which will cover an area of 1,625 ha, or 1,439 ha net (Dvokut Ecro, 2017) (Figure 3.). This is an area of 966 ha cultivated by business entities (Vransko d.o.o. and PIK Vinkovci d.d., ie the former Agricultural Cooperative Nova zora), and 659 ha of agricultural land used by family farms.

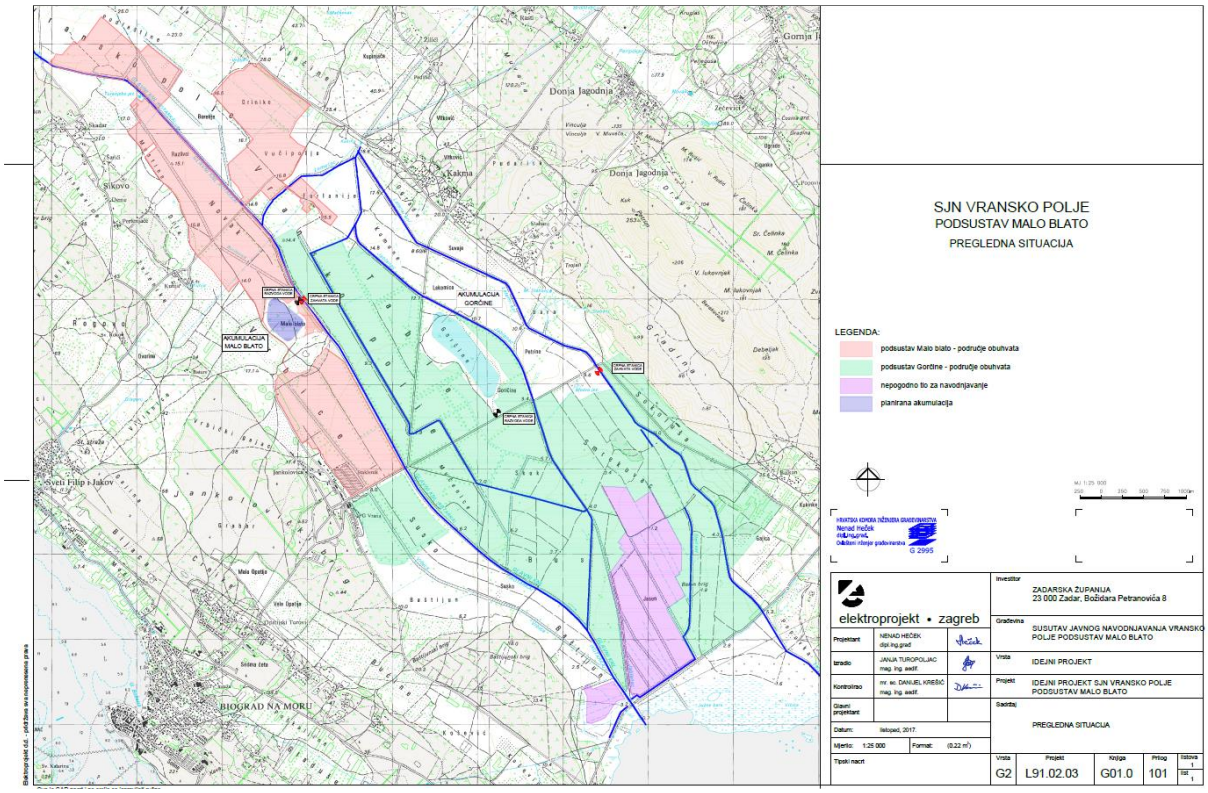


Figure 3. Overview of the part of the Vransko Lake basin and the position of the planned Irrigation System - Phase I (Elektroprojekt, 2017.) two accumulations Goričine and Malo Blato shown with areas of influence. In pink is the area of Jasen that is evaluated as soil unsuitable for irrigation

The abstraction of water for irrigation purposes from the Kotarka Main Canal and the Lateral Canal will reduce surface inflows into Vransko Lake, which together with precipitation falling on the lake surface, have a dominant impact on the process of desalinisation after the period of increased chloride content. The lake is protected from the cumulative effect of salinization of its waters by the desalination process, which is carried out in such a way that increased inflows of fresh water from the Vransko field, by diluting and overflowing saltier waters through the Prosika canal, dilute concentrations of saline waters of Vrana Lake. The process of water exchange in the lake is extremely important for the lake system. In the year when water exchange is weak, there are problems with the salinity of its waters, which according to the results of analyses of autocorrelation functions, is felt not only in that year, but also in the following year (RUBINIĆ et al. 2017). During critical hydrological conditions in the lake and

basin, usually during summer and autumn periods (that are also periods of most intensive agriculture production), there should be no further uptake of freshwater from watercourses (Katičin et al., 2017). In order to reduce the risk of a situation with the impossibility of capturing water for irrigation purposes, it is necessary to implement protective measures on Vransko lake in parallel with the planned construction of irrigation systems by building a movable dam with the reconstruction of the Prosika canal. It is necessary to ensure the partial sealing of the canal, as well as increase the capacity for evacuation of large waters. This could slow down the outflow of water from the lake, and reduce the duration of low water and periods of intensive salinization.

4.2. Status and trends of hydrological, geomorphological and biological process

Hydrological characteristics of the Vransko Lake are rather complex and are result of combination of dominant carbonate lithology combined with impermeable flysch, Mediterranean climate and location in the coastal karstic region of the Mediterranean where coastal aquifers are in contact with the sea. Hydrologically, the existence of the fresh water lake within the narrow coastal zone of the karstic Mediterranean is a rare phenomenon. Due to its complexity such a system is usually more prone to negative influences caused by climate change and human interventions.

The final hydrotechnical interventions were carried out in the second half of the 20th century by widening and deepening the Prosika canal, draining the Jasen flood zone, installing a pumping station, reclamation and draining of the Nadin mud - an important winter and spring flood zone on the higher horizon.

Local water sources on the shores of the Vrana basin have been put into operation by local water supply systems. Part of the water from the reclamation network of canals and excavated wells is used for uncontrolled irrigation of agricultural areas. The water resources of Vransko Lake and its basin are managed by the public company Croatian waters, and the part related to the specifics of protected areas by the Public Institution Nature Park Vrana Lake.

Ecological quality of the lake ecosystem, depends highly on the inflow of freshwater to the lake and has an immense effect on the water level of the lake. Reduced inflows also result in lower water levels in the lake, and thus higher water salinization in the lake. Namely, according to the results of Rubinić, 2014., the chloride content in water, in general, is inversely proportional to the water level in the lake.

For Vransko lake Nature Park the good environmental status can be defined as a state of balance between the trophic categories of phytoplankton, zooplankton and macrophyte algae. Changes in the composition and abundance of the above-mentioned groups affect the composition of food sources (phytocomponents) and suspended organic matter, as well as predators, which can potentially shift the current state of water from relative transparency to a turbid lake state of increased eutrophication. These conditions potentially lead to a decrease in macrophyte constituents, an increase in sediment resuspension, and in the

extreme situations to the occurrence of hypoxic conditions.
The best data collection strategy has to be developed to achieve a good modelling design. Main modelling parameters -salinity and water level, that are directly correlated with the precipitation rates in the catchment area, is already used in Vransko lake area to model climate change impacts. The salinity and water level together with the nutrient concentration are the main initiators of changes in the composition and abundance of above-mentioned groups.

According to the data at measuring stations (Main channel, middle of the lake and Prosika) on which water quality is monitored, an increase in nitrate concentrations is recorded from which can be concluded that the negative consequences of agricultural production are already visible.

The area of Jasen, which is part of the ecological network NATURA 2000, is a biologically important area. Along with intensively used agricultural land, there are parts that indicate very variable water regimes during the year, sometimes very wet or even flooded, and sometimes extremely dry. According to the indicator species of the current habitats, it can be concluded that this area, before drying by a series of canals and a regulation dam, was covered with tall moist *Molinio-Holoschoenion* grasslands, which were regularly mowed and grazed. The entire hydrotechnical project on Vransko Lake and its basin is designed and built for the purpose of draining excess water in winter and spring and obtaining new agricultural land, without taking into account the possible negative consequences for the ecosystem. Such planning and management of water resources of the Vransko basin has resulted in a drastic reduction of flood zones and wetland habitats, the disappearance of floodplain meadows and the shortening of the flooding period. During dry periods, extremely low water levels occur in the lake (lower than average sea tide levels).

The result of the current water regime is a reduction in depth, accelerated eutrophication, negative changes in underwater vegetation, negative impact on fish stocks, poorer water quality, faster warming, increased salinity and a gradual transition to the brackish ecosystem of the lake.

4.3 Evolution dynamics in the Pilot area under Climate Change

The analysis of climatological characteristics by Rubinić (2014.) shows the presence of a global trend of increasing air temperatures, which in the area of influence is about 0.03 °C / year, or even about 2.9 °C / 100 years. with a simultaneous decrease in annual precipitation from 2.0 to 5.9 mm / year, depending on the location in the analysed regional area. Thus, the presence of global trends of increasing sea level was confirmed in the coastal area of Vransko Lake, where it is shown with a growing trend of 5.8 mm / year. All this affects the amount of water inflow into the lake, its level, but also the quality of water in the lake, ie the increase in the share of saline sea water in the lake. The average annual water level in the lake does not have a declining trend, but, depending on the observation period, stagnation or a slight increase. The reason for this is the replenishment mechanism of Vransko Lake, which in conditions of lower water levels in the lake in relation to the sea replenishes the lake with groundwater

with large amounts of saline sea water. (Figure 4.)

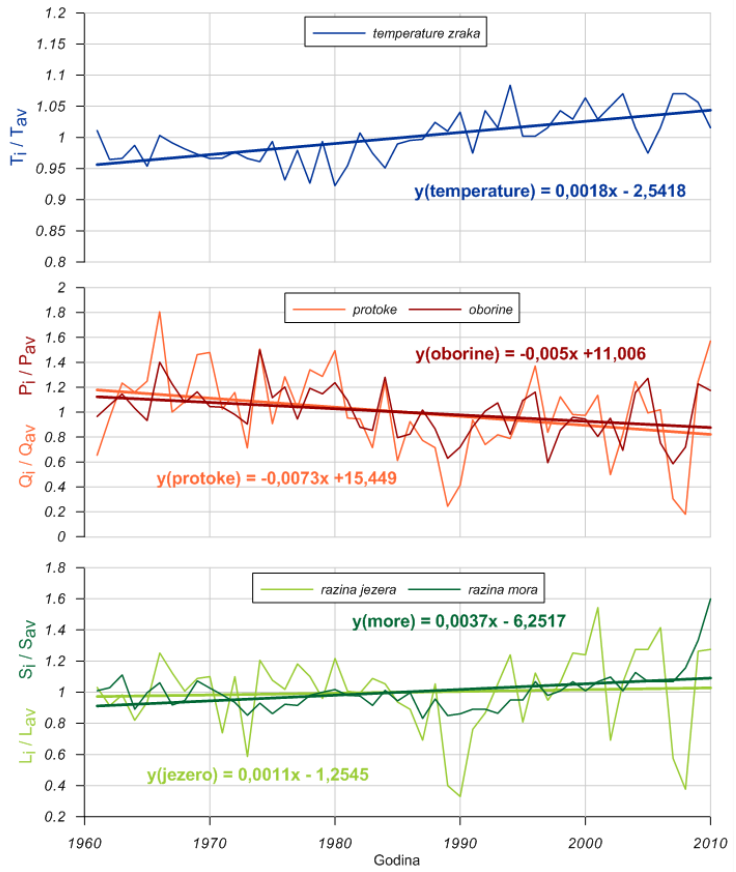


Figure 4. Modular values and corresponding trends of characteristic annual values of selected hydrological indicators in the water system of Lake Vransko (1961-2010) x axis – year, y -axis - light green - lake water level, dark green – sea level, dark red - water inflow, light red – precipitation, blue – air temperature (Rubinić 2014.)

Estimates of characteristic values of mean annual inflows for selected 30-year periods are shown in Figure 5. The value of the average annual inflow of the historical series (1961-1990) of 4.44 m3s-1 was determined as the average of thirty series of annual inflows generated on the basis of the mentioned method of application of the Langbein method (1962). It is also very close (difference of only 3.3%) to the value of the average annual inflow obtained from the map of the spatial distribution of precipitation and air temperature for the mentioned 30-year period of 4.30 m3 s-1.

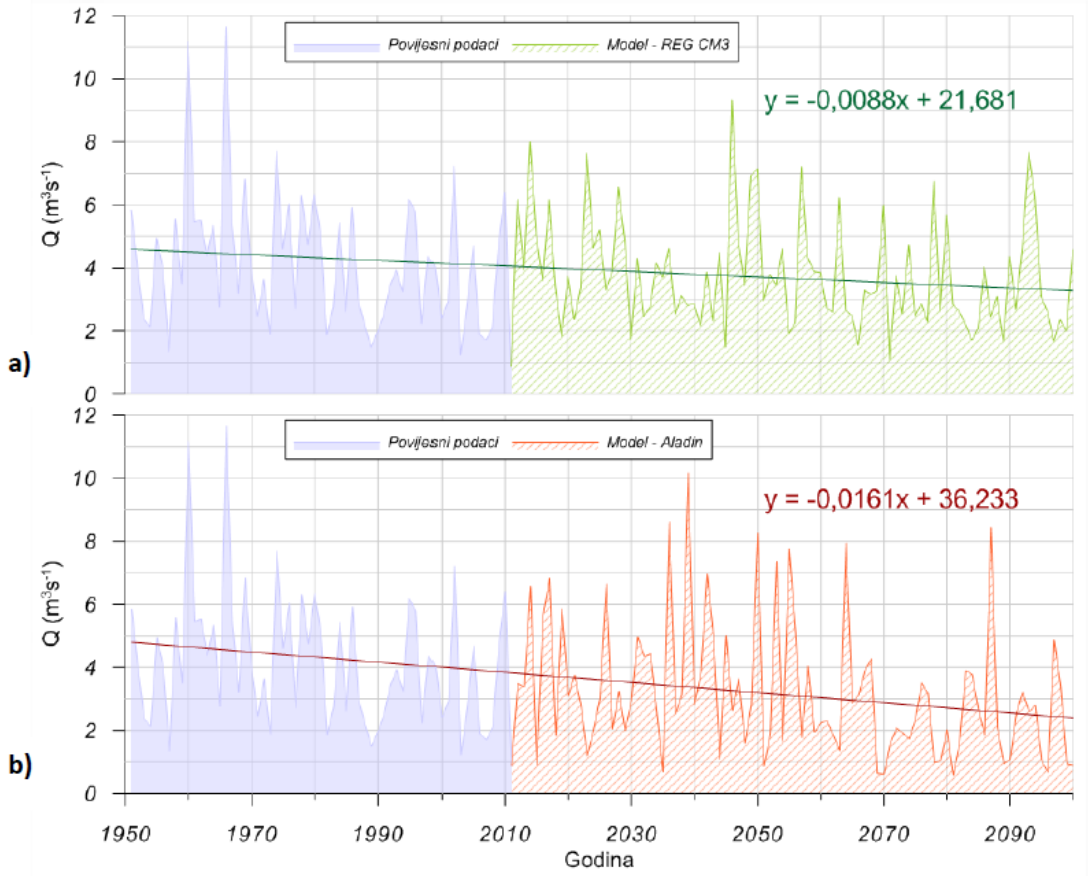


Figure 5. Representation of historical data (1951-2011) and data generated by models (2012-2100) for a series of inflows into Vransko Lake with a corresponding trend for the entire analysed period according to the models: a) RegCM3 and b) Aladin (Rubinić, 2014)

It is evident from the given results that the recorded extremes had the character of very low probabilities of occurrence, below 2%, ie that the return period of their occurrence was less frequent than the 50-year return period. However, given the presence of a trend of increasing levels of the Adriatic Sea, and thus raising the level of water oscillations in the lake and its karst aquifer, it is expected that in the future such high levels, but also extreme droughts with low water levels in the lake, would be even more frequent.

The condition of the lake is very variable - the change of favourable and unfavourable hydrological conditions have the tendency of increasing frequency of negative phenomena and processes. Salinity is increased by decreasing inflows, decreasing lake water levels and rising sea levels (highest mean sea levels most often during the summer dry season), increased evaporation and water abstraction for water supply and irrigation. All this also affects the rise in water temperature. Climate change models show that temperatures will rise further, precipitation will stagnate or fall slightly with more pronounced extremes, and flows will fall. Continued climate change will encourage the intensification of negative trends with the increased need for water for water supply and irrigation. The lake remembers the chloride content, so there are problems if dry periods last, and reduced freshwater and sea water exchange is expected which influences desalination. In addition to climate change, the cause of negative phenomena is also anthropogenic changes in water use (Prosika canal, water use in the basin).

The inflow of sea water also changes sedimentation influencing production in the food chain. Ecologically, there are two alternative conditions in shallow lakes, including Vransko Lake. A shallow clear state dominated by macrophytes that stabilize sediment, extract nutrients from water, as a habitat allow optimal development of zooplankton and macrozoobenthos and affect greater biodiversity. Macrophytes inhibit the development of phytoplankton by competition for nutrients. The ideal condition of macrophytes in a lake is when the presence of Characeae and *Potamogeton pectinatus* species covers more than 50% of the lake surface. As the monitoring results of Macrophytes show, due to pollution, decreasing water levels and / or increasing salinity, the lake ecosystem becomes turbid. In the state of turbid water, macrophytes disappear, sediment is destabilized (which further reduces the transparency of the lake), the disappearance of habitats reduces the biomass of zooplankton and macrozoobenthos causing the dominance of phytoplankton and a significant reduction in biodiversity (Figure 6.).

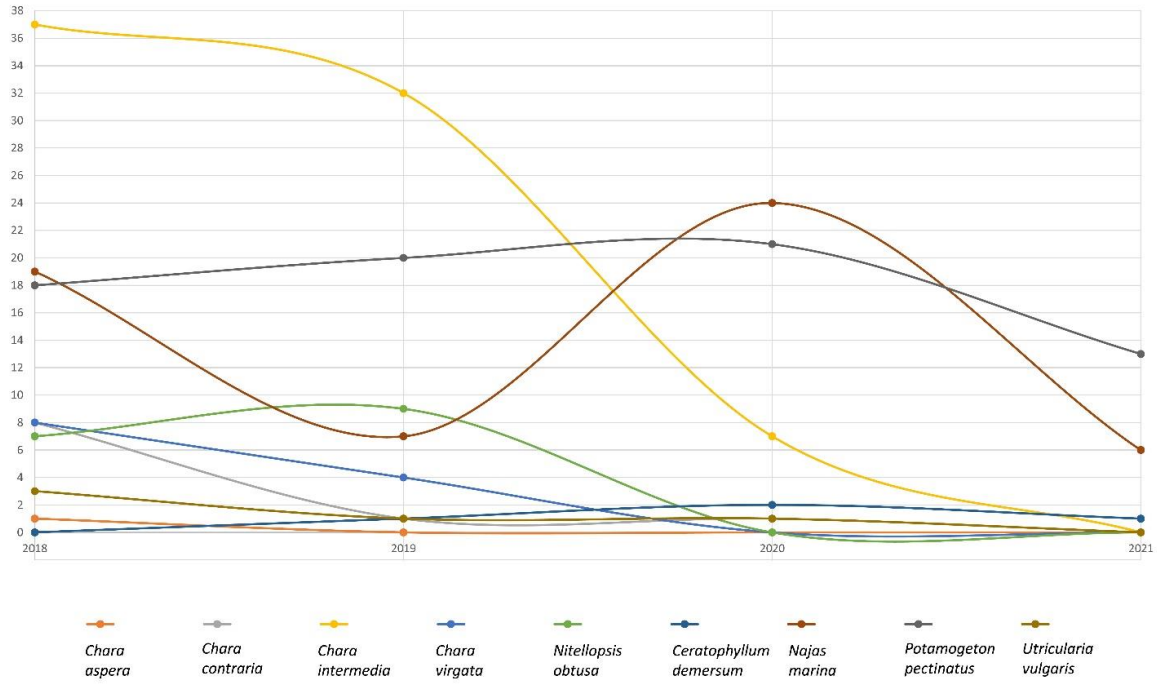


Figure 6. Trend in the occurrence of all macrophyte species recorded in Lake Vrana during 2018 - 2021. The amounts on the y-axis indicate the total number of investigated locations (out of a maximum of 42) where the species were recorded. (HBOD, 2021.)

According to HBOD, 2021., since macrophytes present in the lake are freshwater species, an increase in salinity is expected to reduce the population density of all species. Also, reduced transparency due to increased phytoplankton development and higher amounts of suspended particles prevents the development of macrophytes, including Characeae algae, so in the case of eutrophication, poorer vegetation development is expected. In conclusion, populations of algae will be negatively affected by increased inflow of salt water into the lake, increased inflow of large amounts of nutrients from the surrounding fields and organic load due to activities on the lake.

4.4 Monitoring and information gap-filling strategies

The most prevalent knowledge gap stems from lack of in situ data, predominantly bathymetric and hydrography related data, but also other spatial information data (either maps, sampling data or remote sensing data; LiDAR, Photogrammetry, and other high resolution data) that, when available, was often found to be either fragmented, spatially uncorrelated (resolution, scale, georeferencing etc.), lacking adequate metadata or time continuity to provide sufficient information for analysis and decision making.

The analysis of collected data sets has revealed that the information regarding the analysis of sediments, with focus on the measurements involving solid transport and sediment stocks, are quite scarce. In this case, dedicated monitoring systems are necessary.

Water quality is being measured with Libelium smart water sensors (Libelium Waspmote Plug & Sense!). Data acquisition equipment based on autonomous devices equipped with sensors for measuring conductivity, salinity, dissolved oxygen, water temperature, and temperature, humidity and air pressure is available for 3 different measuring stations in the lake.
The Public institution is financing the research with monitoring of biological diversity of phyto and zooplankton, macroscopic algae Characea, Natura 2000 Habitats monitoring (Eastern sub-Mediterranean dry grasslands of *Scorzoneretalia vilosae*, sub-Mediterranean grasslands of *Molinio-Hordeion secalini* grasslands, Mediterranean high wet grasslands of *Molinio-Holoschoenion*, Mediterranean *Thero-Brachypodiaceae* meadows), Ichthyofauna monitoring, Bird species monitoring (wintering and breeding), amphibian and reptile species.

Combination of limnic and karst relief in areas of highly productive agricultural area in combination with ornithological reserve and Nature park result in many conflicts present in all directions. Particular attention should be paid to monitoring the locations of coastal springs (freshwater and seawater) where the communication occurs. In order to locate the springs, apart from classical methods of hydrological measurements and sampling, it is necessary **to** include the methods of remote sensing, using infrared satellite or aerial images Also, some in situ data was acquired to complete the knowledge.
The quantification of the water inflow and water consumption in case of the Vransko Lake is still not possible due to the high complexity of its hydrological characteristics, but also irregular or absent hydrological monitoring in the past. In line with the functioning of the Vransko Lake, described in Deliverable 3.3.1, it is clear that sediment flux in case of Vransko Lake is still unknown, mostly due to the natural complexity of the lake water-sediment system functioning and the superposed human interventions within the drained area during the last 250 years. Permanent monitoring of the sediment concentration does not exist.

Water quality monitoring has a long tradition within the Vransko Lake area, however, frequent changes of monitoring stations, sampling methodology, analysed water quality parameters etc. resulted in highly dispersed data sets. Even though the Vransko field is the area of intensive agricultural land use, data related to herbicides and pesticides are still largely

scarce. Data about grease and oil in the Vransko field and Vransko Lake are not found in the published literature.

A decrease in water quality monitoring (sampling frequency), and partial sampling method change was identified for the site. Such an inconsistent way of quality monitoring within the mentioned state monitoring program is not appropriate if the monitoring of the spatio-temporal changes in the state of salinity of the Vransko Lake in a longer time series is needed.

There are no maps of ecological quality elements trend available for the Natura 2000 habitats in the Vransko lake Nature park. Orientation towards remote sensing technologies for data collection and filling knowledge gaps in climate change research must be increased. But, the use of remote sensing data without in-situ data collection and verification of remote sensing data does not provide reliable results. Thus, strategic planning and searching out for funding and/or collaboration opportunities allowing utilization of mobile and/or permanent monitoring stations (through acquisition, loan etc.) for collecting data (that cannot be gathered using other methods), needs to be implemented into a common business practice.

Considering the biological aspect of the ecosystem, holistic monitoring should be introduced. The number and biomass of zooplankton microfilters are important for a stable lake ecosystem, because they feed on phytoplankton and thus reduce their biomass. The relationship between macrophytes, zooplankton and fish, which are a significant predator of zooplankton, is very important. Therefore, it is necessary to have a holistic monitoring programme that takes into account all groups together: phytoplankton, zooplankton, macrophytes and fish and model the entire food network.

5. Elements of the participatory process for the Vransko jezero Nature park Pilot Area

5.1 Stakeholders involved

The participatory process involved 42 stakeholders. Representatives of the local, regional and national public authorities and related entities were from the Ministry of Economy and Sustainable developement, Ministry of Economy and Sustainable developement- Nature protection department, Ministry of Agriculture, Zadar county, City of Benkovac, City of Biograd, Pakoštane Municipality, Croatian National water management company, National forest management company Croatian Forests; Benkovac local office, Zadar County public institution for Nature protection Natura Jadera, Croatian academy of arts and Science Department for ornithology. From the regional and local development agencies, environmental agencies and regional associations very interested in participation were NGO Ecologica, FLAG Lostura, NGO WWF Adria, Agency for rural development AGRRA, NGO BIOM and Colić trade - private company for agro technical equipment. Representing the Universities and research institutes were from the Geology and Biology departments from Science faculty of Zagreb, Faculty of civil engineering Rijeka and University of Zadar. The local community consisted of 20 farmers. The process outcomes have collected and consolidated the contributions, ideas and solutions of the above-mentioned stakeholders that are relevant to

the climate change adaptation plan and on the basis of the same, devised measures and activities of the adaptation plan (Figure 7.).

5.2 Design and implementation of the participatory process

The participatory methods used semi structured interviews with 12 local stakeholders (local, regional and national public authorities and regional and local development agencies). The main goal was to get an overview of the main decision makers in the broader Nature park area connected with nature protection, water management and agriculture sectors.

In the period May-June 2021, 20 agricultural producers who cultivate the land and / or are engaged in livestock production along the Vransko Lake area were surveyed. The questionnaire consisted of 21 questions. Also, focus groups, meetings of all three planned focus groups had been held. Two focus groups involved local farmers and small agriculture producers and the third included Ngo-s. A total of 50 participants participated in the focus groups. Three stakeholder workshops with introductory presentations and plenary sessions and facilitated discussions with participants were held. A total of 45 stakeholders participated in the workshops. The workshops were thematic: 1st workshop tackled the knowledge and results of analysis of the impact of Climate change on Vransko Lake with regard to hydrology, sediments, and biodiversity. The 2nd workshop had the topic of Sustainable water management in the light of climate change and the 3rd workshop concerned agriculture and climate change and measures for adaptation to climate change in agriculture.

Figure 7. Participatory process stakeholders in different process events

5.3 Outcomes of the participatory process

The process outcomes have collected and consolidated the contributions, ideas and solutions of the above-mentioned stakeholders that are relevant to the climate change adaptation plan; and on the basis of the same, devised measures and activities that will contribute to good water management and environmentally friendly water flow in the area of Vransko Lake Nature park.

The most important topics discussed were measures of cultivating resistant plant species and varieties, building organic matter in the soil or increasing the carbon content of the soil; soil conservation treatment that are all a part of the regenerative agriculture conceptual design.

Since the Public Institution is not directly responsible for the implementation of adaptation measures to climate change in agriculture, especially on privately owned agriculture land, the planned activities can only be informing, raising awareness of farmers and other responsible institutions, implementing projects in cooperation with farmers and associations, coordination and facilitation with relevant institutions (Croatian forest company, Croatian Waters company, municipalities, and counties), organization of fairs, sales stands, production of leaflets and brochures. Records of meetings, workshops and education with local farmers (number of meetings, number of attendees, topics, etc.), number and type of publications intended for farmers, records of joint activities and projects (number, topics, etc.), etc. can be kept. Vransko jezero public institution does not have the necessary competence, nor the necessary resources, to implement all necessary measures and interventions, especially on water resources, so the implementation of concrete practical actions requires cooperation with Croatian Waters with the unequivocal support of relevant ministries, especially the Ministry of Economy and sustainable development, but also the Ministry of Physical Planning, Construction and State Property. Also, future EU projects are planned as pilot scheme for carbon sequestration and water quality preservations as a measure of adaptation to climate change.

6. Adaptation Plan for the Vransko Lake Nature park Pilot Area

6.1 Jurisdictional framework

The area along Vransko Lake (the catchment area of Vransko field) is an agricultural area, with about 700 ha of utilized agricultural area, cultivated by about 300 farmers, mostly small family farms. Agriculture, along with tourism, is one of the most important economic activities of the population within the Park and in the vicinity of the Park. The area is dominated by a mosaic landscape intertwined with dry stone walls, huts and mounds, woven from olive groves, vineyards, vegetable and field crops, with some pastures, which are mostly used for grazing sheep.

Apart from the economic sense, agriculture has an extremely important role in the cultural and historical heritage of the region, as evidenced by centuries-old olive groves, dry stone walls, folk costumes, agricultural tools and more.

However, the area along Vransko Lake is not only agricultural, but also known for its natural values. Due to its valuable species and habitats, it is protected at the state level. Vransko jezero Nature Park, Ornithological Reserve and Associated Ecological Network Areas (PU 6163) Management Plan, includes two areas protected in categories under the Nature Protection Act (OG 80/13, 15/18, 14/19, 127/19) and two ecological network sites according to the Decree on the ecological network and the competencies of public institutions for the management of ecological network areas (OG 80/2019). These are the Vransko jezero Nature Park and the ornithological reserve located in the north-western part of Vransko jezero and the area of the ecological network Vransko jezero and Jasen protected as important for the conservation of birds (HR1000025) and for the conservation of habitats and species (HR5000025), and the ecological network Ravni kotari (HR1000024). The management plan aims to preserve seven target habitat types, two of which are priority habitat types (Mediterranean occasional ponds and *Thero-Brachypodiete* eumediterranean grasslands); as well as 60 target species, of which 54 are bird species. The total area of the area covered by the Management Plan is 5,913 ha. Administratively, most of the areas covered by the Plan are located in the Zadar County (85%), and a smaller part within the Šibenik-Knin County (15%).

Agriculture is extremely important for the preservation of nature in the area of Vransko lake. Guidelines for conservation measures of an internationally important area for birds, and an important area for wild taxa and habitat types, which directly or indirectly relate to agriculture include:

- Careful implementation of land reclamation
- Reduction of pumping excessive amounts of water from lake tributaries
- Providing incentives for traditional agriculture and livestock
- Prevent lawn overgrowth
- Purposeful and justified land conversion
- Providing incentives for biodiversity conservation
- Preservation of water and wetland habitats in the most natural condition, and their eventual revitalization
- Ensuring a favourable amount of water in aquatic and wetland habitats that is necessary for the survival of habitats and their significant species
- Preservation / improvement of favourable physical-chemical properties of water
- Maintaining a favourable water regime for the preservation of wetland habitats
- Conservation of biological species important for habitat type
- Prevention of the introduction of foreign (non-native) species and genetically modified organisms;
- Avoidance of watercourse regulation and changes in the water regime of water and wetland habitats if this is not necessary to protect the lives of people and settlements
- Preservation of a favourable ratio between lawns and shrubs, including prevention of succession processes (prevention of overgrowing of lawns and bogs, etc.)
- Preservation of favourable low levels of mineral values in soils of dry and wet lawns.

Agricultural area of the Park

The area of the Vransko jezero Nature Park and the Vransko jezero Special Ornithological Reserve is 5,740 ha (MGPU, 2012). However, fertile agricultural land makes up only 3% of the Park area, ie. 175 ha (MGPU, 2012). Of this, 116 ha belong to "valuable arable land" and 59 ha to "particularly valuable arable land" (MGPU, 2012). However, there is even more agricultural land in the Park, as an additional 1,062 ha (19% of the Park area) is "other agricultural area, forests and forest land" (MGPU, 2012). To this should be added about 130 ha of agricultural land in the nearby floodplain Jasen, which is located in the ecological network Natura 2000, and the management is committed to the Public Institution Nature Park Vransko jezero. In total, therefore, it is a matter of approx. 300 ha of fertile agricultural land, the management of which is under the jurisdiction of the Public Institution Nature Park Vransko jezero.

Land resources and their management

Most of the land of the total area of the Nature Park, as well as the entire area of Jasen, is owned by the Republic of Croatia. In addition to the Public Institution of the Nature Park, on behalf of the state as the owner, the state-owned companies Croatian waters and Croatian forests manage about 80% of the area of the Nature Park. Croatian Waters is responsible for the pump at the exit of the Main Channel (Kotarka) into the lake, which controls the water level in the Jasen area. Croatian Waters is also responsible for maintaining canals in the lake area and for measuring water levels, watercourses and water quality in and around the Nature Park. Management of sites with archaeological, cultural and historical heritage in the Nature Park is the responsibility of the Regional Institutes for Cultural Protection. National energy company (HEP) is responsible for transmission lines and the local electricity network that enters the area of the Nature Park. In the area of the Nature Park and Jasen there are parts of the state and joint hunting grounds Biograd, Vransko and Pirovac managed by local hunting associations.

6.2 Identification of the vision for the Vransko Lake Nature park Pilot Area

The Adaptation plan for Vransko lake Pilot area is in line with the objectives, measures and activities of the Climate Change Adaptation Strategy in the Republic of Croatia for the period up to 2040 with a view to 2070 (NN 46/2020), contributing to climate change adaptation measures for the area of water resources, agriculture and biodiversity sectors.

HM02: Support for planning, construction, reconstruction and upgrade of water protection systems and related other hydrotechnical systems (structural measures) and controlled flooded lowland natural floodplains as well as other water protection measures with priority application of river space and natural retention approaches

HM03: Strengthening professional, research and management capacities for assessing the occurrence and risk of negative impacts of climate change and adapting freshwater and marine water systems in current and future climatic conditions

HM 09: Strengthening the professional, research and management capacities for the protection of particularly valuable aquatic ecosystems

P-01: Implementation of a pilot research program on climate change adaptation in agriculture

P-02: Increasing the receiving capacity of agricultural soil for water

P-03: Application of appropriate tillage (eg. conservation tillage and other methods of reduced tillage)

P-04: Breeding of species and varieties of agricultural crops for the food and non-food chain and breeds of domestic animals that are more resistant to climate change

B-01: improving knowledge and creating databases to assess the vulnerability of (sub) natural ecosystems, habitats, wildlife, protected areas and ecological network areas in order to improve predictive models

B-02: Establishment of a system of monitoring climate factors and early warning for protected areas and areas of the ecological network and monitoring of ecosystems, habitats and wild species

B-03: Development and implementation of measures to strengthen the resilience of vulnerable ecosystems, habitats and species

B-04: Integrated resource management (freshwater, marine and terrestrial) for the purpose of conservation and revitalization of natural ecosystems and biodiversity

B-05: Inclusion of climate change adaptation measures in key documents of nature protection and its components and management of areas, species and habitats

B-06: Preservation and application of traditional agricultural practices and knowledge in order to strengthen the resilience of (sub) natural ecosystems, habitats and wild species

B-07: Improving sustainable management and reducing the anthropogenic impact on (pre) natural ecosystems, habitats and wildlife, primarily through sustainable development measures by applying nature-based solutions (NbS)

B-08: Strengthening the professional and financial capacities of the nature protection system

B-09: Transfer of knowledge on the importance of ecosystems, habitats, wild species, protected areas and ecological network areas and the importance of preserving ecosystem services in adapting to climate change

Vision of Vransko jezero Nature Park Pilot area

Awareness on climate change and its impact is raised and information on adaptation options is available to all. Agricultural production resulting from pilot adaptation measures in the Nature Park and the area of Jasen serve as example of good practice of adaptation to climate change and yield local agricultural products that protect nature. Such products are being promoted and marketed while the most endangered habitats and species are preserved by ensuring favourable hydrological regime and ecological requirements.

Vransko Lake water level is actively managed by mimicking the natural cycle of water dynamics – the cycles of flooding of natural meadows in the spring keeping the water level optimal for providing habitats important for migration and bird nesting. Freshwater ecosystem preserved by retaining sufficient fresh water in the lake, which prevents the penetration of sea water and salinization of lake waters. Measures to increase the humus

content of the soil should be the focus of any agricultural production. Adaptation to climate change, especially to the negative effects of drought is possible only if the soil has a good capacity for water, which is primarily achieved by increasing the soil's organic/carbon content. The Nature Park and Natura 2000 Jasen area has implemented regenerative measures to adapt to climate change on agricultural land, in order to revitalize part of the once drained wetland.

The general objectives are restoration and maintenance of a stable freshwater wetland ecosystem and preservation of the existing diversity of habitats, landscapes and geological phenomena, as well as restoring the target species of flora and fauna while offering the local community an opportunity for a higher quality of livelihood and development in accordance with nature.

6.3 Action Plan for the Pilot Area Vransko jezero Nature park and Natura 2000 site Jasen

In the Action plan four specific objectives (SO) are developed:

- Awareness on climate change and its impact is raised, and information on adaptation options is available to all
- The most endangered habitats and species are preserved by ensuring favourable hydrological regime and ecological requirements
- Agricultural production as a result of Pilot measures in the Nature Park and the area of Jasen is an example of good practice of adaptation to climate change
- Local agricultural products from pilot projects that protect nature are promoted and marketed

The activities designed to fulfil the objectives are chronologically organized in a way to first organize lectures, seminars, round tables, study trips for farmers as well as lobby and conduct public advocacy campaigns for the adoption of a legal framework for defining the environment flow and the inclusion of the area along Vransko lake on the list of areas vulnerable to nitrates in order to preserve biological diversity. It is of most importance in the first few years of the plan implementation to organize meetings, informal meetings and thematic focus groups to coordinate action and cooperation with partner institutions such as relevant ministries of agriculture and economy and sustainable development, counties and local self-government units, Croatian waters and the agriculture advisory service. Concerning the knowledge base on climate change effects the Public institution will both encourage and implement scientific research activities and monitoring of the ecological status of the Vransko Lake basin in cooperation with partner scientific institutions and Croatian waters. The plan strives to implement mini pilot projects for adaptation to climate change in cooperation with diverse stakeholders during the next 10 years. In order to support and encourage the adaptation process in agriculture production in the Vransko lake watershed area the Public institution will elaborate the criteria for local agricultural products whose production protects nature and in the same time contribute to the adaptation process, as well as organize sales fairs, allocation of points of sale for farmers in the Nature park, and produce promotional material for the certified products.

Pilot measures design

The plan strives to implement mini pilot projects for adaptation to climate change. The process of designing a pilot measure for carbon farming involves three important steps: the first is to identify what needs to be paid, the second is to calculate the amount to be paid, and the third is to determine which payment mechanisms to use. A measure for growing carbon can be designed in three ways: as a result-based measure (tons of carbon stored in the soil), as a measure based on prescribed practices or as a hybrid, where farmers are obliged to follow certain practices and receive additional payment according to the the result.

Options in which farmers implement measures over several years and then a "carbon bill" is made and paid according to the amount of carbon stored will probably be the least interesting for most farmers. In such a designed scheme, farmers have to wait several years for a return on their efforts and money to improve the soil. There is a risk that, despite the implementation of measures, the results will not be great. One of the possible options is some kind of advance payment, e.g. payment in annual instalments and at the end of the contracted period after the final calculation according to the result.

Farmers, at least in the initial periods of the introduction of such schemes, find it more interesting to pay based on results. Payments are probably lower, but the risk is lower. If the farmer implements the prescribed measures, he does not bear the risk if there are no results. In schemes where payments are according to the result, the result of the failure is borne by the farmer.

Hybrid schemes are probably the best option that will most motivate farmers to get involved. Three options are proposed for the implementation of a pilot measure for carbon sequestration in the area around Lake Vransko.

Option A: information scheme

This option refers to education and professional assistance to farmers. The pilot measure consists of education and development of a plan for carbon storage on the farm. With the help of advisers / consultants, the farmer develops a carbon maintenance / storage plan that includes the selection of the most appropriate measures. These measures may include the application of manure, the sowing of cover crops, sub-crops, intermediate crops, the design of appropriate crop rotation, the planting of hedges, the selection of drought-resistant species and varieties, pasture management, etc. The plan is made for a period of at least five years. This plan should also contain a proposal for the use of measures of the Strategic Plan of the Common Agricultural Policy of the Republic of Croatia for the period 2023-2030, which the farmer can use to implement the plan of maintenance / storage of carbon on his farm. In this scheme, there is no obligation for the farmer to implement the proposed measures or control their implementation. Farmers are not paid subsidies, but receive free education and a prepared plan for the implementation of measures.

Option B: pilot measure

This option refers to the application of a pilot measure for carbon storage in soil. The initial level of carbon in the soil is determined by taking soil samples for analysis. With the help of

advisers / consultants, the farmer develops a plan for the maintenance / storage of carbon on the farm, which includes the selection of the most appropriate measures (as in Option A). The plan is made for a period of at least five years. During the implementation period, the consultants visit the farmer once a year, analyse the implementation of the measures and, if necessary, adjust them based on experience in implementation and in agreement with the farmer. In the middle of the project implementation, control soil sampling and analysis are carried out. At the end of the project, the final measurement and analysis is performed, the amount of payment in relation to the amount of stored carbon is calculated and the support is paid to the farmer. The farmer obliges to maintain the achieved levels for at least 5 years after receiving the last payment, which is determined by re-analysis of the soil.

A hybrid model can be applied as well with annual payments for changes in management and the application of measures plus additional payments according to the established amount per tonne of sequestered carbon. This model, which combines payment for positive management measures and a bonus for the result achieved, is probably the most appropriate because it reduces the risk for the farmer and encourages him to apply the measures consistently.

Option C: planting trees

This option refers to the planting of selected tree species on arable land and pasture land. This can e.g. be a combination of wild species of fruit and poplar, holm oak, etc. Selected species must be domesticated in the area around Lake Vransko that require minimal care and attention. Farmers receive free advice when choosing the types and places of planting trees on agricultural land. In addition to the requirements for planting certain species, it is necessary to meet the minimum number of planted trees, which can be determined individually, depending on the size and position of the plots. A one-time fee is paid according to the determined amount per planted tree. The amount of the fee must be calculated to cover the cost of the seedling and an additional bonus for planting and caring for the trees.

Option D: Conceptual design Of Natura 2000 area Jasen

The conceptual design of regenerative agriculture in the area of Jasen and Jezerine considers three scenarios with different agricultural systems and practices depending on the water regime and changes in water regime that can be expected due to climate change (precipitation regime and intensity, sea level rise and consequent groundwater salinization and soil, etc.). All three solutions are based on greater retention of flood waters in the area of Jasen.

Scenario A is a conceptual solution of minimal changes in the current management of the water regime in the area of Jasen and Jezerine with the implementation of a pilot project to collect the necessary data for detailed design of technical solutions and testing of new management regime of intentional seasonal flooding of wet grasslands. Livestock and grassland wetlands are planned in the upper part of the Jasen area (Upper Jasen) (Anex I, Map no.6.).

The lower part of the area of Jasen (Lower Jasen) is due to maintaining the existing regime of drainage and pumping of water, ie. water retention of a less saturated zone, a planned agroforestry system with permanent crops of short rotation crops (SRC) and different inter-

row crops (combining arable farming, vegetables, meadows and pastures) (Anex II, Map no. 9).

According to Scenario B of the conceptual design, seasonal flooding of the entire area of Jasen (Upper and Lower Jasen, Anex III, IV, V Maps 07, 10, 05) is envisaged, ie the expansion of wetlands to the southern part of the area. By changing the mode of operation of CS Jasen, ie. by determining the minimum allowable level for pumping water from the drainage channel at 1.2 m above sea level, with the installation of dams and accumulation basins (widening and deepening of canals) along all drainage canals, additional saturation zones would be created, as well as additional ecological niches with reduced water levels in the drier part of the year.

According to Scenario C of the conceptual design (Anex VI), seasonal flooding of the entire area of Jasen (Upper and Lower Jasen) is envisaged, and consequently the expansion of wetlands to the southern part of the area. In the Jezerine area, it is planned to expand the flood zone to the northern part of the area by perforating the existing embankment and raising the level of the drainage siphon at 1.2 m above sea level, as well as in scenario B. (Održivo.doo., 2021.)

Challenges of introducing and implementing a pilot measure

At the level of Croatia, and thus for the area around Vransko Lake, there is no estimate of how much organic carbon in the soil can be sequestered by applying various agricultural practices, such as manure fertilization, green manure, etc. Without such assessments, which require years of soil research and analysis, it is impossible to start implementing a results-based carbon sequestration scheme. Such measurements are time-consuming and expensive, especially considering the small farms and plots characteristic of the area around Lake Vransko.

Advisers / consultants with sufficient knowledge of carbon farming measures are crucial for the implementation of this measure. Unfortunately, there are not enough such experts in Croatia. Therefore, before starting to implement these measures, it is crucial to train a sufficient number of experts who will give competent advice to farmers. The experience of existing European schemes indicates that the lack of experts with the necessary knowledge is one of the key elements of the (failure) of such schemes.

6.4 Monitoring plan

According to the Article 81. of the Nature Protection Act (NN 70/05 i 139/08), the management plan is implemented by the Annual Program for the Protection, Conservation, Use and Promotion of the Protected Area. This means that the Annual Programs incorporate activities from the management plan planned for that year, which, if it proves necessary, can be further elaborated within the Annual Program. Through the preparation of Annual Programs, the Public Institution can make minor changes to the planned management and check and redefine the implementation priorities (for that year).

Vransko jezero Nature park expert service creates an annual action programme and annual report with elaboration and evaluation of the results of activity implementation. The programme defines detailed stakeholder inclusion and indicator quantification. The quality of each activity is then subjected to the governing council of the Nature park and then sent for an evaluation to the Department of Environmental and Nature Protection in the Ministry of

Economy and Sustainable Development.

The action plan will be included in the General management plan of Vransko jezero Nature park currently being designed for the period of 2023 – 2032, with the year of 2022. being a transition year preceding the "new" Management plan.

The monitoring of the effectiveness of the activities will be conducted with the Management Effectiveness Tracking Tool (METT). It is a simple, fast, flexible and inexpensive tool for monitoring the effectiveness of management in protected areas. It is designed and implemented in the form of a questionnaire that managers fill out based on available data, and the results largely depend on their assessment. The questionnaire enables the assessment of the effectiveness of the protected area management, the monitoring of progress over time and the timely identification of the need to adjust the management. It is mainly used to identify trends and patterns in the management of individual protected areas. The indicators of the action plan are described in more detail in the Table 1.

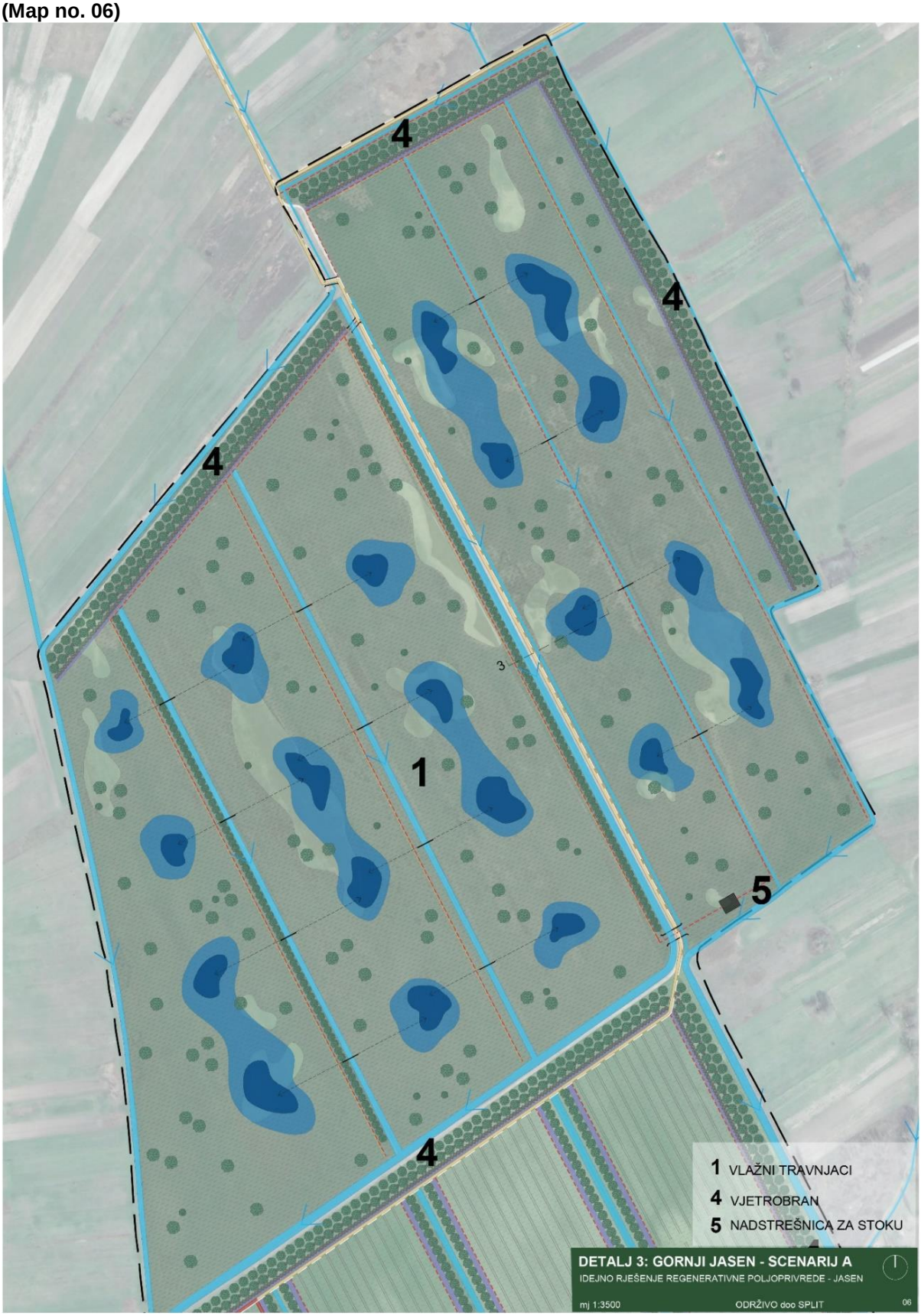
Monitoring the implementation and impact of the Action plan will be developed by checking the list of existing activities necessary for monitoring and development of new activities that will document the results of activities and achieving the specific objectives. The final list of monitoring activities must ensure that the expert service of the Nature park at any moment of implementation can determine the degree of implementation of activities, and the level of achievement of the specific objective.

7. Closing remarks and indications for the implementation of the Plan for the Pilot Area

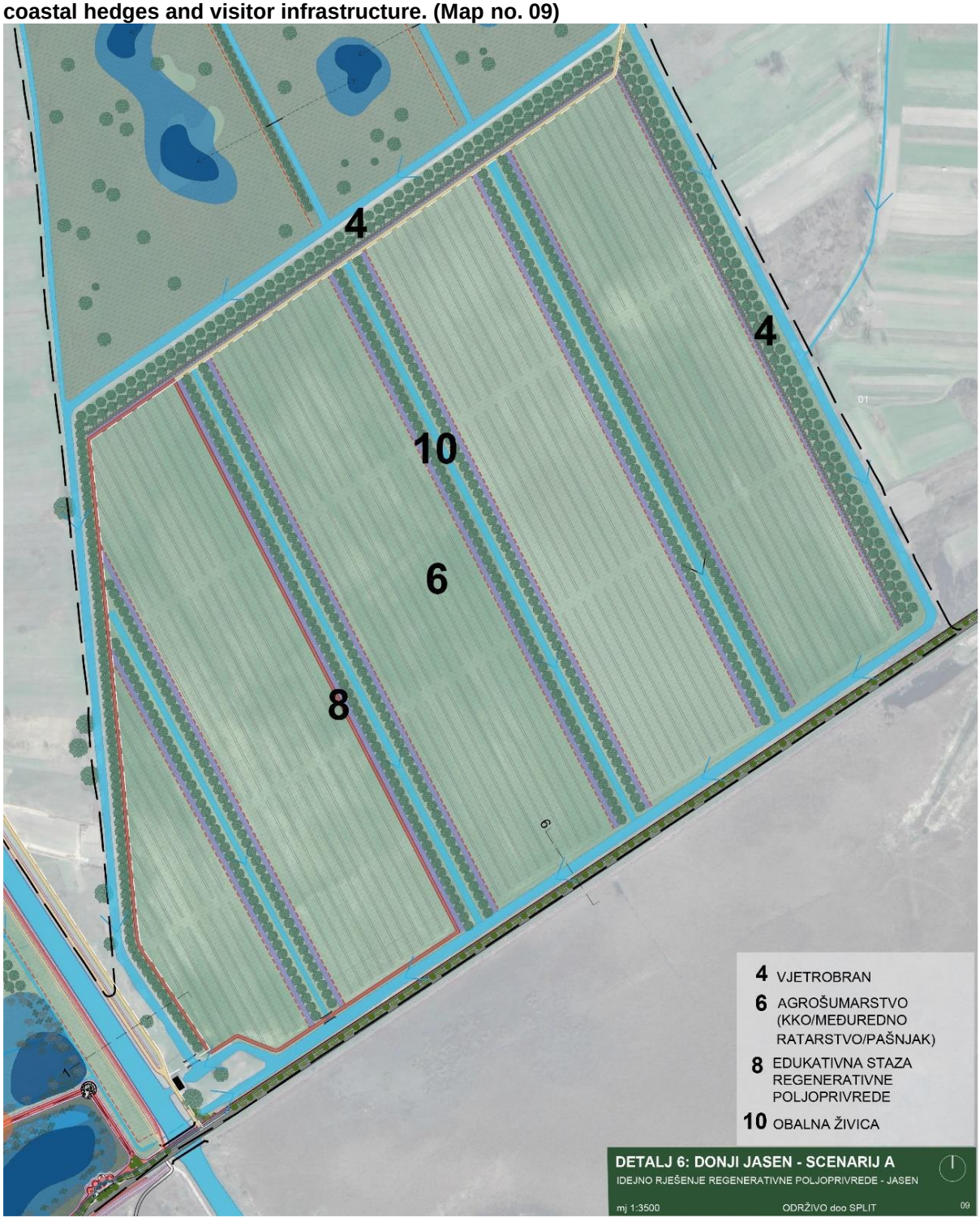
Several activities of the Action plan: Organizing lectures, seminars, round tables and developing educational materials for farmers as well as lobbying and conducting public advocacy campaigns and encouragement and implementation of scientific research are a part of the annual Plan of the Vransko lake Nature park already approved by The Ministry of economy and sustainable development prepared for implementation in 2022. The rest of the activities are planned for implementation in the period of 2023 – 2032. The whole action plan will be incorporated in the Management plan of Vransko jezero Nature park that is being designed and is planned to be finished by the end of 2022. The adoption of the general management plan with the action plan inside, will go through a formal procedure according to the article 134. of Nature protection Act (NN 14/19) with the consent of Ministry of Economy and Sustainable Development. The plan won't be subject of the Strategic Environmental Assessment procedure. The performance evaluation will be implemented by the expert service of the Public institution, on a yearly basis.

Annex: MAPS and TABLES

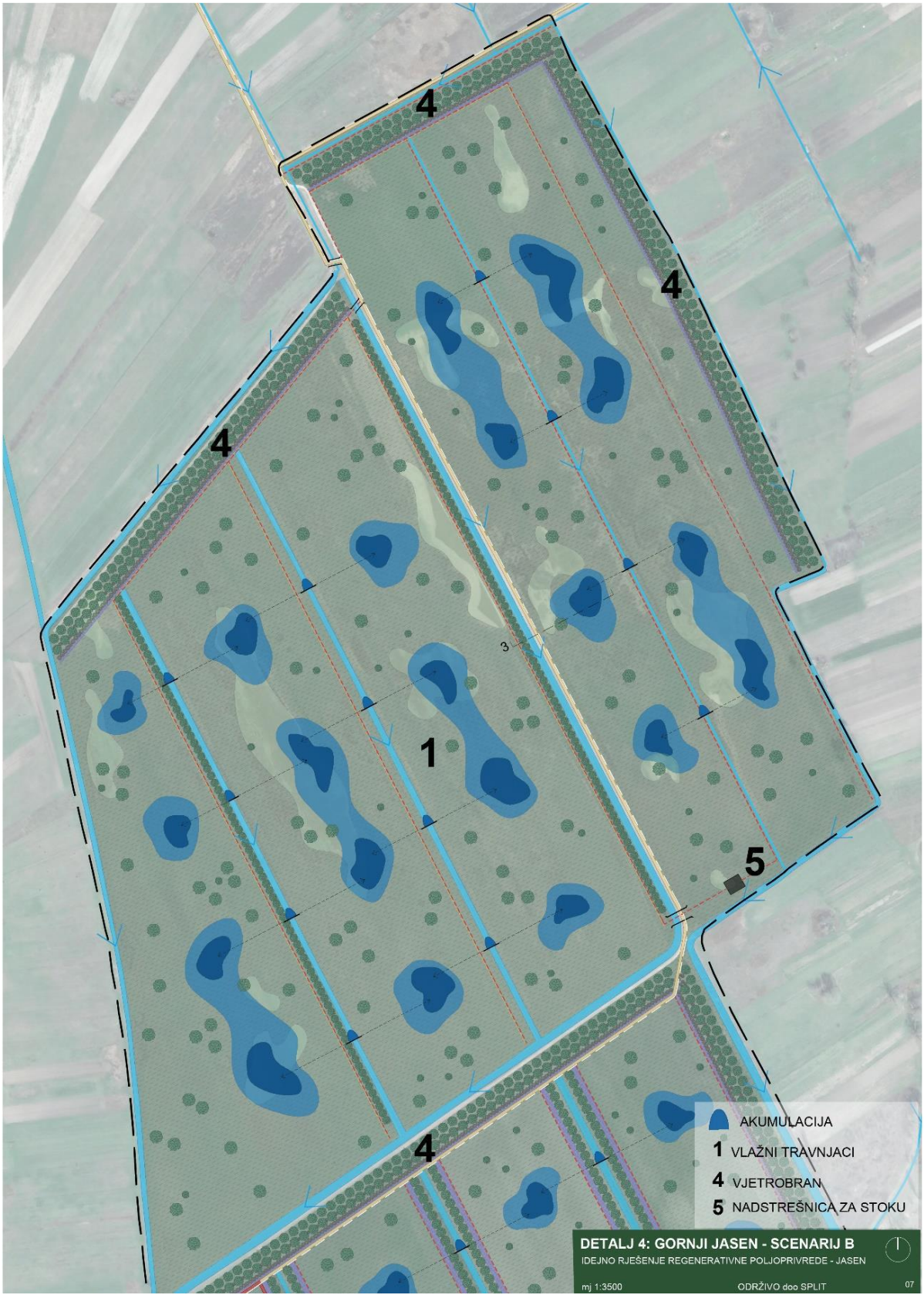
Annex I. View of the wet grasslands in the northern part of the Jasen area (Gornji Jasen) with constitutions, overflow ditches, retention areas and ponds, and windbreaks coastal hedges. (Map no. 06)



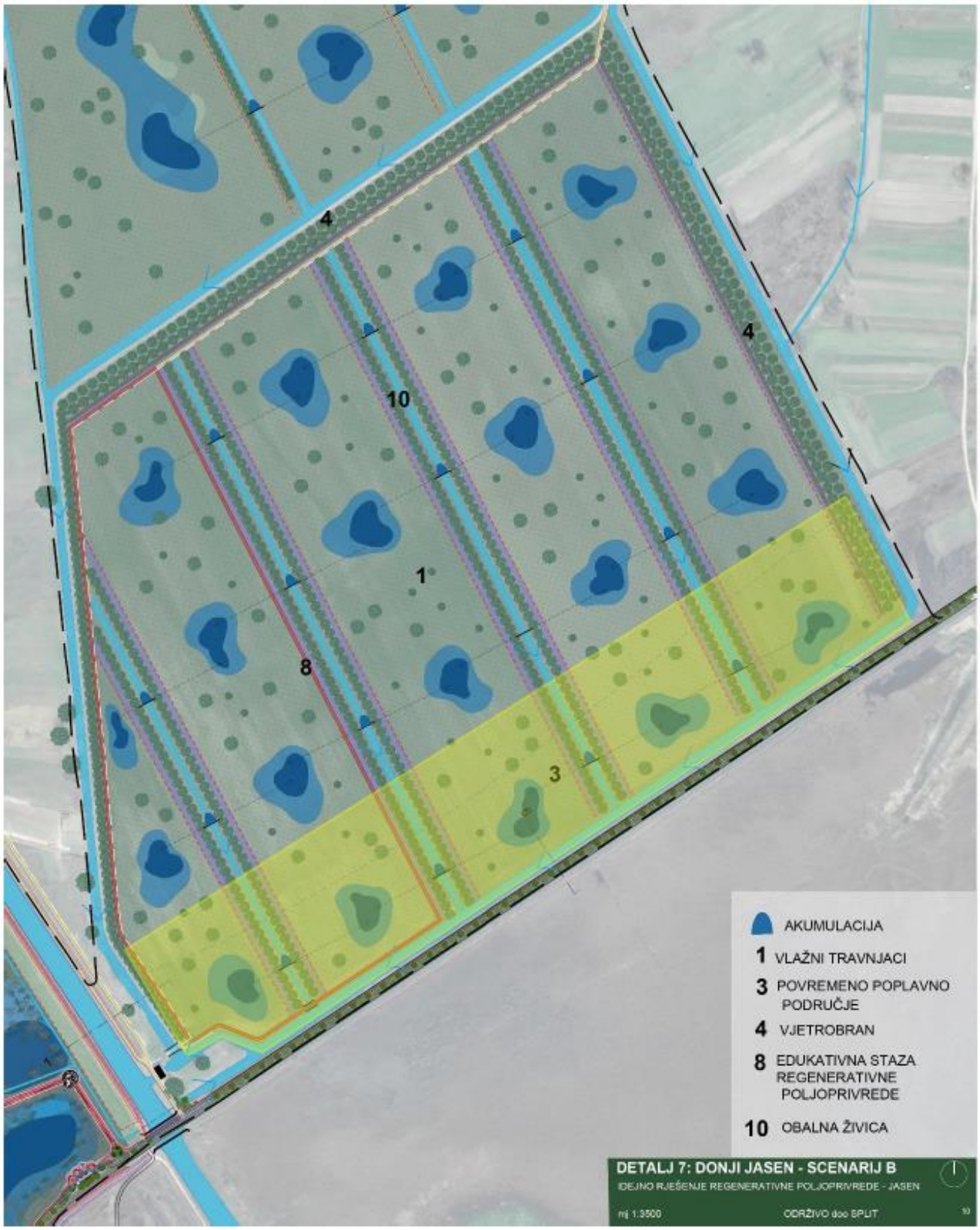
Annex II. View of the agroforestry system in the southern part of the Jasen area (Donji Jasen) with visible rows of short rotation crops and inter-row farming / pastures, windbreaks and coastal hedges and visitor infrastructure. (Map no. 09)



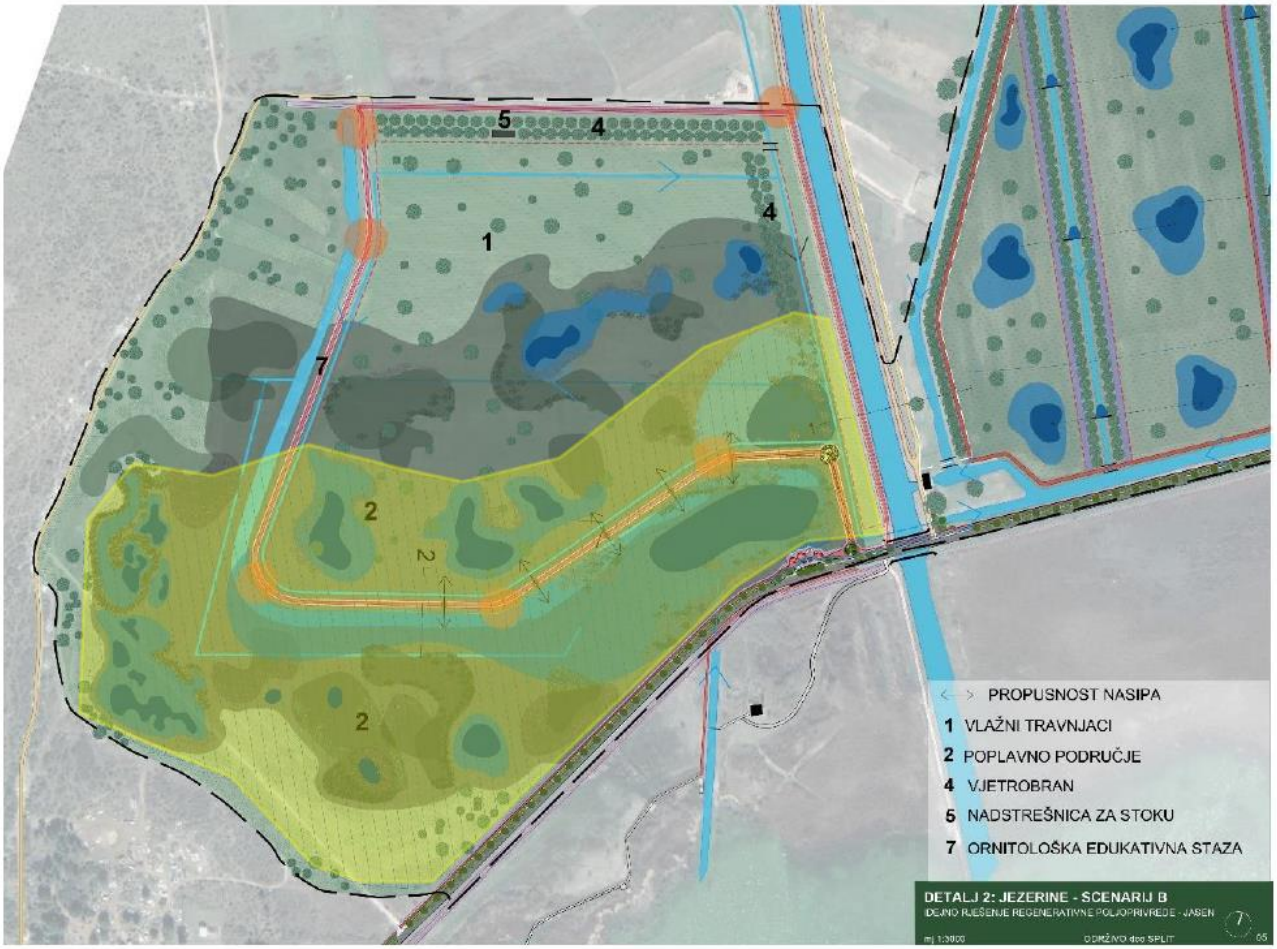
Annex III. View of the wet grasslands in the northern part of the Jasen area (Gornji Jasen) with constitutions, reservoirs, overflow ditches, retention areas and ponds, and windshields and coastal hedges. (Map no. 07)



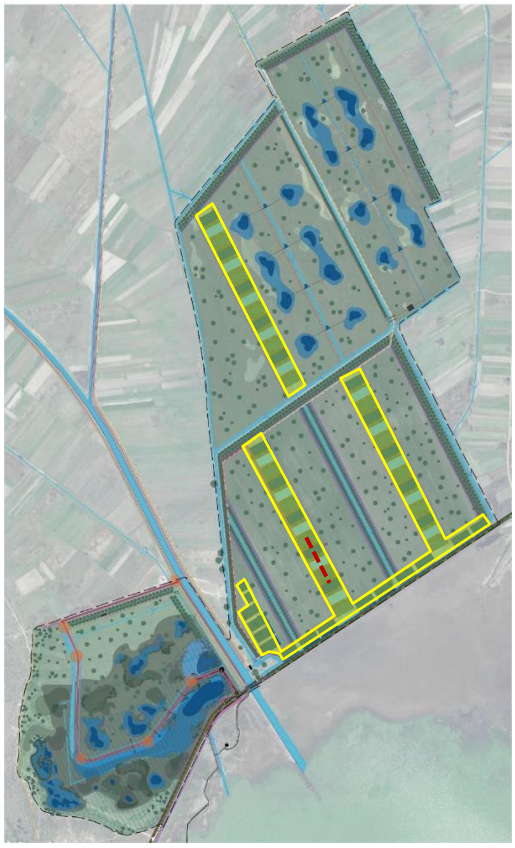
Annex IV. View of the wet grasslands in the southern part of the Jasen area (Donji Jasen) with constitutions, reservoirs, overflow ditches, retention areas and ponds, and windshields and coastal hedges. Occasionally flooded area is marked in yellow, marked with the number 3. (Map no. 10)



Annex V. Figure 17. View of the wet grasslands in the Jezerine area with marked floodplain (yellowpaint), retention areas and ponds, and windshields. (Map no. 05)

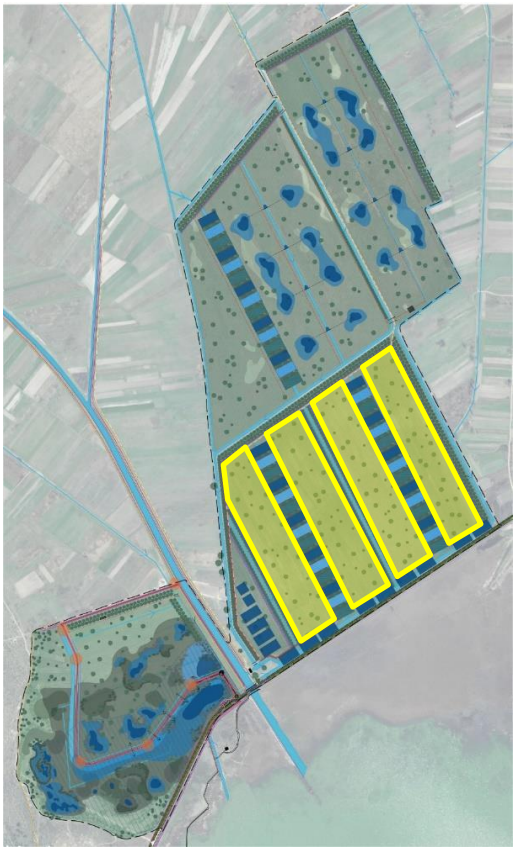


Annex VI. Scenario C elements marked in yellow



The aquaculture area

The area of wet meadows



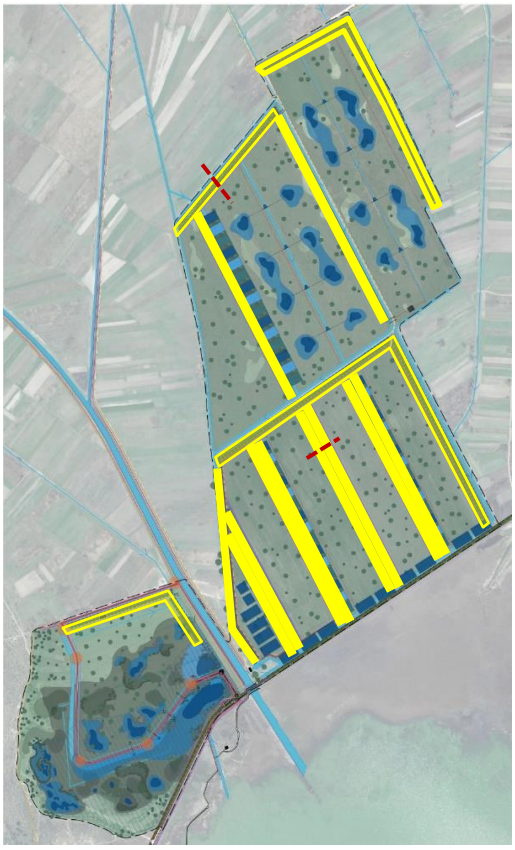


Table 1. Table Specific objectives, activities and indicators for the implementation of the Plan for Adaptation to Climate Change

No.	Specific Objective	Activity	Indicator of Implementation	Associates	Cost (HRK)	Cost (EUR)	Sources of funding	Timeframe
1.	Awareness on climate change and its impact is raised, and information on adaptation options is available to all	Organize lectures, seminars, round tables, study trips for farmers (on climate change adaptation measures, smart irrigation and other measures that contribute to good water management and biodiversity conservation)	Number of lectures, seminars, round tables, study trips Number of participants in lectures, seminars, round tables, study trips	*Agriculture advisory service, external expert associates, Agency for rural development of Zadar County, Zadar county and Pakoštane municipality, NGO-s, scientific research institutions, media representatives, farmers*	950.000	126.667	*Own funding public institution Nature park, EU projects (eg Interreg, H2020, LIFE, etc.), national funds, local government and county funds, participation / registration fee for participants*	*2022-2032*
		Develop educational materials for farmers	Number and quantity of educational materials (manuals, videos, posters)	*Agriculture advisory service, external expert associates, NGO-s scientific research institutions, media representatives*	200.000	26.667	*Own funding public institution Nature park, EU projects (Interreg, H2020, LIFE, etc.), national funds, local government funds and counties*	*2022-2026*
		Organize meetings and expert guided events for journalists and partners	Number of organized meetings and expert guided events Number of participants on organized meetings and expert guided events Number of published informative articles and posts on social networks	*Relevant ministries, Croatian Waters, associations, business sector, media representatives*	150.000	20.000	*Own funding public institution Nature park, EU projects (Interreg, LIFE, etc.), national funds, local government funds and counties*	*2023-2032*
		Organize exhibitions and festivals and produce information and promotional materials for the general public	Number of organized exhibitions and festivals for the public Number and quantity of information and promotional materials for the public (leaflets, posters, picture books, quizzes, games, comics, etc.)	*Agriculture advisory service, external expert associates, local self-government units, associations, scientific research institutions, media, farmers*	300.000	40.000	*Own funding public institution Nature park, EU projects (Interreg, H2020, LIFE, etc.), national funds, local government funds and counties*	*2023-2032*
2.	The most endangered habitats and species are preserved by ensuring favourable hydrological regime and ecological requirements	Lobby and conduct public advocacy campaigns for: 1. Adoption of a legal framework for defining the environment flow 2. Inclusion of the area along Vransko lake on the list of areas vulnerable to nitrates in order to preserve biological diversity	Number of direct communications with state and local officials and officials, representatives of public institutions and companies, representatives of the private sector Number of advocacy campaigns organized and / or participated in by the Public Institution	*Relevant ministries, Croatian Waters, external experts, associations, business sector, media representatives, farmers*	200.000	26.667	*Own funding public institution Nature park, EU projects (Interreg, LIFE, etc.), national funds, local government funds and counties*	*2022-2027*
		Organize meetings, informal meetings and thematic focus groups to coordinate action and cooperation	Number of organized meetings, informal meetings and focus groups with relevant stakeholders and potential partners and number of participants	*Relevant ministries, counties and local self-government units, Croatian Waters, Advisory Service, external expert associates, NGO-s, business sector*	100.000	13.333	*Own funding public institution Nature park, EU projects (Interreg, LIFE, etc.), national funds, local government funds and counties*	*2022-2021*

		Encourage and implement scientific research activities and monitoring the ecological status of the Vransko Lake basin	Number of organized professional meetings and number of participants	*Scientific research institutions, external expert associates, NGO-s*	900.000	120.000	*Own funding public institution Nature park, EU projects (Interreg, H2020, LIFE, etc.), national funds*	*2022-2032*
			Number of studies conducted and applied research					
3.	Agricultural production as a result of Pilot measures in the Nature Park and the area of Jasen is an example of good practice of adaptation to climate change	Implement mini pilot projects for adaptation to climate change (proposed options A, B and C)	Project proposal prepared and submitted for funding (LIFE, Interreg)	*Agriculture advisory service, external expert associates, Agency for rural development of Zadar County, Zadar county and Pakoštane municipality, NGO-s, scientific research institutions, media representatives, farmers, business sector*	16.100.000	2.146.667	*Own funding public institution Nature park, EU projects (Interreg, LIFE, etc.), national funds, local government funds and counties, business sector*	*2023-2032*
			Number of farms / beneficiaries involved in project activities					
			Number of adjustment plans developed					
			Number of soil analyses performed					
			Number of trees planted					
		Implement scenario A of the conceptual design of regenerative agriculture in Jasen and monitor the effects of adaptation measures	Surface area (ha) of regenerated agriculture (wet grassland livestock and agroforestry)	*Zadar County, Municipality of Pakoštane, Ministry of Agriculture, Ministry of Economy and sustainable development, Local action group Laura, Biograd (Business Incubator), farmers*	12.000.000	1.600.000	*Own funding public institution Nature park, EU LIFE or Interreg*	*2023-2032*
			Number of farmers involved in production					
4.	Local agricultural products from pilot projects that protect nature are promoted and marketed	Elaboration of criteria for local agricultural products whose production protects nature	Clearly defined criteria applied in the selection of the producer	*Local action group Laura, Biograd, Agriculture advisory service, external expert associates, Agency for rural development of Zadar County, NGO-s, farmers*	10.000	1.333	*Own funding public institution Nature park, EU projects (Interreg, LIFE, etc.), national funds*	*2024-2026*
		Organize sales fairs	Number of organized sales fairs	*Agency for rural development of Zadar County, Local action group Laura, Biograd (Business Incubator), Zadar county and Pakoštane municipality, business sector*	300.000	40.000	*Own funding public institution Nature park, local government funds and counties, business sector*	*2024-2032*
			Number of farmers-exhibitors at fairs					
		Allocation of points of sale for farmers in the Nature park	Number of permanent and occasional outlets	*Agency for rural development of Zadar County, Local action group Laura, Biograd (Business Incubator), Zadar county and Pakoštane municipality*	150.000	20.000	*Own funding public institution Nature park, local government funds and the counties*	*2024-2032*
		Production of promotional materials (posters, leaflets, brochures, videos, bags, T-shirts, hats, cups, pens, etc.)	Visual identity created for products	*Agency for rural development of Zadar County, Local action group Laura, Biograd (Business Incubator), Zadar county and Pakoštane municipality, business sector*	300.000	40.000	*Own funding public institution Nature park, local government funds and the counties*	*2024-2032*
			Number of manufacturers using visual identity					
			Number of products using visual identity					
			Number and quantity of promotional materials produced					
Total:					**31.660.000**	**4.221.333**		

Literature:

Biondić, R., Biondić, B., Rubinić, J., Meaški, H., (2011): Assessment of the status and risk of groundwater bodies in the karst area of the Republic of Croatia. Croatian waters face the challenge of climate change 479.

Dvokut Ecro, (2017): Environmental impact study of the irrigation system Vransko polje - 1st phase. Dvokut Ecro d.o.o., Zagreb.

HBOD (2021): Research on the composition of algae species of the Characeae family Final report 2018.– 2021., Alegro A., Koletić N., Rimac A., Šegota V., Vuković N., Zagreb

Katičin, D., Ćuže Denona, M., Fressel, N., (2017): Pedo-geochemical characterization of agricultural soils of Lake Vrana, in: Proceedings Management of lakes and reservoirs in Croatia - processes, protection and valorization. Croatian Society for Water Protection, Zagreb.

Ministry of Physical Planning, Construction and State Assets (2012) Spatial plan of Nature Park Vransko Lake, Ministry of Construction and Physical Planning, Zagreb.

Održivo. doo. (2021): Conceptual design of regenerative agriculture for adaptation to the effects of climate change in the area of Jasen in the Natura 2000 area of Vransko Lake and Jasen, Biščević C., Bota H., Gracin M., Ivasović H., Trifunović V., Zlojtro I., Split.

ELEKTROPROJEKT (2017): Sustav navodnjavanja Vransko polje – Idejno rješenje – I faza (Nos. zad. Heček, N.). Zagreb, unpublished

Rubinić, J. (ed.), (2017): Proceedings Management of lakes and reservoirs in Croatia - processes, protection and valorization. Croatian Society for Water Protection, Zagreb.

Rubinić, J. (2014): Vrana Lake in Dalmatia and climatic influences. Faculty of Civil Engineering, University of Rijeka, doctoral thesis.