Co-Creating Nature Based Solutions for Hazards In Divjaka

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Abstract

The project was centered on identifying climate-related hazards through stakeholder experience in Divjaka. From this discovery, participatory planning methods were used to design and develop potential solutions to these hazards using nature. Nature-based solutions (NbS) are being considered for this project because of their lower environmental impact and ability to provide secondary benefits. Our sponsor, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), has applied NbS to other places in Albania, and Divjaka was chosen for this new project because of the importance of the local environment to regional livelihoods. Through the process of community co-design, as well as meetings with local environmental agencies and municipal employees, four potential interventions were chosen.

Acknowledgements

We want to thank all the people who contributed to the completion of this project. This project could not have been possible without the inviting community in Divjakë. Special thanks to Klevisa Decja for connecting us with many of our stakeholders. Thank you, Megi Meksi and Melanie Doka, for acting as our translator, guides, research partners, and friends during our time in Divjakë. Thank you, Ramadan Xhelaolimi, for being our driver and companion. Despite the language barrier, we shared many laughs while on the field, which made our time traveling much more enjoyable.

Thank you to FMO, JICA, RAPA, PPNEA, INCA, and Albert Lika for speaking with us and providing insight into the issue of erosion in Divjakë and solutions to mitigate it. Thank you to the high school students in Divjakë for being enthusiastic and caring about our environment. Your contributions to ideas for nature-based solutions and recommendations for increasing community engagement opened our eyes to how much you want to be involved in ensuring our planet is safe. May your ideas flourish.

Acknowledgements

We want to acknowledge our advisors, Professors Robert Hersh and Professor Leslie Dodson, for their guidance, passion, and dedication to our project. Thank you for continuously challenging us to look deeper, ask more questions, and use different strategies to elicit rich conversations.

Lastly, we would like to thank everyone in the GIZ office for being so inviting and helpful. We'd like to especially acknowledge Rrezearta Ago and Merita Mansaku-Meksi, who acted as our primary sponsors and liaisons to the project. They reminded us there was no such thing as a silly question and encouraged us to dig deeper and learn from the community. We are grateful for the opportunity to work on an issue affecting our environment and learning strategies that work with mother nature.

Authorship

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Executive Summary	Luke	All
Introduction	Nora	Luke
Background	All	Nora
Methods	All	All
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Recommendations	Cristobal	All
Conclusion	Nora	All

Meet the Team

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Executive Summary

Traditionally, engineering projects that use concrete and steel have dominated efforts to reduce and manage the impacts of coastal flooding, sea level rise, and erosion. However, with the effects of climate change growing increasingly concerning, some focuses are shifting towards implementation of nature-based solutions, or NbS. These systems have many definitions, with one being “living solutions inspired by, continuously supported by and using nature, which are designed to address various societal challenges in a resource-efficient and adaptable manner and to provide simultaneously economic, social, and environmental benefits” (Martin, 2020, p. 1). For our project, we will look at NbS as a way to mitigate hazards around Divjaka, a municipality in Albania.

In order to determine the best solutions, we first needed to gauge the community’s interest. Through various interviews, workshops, and site visits, our team wanted to learn about the perceived climate change related hazards, their current strategies to mitigate these hazards, and any solutions they could suggest to us. We then took these recommendations, researched their usage on how it could be applied to a river or lagoon in Albania, and then brought the proposal back to the stakeholders to receive their feedback. We co-created four NbS throughout the park and overall they were supported by most stakeholders.

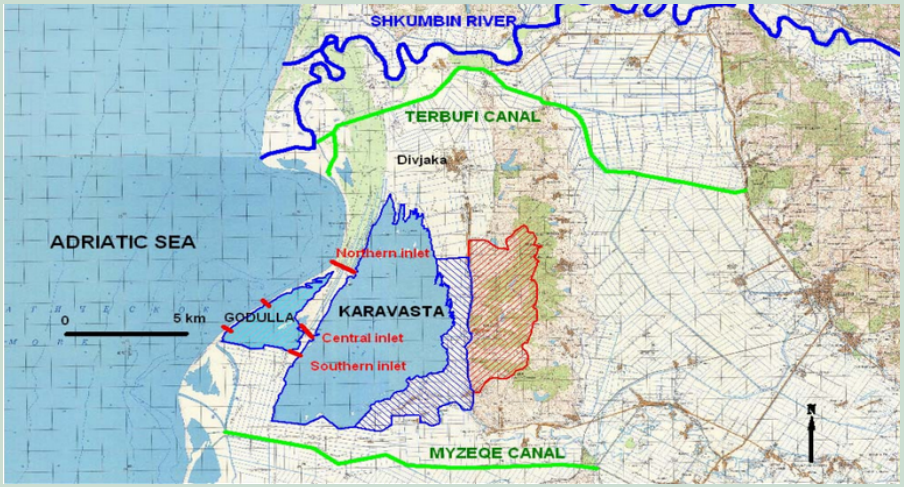

Figure E.1: This is a map showing the watershed and areas of the park that we focused our attention on throughout the project.

To provide some background, the Divjaka-Karavasta National Park is located in Divjaka. The boundaries of this park span north to south from the Shkumbini River to the Semani River and east to west from the Adriatic Sea to the mountains. The park is divided into different zones that have varying degrees of regulations and protection from the Regional Administration for Protected Areas (RAPA). Located in the park is the Karavasta Lagoon. This lagoon is directly connected to the Adriatic Sea by the northern channel.

Also, there are the central and southern channels that connect the Karavasta Lagoon to the Godulla Lagoon, a smaller lagoon, and the Godulla Lagoon to the Adriatic Sea. We learned that soil is eroded from the banks of the Shkumbini River. These sediments are then carried out from the river and into the sea. From here, the southeast winds force the sediments to be deposited along the coast, including in the northern channel. This causes the channel to be filled, blocking the lagoon's only connection to the sea.

Figure E.2: On our site visit to FMO's headquarters, we found fishermen repairing nets for the upcoming eel season.

We hosted interviews with various stakeholders to determine what was going on inside the park and who was being affected. We conducted these meetings with Divjaka municipality staff, RAPA, the Japanese International Cooperation Agency (JICA), the Protection and Preservation of Natural Environment in Albania (PPNEA), the Institute for Nature Conservation in Albania (INCA), the Fishery Management Organization (FMO), and a shepherd named Albert Lika.

The interviews with FMO and Mr. Lika were site visits to the northern channel and the Shkumbini River, respectively. In all of these meetings, we asked about their experiences with climate change. We then proceeded to ask them how they have responded to the hazards presented by climate change and if they had any ideas involving environmental elements that they would want to propose to us.

We took some of their ideas and did some research of our own to co-create a proposal for four NbS in designated spots throughout the park. We brought these ideas to FMO, JICA, RAPA, the municipality staff, and Mr. Lika to gauge their opinions and interest in the proposal.

The four NbS that we proposed were riparian forest buffers along two different bends in the Shkumbini River, rock walls along three different bends in the Shkumbini River, sand dune reforestation of vegetation near the mouth of the Shkumbini River, and rock armor along the walls of the three lagoon channels. The riparian forest buffer was suggested by PPNEA, and when we brought this idea to them, JICA, RAPA, the municipality staff, and Mr. Lika, they all supported the idea. We also informed FMO about the idea, but they were indifferent because they told us that they did not have enough knowledge of the river to comprehend how this would help.

The rock walls along the Shkumbini River banks were also proposed by the municipality staff. These features have already been implemented in some parts of the river, but they are either deteriorated or non-existent in the spots we proposed. We brought our suggestions to the municipality staff, JICA, RAPA, FMO, and Mr. Lika. The staff, JICA, and Mr. Lika all loved this idea and were for it being implemented. FMO again just did not understand the hydrology of the river and were uncertain of the effects of the NbS. RAPA was against this idea saying that we should just leave nature to run its course.

Figure E.3: Location of proposed riparian forest buffers (yellow circles) and proposed rock walls (red circles) along the Shkumbini River

Figure E.4: Location of proposed rock armor along the northern channel

Figure E.5: Location of proposed sand dune vegetation

The sand dune vegetation restoration was suggested to us by PPNEA. We brought this idea to PPNEA, INCA, the municipality staff, JICA, FMO, and RAPA. PPNEA, INCA, JICA, and the municipality staff all agreed that this would be beneficial to prevent erosion occuring at the mouth of the river and then being carried down with the already large mass of sediments from the river. RAPA stated that we should only engage in dune preservation, not restoration. They did not say planting vegetation was bad, their only concern was that we were going to dump more sand on the beach. They said that this would be useless because all the sand would just be whisked away by the wind, but we were not proposing this method anyways. Again, FMO did not understand how the dunes related to the channel, so they were indifferent about this NbS.

JICA were the ones who had the idea to put rock armor in the channels, but FMO was the one to bring it to our attention. When we brought this idea to the municipality staff, JICA, FMO, and RAPA, they all supported this idea. This was the only proposal that received 100% support and zero direct concerns, other than cost.

Through our interviews and first hand experiences, we found that students are passionate about the environment and are willing to contribute. We think that the Divjaka municipality and the schools should partner with the NGO SHUKALB in order to create a youth council. This group would collect water sample data, implement certain NbS like trees along the river bank and dune shrubbery, and host environmental project fairs.

Figure E.6: Poor dune vegetation near the mouth of the Shkumbini River.

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Glossary of Acronyms

AKZM	Agjencia Kombëtare e Zonave të Mbrojtura (Refer to NAPA)
EbA	Ecosystem Based Adaptation
FMO	Fishery Management Organization
GIZ	Gesellschaft für Internationale Zusammenarbeit
IKI	International Climate Initiative
INCA	Institute for National Conservation in Albania
IUCN	International Union for Conservation of Nature
JICA	Japanese International Cooperation Agency
NAPA	National Administration for Protected Areas
NbS	Nature-based Solutions
NGO	Non Government Organization
PPNEA	Protection and Preservation of Natural Environment in Albania
RAPA	Regional Agency of Protected Areas
UNEP-WCMC	World Conservation Monitoring Centre

Chapter 1: Introduction

Introduction

Traditionally, engineering projects that use concrete and steel have dominated efforts to reduce and manage the impacts of coastal flooding, sea level rise, and riparian erosion. However, with the effects of climate change being felt internationally, new methods such as nature-based solutions (NbS) are gaining attention as flexible and resilient alternatives. The definition of nature-based solutions is “living solutions inspired by, continuously supported by and using nature, which are designed to address various societal challenges in a resource-efficient and adaptable manner and to simultaneously provide economic, social, and environmental benefits” (Martin, 2020, p. 1). For example, a project designed to protect and revitalize a forest near a river can reduce flood impacts, provides pollution filtration, and creates habits for native wildlife (UN Environment-DHI, 2018).

For our project, we will look at NbS as a way to mitigate hazards around Divjaka, a municipality in central Albania. The municipality is located by the coast of the Adriatic Sea and borders the Karavasta Lagoon, Albania’s largest lagoon. Climate-related hazards in this region include erosion around the Shkumbini River and drought and salinization in the Karavasta Lagoon.

The regional watershed, which includes the Karavasta Lagoon within the park, and the Shkumbini River along the northern border of the park, provides essential resources to the people living there. Fishermen fish in some parts of the lagoon, farmers work the land near the river, and tourists come to visit the beaches and bird watch. These natural features —the lagoon, rivers, and coastal areas, are affected by erosion and drought. Coastal erosion creates blockages in the lagoon's channels, limiting connection with the sea, leading to decreased oxygen levels and increased salinity within the lagoon's waters, harming fish populations, which in turn harms fishermen and birds. Riparian erosion encroaches on farmland and intensifies flooding of river-adjacent settlements, as well as accelerates problems with coastal erosion.

GIZ is interested in creating a few NbS that could have a positive holistic effect on the region. These NbS must be developed in cooperation with local stakeholders of varying goals. The process of consolidating varying ideas and working across stakeholder groups is fundamental for GIZ to understand future projects. This will also allow these NbS to be designed in such a way that they could potentially be implemented elsewhere at a later point in time, with minimal modifications. GIZ's past work in Albania has included ecosystem-based adaptation projects in Elbasan, and flood mitigation plans in Shkoder.

The goal of our project was to learn from local stakeholders about how hazards are impacting their community, and through collaboration identify nature-based solutions to increase resilience to those hazards. We gained an understanding of the hazards impacting agricultural land and bodies of water in Divjaka through interviews with environmental organizations and field visits. We interviewed residents of Divjaka to learn how they have responded to the effects of erosion, drought, and salinization - the hazards affected by climate change.

We worked with local stakeholders to develop guidelines around incorporated elements and system considerations of various NbS options. Then, in conjunction with our sponsor and community members, we determined interest around certain NbS aligning with the standards created by the locals, with special care given to preserving the native biodiversity. Our project included some broader outcomes as well: to broaden GIZ's network to a more rural area and to provide information that relates to a larger-scale project that our sponsors are working on for another organization, the Green Fund.

Chapter 2: Background

Background

Study Site Overview

Divjaka is a municipality in Albania, located within the region of Fier. Divjaka has a population of around 34,254 people, and the town of the same name has a population of 8,445 people (INSTAT, 2011). The region is largely rural, making agriculture a large contributor to its economy. Fier as a whole is essential to Albanian farming, ranking 3rd in productivity out of the 12 regions (Guri, 2015). Another important livelihood for the population of Divjaka is fishing, which is largely supported by the Karavasta Lagoon located in the west of the region, near the coast of the Adriatic sea. This lagoon and its surrounding land are a protected zone, referred to as the Divjaka-Karavasta National Park. This park plays a central role to the people living in Divjaka through farmland, fishing zones, and ecotourism (JICA, 2014).

Figure 2.1: This is a map of Albania, which highlights the various counties and the regions contained within them. Fier is located on the west coast near the center, and Divjaka can be seen as the most northwestern municipality within Fier. (Wikimedia Commons, 2012)

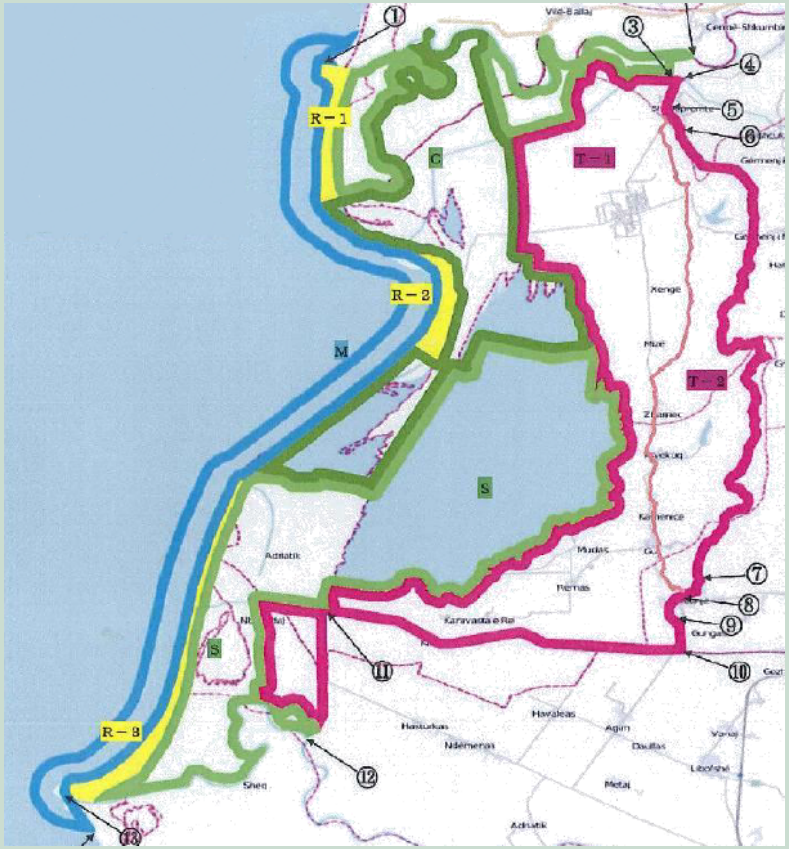


Figure 2.2: This map highlights the four subzones of the park. Dark green indicates the central subzone, light green indicates the sustainable use subzone, red indicates the traditional use subzone, and yellow indicates the recreational subzone. The map also indicates the marine zone in blue. (JICA, 2014)

Divjaka-Karavasta National Park

The Divjaka-Karavasta National Park spans a total area of 22,230.24 hectares, or around 55,000 acres (JICA, 2014). This area includes portions of the Shkumbini River bank and riverbed, the entirety of the Karavasta and Godulla lagoons, large areas of pine forests, and fields used for traditional farming. The park is broken into four zones, each with different permitted uses. These zones are defined as the center subzone, sustainable use subzone, traditional use subzone, and recreation subzone. Additionally, the area extending up to one kilometer out to sea has been designated as a marine zone (JICA, 2014).

The core subzone must not be disturbed because of the importance of the natural features. This zone contains the pine forest between the lagoon and the sea, the pelican breeding islands, and the Godulla lagoon, the smaller lagoon between the Karavasta Lagoon and the sea. The sustainable use subzone can be used for economic activities with the acquisition of a permit. Contained in this zone are the Karavasta Lagoon, everything between the riverbeds of the Shkumbini River, and the area between the southernmost channel and the Seman River. The traditional use subzone allows all traditional and economic activities with the possession of a permit. It encloses the agricultural lands, forests, and water resources that surround the eastern and southern shores of the lagoon. The recreational subzone encapsulates the shoreline from the Shkumbini River to the Seman river, which is used by tourists and visitors for recreation (INCA, 2014). New constructions of any kind are only permitted inside the recreational

subzone, but reconstruction of existing roads and buildings is allowed in all zones (AKZM). Additionally, scientific research is permitted in all zones of the park as well (AKZM).

These protected areas of the park are managed by the Regional Administration for Protected Areas (RAPA), which acts as the park services. This agency is under the National Agency for Protected Areas (NAPA), which is located in Fier. Small groups of rangers are tasked with protecting specific areas from illegal activity due to the large size of the park.

Karavasta Lagoon

The Karavasta Lagoon is the largest lagoon in Albania. This park was established in 2007 by the Council of Ministers of Albania. Even before this, the lagoon was protected by the Ramsar Convention in 1994 (INCA, 2017). The Ramsar Convention has declared the Karavasta Lagoon as a wetland of international importance as it contains a diverse set of plants and animals (Ramsar, 1971). One of the endangered species that rely on the lagoon is the Dalmatian Pelican, which breeds seasonally on a small island in the lagoon. Since the species has not responded to artificial habitats and relocation attempts, the well being of the birds is inextricably linked to the protection of the lagoon (Totoni, 2017). The Karavasta Lagoon is connected to the sea both directly and indirectly, as seen in Figure 3. The Godulla Lagoon connects the main lagoon to the Adriatic sea through two channels. The most northern channel connects the Karavasta Lagoon and the sea directly.

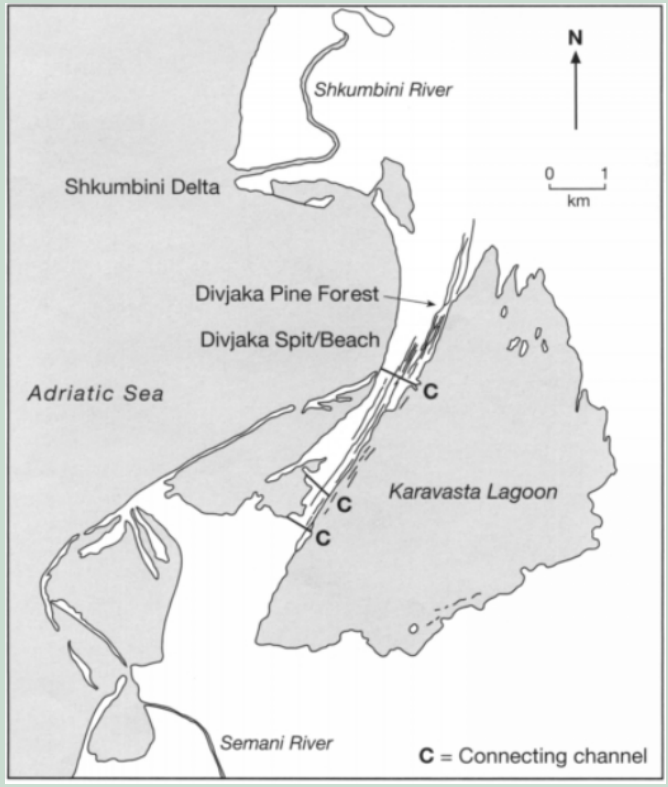


Figure 2.3: This map centers on the Karavasta Lagoon and the surrounding area. Areas of significance are marked with arrows, and the Karavasta Lagoon channels are labeled with the letter C. Notably, the Shkumbini River has changed course since the map's publication in 2003, and the Shkumbini Delta has now been largely eroded away. (Brew, 2003)

Shkumbini River

The Shkumbini River forms the northernmost border of the national park. It is one of the longest rivers in Albania at a total length of 181 kilometers and passes through multiple municipalities (Cullaj, 2005). Large amounts of deforestation have been recorded near the upper parts of the river, west of the source (Cullaj, 2005). Additionally, measurements taken of the Shkumbini show high concentrations of organic pollutants being found in the river, along with wood debris carried into the river by landslide and flash flood events (Cullaj, 2005). High quantities of sediments have also been recorded throughout the river, especially close to the outlet (Cullaj, 2005).

Hydrological System

Erosion and the Hydrological System

Erosion is defined by the process of ground sediment being removed and carried away from an area by natural forces (Erosion, n.d.). This phenomenon occurs in rivers where the water currents wash away loose soil on river banks. Then, the flow of water carries the soil downstream and deposits it further down the river or into the sea. (Das, 2019). This process is called deposition and, along with erosion, it changes the structure of rivers and water systems such as the Shkumbini River, Semani River and Karavasta Lagoon coastal area.

As mentioned previously, the Shkumbini River is a major river in Albania. It runs through two cities, Librazhdi and Elbasan, both of which collect monthly precipitation data. Librazhdi is located along the upper part of the Shkumini River and Elbasan sits near the middle. Librazhdi experiences more rainfall than Elbasan, which supports higher erosivity in the upper region. Moreover, the area of the Shkumbini River catchment is about 2444 km^2 (Ciavola, 1999). This means that there are high levels of sediment being washed away early in the geography of the river makes the Shkumbini especially susceptible to erosion.The Shkumbini River produces a sediment discharge of 7.6x106 tonnes per year. This sediment discharge to area ratio is high compared to other rivers found in the Balkans (Ciavola, 1999). According to a study conducted in 2010, they found that the amount of sediment deposited increases when the depth of the Shkumbini River decreases. This leads to an increase of eroded material found downstream of the river, where it becomes shallow (Saraci, 2017). Considering that the river's erosion risk is substantial throughout its course, this effect leads to compounding erosion risk closer to the river's mouth and higher deposition in the Adriatic Sea.

Deposition and the Consequences of Erosion

Lagoon Formation

The formation of the Karavasta Lagoon was possible through the dynamic hydrology of the region. As can be seen from Figure 2.4, the coastal area of the lagoon is characterized by the Shkumbini and Semani river deltas. Over time, sediments from these rivers have built up to the north and south of the lagoon. Sediments from the river deltas are responsible for the shape of the coastline and the

formation of the Godulla Lagoon. The shape and features of this area change rapidly, and influence the channels and how much water reaches the lagoon (Ramsar, 1996).

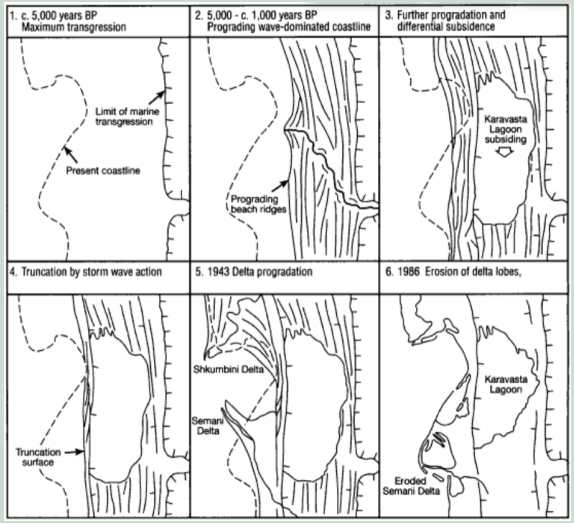


Figure 2.4. Diagram of the formation of the Karavasta Lagoon over 5,000 years (Brew, 2003)

Shkumbini River

The eroded material carried from the Shkumbini River into the Adriatic Sea is high, but the water discharged is low; therefore, there is an abundance of accumulated material found at the mouth of the river.

After the sediment leaves the river delta, waves and current coming from the Adriatic Sea push the sediment mass southwest towards the coast. The large amounts of eroded material reach the shore along the northern part of the Karavasta Lagoon. The deposited materials accumulate over time, causing the spit between the Karavasta Lagoon and Adriatic Sea to grow (Brew, 2003).

From data collected in previous studies, it can be determined that the geography and hydrology of the Shkumbini River basin and Adriatic Sea lead to the expansion of the northern coastline of the Karavasta Lagoon through eroded materials.

Figure 2.5: A particularly highly eroded bluff on the northern bank of the Shkumbini. When the river's water runs high it overflows into the nearby fields. The sediments that are eroded from this bank likely end up traveling downstream.

Figure 2.6: Satellite image of the Karavasta Lagoon. The northern channel can be seen right above the Godulla lagoon (Google Earth, 2022)

Livelihoods and Ecological Implications of Erosion

The rapidly changing coastal formation is an issue because of the ways in which the wildlife and people of the Divjaka depend on the Karavasta Lagoon and surrounding environment. One of the most prominent problems comes from a drop in oxygen levels in the water of the lagoon because of a lack of water flowing into the lagoon. Without enough open and functional channels connecting the lagoon to the sea, the lagoon will become progressively more isolated from oxygenated water. Additionally, the water salinity in the lagoon becomes substantially higher in the summer months when water evaporates (Ramsar 1996). The insufficient water quality harms local fish and bird populations, which cannot live and reproduce in such conditions. This cascades into the disruption of the ecosystem and reduced biodiversity in the park. The Divjaka-Karavasta National Park is a major asset and attraction that supports the tourism industry (Ramsar, 1996). The hazards can be interpreted through the causal pathway shown in Figure 2.7.

Plants and Wildlife

The lagoon is a crucial habitat for many species of fish, birds, and other animals. Among these is the Dalmatian Pelican, an endangered bird that lives in the Divjaka Karavasta National Park and the small islands in the north of the lagoon. Additionally, there are over 200 other species of birds that rely on the lagoon in some way, be it for migratory reasons or for native habitation (Canalli, 1998). Without the connection to the sea, the water in the lagoon cannot cycle effectively, causing problems not only with salinity but also oxygenation and water levels, causing problems for fish populations and bird populations alike.

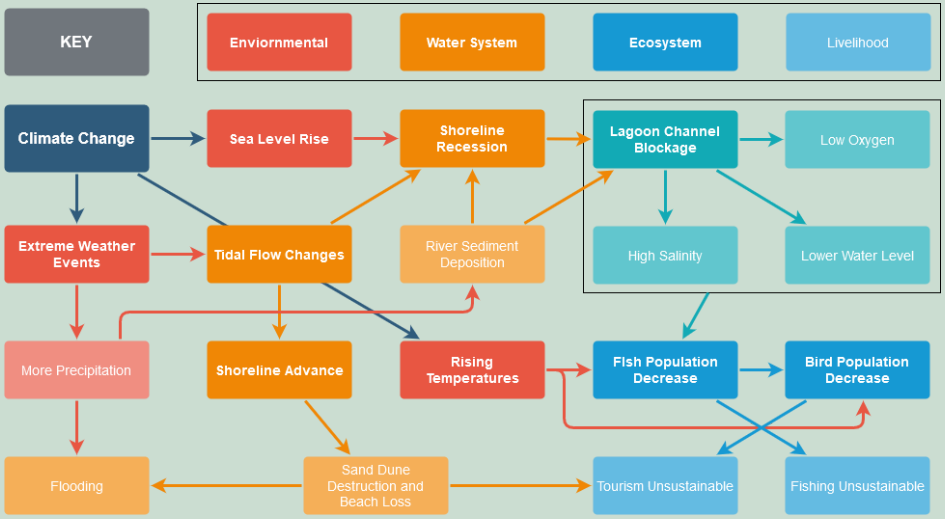


Figure 2.7: A causal pathway that shows a portion of the environmental hazards that the lagoon and national park's ecosystem experience. The livelihoods that are sustained by these natural assets are terminal nodes that are threatened by unregulated natural processes. For example, river sediment deposition and shoreline recession are responsible for the isolation of the lagoon, leading to decreases in bird and fish populations.

Tourism

The beaches on the coast of the Adriatic Sea are a popular destination for tourists. Since these beaches are the only zone designated recreational by the zoning of the park management plan, the parks administration is concerned with preserving them. In the years 1995-96, it was estimated that the beaches were visited by more than 8,000 visitors per day between the months of July and August. Divjaka locals view this sort of tourism as a boon because of the income it brings to the area, and are interested in increasing boarding capacity (Ramsar 1996). Divjaka and the surrounding smaller villages have built hotels, guest houses, and amenities to accommodate tourists coming from Albania and other countries, but the infrastructure of the park and beaches does not effectively support the traffic of visitors (Ramsar, 1996).

Much of the draw of Divjaka as a tourist area comes from the natural beauty of the forests, beaches, and lagoon. Damage to the natural environment would not only take away this asset, but also the habitats of rare and endangered species, which is another substantial but understated attraction for birdwatchers and nature enthusiasts.

Stakeholders in Divjaka

Many actors play a pivotal role in understanding how erosion affects Divjaka's community. The key stakeholders for this project are members of the Fishermen Management Organization (FMO), park officials of the Regional Administration for Protected Areas (RAPA), the municipal government of Divjaka, Non-Government Organizations (NGOs) familiar with the Divjaka region, government organizations such as the Japan International Cooperation Agency (JICA), and students enrolled in Divjaka's high school.

FMO

Due to the salinization of the Karavasta Lagoon, fishermen are interested in solutions to decrease salinity and increase the fish population. Not only would solutions improve fish productivity to support wildlife, but they would also support their livelihoods (L. Xharo, personal communication, November 4, 2022). In Divjaka, there are three fishing NGOs located in the Karavasta Lagoon, with the FMO being the most accessible due to their connections to JICA and the municipal government.

RAPA

RAPA is a subdivision of the National Agency of Protected Areas (NAPA). Each county has its own administration (Elton Daka, Personal Communication, November 1, 2022). This project primarily collaborated with RAPA Fier, which is responsible for upholding the protections afforded to the Divjaka-Karavasta National Park. This organization will be referred to as just RAPA. Each regional administration shares the same goals as NAPA: management, protection, development, and operation of protected areas (Elton Daka, Personal Communication, November 1, 2022). Therefore, RAPA's interest is in safeguarding the environment and preserving biodiversity.

INCA

INCA's participatory approaches contribute to its mission of safeguarding the environment through the conservation of the ecosystem and the regulation of rural development in Albania (INCA, 2022). According to INCA, their goal is to "undertake conservation measures when possible and appropriate to protect species and their habitats" (INCA, 2022). In addition, INCA offers many services to realize environmental development programs. For instance, INCA assesses biodiversity by conducting scientific research on flora and fauna in specific areas. They also provide environmental education training, preparation of management plans, and much more. INCA has taken several actions to contribute to its goal, such as helping the development of the park's first management plan in 2014.

PPNEA

PPNEA is one of the first environmental NGOs working in Albania to preserve nature and biodiversity (PPNEA, 2022). Currently, PPNEA's primary work revolves around the conservation of "keystone, threatened and rare species and conservation of high biodiversity value areas" (PPNEA, 2022). In addition, PPNEA has expanded its work to almost all national parks and protected areas in Albania. They have made significant advancements in protecting wetland habitats and coastal regions. One of their projects conducted in the Divjaka-Karavasta National Park consisted of protecting endangered species such as the Dalmatian Pelicans present in the Karavasta Lagoon. This project focused on bringing awareness to the importance of the pelican and clearing misconceptions locals had about the pelican's effects on the declining fish population in the Karavasta Lagoon (Xhemal Xherri, personal communication, November 7, 2022). In its projects, PPNEA has brought together national and regional organizations on different occasions by organizing seminars, training, workshops, and conferences and remaining vigilant in conservation efforts by collaborating with other ecological coalitions (PPNEA, 2022).

Municipality

The local government is mainly interested in growing Divjaka's economic development to make it an attractive place to live (Fredi Kokoneshi, personal communication, November 2, 2022). However, since the rich natural landscape and livelihoods that rely on it are a substantial factor in this, they are bound to maintain sustainable development. Divjaka has seen an increase in tourism and plans on expanding on agrotourism, where activities bring visitors to farms and the national park (Fredi Kokoneshi, personal communication, November 2, 2022). Recent developments have been made in the national park in areas where tourists come to bird watch, as well as along hiking trails where visitors can see more wildlife (Elton Daka, personal communication, November 1, 2022).

Students

Students in Divjaka care deeply about the environment and their town. Many students and schools have raised awareness about pollution and its environmental effects, carbon dioxide and ways to reduce emissions, and many more; this has resulted in students taking action and conducting several tree plantings within the community. Students are very interested in helping the environment and protecting their community.

JICA

JICA is a Japanese governmental agency that aims to develop the Japanese and global economy and international partnerships, supporting socio-economic development and improving the economic stability of developing regions (JICA, 2022). According to a statement by JICA, "Because stability and development in Albania would contribute to stability in the Balkan region... It is important to assist efforts for development and reform and to take initiatives for sustainable and stable development. JICA [will] assist in its cooperation schemes primarily in agriculture, infrastructure development, medical care, education, and the environment." (JICA, 2022) In the Divjaka-Karavasta National Park, JICA is focused on studying the ecosystem and the role of eco-tourism in the operation of the park.

Albanian Responses to Present Hazards

Stakeholder groups have noticed similar hazards in other places of Albania, and have addressed them in various ways. In 2011, Albania saw about 46 million cubic feet of trees cut down across the country (Mejdini, 2015). The NGO "Green 2000" says that deforestation in Albania has led to a noticeable increase in erosion --- especially along river banks --- because tree roots can strengthen the soil around them, mitigating the effects of erosion.

One method to reduce this is the establishment of policing groups to report illegal logging. Local civil society organizations enlisted community members of nearby erosion hotspots to partake in these groups, as those community members most directly face the problems caused by this erosion (Green, 2021). Another method was the implementation of a law in Albania in 2016 that banned logging across the country unless it was done by specific government officials. They hoped not only to replenish tree populations, but also to slow erosion along the coastline (Mejdini, 2015). Albania's responses to mitigating erosion have not been that successful. In Albania's 2022 commission report, the European Union stated that "Albania does not adequately ensure enforcement of the forest and logging laws" (European Commision, 2022, p. 112). Additionally, some regions have attempted to control erosion using nets along vulnerable banks, but these projects are often discontinued or left to fall into disrepair (A. Lika, personal communication, November 30, 2022).

Tools and Criteria For Developing NbS

Existing engineering interventions, while effective in the short term, have the potential to cause damage to ecosystems and create new vulnerabilities for communities and biodiversity (Zingraff-Hamed, 2020). This has led to a recent interest in research and implementation of solutions that utilize natural systems and the environment, also known as nature-based solutions, or NbS. Since NbS has not been a global focus for very long, there are a number of differing definitions provided by various organizations. However, a definition that is widely cited comes from the International Union for Conservation: "IUCN defines NbS as: 'Actions to protect, sustainably manage and restore natural or modified ecosystems that address societal changes effectively and adaptively, simultaneously providing human well-being and diversity benefits.'" (IUCN, 2019, p.2) This definition highlights the mindset behind NbS most clearly: nature-based solutions are not only about addressing issues, but also about creating additional benefits. However, like any project, tradeoffs need to be considered during implementation. Unlike traditional engineering projects, NbS require a level of community involvement in all stages of planning in order to be most effective (IUCN, 2020).

IUCN Criteria for NbS

The processes around design, implementation, and maintenance have yet to be standardized since NbS are a still emerging phenomenon. IUCN has identified “a pressing need for greater clarity and precision of what the concept [NbS] entails and what is required for it to be deployed successfully.” (IUCN, 2020, pg. 2) Predictions that NbS could provide 30% of the mitigation required to stabilize rising global temperatures have created a desire for a clear method to identify necessary criteria for the formation of NbS, leading to the eight guidelines found in Figure 2.8 (IUCN, 2020).

While some criteria are directly related to phases of the NbS process, they all can be used more generally to develop questions for research, interviews, and surveys that allow for the collection of information from stakeholders. The stated goal of the provided standard is to be used as a hands-on tool for turning NbS from a concept into a series of direct actions (IUCN, 2020).

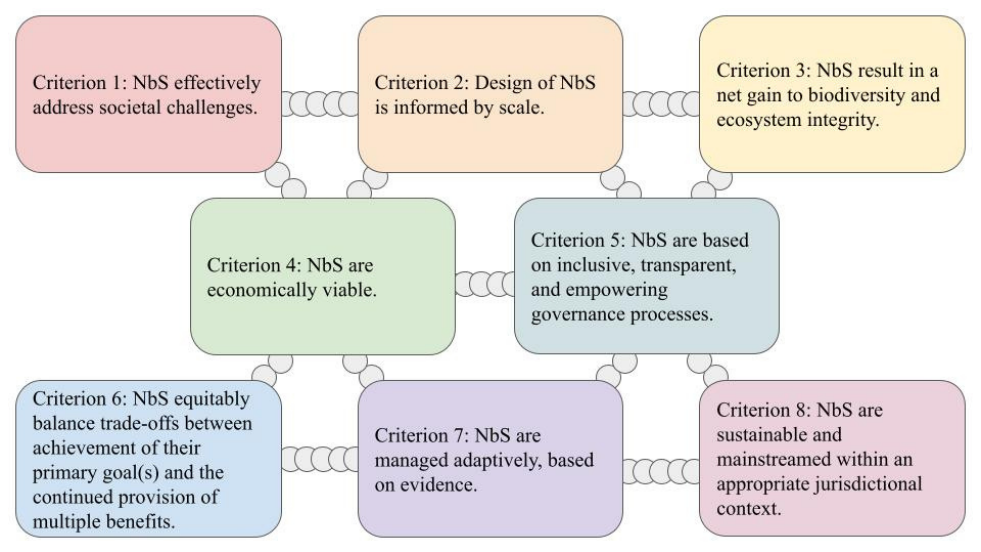


Figure 2.8: The eight criteria identified by IUCN as essential considerations for NbS. Each statement addresses a different component of NbS, including the social, environmental, and institutional relevance of a potential project. (IUCN, 2020)

Expert Community Approach to NbS In Europe

A 2022 study done to identify potential NbS around flood risk management provides some interesting insights into NbS development as a whole. This workshop consisted of 35 experts from 32 countries all around Europe. The identified NbS were sorted into 12 categories, and the most frequently suggested categories were broken down by frequency in five regions chosen by similar ecological and natural characteristics. This process highlighted differences in perception of the concept and definition of an NbS, as well as a need for an understanding of what is considered natural by various stakeholder groups (Raska, 2022).

From there, the experts were asked to identify potential barriers to implementation for each category of NbS. These barriers fit into four main groups: unknown effects of NbS, decisions related to the location of NbS, existing institutions, and availability of resources and resource capacities. The frequency of each identified barrier was then recorded for the NbS categories, assigned a representative letter, and placed into a visual matrix (Figure 2.9).

For example, the most commonly identified barriers to floodplain retention NbS were objective and benefit trade-offs, difficulty in acquiring land for the project, and unclear landowner compensation plans (Raska, 2022). These barriers often interact with each other as well, as illustrated by Figure 2.10. Barrier cascades are identified as situations where an identified barrier is the direct cause of another. Compound barriers are identified when a barrier suggests another barrier, creating a cycle of obstacles.

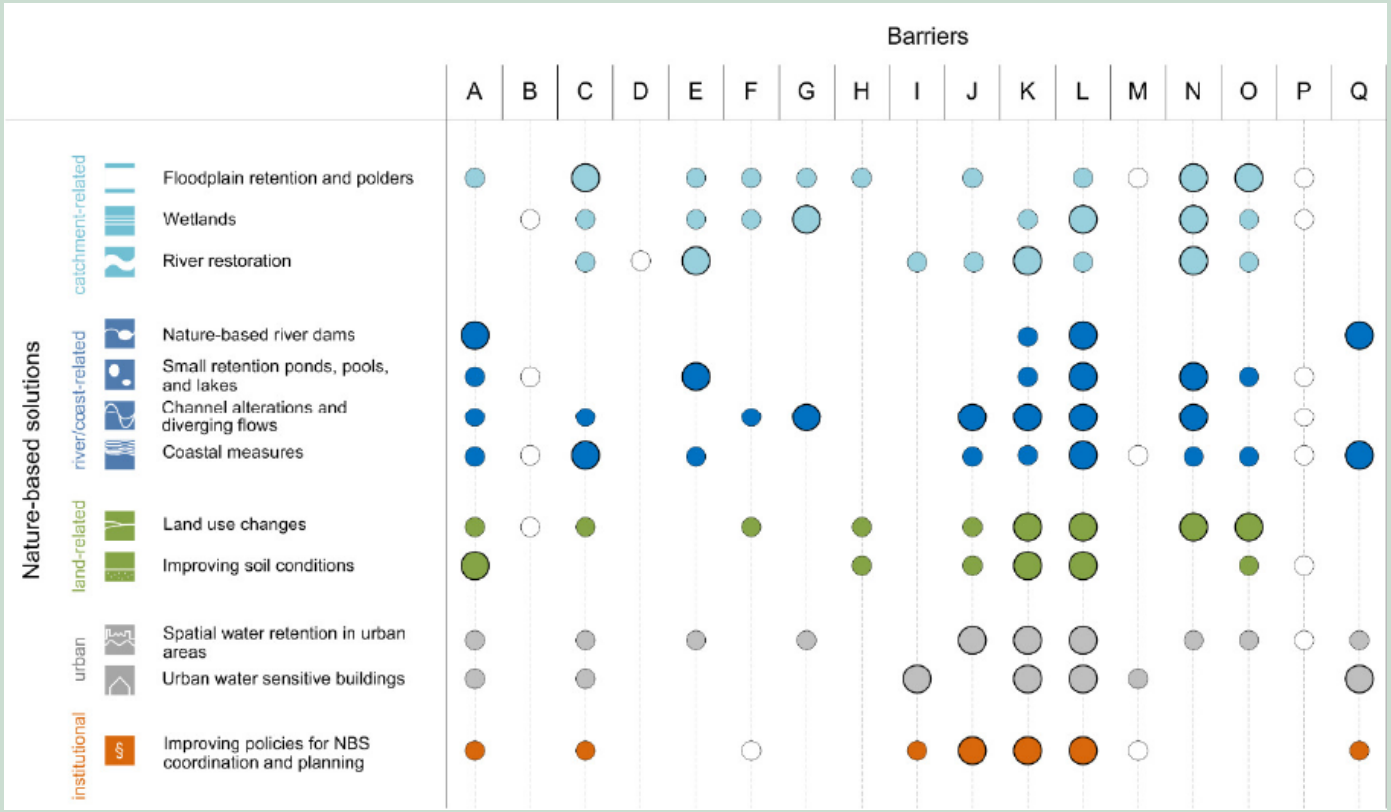


Figure 2.9: This matrix serves as a visual representation of barrier identification frequency. The letters at the top of the table each have a barrier associated with them. The size of the colored dots corresponds to the frequency with which each barrier was identified for the NbS type. Small white dots indicate that a barrier was not identified for an NbS group at all. (Raska, 2022)

To address this, experts created research questions in order to gain additional information on the interactions within these systems of barriers. Questions were formulated by tracing out the potential pathways of cascading and compound barrier interactions. The goal of these questions were to further research around these barriers, as well as to bring in a transdisciplinary approach that will, in the long term, prove more effective for implementation. Additionally, these questions can potentially be applied to different NbS groups depending on the societal and institutional frameworks in place (Raska, 2022).

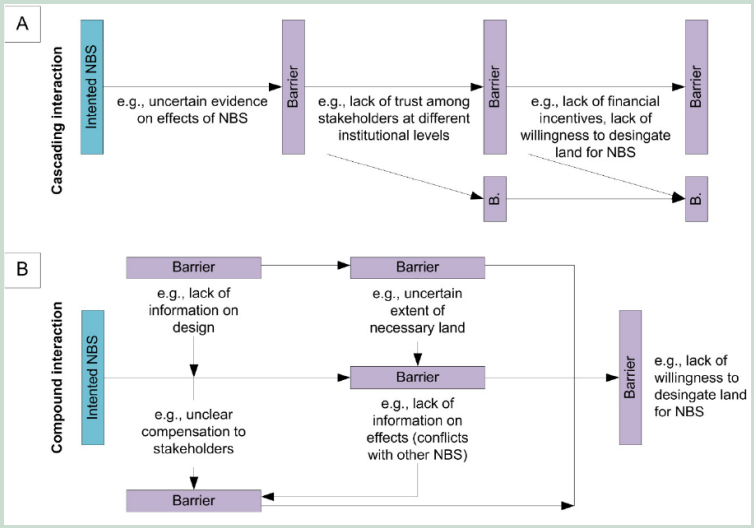


Figure 2.10: The top diagram represents a cascading barrier interaction. The bottom diagram represents a compound barrier interaction. (Raska, 2022)

The limitations of this study largely centered around the use of experts instead of evidence. There was not an even distribution of expert type per region examined, so there was not a purely balanced group composition. Additionally, the experience in stakeholder engagement and field of expertise varied from expert to expert. Finally, this approach is designed to create paths for future research, and no conclusions drawn by the study are yet backed up with experimental evidence. In order to assess community members' perceptions of potential NbS, stakeholder identification has to be completed to determine who has an interest or could be affected by it.

Stakeholders Identification in Relation to NbS

A report presented in 2020 built a systematic approach to identifying stakeholders that would be beneficial in the design and implementation process of an NbS. In order to do this, they broke the roles of stakeholders into the following six groups: the decision-makers, the implementers, the facilitators, the experts, the sponsors, the lobbyists, and the mediators. The first three groups are often government agencies or powerful institutions that have authority and expertise in the area, while the last three are often the general public. After this, they broke the systemic approach into the planning, design, implementation, operation and maintenance, monitoring, and evaluation stages. Finally, they determined the characteristics of a stakeholder by their relation to an NbS and their relation to the hazard or hazards (Zingraff-Hamed, 2020)

Nature-Based Solutions in Albania

Despite the relative newness of NbS on a global scale, pilot programs have previously been conducted in Albania. Most have been conducted within regions that have been studied more in depth, located to the north of Albania.

Kune-Vain Lagoon NbS

Around the Kune-Vain lagoon, located in the northern region of Lezhe, there was a project to design and implement an NbS that would reduce erosion. One goal consisted of raising both awareness of climate change risks and the potential of NbS as solutions to these risks. To achieve these two objectives, four method pathways were identified. The first method developed was creating a knowledge management plan and a communication strategy. The second method was to establish an awareness-raising campaign. The third method was to produce “scientific reports on the performance of implemented EbA interventions and research projects underway.” (Republic of Albania, 2017, p. 36) The final method was to create a website that contained project documents and information about the lagoon. All these methods were utilized in an effort to gauge the opinions and level of understanding about the lagoon from stakeholders; moreover, these methods helped to raise the level of understanding and awareness on the project overall (United Nations Environment Programme, 2015). The implemented NbS was believed to be the most practical and most wanted by the community, based on stakeholder information collected by the report. The Kune-Vain Lagoon faces erosion along the narrow strip of land that separates the lagoon from the Adriatic Sea, which has been worsening. This lagoon hosts a vast range of biodiversity, as well as protects the nearby village from the rising sea level (United, 2015). To address the risks posed, the eroding land was reforested with Aleppo pine, stone pine, four-stamen tamarisk, english oak, and manna ash trees (Gjini, 2015).

According to their report documents, these native foliages are also flood resistant and can withstand high salinity levels. Their hope is that the roots of these plants will strengthen the soil and prevent it from eroding further (United, 2015).

GIZ Sand Dune Restoration

Another NbS project done within Albania was a sand dune restoration project that took place in the Buna estuary, located in the northern region of Shkoder. This project was undertaken by our sponsoring organization, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ). The goal of this project was to plant a number of reeds --- scientific name *Ammophilia Arenaria* --- in order to reduce the severity of coastal erosion found in the area (Deutsche Gesellschaft für Internationale Zusammenarbeit, 2021). These plants were chosen not only because they are native to the area, but also because their roots run nearly two meters deep, making them good at holding on to sandy soil. Additionally,

their large leaves slow down winds coming in from the sea, making it more difficult for the wind to blow sand away (Deutsche, 2021). Ammophila Arenaria also has a high tolerance to drought and temperature fluctuations, making it well suited for a harsh coastline environment. Beyond the natural benefits, the leaves of the plant have been used for weaving baskets and ropemaking, satisfying the requirement for NbS to contain social benefits as well (Deutsche, 2021). GIZ is very proud of this project, as it won an award through the Climate Champions program for Best Practice (R. Ago, personal communication, December 5, 2022). However, GIZ's involvement in Albania began many years before the implementation of this pilot.

GIZ in Albania

GIZ's presence in Albania began in 1988 (Deutsche, 2021). At the time, and even now, Albania is one of the poorest countries in Europe. However, despite Albania's setbacks set by the communist regime, Albania intends to integrate into the European Union. GIZ recognizes these efforts and, in cooperation with Albania, plans to support rural development, sustainable infrastructure, governance and democracy, environment and climate change, economic development, and employment (Deutsche, 2021).

More generally, GIZ is a German organization working under the commissioning party of the German Federal Ministry for Economic Cooperation and Development (Deutsche, 2021). GIZ has over 50 years of experience in various areas, such as economic development, energy, the environment, and peace and security (Deutsche, 2021). GIZ works with stakeholders worldwide to generate ideas for political, social, and economic change to develop these into concrete plans and implement them. Through the process of development, GIZ uses sustainability as its guiding principle.

Interest of NbS in Albania

Our sponsor is interested in NbS for a number of reasons. Currently, GIZ is working on a proposal for the Green Climate Fund focusing on the analysis and implementation of NbS in the coastal area. In general, holistic NbS approaches in Albania have remained largely unresearched as of yet. GIZ and other organizations have done many small pilots, but primarily as pilot interventions rather than holistic solutions for larger communities (Rrezearta Ago & Merita Meksi, personal communication, September 28, 2022). Therefore, GIZ wants to increase its experience with NbS and elicit NbS ideas from community members. GIZ is concentrating on the coastal areas of Albania because they have been recognized by one of the national communications towards the international convention for climate change as the most affected by climate change (Rrezearta Ago & Merita Meksi, personal communication, September 28, 2022). Lastly, GIZ intends to contribute additional information around creating NbS for straightforward replication (Rrezearta Ago & Merita Meksi, personal communication, September 28, 2022).

This Project's Goals

Our research will contribute to GIZ's proposal for the Green Climate Fund through the understanding of the development process of a holistic NbS, emphasizing community participation. Additionally, our project aims to establish GIZ in Divjaka for potential future projects to promote its goals of rural development and NbS, since GIZ has no previous involvement in the region outside of tourism-related developments. Finally, our project aims to deepen our understanding of the community in Divjaka to design a NbS collaboratively. To summarize, the gaps our project seeks to bridge are the possibilities of NbS in Divjaka, the extent of potential community engagement and support for NbS, and attitudes towards NbS design and development through community participation.

Chapter 3: Methods

Methods

The goal of our project was to learn from local farmers, fishermen, municipal government, and park services about how erosion disrupts the regional ecosystem both directly and indirectly, and to collaborate with affected people to identify and devise nature-based solutions to increase their resilience to the listed environmental hazards.

- Form an understanding of the hydrological system and how the Shkumbini River, Karavasta Lagoon, and Adriatic Sea interact to influence agriculture, aquaculture, tourism and ecology in Divjaka and the Divjaka-Karavasta National Park
- Document stakeholders' coping strategies regarding erosion, as well as hazardous effects such as salinization and drought
- Gather criteria from local stakeholders and experts through both formal and informal conversations
- Work with community members to identify possible NbS interventions

Form an Understanding of the Hydrological System and how the Shkumbini River, Karavasta Lagoon, and Adriatic Sea Interact

Our project relied on an understanding of the hydrological, ecological, and administrative systems in Divjaka. This included learning about present hazards affecting the watershed. We accomplished this through 9 key informant interviews, located in Table 1, and hazard mapping with both central and regional government agencies, as well as with environmental NGOs, international project organizations, park rangers, and local livelihood groups that are working in the lagoon and local river systems.

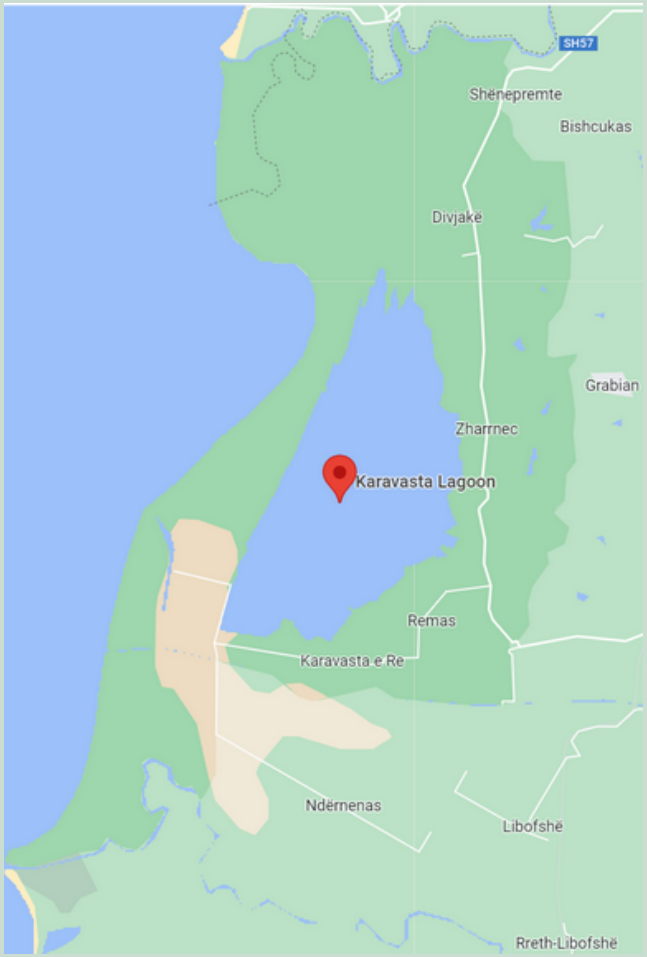
Key Informant	**Number of Interviews**
Municipality of Divjaka	2
RAPA	2
JICA	1
FMO	2
INCA	1
PPNEA	1

Table 1: This table highlights the breakdown of our key informant interviews.

Our initial key informant interviews took place with the urban planner and a soil specialist employed by the municipal government of Divjaka. We sought to collect information on prior environmental projects and current infrastructure related to coping with climate hazards, as well as to identify the areas most at risk from climate hazards.

From there, we met with Elton Daka, a ranger working under RAPA at the Divjaka-Karavasta National Park. His interview was focused on identifying where and how climate change had affected the park, the importance of the lagoon and park to the community, and plans for further environmental projects within the protected area.

The key informant interview with PPNEA involved talking with Zydjon Vorpsi and Xhemal Xherri about their projects in the park and their experiences with climate hazards affecting the park, as well as getting more information on community involvement in environmental projects. Additionally, we met with Genti Kromidha and Emirjeta Adhami from INCA to discuss their work on the previous park management plan, as well as their involvement in community education and awareness. Other key informants include JICA, another international organization that has been doing environmental projects in the park. An outline of interview questions for these groups is located in Appendix B.



Figures 3.1 & 3.2: These maps were shown to the municipal government staff, RAPA rangers, FMO, and JICA to indicate areas affected most substantially by climate change related hazards. The first map was replaced with the second to show greater detail in the Godulla Lagoon (Google Maps, n.d. and Apple Maps, n.d.)

During our key informant interviews, we used hazard mapping to understand what our participants believe are high-risk areas in Divjaka. This activity took place after a discussion of what climate hazards were observed by the interviewees to be present in Divjaka. We prompted participants to highlight areas on a printed map where they thought those hazards had the most significant effect. This activity was conducted in interviews with one or two informing participants. After circling, boxing, or otherwise identifying areas on the map, the participants were asked to provide more details about how specifically the hazards had affected the area that they marked. This created additional dialogue between the team and the participants related to hazard response, coping strategies, and how those strategies might be adjusted to include additional NbS interventions, among other things. Conducting hazard mapping early in our research gave our team insight into where to perform site visits and transect walks to gain a deeper understanding of the hazards, further expanded on in section 3.2. From there, we combined our team observations with the maps created during the exercise to assist with site selection for a potential final project.

Conducting site visits to the Karavasta Lagoon, surrounding farmlands, and the Shkumbini River provided insight into the state of the area ecosystem. The goal of these site visits was to gain a deeper understanding of how different ecosystems, agriculture, fish, and local people coexist and influence each other. We observed the sites with experts such as park rangers, conservationists, fishermen, or farmers, depending both on availability and what we hoped to learn about the

Figure 3.3: The team during our key informant interview with PPNEA.

Figure 3.4: Members of the Fishery Management Organization.

specific area. Site visits are crucial because of the level at which our focuses intersect. Additionally, the Karavasta Lagoon is a central part of the region, as well as being a National Park, so any possible impacts on its existing ecosystem need to be considered. The issues are also very interconnected. Local farmlands affect the environment through runoff and erosion, as well as having their own ecosystems in varying levels of balance. These farmlands surround the Shkumbini and Semani rivers, which receive waste from human settlements as well as threaten them with flood damage and erosion. The rivers collect various kinds of pollution from the regions it flows through and shape the landscape through their movement. A technical understanding of hazards and hazard-affected regions will become the foundation of our assessment of nature based solutions and their viability. It is important to understand how these systems affect people's lives and the environment because the solution's ability to improve conditions for the stakeholders must be weighed against the resources and work required.

Document Local Stakeholders' Coping Strategies to Natural Hazards

We aimed to determine stakeholders' current means of addressing the affected areas. After looking into the consequences of the most prominent hazards in Divjaka, we sought to understand the coping strategies community members established for these natural hazards. Through semi-structured interviews, field visits, and

participatory techniques such as transect walks, our group developed an understanding of:

- Residents' perception of Divjaka regarding drought, heat waves, and soil erosion.
- The problems that these people face and the ways they cope to adapt.
- Ways in which coping strategies can be enhanced and assisted by natural features.

Our group performed participatory activities with individuals and groups selected by snowball sampling where previous participants recommended additional participants. GIZ put us in contact with our first stakeholder groups, the Divjaka municipality staff and the Regional Agency of Protected Areas (RAPA) in Divjaka. Our team also reached out to the Institute for Nature Conservation in Albania (INCA) and the Protection and Preservation of Natural Environment in Albania (PPNEA) to discuss their work in Divjaka. Our team also happened to meet a local shepherd, Albert Lika, when we were walking along the Shkumbini River. We met with Klevisa Decja, the mayor of Divjaka's secretary, Dorian Spaho, Aleksander Lapi, the Soil Protection and Management Specialist, and Elbareta Nishitsa, the Director of Urban Planning. During this meeting, Ms. Decja provided us with the contact of Ilia Dhamo, the Director of the Fishery Management Organization (FMO). At our meeting with FMO, they suggested that we meet with Dr. Sajmir Hoxha from the Japan International Cooperation Agency (JICA). Through snowball sampling, we found multiple sources to relay the strategies they have taken to mitigate the natural hazards.

We met with members from the Divjaka municipality staff, RAPA, INCA, PPNEA, and JICA to discuss their methods to prevent the perceived problems. The municipality staff and RAPA are two government organizations, so we targeted our questions about what is being done legally and on a grand scale of the park. The municipality staff does not work in the field as much as RAPA, so we asked questions around what they have heard and seen through other organizations, data, and the community. When we met with Elton Daka, a park ranger, we wanted to understand what they had experienced throughout the park when they worked. The NGOs, INCA and PPNEA, were located in Tirana, but both organizations had done work in Divjaka. When we met with Zydjon Vorpsi and Xhemal Xherri, both PPNEA project managers, we focused our questions on their work in the park and their use of community engagement to develop coping strategies. We asked similar questions directed towards INCA's hydrologist, Emirjeta Adhami, and her work in Divjaka. Finally, in our meeting with Dr. Hoxha, the project manager at JICA, we asked technical questions about what has been done in the past, and future projects they are working on to implement any responses to the present hazards.

Our team decided to understand the coping strategies that Llaba Xharo

and Albert Lika use by performing field visits at their workplaces. We met with Mr. Xharo at FMO's headquarters located by the mouth of the northern channel of the Karavasta Lagoon. Similar to the Tirana NGOs, we asked him about the work FMO has done in the lagoon and how they have gotten the community involved. In addition to this, we asked Mr. Xharo to show us some examples of how they have reacted to the natural hazards. We could not do this with the Tirana NGOs; however, we were in the field, so he was capable of showing us the methods they have put in place to counteract the hazards. Although we met Albert Lika by chance, we were still prepared to ask questions similar to the FMO meeting. We met Mr. Lika when we were walking along the Shkumbini River and he offered to take us further along. Since we were in the field, we asked him to show us examples of his work to avoid them. Both field visits allowed us to gather information orally and through first hand experiences.

Figure 3.5: Albert Lika leading our team on a transect walk along the Shkumbini River

Information gathered through our participatory techniques prompted further discussions with participants through semi-structured and unstructured interviews. The flexibility of semi-structured interviews allows for comparisons across interviews with regularly scheduled questions, as seen in Appendix C, and further elaboration by spontaneously pursuing another area as initiated by the informant. Unstructured interviews are treated more as a conversation, with a few topics that would be discussed. Unstructured interviews encourage differences of opinion rather than responses adhering to a particular standardized format. We took the information we had learned about current coping strategies and looked to work with local stakeholders to design an NbS for the perceived hazards.

Co-creating NbS with local stakeholders and experts

Through additional iterative interviews, we elicited locals' ideas on possible NbS for the Karavasta Lagoon in the Divjaka-Karavasta National Park and the Shkumbini River. Specifically, interviews consisted of meetings between two or more individuals within a stakeholder group collaborating to either start or finalize a design or modify an existing one. For example, a group consisted of two or more fishermen, two or more municipal government staff members, and so on. The setting of these meetings was in each stakeholder's occupational environment. For instance, an interview with fishermen took place while they mended their nets near the lagoon, whereas an interview with park officials took place in the Divjaka-Karavasta National Park. We performed additional mapping exercises during these activities to understand where participants believed we could place their interventions. We also asked about the time frame of implementation, the amount of work necessary to complete the solutions, maintenance, and attempted to work with them to estimate costs and resource requirements. Our meetings resulted in generating new ideas for NbS and listing existing NbS possible for the identified sites. In addition, these interviews established criteria that other solutions presented had to address. The participants discussed possible short-term and long-term interventions to address erosion. They were encouraged to explain the possible benefits and trade-offs of potential NbS.

During these interviews, we first asked participants what solutions they had; afterward, we would present participants with a definition and examples of a NbS and ask how they would use nature to enhance or alter the proposed solution. Then, to encourage additional discussion, we would present what other stakeholder groups have discussed for NbS in areas and ask them what they thought of their idea. Finally, as the conversation continued, we asked stakeholder groups what benefits, limitations, and trade-offs each idea had.

Our initial activities began with the fishermen at their workplace near the Karavasta Lagoon while they tended their nets. Llaba Xharo, a fisherman with significant experience, was adamant about an intervention using nature. We began with the fishermen

because we sought to gain ideas from locals whose livelihood is directly affected by the salinization in the lagoon caused by erosion. Once they proposed their interventions for the Karavasta Lagoon, we met with INCA and PPNEA, who shared a common idea for an intervention on the coast interest and widened our perspective to ideas for solutions. In addition to broadening our scope of solutions, NGOs provided criteria such as ensuring solutions do not disturb the wildlife and biodiversity of the area. Following a meeting with the NGOs, we met with park officials. One of the park officials, Elton Daka, proposed his ideas and made suggestions to the arguments presented by other stakeholder groups. His thoughts continued to increase our understanding of the park system. Thus we learned about the process of development in a protected area.

Figure 3.6: Design workshop with staff members of the municipality where they highlighted NbS placements along a map of the Shkumbini River.

Continuing to enlarge the scope of perspectives, we met with experts from JICA. Dr. Sajmir Hoxha provided our group with additional considerations about the possible implementation of the NbS that were beginning to be designed from previous interviews. Afterward, we met with three municipality staff members to elicit ideas on the NbS for the river and placement for each idea, as seen in Figure 3.6. We sought to gain ideas from a group interacting more with the Shkumbini River and learn of any interventions done in the Shkumbini River. Dorian Spaho provided vital insight on NbS placement along the Shkumbini River; this provided necessary details for our transect walk along the Shkumbini River. One of the shepherds, Albert Lika, expressed sentiments that only those who have experienced a change in their livelihoods could say. In addition, we gained insight into improved placements of NbS.

To garner unique NbS combinations for system development, we held a workshop with 10th-grade high school students in Divjaka, as seen in Figure 3.7. We broke the classroom into two sides and asked students near each other to form subgroups. Subgroups consisted of 3-6 students. We gave students image clippings of natural materials such as rocks, vegetation, and trees on cards that contained a brief description of what they could do to mitigate erosion and asked them where they would place those materials to reduce erosion effectively. We assigned letters to each image clipping to allow students to reuse materials and specify the exact area where they would want to place them. For example, the letter A represents rocks, trees with B, and

vegetation with C. After placing the elements, they had to devise a plan to use the community to maintain this project. Students developed brilliant ideas for community participation and showed enormous interest in the environment.

Figure 3.7: Design workshop held with 10th-grade students at the high school in Divjaka where students devised a system-wide NbS.

After completing multiple iterations of interviews, we had a list of several possible NbS. Once we had at least an NbS for each study site, we began to create an NbS system model that addresses erosion in the Shkumbini River and its effects on the Karavasta Lagoon. The model contained the location, type of NbS, material required for the intervention, intended result, and groups willing to participate in its implementation. For instance, the model showcased places on a map to place rock-based NbS along the Shkumbini River to slow down erosion as well as places for a potential riparian forest buffer. This model was discussed with JICA, and brought to our other stakeholder groups during additional follow-up interviews.

Chapter 4: Findings

Findings

By integrating our methods with the framework proposed in section 2.6 of our background chapter, we learned about the hydrological interactions between the watershed in Divjaka, the community's critical hazards and suggested strategies to mitigate those hazards. Everything we learned was from our stakeholders. Stakeholder identification was conducted by understanding people's relationships to the project's site. For example, FMO is considered a stakeholder since the effects of erosion directly impact their livelihoods. Using this framework, we worked with stakeholders to understand their perceptions of the problems and solutions. Furthermore, we used the IUCN NbS criteria to formulate the interview questions asked to our stakeholders. That framework gave us a clear approach to seeking out information, so our questions remained relevant to NbS design and development. Each NbS design came about through a combination of stakeholder identification and criteria development.

Figure 4.1: This figure showcases one of the worst cases of erosion on the Shkumbini River. The slope along this segment is nearly vertical and has no vegetation.

Riparian Forest Buffer

Erosion and other hazards along the river can be addressed through the use of trees

The municipality had previously intervened in areas where the flooding was very severe. These interventions mostly involved concrete structures, but there were some areas along the river where trees were planted in order to both reduce erosion and limit flood impacts. JICA agreed that doing additional tree planting would be beneficial, especially in the areas affected by gravel extraction processes. They also supported trees as a way to address extreme weather events around the river. Using trees to address this erosion also minimizes the potential of significant changes to the flow of the river. Mr. Lika and the municipality were both able to show us places where an erosion intervention caused the Shkumbini to speed up somewhere else, accelerating erosion in a different place.

Figure 4.2: Thick tree line along the the Shkumbini River that we discovered during our initial visit to the river

Various stakeholders proposed a riparian forest buffer

Albert Lika and various other stakeholders like PPNEA, JICA, RAPA, the school, and the municipality staff either suggested a riparian forest buffer model or supported the potential implementation of it when we presented them with this possible NbS. Xhemal Xherri from PPNEA was one of the first stakeholders to mention the idea of reforestation in order to strengthen the soil and mitigate erosion. Our team researched this topic and decided to propose this solution in upcoming meetings with stakeholders.

Figure 4.3: Overview of the two proposed riparian forest buffer sites along the Shkumbini River. These sites are located in the orange circles. (Google Earth, n.d.)

We determined through interviews and our own research the most practical and beneficial practice for implementing a riparian forest buffer. JICA mentioned that the ideal location would be along the bends in the river where vegetation was scarce. We then used RAPA's national park management plan to determine what tree species were native to the area and which had roots to hold the erosion in place. Finally, we found out through the school and the NGOs that the youth in Divjaka have planted trees in the past and would be willing to participate in implementation.

Stakeholder perception of the proposed riparian forest buffer was largely positive

We presented this intervention in consecutive meetings with RAPA and the municipality staff, both of whom said that this would benefit the ecosystem and fight against erosion. JICA also expressed support for this idea, and supported planting in degraded locations along river bends. When we asked the high schoolers to place trees anywhere in the park, 3 out of the 6 groups placed them along the river. We did not show a picture to Mr. Lika because the example of a riparian forest buffer was across the river, and from our conversation with him, he told us he supported it

We also presented this idea to FMO, and they said that they did not know enough about the river to support this idea. They made it clear that they were not opposed, but that they do not know how it would work or what the benefits might be.

Drawbacks of this intervention include land use complexities and erosion severity.

While a riparian forest buffer addresses multiple river hazards, there are a number of barriers to implementation. Much of the land around the river is privately owned, creating a need for the creation of a payback system. On the national park side, we learned from RAPA that there are many different institutions that need to be consulted and give approval before a project can be implemented. Additionally, when looking at maps with the municipality, it became clear that some areas along the river have been eroded too severely to plant trees.

Rock Walls in the Shkumbini River

Severity of river erosion is debated among stakeholder groups

According to the Divjaka municipality staff, erosion hazards were the most important to address. During a meeting, we performed a mapping exercise where we asked the Director of Urban Planning, Elbareta Nishitsa, and Mr. Lapi to mark areas most affected by erosion, as seen in

Figure 4.4: One of the specific riparian forest buffer sites. The red line shows where the tree line would be planted.

Figure 4.5. They added that coping strategies in the Shkumbini River remain limited. In addition, they circled areas in the river where previous interventions, which consisted of concrete structures, had been placed.

However, when we met with INCA, we received contradicting information on the severity of the erosion. INCA believed that the Shkumbini River “is not that wild” and that the impact of erosion and flooding of the river is less critical because it is an area where people do not live. In addition, they mentioned that the river flood could be beneficial for farmers since it can water their fields. However, during our transect walk, we met a farmer who also tended sheep named Albert Lika. His concerns were tied to the increased flooding caused by erosion of the riverbanks. He claimed that these flood events compact the soil and bring sandy sediments, chemicals, and other pollutants into the fields. This sand is reducing yields by a significant amount: Albert said that an area that used to yield 50 quintiles of wheat has only been producing three quintiles.

Previous rock interventions have had both positive and negative effects.

Rock walls have the potential to mitigate erosion, but they also can affect erosion in other areas of the river. We learned about two methods of rock or concrete wall implementation where one ran parallel with the bank and another was perpendicular protruding

Figure 4.5: This map shows where along the Shkumbini River erosion has its largest effect and where interventions have been placed by the Divjaka municipality.

out from the bank. PPNEA and INCA both told us that the parallel banks put in near the start of the river had made the river faster, making erosion worse in some areas. Then, the municipality used maps to show us the perpendicular rock walls that were designed at the vertex of bends in the river. The idea was that water would crash into the soil at these bends and wash it away; however, the water does not carry away much soil when there are rocks present as most of the force is absorbed by the rocks, not the soil. The municipality staff displayed how these systems had worked in the past 7 years because there was evidence of land containment around the rock walls instead of erosion.

During the transect walk with Mr. Lika, we found the concrete structures that the municipality mentioned placing in specific bends of the river, as seen in Figure 4.7. Once we arrived at one of these sites, we noticed that some nearby concrete structures had degraded significantly. Previously, the municipality of Tirana had used concrete from old communist-era bunkers to reinforce the rivers. However, Albert says that some of these supports have been destroyed because of the rising pressure and water level of the river.

During this walk, we noticed that some structures were composed of rocks rather than concrete, as seen in Figure 4.8. During a meeting we had with the municipality a theme kept coming up: concrete versus rocks. At first, they stated they were more interested in using concrete instead of rocks for implementation. However, when asked what difference the choice of material has on the project, they were unsure. Later in our discussion we

Figure 4.6: This image shows the land next to the Shkumbini River where the shepherds grow their crops.

Figure 4.7: Degraded concrete structures placed by the municipality approximately 7 years ago.

discovered that during the communist regime, they had used rock barriers to slow down the speed of the water. Therefore, they demonstrated that concrete is not the only choice in this project and are willing to use rocks.

A community member perceives a lack of communication with government officials.

Mr. Lika feels that intervention would be nearly impossible with the new municipality official, who he claims “is not doing enough about the issues in the Shkumbini River.” According to Mr. Lika, this government official once came to “see the river” but actually just went a few meters from the road and then left. In addition, the government hasn’t done anything to restore a previously successful project to fight erosion, nor have they followed up on their promises to fix the road that runs along the river. Albert seemed to have a negative perception of the government authority and their lack of activism with the erosion of the river.

Additionally, Mr. Lika reported concerns about the lack of support financially from the government. He and the other man with him were renting the land to take their sheep out during the day and grow various kinds of wheat and corn throughout the year. He explained that “profits tend to be so low that all earnings from previous harvests go into the next season. However, there is no financial support for farmers from the state, despite the sharp increase in price to produce wheat.” The municipality has a conflicting viewpoint. During one of our first semi-structured

Figure 4.8: This figure showcases additional structures we found along the river.

interviews, Aleksander Lapi, the municipality's specialist in Soil Protection Management, mentioned that "individual and personal land is damaged, which is paid back by the municipality." However, the municipality has a fixed budget, with only 4% dedicated to financing damaged land, and they cannot afford to distribute funds early into the year. Therefore, they must consider which affected people receive funding on a case-by-case basis. Although Mr. Lika is not a citizen of Divjaka, these claims hold true for other municipalities. Therefore, farmers and shepherds like Albert Lika, have no financial resources to meet their needs and accomplish their goal. Municipalities, however, have limited financial resources but are not able to guarantee their financial support.

RAPA's goal is to prevent illegal use of land and maintain the protected area. Since 2015, RAPA has made efforts to fine and jail people who are caught poaching, digging, and logging in the Divjaka-Karavasta National Park. The concern is that if the river bank is eroding, farmers will lose land and resort to using the restricted land in the national park. In the past, RAPA has made efforts to raise awareness to the community and initiated replanting projects in the park. Although RAPA does not provide financial support, they do provide educational resources for the community.

Walls in the area address the erosion, but not much is known about long-term effects.

After hearing from the municipality staff and Albert about the rock walls along the banks of the Shkumbini River and seeing them for ourselves first hand, we decided that more of these structures along the river could be helpful in mitigating erosion. The proposed area is highlighted in figure 4.11. As can be seen, 3 rock walls would be implemented at the bend in

the river to mitigate the erosion there. Figure 4.9 is taken from where the middle rock wall would be implemented. When we brought this idea up with Dr. Hoxha, he was in support of it and noted that if it could work in the channel, then ideally it should work in the river. He believed that these rock walls placed at a bend in the river would be effective in reducing the amount of eroded sediments that came from the banks of the river.

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Similarly, we mentioned this idea to Elton Daka, a park ranger, but he seemed hesitant to support this rock wall system. He mentioned that JICA was doing a similar thing in the channels, which we already knew, but he was uncertain if it would work on the river banks. His fear was that water in the river moved faster than water in the channels, so the force of river water on the rocks may erode them before they make a difference.

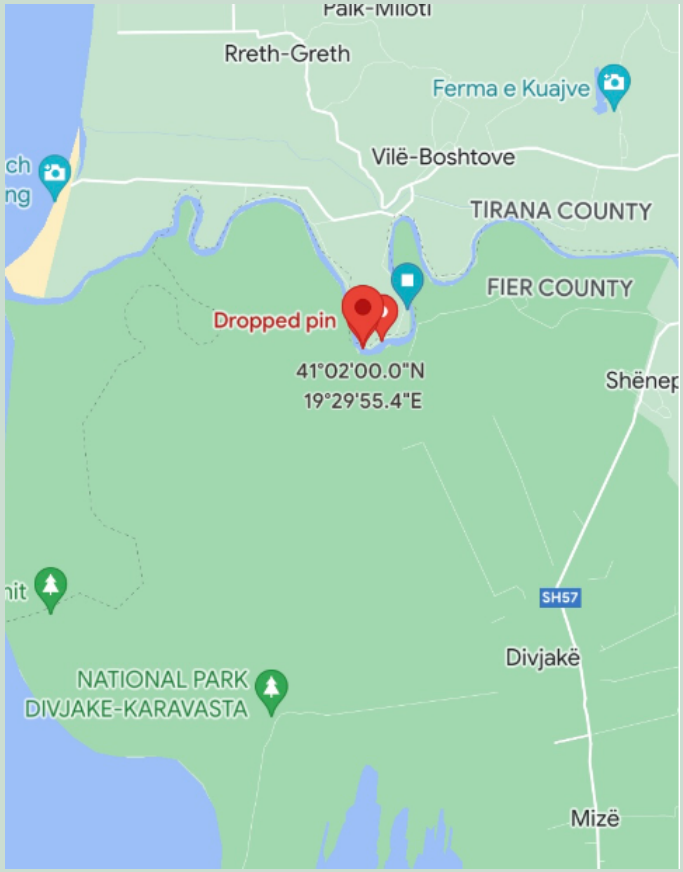

Figure 4.9: This figure showcases where along the Shkumbini the concrete structure in figure 4.5 was located.

In our last meeting with FMO, we brought up the idea of rock walls along the banks of the river. Llaba's response was that he did not know much about the river, so he was unsure if at project would work there. This was a similar response to the proposed riparian forest buffers.

Figure 4.10: Field Photo with Erosion Gradient along Shkumbini River

Figure 4.11: The location proposal to place 3 rock walls at a bend in the Shkumbini River

The Lagoon Channels

Perceptions of hazards in the lagoon vary greatly from stakeholder to stakeholder.

The municipal government showed little concern about erosion when asked about the lagoon; they believed the only problem there was occasional flooding on the surrounding beaches. They also did not believe the lagoon was generally at risk, expressing that they felt previous issues there had been addressed successfully through regulations around hunting and fishing. RAPA said there were no problems with flooding in the lagoon, but that sea withdrawal and erosion posed a threat. We asked them to show where the affected areas of the park were during the mapping exercise and they highlighted the channels as being one of them, as can be seen in Figure 4.14. PPNEA said that low water levels in the lagoon had been harming pelican populations, and that the lagoon connections to the sea needed to be maintained more effectively. PPNEA also highlighted that a lower water level increased the level of salt present in the lagoon, which harms fish populations. INCA agreed that coastal erosion was a problem for the lagoon because of the channels, but they did not think it was the largest issue surrounding the park. Their concerns were primarily about stopping further development, and less about addressing problems that may already be present. Additionally, INCA was hesitant to suggest any solutions for the channels, saying that nature should be left to run its course, despite the problems that occur. JICA said that, from their data collection, salinity levels in the lagoon were high but that communication between the sea and lagoon

Figure 4.12: Mapping exercise performed by Elton Daka, a park ranger of RAPA, where he identified the most affected areas and the interactions between the Shkumbini River and the Karavasta Lagoon (Google, n.d).

was "not terrible." FMO expressed the most direct concern for the lagoon. They highlighted unpredictable tides, the Godulla Lagoon depth decreasing from 5 meters to 1 meter, and high salinity levels as severe hazards that directly affect their livelihoods. They also expressed frustration that the municipality was not making more of an effort to help them.

Previous efforts to address problems have not affected the lagoon long term.

The stakeholders had conceptualized and performed a range of solutions to address the cascading effects of the blocked channels. In an effort to correct the depleted fish populations, FMO explained that laws were created to control the licenses, areas, and seasons to fish. They brought up problems with the fishing area laws, because the shallowness of the channels meant that most fish have been moving deeper into the lagoon, outside of the designated fishing zones. Additionally, we heard that the government has been giving out more fishing licenses than they should be in order to try to boost the economy, so the intended purpose of these licenses - to reduce the number of people fishing - is not being fulfilled. Llaba went on to criticize the government for their incompetent policing strategy and for their failure to incriminate most illegal fishermen.
When it comes to addressing the sediments filling the channels, all stakeholders were in agreement that not much had been done. RAPA said that previously, there had been an effort to widen and deepen the channels in order to increase the flow of water, but that the sandy soil had refilled them within a few days. JICA supported this claim, saying that the constant maintenance of the channels was time-consuming and expensive.

When it came to addressing the declining fish population due to the salinity of the lagoon, PPNEA, INCA, and RAPA expressed high concern for the biodiversity as a whole. Decrease in fish and bird population contradicts the goal of preservation of biodiversity of these organizations. Their concern is that if the salinity continues to increase, a significant portion of the fish, birds, and other wildlife will die or migrate to another location. Although these groups do not offer financial support, they can contribute to increasing the awareness of issues about the declining fish population in the lagoon to encourage the municipal government and other groups to take action.

Implementation of rock armor would lead to environmental and community benefits.

Rock armor along the channel was proposed as a potential

method to prevent the channels from being blocked with sediments. FMO, RAPA, and JICA all suggested the use of rocks to reinforce these channels. The municipality felt that rock armor would cause less disruption to the lagoon ecosystem. FMO held a similar view, and expressed the feeling that rock armor could cause significant improvements to the channel and lagoon ecosystem in 3 to 4 months. RAPA felt more strongly about the problem being addressed as opposed to the method used, and re-emphasized the importance of the lagoon to the livelihoods and to the ecosystem of the region. He stated that the problem needed to be fixed “no matter the cost.” JICA was more supportive of rock armors, and also suggested the use of timber sticks as further reinforcement. When we asked about using plants to enhance rock supports, all organizations expressed concerns relating to the looseness of the sandy soil. If plants were dislodged by currents near the channel mouths, they would become part of the blockage, exacerbating the issue. Regarding placement of rock armor, JICA noted that they could be any length, but around the mouth of the channel would be most helpful. This feedback led us to the conclusion that rock armor along the lagoon’s northern channel, and especially around the channel mouth, would be a viable NbS for this area. Through various interviews, site visits, and group activities with stakeholders, we were able to gauge a range of perceptions about climate related hazards, actions taken to combat these hazards,

Figure 4.13: The proposal was to implement rock armor in the northern channel near the Adriatic Sea side.

elements to consider in an NbS, and a system of NbS themselves. The most important part of our findings was that numerous groups and individuals presented us with their own NbS; moreover, when we proposed these potential NbS to important stakeholders in Divjaka, they were generally well received, despite differences in hazard perception. While we were able to gauge a wide range of opinions, there could always be more work in taking the next steps.

Sand Dune Restoration

Erosion in the Shkumbini River may be accelerating coastal erosion.

Three stakeholder groups brought up the significant changes to the coastline of Divjaka, although specific figures varied from group to group. Table 2 illustrates differences between stakeholders of the various distances of sea movement, and over how many years that change occurred.

INCA and PPNEA also brought up coastal erosion as a major issue, but did not have any numerical information about the coastline changes. These changes were theorized to be caused by a change in river behavior, related to the mouth of the river moving north. JICA's Albanian Technical Coordinator Dr. Sajmir Hoxha, told us directly that "The location of the river is no longer where it was 30 years ago." The reason for the mouth moving is still not known for certain. The municipality suggested that a large earthquake or previous concrete interventions could have been the reason for the shift, and JICA theorized that it could be related to the amount of gravel extraction from the river.

Stakeholder	Distance	Timeframe
Municipal government	300 m	20-25 years
RAPA	1 km (1000 m)	30 years
JICA	50 m per year	n/a

Table 4.1: This table displays the recession of the sea over time according to each stakeholder.

Figure 4.14: The two proposed sand dune restoration sites which are circled in orange. One is at the new river mouth and the other is at the old river mouth

Dr. Hoxha also explained how the river mouth moving north and inland has caused the coast below the river to grow towards the sea. We then looked at a map similar to the one pictured in Figure 4.13 that shows the changing of the coastline. From the map, it is clear that land around the mouth of the river has been moved towards the lagoon coast, further removing it from the sea. Aside from the map showcasing how the coast has changed, Dr. Hoxha reported that there was not much data on the Shkumbini River.

Coastal erosion contributes to the blockages in the lagoon channels.

FMO told us that the channels were being filled up with sediments from the coast. They said that since the land is expanding towards the ocean with the deposition of soil, that the channel no longer connects the sea to the lagoon. From previous stakeholders, we know that the sediment along the coast is connected to erosion from the Shkumbini River. INCA also backed up this claim, highlighting the loss of land around the mouth of the river and the gain of land down by the lagoon.

The effectiveness of dune restoration in this area is debated.

PPNEA and INCA both emphasized the importance of protecting the coast from erosion as much as possible. Both suggested that restoration of sand dunes would reduce coastal erosion, help prevent coastal flooding, and limit

the negative effects of sea level rise. This restoration would include planting of vegetation. Similar to the riparian forest buffer, vegetation on dunes allows for roots to hold sandy soil. Sand dune restoration could also include additional beach nourishment, which is the moving of sediments from another beach or a riverbed in order to replenish areas of coast that have been largely eroded. However, RAPA had some reservations about its effectiveness. Their primary concern was the coastal wind and the sea would carry the sand away too quickly. JICA brought up a previous dune planting project done by RAPA, and that these replantings had very positive effects. JICA's concerns were around the most effective way to protect the dunes: they felt the larger issue around the sand dunes is their destruction by tourists, and suggested that a more effective way to address dune problems is through traditional protective measures like fences.

Figure 4.15: Changes of the coastline during the last 30 years. Along with the coastal changes, the Shkumbini River diverted its course in 1992, shifting its mouth further north. (Google Earth, 2022)

Chapter 5: Recommendations & Conclusions

Recommendations

According to feedback from community members and expert informants in Divjaka, there are several ways to improve community participation in NbS design and implementation. These ideas represent an attempt to engage the community of Divjaka in action that can set a precedent for further knowledge and the development of positive change in protecting the environment.

Improve Stakeholder Capacity and Knowledge of NbS Design and Implementation using Parametric Toolbox

Through a partnership amongst the International Institute for Environment and Development (IIED), the International Union for Conservation of Nature (IUCN), the World Conservation Monitoring Centre (UNEP-WCMC), and GIZ, they created a draft version of a database toolkit containing tools and methodologies relevant to Ecosystem-based Adaptations (EbA) (Charlotte Hicks et al., n.d). The tool's development was part of the International Climate Initiative (IKI) funded global projects Ecosystem-based Adaptation (EbA): strengthening the evidence and informing policy, implemented by IIED, IUCN, and UNEP-WCMC, and Mainstreaming Ecosystem-based adaptation (EbA): Strengthening EbA in planning and decision-making processes, implemented by GIZ (Charlotte Hicks et al., n.d).

Both projects aimed to "show climate change policy-makers the conditions for which EbA is practical" (Charlotte Hicks et al., n.d). Additionally, they wanted to showcase the natural systems' benefits, costs, and limitations to promote "more suitable integration of EbA principles into policy and planning" (Charlotte Hicks et al., n.d).

The database currently consists of 222 tools and methodologies identified as being useful for one or more stages of EbAs, such as Planning, Assessment, Design, Implementation, Monitoring & Evaluation, and Mainstreaming, as seen in table 3 (Charlotte Hicks et al., n.d). This database aims to support EbA planning and implementation by showcasing existing tools, their use to identify project gaps, and documenting experiences with existing EbAs by considering the fields in table 2 (Charlotte Hicks et al., n.d).

When GIZ publishes this tool, we propose they host it on their website and share it with municipality staff members for future development projects. One of the most significant gains could be an increase in EbA projects, minimizing knowledge gaps, and increasing capacity. In addition, this tool should have the option to submit an EbA, where other GIZ experts review that EbA. According to the tool's drafters, the current database is not exhaustive due to referencing existing EbA tool inventories and online searches. Therefore, this database can benefit from submissions from other groups, such as municipality staff members and other stakeholders.

Planning	*Reviewing and stocktaking of socio-ecological information as well as information on the institutional and regulatory context*
Assessment	*Analysing climate change scenarios and assessing current and future vulnerabilities*
Design	*Identifying, selecting and appraising adaptation options*
Implementation	*Developing a clear, long-term implementation strategy*
Monitoring & Evaluation	*Developing an M&E system to support adaptive management*
Mainstreaming	*Integrating EbA into exisitng policies, frameworks, planning mechanisms and projects*

Table 3: This table showcases the filterable options available in the EbA toolkit (Charlotte Hicks et al., n.d).

Primary ecosystem	*Agriculture; Drylands and Deserts; Forests and Woodlands; Inland Waters; Marine and Coastal; Mountains; Rangeland and Grassland; Urban*
Target audience	*Decision-makers; Policy-makers; Project planners and managers*
Operating scale	*Global; Regional; National; Provincial; Local; Community; Site-level*
Resources/Time required	*Additional equipment needed; manpower; length of time to apply*
Skills/Training required	*Specialist skills needed; training needed or offered*
Accessibility	*Open or restricted access*
Language	*Language options available*

Table 4: This table showcases the attributes each EbA in the database would have entered. These fields attempt to bridge project gaps (Charlotte Hicks et al., n.d).

Awareness Raising Campaign

From our discussions with farmers and fishermen in Divjaka, we learned some people have knowledge gaps about the watershed in Divjaka and its importance. Therefore, we propose GIZ collaborates with INCA and RAPA to promote awareness of issues such as erosion in the Shkumbini River, how that affects the Divjaka community, which community members are affected, and how they can contribute.

By raising awareness, we aim to bridge knowledge gaps and empower people to take action and contribute to a solution. Furthermore, collaborating with INCA simplifies this process since they have created environmental education training and capacity-building activities (INCA, 2022).

High school students in Divjaka believe that the most effective awareness-raising method for younger groups is through social media posts, flyers, and public speaking about these issues. Whereas for older generations having direct conversations about these issues works best for older groups.

Private Land Owner Incentives

While conducting our study, our group did not interview private landowners near the Shkumbini River, where we proposed placing some interventions. Therefore, we suggest meeting with private landowners to understand their views on implementing NbS on their land and long-term monitoring efforts.

In addition, meeting with private landowners will allow GIZ to understand possible incentives and conditions to encourage private landowners to allow for NbS on their land. Interviews or meetings with private landowners can be initiated by the municipality and then, through snowball sampling, increase the number of stakeholders to interview.

Erosion Monitoring Scheme

According to our discussions in Divjaka, implementing a NbS requires increasing climate data on the erosion of the Shkumbini River. Therefore, we propose GIZ collaborates with the municipality for this project to monitor erosion along segments within Divjaka's jurisdiction. Recording data on erosion over time allows comparison of before and after interventions to determine their effectiveness and quantifies the erosion rate for a specific part of the river

According to Victoria Bamford, a research fellow at the University of New Hampshire, a method of erosion monitoring is placing two markers at fixed locations perpendicular to the shoreline and routinely measuring the distance from the fixed markers to the point of erosion to record changes as seen in figure 1 (Bamford, 2021). The benefit of this method is its simplicity.

To record changes in the land, we must measure the distance between stakes A and B and between stake A and the erosion site. According to Bamford, the distance between stakes A and B serve as reference points to ensure that you are measuring from the same distance and along the same line each time (Bamford, 2021).

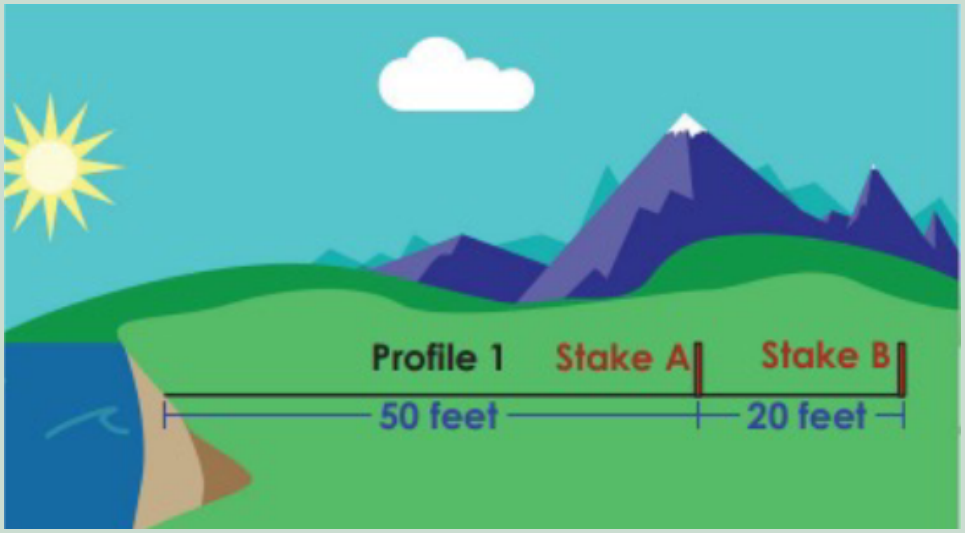

Figure 5.1: This image showcases an example of the monitoring system (Bamford, 2021).

Bamford suggests measuring every one to three months and after storms. Additionally, she recommends increasing the frequency of data collection during months of considerable change. Therefore, as a result of this continued data collection, we will determine the rate of erosion, possible trends, and weather effects.

In addition, a supplement to the recorded data is taking photos of the site to observe changes over time. Bamford recommends that pictures contain both the stakes and the erosion sites within them to maintain a reference point (Bamford, 2021).

Date	Distance between Stakes (feet)	Distance between Stake A and the Erosion Site (feet)	Photos Taken? (Y/N)	Notes
1/13/21	20.0	50.0	Y	Baseline measurement.
2/14/21	20.0	50.0	Y	No change.
2/22/21	20.0	49.5	Y	Day after a storm.
3/13/21	20.0	49.5	Y	No change.
4/12/21	20.0	49.4	Y	Rainy all last week.
4/17/21	20.0	49.3	Y	Day after high tide flooding.
5/11/21	20.0	49.3	Y	No change.

Figure 5.2: This image shows data a monitoring sheet can contain (Bamford, 2021).

Database of Interventions Placed on Map

After meeting with the municipality, we learned of a mapping tool they use called the ASIG Geoportal. This tool showcases information such as protected areas, hydrography, species distribution, natural risk zones, land plots, land borders, etc. In addition, ASIG geoportal shows images of the site you zoom on.

To increase transparency and knowledge on previous interventions, an addition to this tool would be to connect it with a database of all public works projects specifically for nature-based projects. We propose that GIZ partner with the municipality of Divjaka to make the proposed additions to this website.

Conclusion

Our project began with an objective to learn about the water system present in the region of Divjaka, and to develop NbS that are able to reduce harm caused by the natural hazards present there. As we traveled to the site to speak with stakeholders, we learned in-depth about their interests and their livelihoods. Hearing first-hand the effects that climate change hazards have had on this community brought our team deeply into the project.

As we formed an understanding of the ecological systems present, we were able to learn about the social and societal systems present as well. These experiences shifted our understanding of the project as a whole: instead of looking for ways to solve a large-scale problem, we looked for ways to understand a large-scale system and address the problems within it. This full experience of the people and the area made clear the possibilities of community-based approach to an NbS design.

From here, our project provides a starting place for GIZ to create pilot programs and potentially larger-scale interventions in the region. By informing our sponsor on the environment and attitudes of local stakeholders, we hope to have created a way forward for GIZ to implement NbS in Divjaka. By creating an outline of the methods we used to engage stakeholders, writing proposals from the information gathered during these stakeholder engagements, and engaging in desk research alongside our sponsors, we hope to have provided some small steps in a journey that will take GIZ's work with NbS to more people.

Appendix A: Interview Consent Statement

Interviewer(s):
Interviewee(s):
Date:
Time:
Location:

Hi, our names are Andrei, Cristobal, Luke, and Nora. We are students working with GIZ to understand how people in Divjaka have been affected by climate change. Would you be willing to answer a few questions? (yes/no) If yes, do we have permission to audio and video record this interview? (yes/no) Recording the interview is optional, and all private information from this interview would be kept confidential if you choose. You are free to skip any questions you do not wish to answer, and you can withdraw from the interview at any time. You also can choose to keep any information shared confidential at any point after the interview. In addition, our report will not contain names or any kind of personal information without consent. Before we begin, do you have any questions for us?

Appendix B: Key Informant Interview Questions

B.1 - Municipal Government

- From your experience, which climate-related hazards are the most devastating physically and economically to the land in and around the National Park? Ex: Flood, drought, etc.
- Where are these hazards most relevant?
- How have you responded to these hazards?
- What is the view of environmental challenges affecting Divjaka? Affecting the lagoon in the national park?
- What infrastructure/development is present for mitigating these hazards?
    - IF NEEDED: specify water resources.
    - IF NEEDED: tourism affecting the area.
- Have you used community participation for these mitigation projects?
- What organizations or groups have you collaborated with in development projects? What donors have been involved?
- How have you initiated this?
- What tactics did you use?
- What challenges have you faced with getting the community to participate?
- What are the perceptions of community involvement in the community?
- If you were to use community involvement how would you do it?
- What does a successful project look like?
- How do you maintain projects?
    - Costs.
    - Labor hours. (how much upkeep it needs)
- At what point does a project stop receiving attention from the municipality/community? (resources decrease)
- What future projects are planned to mitigate the hazards you identified?
- How could they use more sustainable development practices (nature) to improve these projects?

B.2 - RAPA Fier, Divjakë-Karavasta National Park

- Why is the park important to you? To the community?
- We are focusing on flooding, drought, and heat waves. Do you feel that these natural issues affect the park?
- Looking at this map, can you point out the most affected areas?
- Do you feel that your work is supported by the larger government organization that you are a part of?
  - Do you feel supported by the municipal government?
- How does this organization differ from NAPA? (in the work done, in the goals of the organization, etc.)
- To raise awareness of the hazards present in the park, do you use community engagement?
- How do you go about that?
- Do you reach out to people directly?
- Has your organization done work with the development of the park?
- Based on the hazards you mentioned, how would you devise a solution using community engagement?
- How would this differ using nature?
  - Would it be harder?
  - Would it be better?
  - Why?

B.3 - NGOs and International Organizations

- What projects are you working on in Divjaka?
- What are/were the end goals of this project?
- What conclusions have you drawn from these project experiences?
- Has there been community involvement?
- Was this project influenced by the climate hazards present in Divjaka?
- How did those hazards affect the project?
- What was done to adapt to them? to mitigate them?
- Have you worked on other projects that are relevant to mitigating climate change hazards in other places?
- Are any of those projects relevant to our identified climate hazards?
- Have you done any work with nature-based solutions in other places?
    - If unfamiliar with the term, give a brief explanation with some examples
    - (if yes)
        - What was that experience like?
        - Was it successful?
        - What challenges did you face?
- How might NbS be applied to a previous project you have worked on?
- How might NbS be considered for the issues you have seen in Divjaka?
- Do you think there is any possibility for a NbS here?

B.4 - Fishery Management Organization

- What is the status of the organization? (NGO, state organization, etc.)
- What is your work within the community?
- Whose interests are they representing?
  - Livelihood or occupational?
- Over time, how much do you think the fish population has been reduced by?
- Where are the main areas that people fish? (mapping activity)
- Do these areas experience flooding, drought, salinization?
- How have these climate change issues affected fishing and the fish?/the fishing industry in Divjaka?
  - Provide general examples and see if they have any experiences that may be parallel/similar
  - With what severity?
  - Have these problems gotten worse in recent years? How so?
- Can you show us on the same map provided earlier which channels are active and which ones are not?
- What measures have you taken to adapt to the situation? (to increase the number of fish? to keep the number of species intact?)
- What have other organizations done to prevent the channels from being blocked?
- What else do you think can be done?
- What else do you think needs to be done?
- What will happen in 40 years if the problem is not fixed?
- What will happen in the next 40 years if the problem is fixed?

Appendix C: Semi-Structured Interview Guidance

Questions for general public:

- Have you noticed any environmental changes in the surrounding area?
- How have any changes affected your livelihood?
- Have you noticed any attempts to improve the impacts of any environmental changes?

Questions for Farmers:

- Divjaka has been affected by drought, how has that affected your farm?
- When you started farming, what were your farming practices?
- What are your current farming practices?
- What led to those changes, if any?
- Would you be willing to change your farming practices?

Questions for Fishermen:

- The Karavasta Lagoon has experienced eutrophication due to soil erosion, how has this affected your fishing?
- What changes would you be willing to make to improve the state of the Lagoon?
- When you started fishing, what were your fishing practices?

Questions for NGOs:

- What have you learned from planning your projects?
- What does your process for proposal of environmental solutions look like?
- How have you gone about managing land use for these projects?
- What are the biggest obstacles you have faced in implementation of these projects?
- How do you determine if a project was successful?