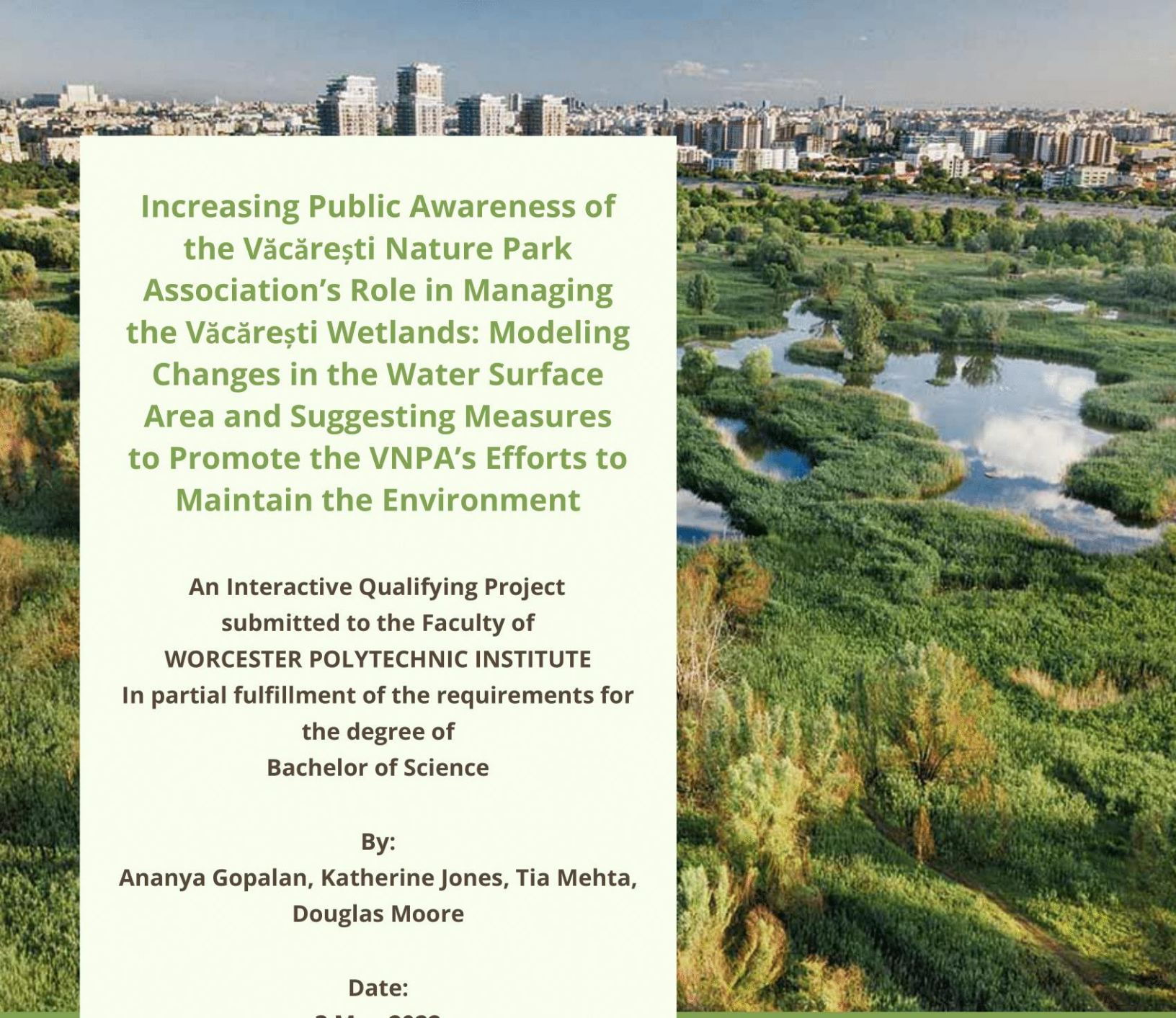


Increasing Public Awareness of the Văcărești Nature Park Association's Role in Managing the Văcărești Wetlands: Modeling Changes in the Water Surface Area and Suggesting Measures to Promote the VNPA's Efforts to Maintain the Environment

An Interactive Qualifying Project
submitted to the Faculty of
WORCESTER POLYTECHNIC INSTITUTE
In partial fulfillment of the requirements for
the degree of
Bachelor of Science

By:
Ananya Gopalan, Katherine Jones, Tia Mehta,
Douglas Moore

Date:
3 May 2022

Report submitted to:
Dan Bărbulescu
Văcărești Nature Park Association

Professors Althea Danielski
and Robert Kinicki

PARCUL NATURAL VĂCĂREȘTI

WORCESTER POLYTECHNIC INSTITUTE 1865

WPI

Increasing Public Awareness of the Văcărești Nature Park Association's Role in Managing the Văcărești Wetlands: Modeling Changes in the Water Surface Area and Suggesting Measures to Promote the VNPA's Efforts to Maintain the Environment

An Interactive Qualifying Project
submitted to the Faculty of
WORCESTER POLYTECHNIC INSTITUTE
in partial fulfillment of the requirements for the
degree of Bachelor of Science

by
Ananya Gopalan
Katherine Jones
Tia Mehta
Douglas Moore

Date:
3 May 2022

Report Submitted to:

Dan Bărbulescu
Văcărești Nature Park Association

Professors Althea Danielski and Robert Kinicki
Worcester Polytechnic Institute

Abstract

In collaboration with the Văcărești Nature Park Association (VNPA) located in Bucharest, Romania, this project evaluated options for improving the Văcărești Nature Park's (VNP) perceived value by increasing community engagement online and demonstrating the severity of water loss through a predictive model. The team remotely completed VNPA staff interviews and modeled the water surface area of the park using Geographic Information Systems (GIS). The team conducted a case study on the social media of other nature parks, researched water depth measuring technologies for a citizen science project, and recommended ways for the VNPA to expand their online presence by using popular hashtags and posting interactive content, such as livestreams.

Executive Summary

Motivation and Background

The Văcărești Nature Park (VNP) is a hub of biodiversity located in the heart of Bucharest, Romania (see Figure E.1). The VNP began as a hydrotechnical reservoir, commissioned by former communist leader, Nicolae Ceaușescu. The government abandoned the project after the fall of communism in 1989. Due to groundwater sources unforeseen by the project's designers, the reservoir began to fill with water, supporting the development of an accidental urban wetland.

Figure E.1. View of the Văcărești Nature Park (DJI_0320.Jpg (1200×800), n.d.)

In 2012, Dan Bărbulescu (our main collaborator), along with a group of environmental protection activists and experts, started the VNPA and began to lobby for the protection of the Văcărești area. A Romanian government decision established the VNP in 2016, and it became the first urban nature park in Romania (Our Association – Parcul Natural Vacaresti). The VNPA continued to manage the park until the Romania government passed an ordinance, banning environmental NGO's from managing nature protected areas (*Protected Areas in Romania without Custodians and Protection?*, n.d.). The ordinance first delegated control of the VNP to the National Agency for Protected Nature Areas (ANANP). The ANANP failed to provide the VNPA with management solutions and resources needed to properly maintain the ecosystem of the park.

The Bucharest Municipality then took control of the park, specifically the Ministry of Environment (N. Marin, 2022). This governmental body lacks the expertise needed to properly maintain a nature protected area. Therefore, the VNPA cannot conduct proper management. They are limited to superficial maintenance and can not carry out large scale operations such as removal of invasive species of reed beds (see Figure E.2).

Figure E.2. Reed beds in the VNP (Burned-Tree-Riverbank-Closeup-Landscape-40271171.Jpg (800×533), n.d.)

To address the lack of support from the Bucharest Municipality, the goal of this project was to assist in convincing policymakers to provide the VNPA with managerial assistance by recommending plans to increase the park's perceived value

and predicting how water surface area in the Wetlands will change without intervention.

During the execution of the project, the team considered the following project stakeholders: the VNPA, the local community, and the Bucharest Municipality. With proper management support, all stakeholders can benefit from the resources the park provides.

Methods

To increase the perceived value of the park and demonstrate the severity of water loss, the team devised three objectives to achieve their goal:

1. Increase community engagement with the VNPA's online presence.
2. Propose new techniques to measure water depth in various locations in the park.
3. Demonstrate how water surface area has changed in the past, predict how water surface area will likely change in the future, and highlight its impact on the Wetlands ecosystem.

The team conducted five interviews that contributed to the completion of Objectives 1 and 2, as well as providing additional information about the relationship between the project and its stakeholders.

The interviews were semi-structured and the team conducted them over Zoom and email. The interviews spanned a variety of topics including ecology, management of the park, and the VNPA's social media. Question topics were tailored towards the expertise of the interviewee. The team inductively coded and analyzed the interviews in order to identify the highest priority issues the VNPA faces. The team identified eight main themes throughout the interviews, and further divided these into sub-themes.

In order to complete Objective 1, the team investigated the VNPA's current social media practices and online presence. The team divided this objective into two components: increasing digital traffic to the VNPA Instagram page and researching the specifications of establishing a wildlife livestream. The team performed a case study of the social media of other NGOs and nature parks in order to examine the strategies of more popular accounts. Interviewing Victor Marin, the communications coordinator of the VNPA, helped to identify the VNPA's current social media practices. Along with this, the team researched various camera and data transmission options to recommend the best livestream system to the VNPA.

To recommend a suitable and cost-effective water depth sensing technique, completing Objective 2, the team researched autonomous and handheld depth sensing devices. The team gathered information about cost, sensing capabilities, and ease of use of each device. At the recommendation of Dan Bărbulescu, the team focused on technologies that volunteers working with the VNPA could easily use to measure water depth so it can become a citizen science project.

The main technical component of this project involved processing and analyzing satellite images from the Copernicus and Skywatch programs. The results of this analysis contributed to the completion of

Objective 3. Using Geographic Information Systems (GIS), the team performed Normalized Difference Water Index (NDWI) analysis on satellite images from 2015 to 2022 to estimate the water surface area in the park over time. Figure E.3 is an example of a satellite image after NDWI processing. After calculating the trend in water surface area over this time period, the team performed linear regression analysis to project the future water surface area in the park.

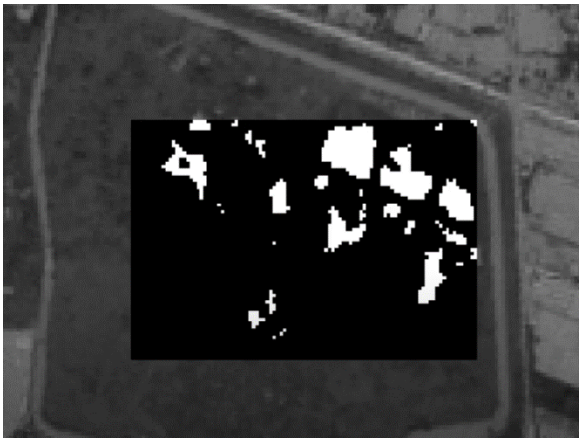


Figure E.3. NDWI processed image with threshold applied (Copernicus, n.d.)

Results

Interviews provided context for Objectives 1 and 2 and connected the current problems the VNPA faces to the project stakeholders.

The VNPA's Main Authority is the Bucharest Municipality

One of the greater problems the VNPA is currently facing is a lack of cooperation from the Romanian government, manifesting as superficial maintenance and a lack of regulations. Interviews with Dan Bărbulescu and Nicoleta Marin revealed that the Municipality lacks the qualifications needed to properly maintain the VNP. The park currently lacks both visiting regulations and a means to enforce them, both of which are the responsibility of the Municipality.

Changes in the Park's Ecosystem

The VNPA faces difficulty controlling invasive species such as reed beds, leading to the need for management intervention within the park. Dan Bărbulescu and Nicoleta Marin agreed that the invasion of reed beds, which lead to shrinking ponds, is of utmost concern. Dan Bărbulescu believes that if the lakes and ponds continue to shrink the ecosystem of the park will change drastically, which would be a huge loss for the city's nature and biodiversity. Without additional management support for the park, the VNPA has not been able to maintain a balanced ecosystem with trees, wetlands, and grasslands. One such environment is shown in Figure E.4.

Figure E.4. A pond in the VNP (Biodiversity – Parcul Natural Vacaresti, n.d.)

Objective 1: Expanding the VNPA's Outreach Through Web Engagement

Analysis of the VNPA's social media activities revealed that they have a very active online presence and that Facebook is

the most widely used social media in Romania. The results of the team's case study found that other nature parks encourage their visitors to follow their social media through nature tips and photo contests, where visitors compete to submit the best photo in the park for a reward. The case study also highlighted the influence that high-traffic (popular) hashtags have on the visibility of social media posts. The VNPA does not include high-traffic hashtags in their posts, and lacks that community engagement that other nature park social medias have.

Based on comparative research of other nature parks, the team noted the popularity of livestream broadcasts. VNPA staff pointed out that the park does not have sufficient infrastructure to support wired livestreaming service. Conversations with PixCams, an organization that helps set up wildlife camera systems, led the team to research an EZ Bridge point-to-point Wi-Fi transmitter and a 4G USB module, a small device that connect any USB-enabled camera to a 4G network. The team also researched three different camera options, focusing on cost, resolution, weather resistance, and power usage.

Objective 2: Citizen Science and Water Depth

The team explored several technologies for use in water depth measurement in the park. The team compared two autonomous devices (a drone and a boat) and one handheld device (a commercial fish finder), gathering information about their cost, ease of use, and sensing capabilities. The two autonomous platforms were prohibitively expensive and the team abandoned them early in the team's research. The fish finder, however, was a promising solution due to its ease of use and affordability.

Objective 3: GIS Analysis

Using the NDWI technique on 34 satellite images from 2015 to 2022 yielded a chronology of water surface area data points. After plotting these data points, the team generated a trendline that showed water surface area in the park has been decreasing over time (see Figure E.5). The team calculated that there has been a 51% decrease in water surface area in the past seven years. The team then extended the trendline to estimate the water surface area over the next 10 years and found that it is projected to decrease by 67% if no management intervention takes place.

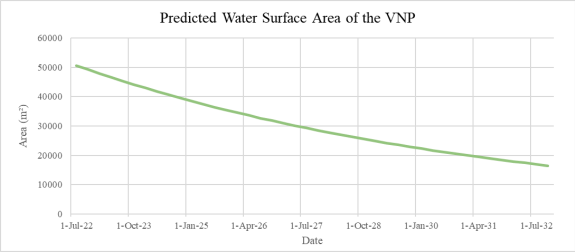


Figure E.5. Graph of Predicted Water Surface Area of the VNP

Recommendations

The team proposed a set of recommendations to the VNPA that could increase the parks perceived value and highlight the urgency of their need for management intervention. The VNPA should include the following content in their Instagram posts:

- High-traffic hashtags (see Table E.1 in Appendix E)

- Profiles about VNPA staff
- Park events and activities
- Photo contests, nature trips, Q&A sessions with park staff
- Collaborations with other nature parks or local businesses

The VNPA should also install the necessary hardware to broadcast a wildlife livestream: an IP camera and an EZ Bridge Wi-Fi transmitter. There are many model options for IP cameras and the VNPA can choose one that fits their budget. They should install the camera in an area of the park with high levels of wildlife activity and make the livestream accessible through their website or YouTube channel.

Lastly, the VNPA should use commercial fish finders in a citizen science project to measure the water depth of lakes and ponds in the Wetlands.

Conclusions

Based on the results of this project, the team concluded that the main obstacle preventing the VNPA from effectively managing the park is its relationship with the government. By gathering a greater following for their online presence through updating social media, creating livestreams, and launching citizen science projects, the VNPA can demonstrate how important the park is to the local Bucharest community. The VNPA can use the results of the GIS analysis to highlight the urgency of implementing a proper management strategy due to the rapidly shrinking water surface area. Calling the government's attention to the VNP's value to the community and its need for management intervention could influence the Bucharest Municipality to provide the VNPA with the support it needs to develop and execute a thorough park management plan.

By demonstrating the value of the park and its rapid water loss to a wider audience, the VNPA can garner the support they need to appeal to the Bucharest Municipality and work towards creating an effective management plan. With the cooperation of the Municipality, the VNPA could achieve proper care and management of the park. Dan Bărbulescu envisions this as establishing visiting regulations, a park ranger body, or a large-scale operation to remove invasive reed beds. These steps would help to ensure the longevity of the Văcărești Wetlands for generations to come.

Figure E.6. Duckling in the Pond in the VNP (Biodiversity – Parcul Natural Vacaresti, n.d.)

References

Biodiversity – Parcul Natural Vacaresti. (n.d.). Retrieved May 2, 2022, from https://parcnaturalvacaresti.ro/en/biodiversity/

Burned-tree-riverbank-closeup-landscape-40271171.jpg (800×533). (n.d.). Retrieved May 2, 2022, from https://thumbs.dreamstime.com/b/burned-tree-riverbank-closeup-landscape-40271171.jpg

DJI_0320.jpg (1200×800). (n.d.). Retrieved May 2, 2022, from https://geographical.co.uk/images/2021/Vacaresti/DJI_0320.jpg

Our Association – Parcul Natural Vacaresti. (n.d.). Retrieved May 2, 2022, from https://parcnaturalvacaresti.ro/en/our-association/

Protected areas in Romania without custodians and protection? (n.d.). Retrieved May 2, 2022, from https://wwf.panda.org/wwf_news/?332550/Protected-areas-in-Romania-without-custodians-and-protection

Table of Contents

Table of Authorship

Author	Sections of Authorship
Ananya Gopalan	2.1, 2.1.1, 2.4, 2.4.1, 3.1, 3.1.1, 4.2.3, 4.3,
Katherine Jones	2.2, 2.3.3, 2.4.2, 3.1.2, 3.4, 3.4.1, 4.1, 4.2, 4.2.2, 4.5, 4.5.1,
Tia Mehta	2.1, 2.1.2, 2.6.2, 3.3, 3.4, 3.4.1, 4.1, 4.2, 4.2.1, 4.7
Douglas Moore	2.3, 2.3.1, 2.3.2, 2.5 (and all subsections), 2.6, 2.6.1, 2.6.2, 2.6.3, 3.2, 3.3, 4.4, 4.5.1, 4.5.2, 4.6 (and all subsections)
All	1.0, 2.0, 3.0, 4.0, 5.0, 6.0 (and all subsections), 7.0

All authors contributed to edits and revisions of each section.

List of Figures

List of Tables

1.0 Introduction

Wetlands ecosystems are particularly susceptible to the impacts of climate change and drought. For decades, southeastern Romania has experienced an increasingly arid climate (Dobri et al., 2021). Climate change has affected the Văcărești Wetlands in Bucharest, Romania, causing its water surface area to steadily dwindle over the years, with groundwater depleting due to drought and overgrown reed beds (Bărbulescu, 2022).

The Văcărești Wetlands is an important greenspace in the heart of Bucharest, Romania, that serves as an ecotourism destination and a home for many protected species. The Văcărești Nature Park Association (VNPA) is the organization that maintains these wetlands. In 2014, environmentalists established the VNPA, a Romanian NGO, with the purpose of protecting the park ecosystem and wildlife (*Our Association – Parcul Natural Vacaresti*). However, the VNPA is struggling to maintain the wetlands due to a policy change that caused a shift in management. In 2018, the Romanian government banned environmental NGOs from managing nature-protected areas, leaving the VNPA without the authority to conduct large-scale maintenance efforts.

The lack of maintenance has led to a noticeable decrease in the water surface area of the Wetlands. To garner public support for park maintenance, the VNPA employs a variety of social media websites. The VNPA posts frequent updates on the plant and animal ecosystems within the park to broaden community awareness of the Wetland biodiversity. This online presence helps attract volunteers who aid the VNPA with cutting reed beds, hosting community activities (such as group birdwatching and hiking), and measuring water levels. The VNPA collects data on water levels to better understand park hydrology and advocate for a formal maintenance plan.

The goal of this project was to assist in convincing policymakers to provide the VNPA with managerial assistance by recommending plans to increase the park's perceived value and predicting how water surface area in the Wetlands will change without intervention. To accomplish this goal, the team devised the following three objectives:

1. Increase community engagement with the VNPA's online presence.
2. Propose new techniques to measure water depth in various locations in the park.
3. Demonstrate how water surface area has changed in the past, predict how water surface area will likely change in the future, and highlight its impact on the Wetlands ecosystem.

The team investigated the social media profiles of various nature parks and NGOs and interviewed the VNPA's communications coordinator in order to determine beneficial strategies that the VNPA could adopt. To gain a broader data set, the team examined both European and American profiles. The team focused on the Facebook and Instagram pages of these parks by comparing the number of likes, content, number of followers, and the types of hashtags used. The results of this comparison guided the team's recommendations for increasing community engagement through social media.

By researching water depth measuring techniques, the team assisted the VNPA in finding new technologies to document changing water levels in the Wetlands. The VNPA staff wanted a new method of measuring water depth that volunteers and community members could perform as a citizen science project. The team evaluated options based on cost, ease of use, and depth sensing range to find a suitable recommendation for the VNPA.

The team assisted the VNPA in estimating water surface area in the park by analyzing current and historic satellite images of the Wetlands using geographic information system (GIS)

software. Researchers have never studied the Văcărești Wetlands in this manner (Ali & Jaber, 2020; Hussaini et al., 2019). The team conducted research on a smaller geographical scale and with more frequent imaging than in past studies. The team used the findings to create graphs and predictions for the VNPA that illustrate the severity of the problem and the consequences that will occur if the government does not take action.

2.0 Background

This chapter introduces the challenges the Văcărești Nature Park Association (VNPA) face as it works to maintain the Wetlands with little support from the Romanian Government. The chapter begins with a brief discussion of Romanian history and how it affects the social, political, and economic culture today. The following section describes the potential economic and environmental values of the Wetlands. The subsequent section details the recent deterioration of the Wetlands due to drought and climate change and its implications on the health of the park's ecosystem. The final sections detail the three main components of the project, which include web engagement, water depth measurement techniques, and Geographic Information Systems modeling of water surface area.

2.1 Origins of the Wetlands

The Văcărești Wetlands is the largest "compact green space" in Bucharest and covers an area of 183 hectares (*Văcărești Nature Park – Parcul Natural Vacaresti*, n.d.). In addition to biodiverse species and habitats, the Văcărești Nature Park (VNP) offers an interesting contrast between the urban, anthropized area and the natural wetland with expanses of reed, swamps and wetland-specific trees and vegetation. While visiting Văcărești in 2012, Tobias Salathe, a senior advisor for Europe at the RAMSAR Convention on Wetlands of International Importance, stated: "Văcărești will undoubtedly be one of the most innovative urban wetland projects in the world" (*Brief History – Parcul Natural Vacaresti*).

The VNP was not originally a wetland reserve. During the late 1970s and early 1980s, Romania's communist leader Nicolae Ceaușescu forcefully industrialized Romania without considering the impact of his actions on other areas of development within the country. This

rapid industrialization led to a lack of focus in areas such as urban planning and environmental governance. In 1988, the communist regime began extensive hydrotechnical development on the Văcăreşti Lake.

Figure 2.1. A photo of the Văcăreşti Reservoir in 1989 (Andrei Birsan Vacaresti 1989 web.Jpg (1908×1242), n.d.)

The government intended for the site to be a part of the flood-defense hydraulic-engineering system in Bucharest. To make room for the Văcăreşti Lake reservoir (Figure 2.1 shows this is 1989), the regime destroyed the Văcăreşti borough (a neighborhood of individual dwellings). Designers abandoned the project after the fall of communism in 1989 and its status remained uncertain until 2002, when the government auctioned the land off to private investors (Ianos et al., 2014). Figure 2.2 shows an aerial view of the park taken around 2015, when the VNPA became responsible for the management of the park.

Figure 2.2. Aerial view of the Văcărești Nature Park in 2015 (How Nature Turned a Failed Communist Plan into Bucharest's Unique Urban Park | Cities | The Guardian, n.d.)

2.1.1 Government Funding for NGOs

Following the collapse of communism in 1989, Romania began the shift from a socialist to democratic government. The country faced difficulty restructuring an outdated industrial base, rebuilding an agricultural sector that was inefficient, and removing government subsidies for consumer goods. This period of regrowth engendered the rise of many non-governmental organizations (NGOs). While the government made much progress towards a functional democratic society in the late 90s to early 2000s, the 2008 global economic crash slowed the pace of liberalization and privatization of services needed for a well-functioning market economy (Constantin et al., n.d.). This resulted in high levels of poverty, unemployment, skyrocketing inflation, and shortages of consumer goods. These became the primary focus of Romanian government aid, rather than supporting NGOs.

The government is reluctant to fund NGOs unless they are sure of a return on investment. Therefore, NGOs are unable to complete much work on their own (Zbuchea & Bîr, n.d.). The

local government focuses on issues policymakers consider important, such as official events and legislative initiatives, overshadowing the needs of the people. Currently, this lack of governmental support hinders the VNPA's efforts to maintain the park.

2.1.2 Management of Natural Protected Areas

The Văcărești land began to garner attention in 2012 after the publication of the article "The Delta Among the Blocks" in the May issue of the National Geographic magazine. The article pointed out the rich biodiversity of the area, and introduced the idea of turning the land into a nature park. Dan Bărbulescu, along with a group of environmental protection activists and experts, started the VNPA and began to lobby for the protection of the Văcărești area. The group received project support from Kogayon, National Geographic România, Salvați Dunărea și Delta (Save the Danube and the Delta) Association and Ecopolis. Romanian government decision no. 349/2016 established the VNP in 2016, and it became the first urban nature park in Romania (Our Association – Parcul Natural Vacaresti).

In the years that followed the VNPA independently managed the park. In 2018, the Romanian government passed an emergency ordinance banning environmental NGOs from managing nature protected areas and delegated the control to the National Agency for Protected Natural Areas (ANANP), a subset of the Ministry of Environment (*Protected Areas in Romania without Custodians and Protection?*, n.d.). The ANANP has failed to provide the solutions and resources needed for the VNP to reach its previous state of maintenance (*Organizațiile Non-Guvernamentale Din România Cer Protecție Pentru Parcul Natural Văcărești*). As a result of the ordinance, the park no longer has a functional management structure, a scientific and advisory council, nor a ranger force. While the VNPA is able to carry out superficial maintenance, more

complex operations require prior approval from the ANANP. The VNPA wrote a letter to the ANANP in 2020 requesting a park guard, and a formal management plan for biodiversity conservation and ecological reconstruction (*Organizațiile Non-Guvernamentale Din România Cer Protecție Pentru Parcul Natural Văcărești*). The ANANP denied all their requests, leaving the VNPA unable to manage the park properly, contributing to the decline of the Wetlands.

Earlier this year, management shifted yet again to the Bucharest Municipality. Similar to the ANANP, the Municipality lacks the experience and knowledge in managing nature protected areas. Because of this, the VNPA cannot carry out proper managemengt in the park, as the Municipality doesn't know what kind of management to perform (N. Marin, Bărbulescu, 2022).

2.2 Park Degradation and the Need for Conservation

Drought and global climate change currently threaten the health and longevity of the Văcărești Wetlands. There are many factors that contribute to the onset of drought, such as precipitation amounts, soil character, humidity, and wind speed (Dobri et al., 2021). Between the years 2001 and 2020, southeastern Romania experienced a decrease in precipitation combined with an increase in evapotranspiration (Dobri et al., 2021). Evapotranspiration is the simultaneous process of soil moisture evaporation and plant transpiration. This combination contributes greatly to an uptick in the aridity of the region, amplifying the effects of the drought.

The pressures on wetlands due to climate change are likely to come in the form of changes in hydroperiod (the portion of the year during which wetlands hold water), extreme weather events, and deviations from average temperature. These climate events can lead to altered groundwater flow and depth, invasive species rampaging habitats, and increased heat stress on wildlife (Erwin, 2009). Because wetlands are extremely sensitive to changes in the

quality and quantity of their water supply, both climate change and drought are greatly detrimental to the health of these ecosystems. A reduction in the water surface area of the park means loss of potential habitat space for aquatic species, as well as limiting the growth of vegetation that uses this water supply. Shrinking populations of these species leads to a disrupted food chain in the ecosystem.

An important strategy for the management of wetlands is the reduction of stressors that inhibit the ecosystem's ability to respond to climate change. In the case of the Văcăreşti Wetlands, an example of these stressors is the spread of invasive reed beds. Reeds and other grasses use more water than other vegetation, drawing heavily upon the already dwindling water supply. The reeds can also grow to such heights that they block visibility of other areas of the park, as seen in Figure 2.3.

Figure 2.3. Reeds beds in the Vacaresti Nature Park (3-1.Jpg (1250×834), n.d.)

2.3 Potential Value of the Wetlands

The conservation of the nature park is mutually beneficial to the environment and the municipality. City planners and policy makers have the opportunity to take advantage of the aforementioned ecosystem services that the wetlands provide. Municipalities can design selective management strategies to increase the output of desired services, such as the mitigation of pollution and heat (Palta et al., 2017).

The government and NGOs can reach a mutual benefit (Cheng, 2019). For example, funding for parks contributes to the upkeep of park activities and vegetation, inherently increasing ecotourism, which is financially beneficial to the government. A nonprofit such as the VNPA can organize events that bring locals together and raise the public's perceptions of NGOs. Consequently, funding the VNPA would not only be beneficial to the government and the nonprofit, but also the community as a whole.

2.3.1 Economic Value

Over time, the government can recoup initial costs of funding a nature park NGO and create sustainable economic growth for a region. Central Park, in New York City, is a prime example of an economically beneficial ecotourism destination. The Central Park Conservancy (CPC) in New York is a nonprofit organization founded in 1980 to restore the park from previous decades of neglect. It employs more than 300 staff members and has around 3400 volunteers as of 2021. (In comparison, the VNPA has about 15 active volunteers). As a result of the CPC's restoration efforts, Central Park now brings an estimated $1.4 billion in annual revenue to New York City (Castle, 2021). Although the US government does not fund the CPC, it is a good example of investments in ecotourism destinations that positively benefit a region's

economy. Globally, 40-60% of all tourists are nature tourists, and ecotourism accounted for around 20% of global travel in 1998 (The International Ecotourism Society, 2000). Similar to Central Park, the Văcărești Wetlands has the potential to bring about sustainable economic growth to Bucharest if the VNPA is able to maintain the nature park properly.

2.3.2 Community Benefits

Along with its potential economic impact, the Văcărești Wetlands provides valuable community space. There are trails for joggers, walkers, and cyclists in the park (see Figure 2.4), as well as bird-watching areas with observation towers (see Figure 2.5). Within large cities like Bucharest, access to protected nature areas is especially beneficial. Urban green spaces have been linked to "physical and psychological benefits" (Lee & Maheswaran, 2011). Possible benefits include increased cardiovascular health, bone health, and mental well-being (Lee & Maheswaran, 2011).

Figure 2.4. A group of cyclists using a trail in the Văcărești Nature Park (Walking Down and by Bike - Vacaresti Natural Park, n.d.)

Figure 2.5. People using an observation deck in the park (Walking Down and by Bike - Vacaresti Natural Park, n.d.)

Additionally, the park's educational value is an important factor. Park leadership conducts field trips with local schools and provides guided nature walks, educating the public about biodiversity and the importance of urban greenspaces. Figure 2.6 depicts a park ranger giving a tour to students. Raising awareness of environmental issues is crucial, especially as drought and desertification have swept over many parts of Romania and Eastern Europe in recent years (Welle, n.d.).

Figure 2.6. A park ranger talking to a group of local students (BSB Science, 2018)

2.3.3 Environmental Services of Accidental Ecosystems

Accidental urban wetlands form as a byproduct of municipal infrastructure and can have organismal, hydrological, and soil systems similar to those in natural wetlands (Palta et al., 2017). Ecosystem services are "a means of assessing, managing, or designing" (Palta et al., 2017) environments to maximize the benefits ecosystems can supply. These systems are smaller subdivisions of larger accidental ecosystems and can provide the same functions and services as their organic counterparts (Palta et al., 2017). Examples of such services include mitigation of heat and pollution, along with carbon sequestration (the process of capturing and storing carbon dioxide from the atmosphere). These accidental environments serve as low-cost means of reducing urban pollution, as well as providing habitats for vulnerable species.

The Văcărești Wetlands are home to an incredibly biodiverse array of flora and fauna. The current floristic inventory of the park lists 101 taxa, including *Wolffia arrhiza*, a rare species

of flowering plant threatened at a national level. The wetlands are home to over 138 bird species, 6 orders of insects, and a variety of amphibians and mammals, such as otters, as seen in Figure 2.7, and foxes (*Biodiversity – Parcul Natural Vacaresti*, n.d.). Changes in the environment will directly impact the biodiversity of the park. If water levels continue to drop, the park will "lose fish species, then maybe the mammals that feed on those species, then the birds that feed on small insects that live underwater or on the water" (N. Marin, 2022).

Figure 2.7. Image of an otter swimming in the Wetlands (Biodiversity – Parcul Natural Vacaresti, n.d.)

2.4 Web Engagement

With today's technological advancements, internet use has become a large part of society's day-to-day lifestyle. Social media usage has a variety of different purposes, including personal, business, and promotion of NGOs. NGOs use their online presence as an activist tool to "disseminate their initiatives and needs" (Carrasco- Polaino et al., 2018). Most organizations face the challenge of employing effective communication methods to mobilize local residents by engaging them in their social media campaigns. NGOs seek strategies that enable them to raise awareness of their organization, their mission and its needs. Through a variety of interactive

media, NGOs can increase engagement with their local community. This may include livestream Q&As, public contests, and in the case of many environmental NGOs, wildlife cameras.

2.4.1 Social Media

In hopes of spreading awareness of the Wetlands, the VNPA utilizes social media strategies to highlight the varying plant and animal ecosystems in the park. For example, the VNPA employs the usage of Instagram and Facebook to update followers (2,087 followers on Instagram an 17,147 on Facebook) to advertise the happenings in the Wetlands. Similarly, other National parks such as Yellowstone National Park (YNP) use social media in the same manner, to educate the public and protect the park wildlife. A recent YNP Instagram post featured two pictures: one of a beaver and one of a muskrat. The post highlighted the difference between these rodents and encouraged the community to keep an active lookout for both animals. Yellowstone is not only able to engage, but also educates the community and tourists on the park's wildlife, inherently broadening interest that often yields support for the park. Expanding the VNPA's online presence in a similar manner should contribute to the increased support of the organization and the park.

2.4.2 Trail Cameras & Livestreams

Since the onset of the COVID-19 pandemic, wildlife livestreams have risen in popularity as a digital avenue for the public to remain engaged with local zoos, nature reserves, and wildlife preservation efforts (von Essen et al., 2021). Parks use such surveillance to "sate the public's curiosity" for interactions with nature (von Essen et al., 2021).

"Fat Bear Week," an annual event hosted by Katmai National Park in southern Alaska, is an example of the successful use of wildlife livestreams to increase community engagement.

Katmai is one of the least-visited National Parks in the United States, but its Brooks Camp area is renowned for brown bear viewing opportunities (Dagan, 2019). The park uses a series of webcams to broadcast 24/7 footage of popular bear-viewing locations, and during Fat Bear Week, millions tune in to place virtual bets on which bear will gain the most weight to prepare for hibernation. In 2018, there were 37,018 visitors to Katmai, but the bear-viewing livestream garnered more than 10 million views. Katmai National Park is a remote backcountry area so online "visitors" provide twice the economic value than that of in-person visitors (Dagan, 2019).

Our project team decided to explore the concept of the VNPA harnessing the popularity of such livestreams and improving the effectiveness of their social media outreach to increase community engagement and build interest towards the park. Offering the public a glimpse into the Wetlands' abundant wildlife could stir interest and draw more visitors, both local and international ecotourists, to the park, while social media campaigns similar to Fat Bear Week can attract further attention.

2.5 Importance of Water Depth

Water depth is an important part of wetland ecology. The previous Văcărești Nature Park IQP group identified water depth as a critical factor in preventing the expansion of reed beds. The invasive reed species, *Phragmites Australis,* cannot grow in water that is over two meters deep (Herrera et al, 2021). The previous IQP group interviewed specialists who recommended excavating the shorelines of the ponds in the park to make them steeper, which would increase the water depth, reducing the amount of habitable area for reed beds (Herrera et al., 2021). Sufficient water depth is also important for aquatic lifeforms. Shallow water leads to higher thermal penetration, which increases the temperature of the body of water (Kundu et al., 2022).

Increased water temperatures can cause lower dissolved oxygen content, which leads to algal blooms, altered behavior of aquatic species, and altered biochemical processes in the ponds (Kundu et al., 2022). These environmental factors are critical for the survival of aquatic species and others that rely on them for food (Kundu et al., 2022).

2.5.1 Bathymetry

Bathymetry is the study of underwater depth features in oceans, lakes, rivers, and other bodies of water. Bathymetry surveys generate 3D maps of bodies of water using data points that include information about depth and position. Figure 2.8 is an example of a 3D map generated by a research team conducting a bathymetric study of Egypt's coastline near the city of Alexandria. Bathymetry allows for researchers to study subsurface features in bodies of water that would normally be invisible to them. In addition, Bathymetric 3D models provide information about the volume of water contained in a lake or pond. If researchers conduct multiple studies over time, they can utilize this information to determine how the amount of water in a lake or pond changes over time.

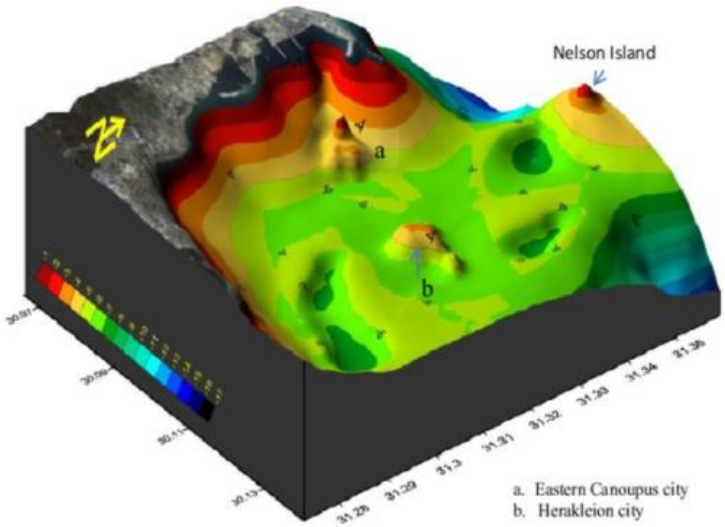


Figure 2.8. Bathymetric Map of the Coast of Egypt near Alexandria (Hamouda et al., 2015)

2.5.2 Autonomous Water Depth Mapping Platforms

Several companies offer water depth mapping services through autonomous vehicle platforms, and there are also techniques to create custom autonomous platforms by utilizing open-source hardware and software. CEE Hydrosystems is a company that specializes in shallow water depth mapping. They sell an autonomous boat, called the CEE-USV, (see Figure 2.9) that employs sonar to measure depth for bathymetric surveys (*CEE-USV | CEE Hydrosystems*, n.d.). Companies have completed bathymetric surveys of freshwater reservoirs, saltwater lagoons, and other bodies of water with the CEE-USV where manned boats are not able to travel.

Figure 2.9. CEE-USV Autonomous Boat (CEE-USV | CEE Hydrosystems, n.d.)

ASTRALite is a company that provides an unmanned aerial vehicle (UAV) platform for bathymetry and topology surveys. Their UAV system has completed surveys for use in coastal mapping, dam inspection, disaster response, and natural resource monitoring, among other applications (*Application | Topo-Bathy LiDAR | USA | ASTRALITE*, n.d.). Figure 2.10 displays the ASTRALite UAV in action.

Figure 2.10. ASTRALite UAV ("ASTRALiTe Edge, First Small-Scale LiDAR for Underwater Exploration," 2019)

2.5.3 Commercially Available Ultrasonic Depth Finders

Fish finders are a type of commercially available water depth finder for everyday consumers. Users with minimal technical background can get easy access to fish finders. Companies mass produce their components, making them relatively inexpensive in comparison to the custom equipment that autonomous depth mapping systems use. Fish finders report information about the water depth and temperature, and some are capable of displaying a height map based on information from ultrasonic sensors (see Figure 2.11.).

Figure 2.11. A LOWRANCE Brand Fish finder (Lowrance HOOK2 5 Fish Finder with SplitShot Transducer, n.d.)

2.6 Geographic Information Systems

The team analyzed satellite images using Geographic Information Systems to present and model the hydrology of Văcărești Nature Park. Geographic Information Systems (GIS) are computer programs that analyze and visualize data in fields such as earth sciences, biology, resource management, hydrology, and many other fields, using geological data. The strength of GIS is that it enables users to take large amounts of complicated data and transform those datasets into intuitive, easy to understand visual representations. In the future, the VNPA should be able to present the team's models stemming from the analysis of GIS images to convince the government of their need for support.

2.6.1 Previous Uses of GIS to Model Water Surface Changes Over Time

Researchers have used GIS software to model water surface area changes in wetlands and lakes. By looking at previous studies, the team was able to compare methods utilized by previous

researchers. In Central Africa, for example, the Lake Chad Basin's surface water area shrank by more than 90 percent over the span of five decades as a result of climate change and drought (Hussaini et al., 2019). A research team from the geography department at Aminu Saleh College in Nigeria employed GIS software and satellite images to map surface water area over time, highlighting the changes from 1985 to 2015. The staff focused on surface water area, as it is an important part of the water cycle and is critical to environmental sustainability (Hussaini et al., 2019). Figure 2.12a, 2.12b, and 2.12c show images the Nigerian research team produced to highlight shrinking surface water area.

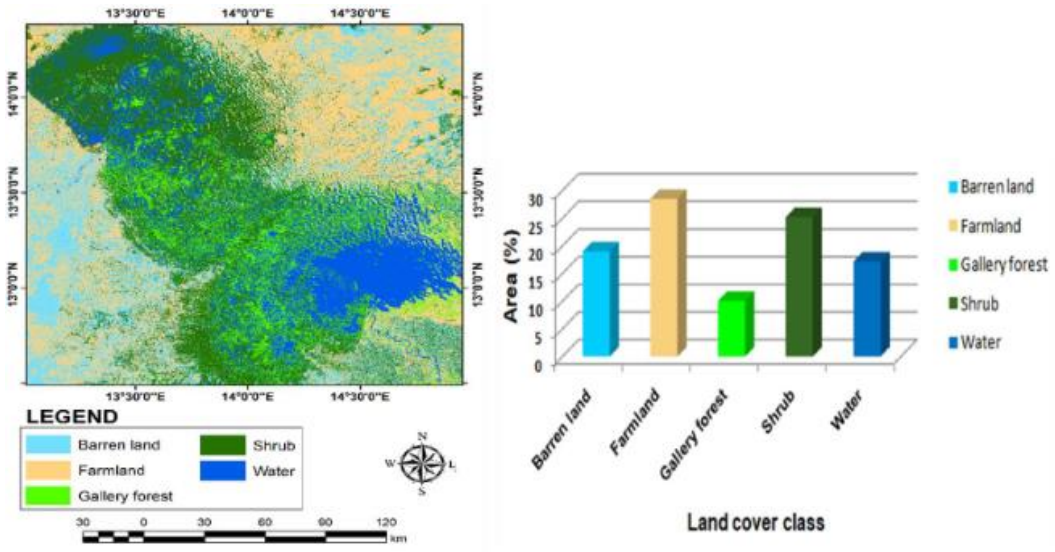


Figure 2.12.a. Survey Results for the Year 1985 (Hussaini et al., 2019)

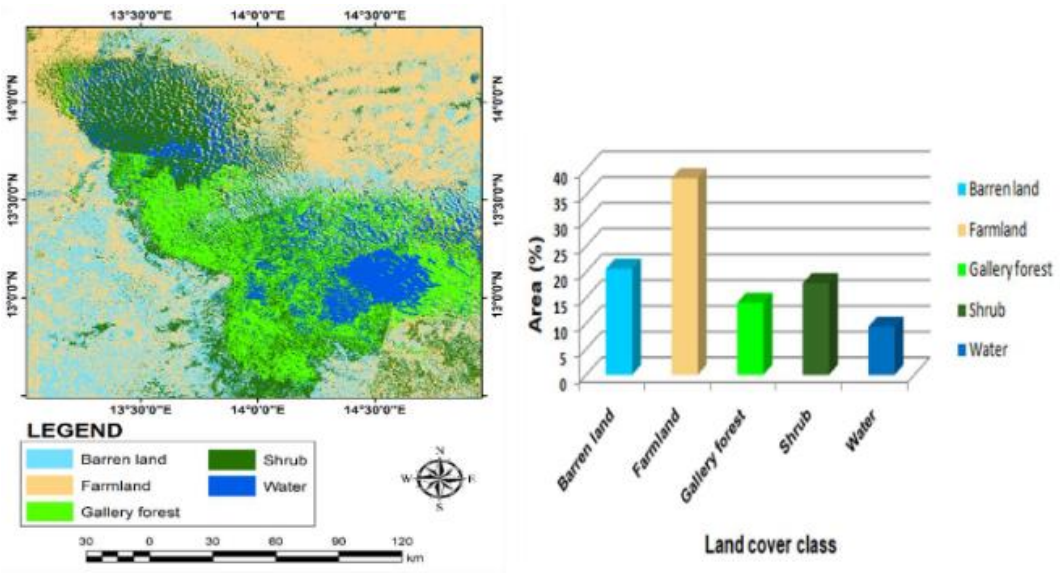


Figure 2.12.b. Survey Results for the Year 2000 (Hussaini et al., 2019)

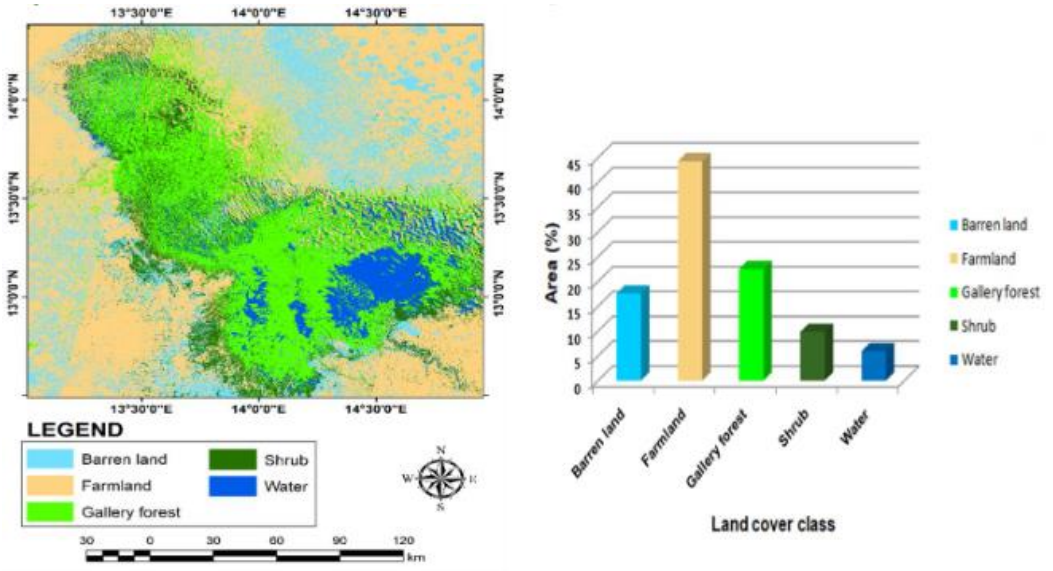


Figure 2.12.c. Survey Results for Year 2015 (Hussaini et al., 2019)

Another study in 2020 examined water levels in Razzaza Lake in Iraq utilizing satellite images from 1998, 2008, and 2018. Previously, wetland areas surrounded Razzaza Lake, providing habitats for birds, fish, and reptiles, but shrinking water surface area has reduced the number of resources available to these animal populations, negatively impacting biodiversity (Ali & Jaber, 2020). These researchers employed satellite imagery to create maps of areas with

deep water, arable land, and barren soil. Figure 2.13 illustrates the shrinking regions of deep water in the lake. The lake lost 57.9% of its deep-water areas and 38.7% of its shallow water areas since 1998 (Ali & Jaber, 2020).

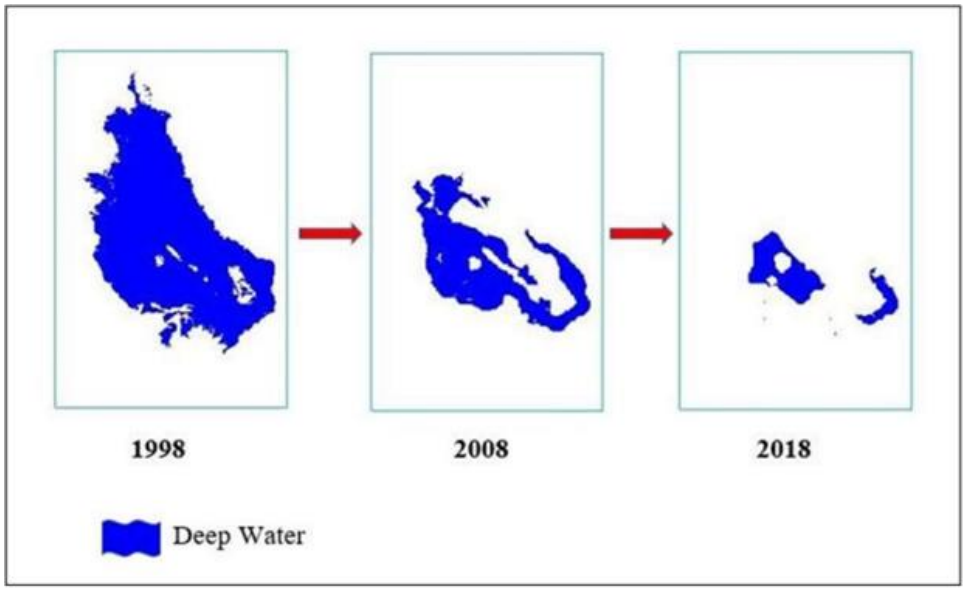


Figure 2.13. Deep water areas in Razzaza Lake over time (Ali & Jaber, 2020)

2.6.2 Copernicus and Skywatch Satellite Data

The European Space Agency worked with the European Union's Earth observation program to create the Copernicus program. Copernicus satellite images are available to the public at no charge, and their records go back to the start of the program in 2014 (*Copernicus in Detail | Copernicus*, n.d.). Images of the Wetlands only go back to late 2017, so the team used another satellite program, Skywatch, to gather older information. The cameras on the satellites in the Copernicus program can distinguish features down to 10 meters in size, and the satellites revisit the same area every five days to take new photos (*Sentinel-2 - Missions - Resolution and Swath - Sentinel Handbook - Sentinel Online*, n.d.) The satellites take images in the visible spectrum and with infrared and thermal cameras. The team gathered visible and infrared images

in order to create maps of surface water in the park, and processed those images to determine trends of surface water over time.

Skywatch is a Canadian company founded in 2014 that provides access to a network of satellite images available for purchase. The site offers data from NASA, the European Space Agency, San Francisco-based Planet, and more (Werner, 2020). Skywatch has images of low, medium, and high resolution with the latter two requiring payment for access. The medium resolution images cost $2.50 / km², and the area of interest for the image can be as small as one-tenth of a square kilometer (*Pricing*, n.d. ,Werner, 2020). Figure 2.14 is an example a of a medium resolution image from the Skywatch site. The team looked at medium resolution images beginning in 2015 up until 2017 to expand the data available for our models.

Figure 2.14. Image taken from Skywatch satellite network (Sources, n.d.)

2.6.3 QGIS and Normalized Difference Water Index

The team used QGIS, a free and open-source GIS program, in order to determine surface water area in satellite images with Normalized Difference Water Index techniques. The Normalized Difference Water Index (NDWI) is a number that measures the ratio of green to near-infrared light that an object reflects. Water reflects green light but absorbs near-infrared light very well. GIS software employs NDWI to extract surface water features from satellite images according to the equation in Figure 2.15.

$$NDWI = \frac{Green\ Channel\ Brightness - Near\ Infrared\ Brightness}{Green\ Channel\ Brightness + Near\ Infrared\ Brightness}$$

Figure 2.15. NDWI formula

Figure 2.16.a and Figure 2.16.b show an example of an image generated using NDWI methods to distinguish between areas of water and land. Figure 2.16.a is a satellite image before processing, and Figure 2.16.b is the same photo after NDWI processing.

Figure 2.16.a. Unprocessed Satellite Image (Geo Guru, 2020)

Figure 2.16.b. Processed Image with Water and Land Features Separated (Geo Guru, 2020)

NDWI values above zero indicate bodies of water, and values below zero are land. Figure 2.17 is an image the team generated in the GIS software from Copernicus satellite data of the Văcărești Wetlands from 2021. Black pixels are water features, white are non-water features, and the red areas are boundaries of the park. NDWI analysis offers a way to quickly and accurately determine the amount of surface water in an image.

Figure 2.17. VNP Water body extraction in 2021 using GIS software and NDWI

2.7 Summary

This chapter reviewed the history of the Văcărești Nature Park in Bucharest, Romania. The Văcărești Wetlands have great potential as a ecotourist attraction, but lack sufficient management support. During the execution of the project, the team considered the following project stakeholders: the VNPA, the Bucharest community, and the Bucharest Municipality. With proper management support, all stakeholders could benefit from the resources the park provides. The community could benefit from access to nature through a thriving greenspace in the heart of the city, and the Bucharest Municipality could see economic benefits from increased ecotourism. The next chapter outlines the methods the team took to help the VNPA showcase the potential value of the Wetlands.

3.0 Methodology

The goal of this project was to assist in convincing policymakers to provide the VNPA with managerial assistance by recommending plans to increase the park's perceived value and predicting how water surface area in the Wetlands will change without intervention. To accomplish this goal, the team devised the following three objectives:

1. Increase community engagement with the VNPA's online presence.
2. Propose new techniques to measure water depth in various locations in the park.
3. Demonstrate how water surface area has changed in the past, predict how water surface area will likely change in the future, and highlight its impact on the Wetlands ecosystem.

Figure 3.1 visualizes the connection between the project's objectives, methods, and deliverables.

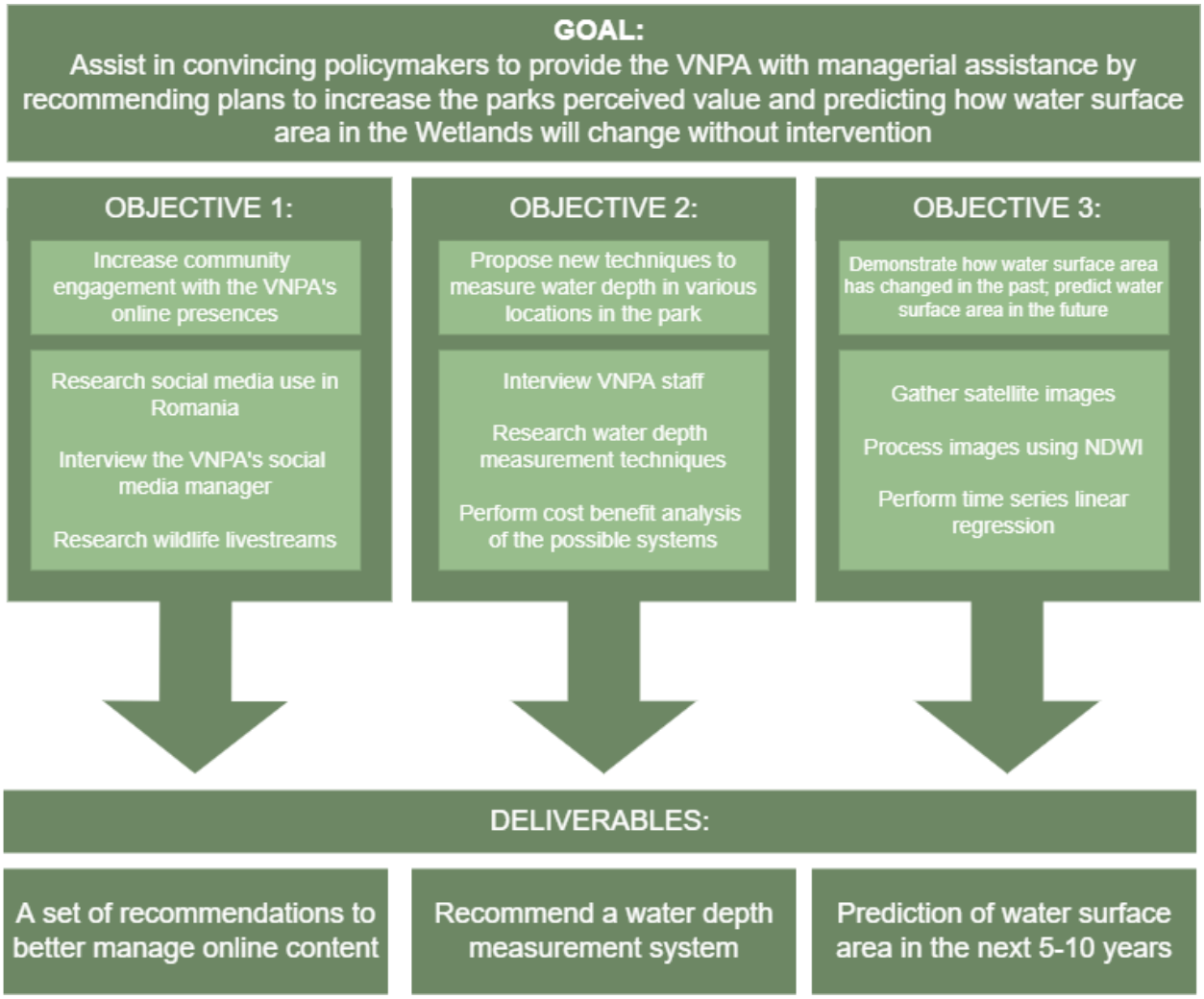


Figure 3.1. Flowchart linking the project's goal, objectives, tasks, and deliverables

The group assigned each team member a specific set of tasks relating to an objective on which each member worked independently and in parallel between March 14th and May 3rd. The chapter begins with an overview of the interview and coding process, then goes on to detail the specific methods the team used to accomplish each objective and create the final deliverables.

3.1 Interviews and Coding

The team conducted five interviews with VNPA staff. The VNPA is currently comprised of twelve full-time employees, so the five interviewees represented a sample size of 42% of the

organization, with a range of specializations. Table 3.1 details the interviewees positions in the VNPA and the format in which their interview took place.

Table 3.1. Interview Dates, Format, and Focuses

Interviewee	Title	Date	Format	Interview Focus
Dan Bărbulescu	Executive Director	8 April 2022	Zoom	Management
Nicoleta Marin	Project Lead	30 March 2022	Zoom	Management
Victor Marin	Communication Officer	19 April 2022	Zoom	Social Media
Bogdan Mihalache	Landscape Engineer	29 March 2022	Zoom & Email	Plant Maintenance
Florin Stoican	President	8 April 2022	Email	Management

Four interviews took place over Zoom, with the exception of one instance when the interviewee experienced technical difficulties mid-conversation. In this instance, the team finished the interview over email. The last interviewee answered questions solely through email. Prior to the interviews, the team wrote a set of questions (see Appendix A) and divided them into sections by topic (see Table 3.2).

Table 3.2. Interview Questions

Topic	Questions
Interviewee Background	A.1
VNPA Resources	A.2-A.4
Wetlands Ecology	A.5-A.10
Park Maintenance	A.11-A.12
Government Relations	A.13-A.15
Social Media	A.16-A.19

The interviews were semi-structured, with at least two members of the IQP team present. The semi-structured nature allowed for the interviews to remain conversational, and for the interviewer to reword questions as needed. Based on the interviewee's area of expertise, the team

included or omitted certain sections. The team conducted all interviews in English. At the start of each interview, the interviewer read the informed consent policy to the interviewee (see Appendix A). With express permission from the interviewees, the team recorded the Zoom interviews and later transcribed them. See Appendix B for transcriptions.

After the completion of all five interviews, the team used inductive coding to identify themes and sub-themes based on the reoccurring topics in the interviews. Table 4.1 lists the eight main themes and their sub-themes.

Table 3.3. Main Themes and Sub-Themes

Theme	Sub-themes
Community perspective of the park	General public
	Relationship with other NGOs
Ecology	Reed beds
	Water surface area
	Fire hazard
	Changes in ecosystem
Future of the park	Management structure
	Education
	Awareness
Maintenance/management of the park	Water levels
	Security
	Vegetation
	Management plan
Management authority	National Agency for Nature Protected Areas (ANANP)
	Bucharest Municipality
Resources	Financial
	Physical
Social media	Target demographics
	Facebook
	Instagram
	Disparity
Volunteering	No sub-themes

The team analyzed the sub-themes and noted whether the interviewee expressed a positive, negative, or neutral opinion on them. Sorting the mentioned sub-themes by connotation made the high priority issues more apparent to the team. The team did not limit a statement to be categorized with only one connotation in instances where the interviewee expressed contrasting opinions. These interviews contributed to the completion of Objectives 1 and 2. The following sections will further discuss how the interviews supplemented the completion of each objective.

3.1 Objective One: Increase Web Engagement for the VNP

To increase community engagement with the VNP, the team's first objective involved investigating the organization's current social media and online presence. The team divided this objective into two components: increasing digital traffic to the VNPA Instagram page and researching the specifications of establishing a wildlife livestream in order to make a recommendation. For both components, the team hoped to create a more interactive and captivating online experience for the community.

3.1.1 Social Media

Updating the VNPA's social media should broaden awareness of the organization's efforts to maintain the wetlands. The team researched the social media presence of other NGOs and national parks in Romania and other countries, including the Romanian Space Initiative, Plitvice Lakes National Park, Piatra Craiului National Park, and Yellowstone National Park. The team chose to research this selection of profiles because they have successful social media pages that the VNPA could model their strategies after. The group compared the Instagram and Facebook pages of these organizations with that of the VNPA, noting the number of posts, followers, average likes and comments per post, content of each post, and hashtags. Along with

this case study, the team interviewed the head of the VNPA's social media, Victor Marin, to identify social media strategies that the VNPA currently uses, as well as their goals for their Facebook and Instagram pages.

3.1.2 Investigating Wildlife Livestreams

By offering a live look into the Wetlands, the VNPA could spark the curiosity of those who have not yet visited the park. In order to recommend a livestreaming system and method that would best suit the needs of the VNPA, the team conducted a case study on other wildlife organizations that offer wildlife livestreams, including the San Diego Zoo ape habitat in San Diego, California, an osprey nest in Charlo, Montana, Katmai National Park in King Salmon, Alaska, and a backyard fox camera in Lichfield, England. The team noted details such as the number of cameras available in each location, whether any background information about the location accompanied the livestream, and whether each broadcast was 24 hours a day.

The team reached out to PixCams, a volunteer driven organization that works to help make livestreaming solutions cheaper and easily accessible for educators, researchers, nature parks, and the public. A member of the team contacted the organization's help line for information about how to set up a livestream camera in a location with no power or Wi-Fi. The team's questions related to monthly cost of operation, the possibility of using solar panels as a means of powering the livestreaming setup, and information about software requirements for connecting a livestream to streaming platforms like YouTube and Twitch. Through communications with PixCams and analysis of potential costs and product specifications, the team developed a set of options for livestream setups.

The team compared various models of outdoor cameras to determine which device would best serve the VNPA, weighing the benefits and limitations that came with each option. This cost-benefit analysis included details such as the power source of the cameras, whether the camera stores footage over the internet or on a SD card, and the product prices to determine the best camera for the VNPA, and performed a cost-benefit analysis of the options. This contributed to the completion of Objective 1.

3.2 Objective Two: Researching Water Depth Sensing Technologies

To recommend a suitable and cost-effective water depth sensing technique, the team researched autonomous and handheld depth sensing devices including the CEE-USV unmanned boat from CEE Hydrosystems, the ASTRALite EDGE unmanned aerial vehicle from ASTRALite, and a selection of consumer grade fish finders from Hawkeye electronics, Lowrance Marine and Fishing Electronics, and Garmin. This research included gathering information about the cost of each device, its limitations regarding dimensional accuracy, maximum sensing depth, and ease of use. Through informal correspondence and the interview with our collaborator, Dan Bărbulescu, the team identified which of these factors were most important in selecting a sensing technique and narrowed down the search for an optimal device. From the initial research, the team developed an understanding of the available technologies in order to make final recommendations for depth sensing devices suitable for the VNPA and its volunteers. These tasks contributed to the completion of Objective 2.

3.3 Objective Three: Demonstrating and Predicting Changes in Water Surface Area

The main technical component of this project involved processing and analyzing satellite images from the Copernicus and Skywatch programs in GIS software, using NDWI techniques

and time series analysis. The team predicted the future trajectory of water surface area through linear regression analysis. The team used these trends to provide evidence of the urgency of the VNPA's need for management intervention. Figure 3.2 maps out the flow of technical work in the project.

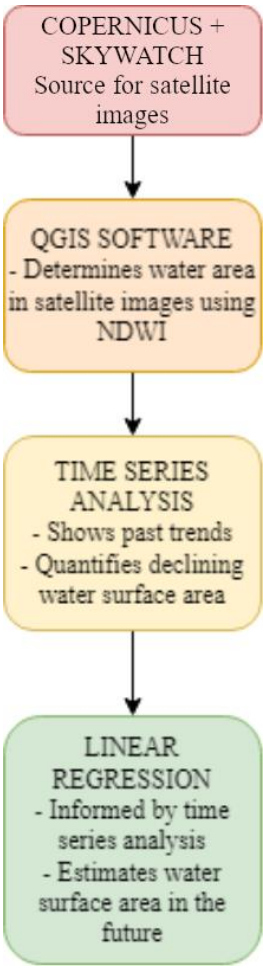


Figure 3.2. Flowchart for technical work on the project

The team examined 34 satellite images from 2015 to present day, sourcing data from the Copernicus and Skywatch programs' websites. It took the team approximately ten hours to analyze the images. The team downloaded at least four images per year from the Copernicus program, and at least one image per year from the Skywatch program. The cost of each Skywatch image limited the team from using more per year. The team then imported the image

data into QGIS software. NDWI techniques in QGIS determined the amount of water surface area in each image in hectares, and then the group plotted the amount of water surface area over time using time series analysis.

After completing the time series plot, the team performed linear regression analysis in Excel to estimate water surface area trends in the park over the next 5-10 years. The intent was that predictions from the linear regression would provide objective evidence that the park's water surface area will continue to shrink if the government does not take intervention to improve its maintenance.

To quantify the trends of water surface area, the team analyzed satellite images using the NDWI technique and GIS software. Figures 3.3 to 3.5 provide an example sequence of images that replicate the process the team used to quantify the amount of water surface area in the park. Figure 3.3 shows an unprocessed near infrared grayscale image from Copernicus. Figure 3.4 shows an NDWI processed image that combines information from the near infrared and green grayscale images. Figure 3.5 is the same image in Figure 3.4 with a threshold value applied to a rectangular region of the park in order to separate land and water features.

Figure 3.3. A near infrared grayscale image of the VNP in 2018 (Copernicus, n.d.)

Figure 3.4. NDWI processed image (Copernicus, n.d.)

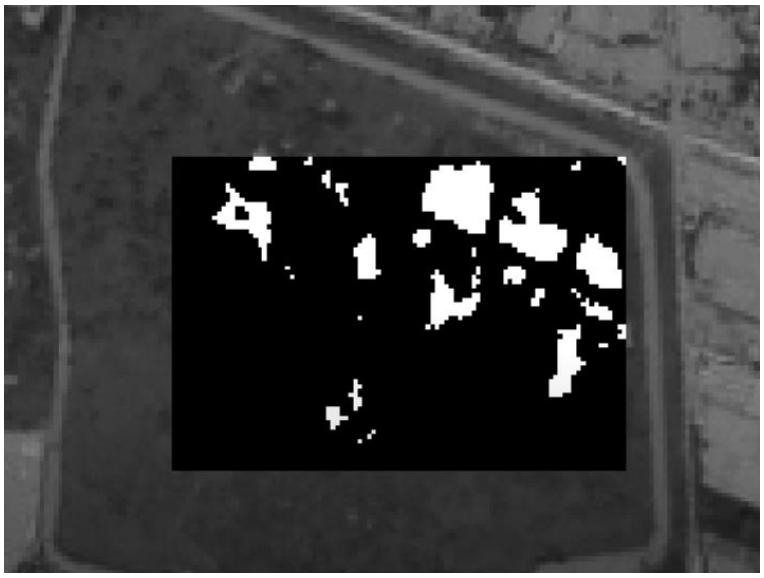


Figure 3.5. NDWI processed image with threshold applied (Copernicus, n.d.)

Once the team applied a threshold operation to the areas of the park with water, the next step involved calculating the amount of water surface area in the region of interest using the area reporting function in QGIS. Figure 3.6 depicts the area calculation output for the image in Figure 3.5.

Projection: EPSG:32635 - WGS 84 / UTM zone 35N

Width in pixels: 100 (units per pixel 10)

Height in pixels: 69 (units per pixel 10)

Total pixel count: 6900

NODATA pixel count: 0

Value	Pixel count	Area (m²)
0	6113	611300
1	787	78700

Figure 3.6. Example GIS output with 2018 water surface area value highlighted

4.0 Results and Analysis

This chapter discusses the team's findings and analyses from the methods described previously. The chapter details the results from VNPA interviews, technical research regarding water depth sensing and trail camera systems, observational research of various nature park social media accounts, and the results of the team's GIS analysis.

4.1 Interview Results

The results of the five interviews with the VNPA staff guided the team's research by highlighting the highest priority issues the VNPA and the project stakeholders face. Figure 4.1 shows the number of times the VNPA staff mentioned the main themes.

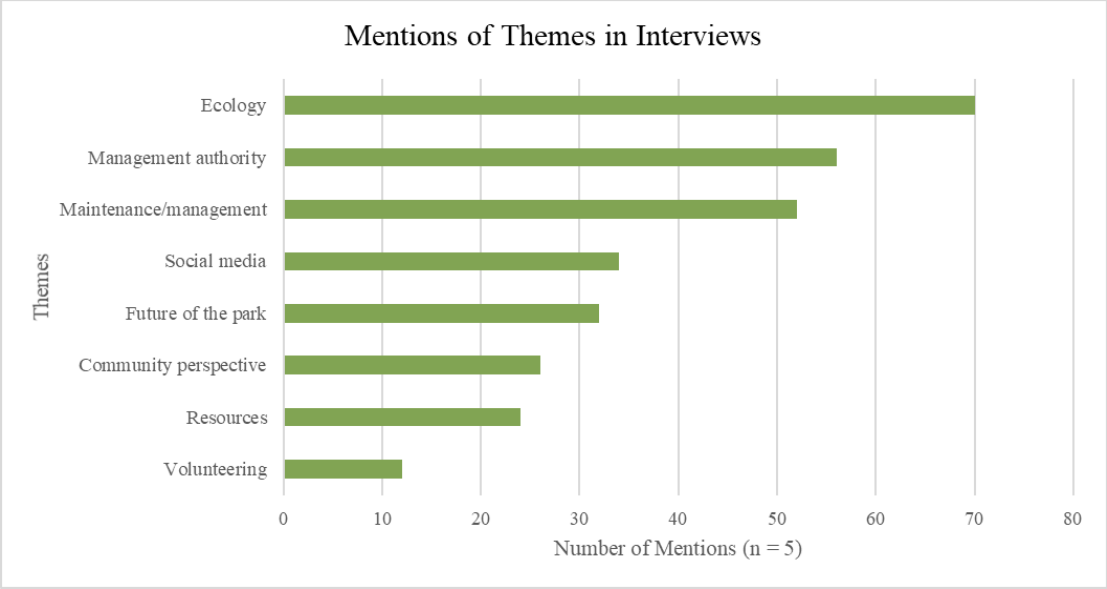


Figure 4.1. Graph of mentions of themes in interviews

The most frequently mentioned topics by the VNPA staff were ecology, management authorities, maintenance/management of the park, and social media. This information influenced the allocation of the team's efforts in each area of research, and contributed to the analysis of the

relationship the park has with its stakeholders. The emphasis on ecology influenced the team to focus heavily on livestream camera research. The reoccurring mentions of the management authorities and park maintenance/management highlighted the importance of the evidence the GIS analysis and prediction would provide. Lastly, the repeated mention of topics related to social media underscored the importance of improving the VNPA's online presence.

The team identified issues from the sub-themes with the most negative mentions. The team made a set of tables for each interview containing the number of times the interviewee mentioned each theme and sub-theme, and the connotation of the comment. The full set of coded tables is available for reference in Appendix F. Figure 4.2 provides a visual representation of the themes and sub-themes broken down by positive, negative, and neutral mentions.

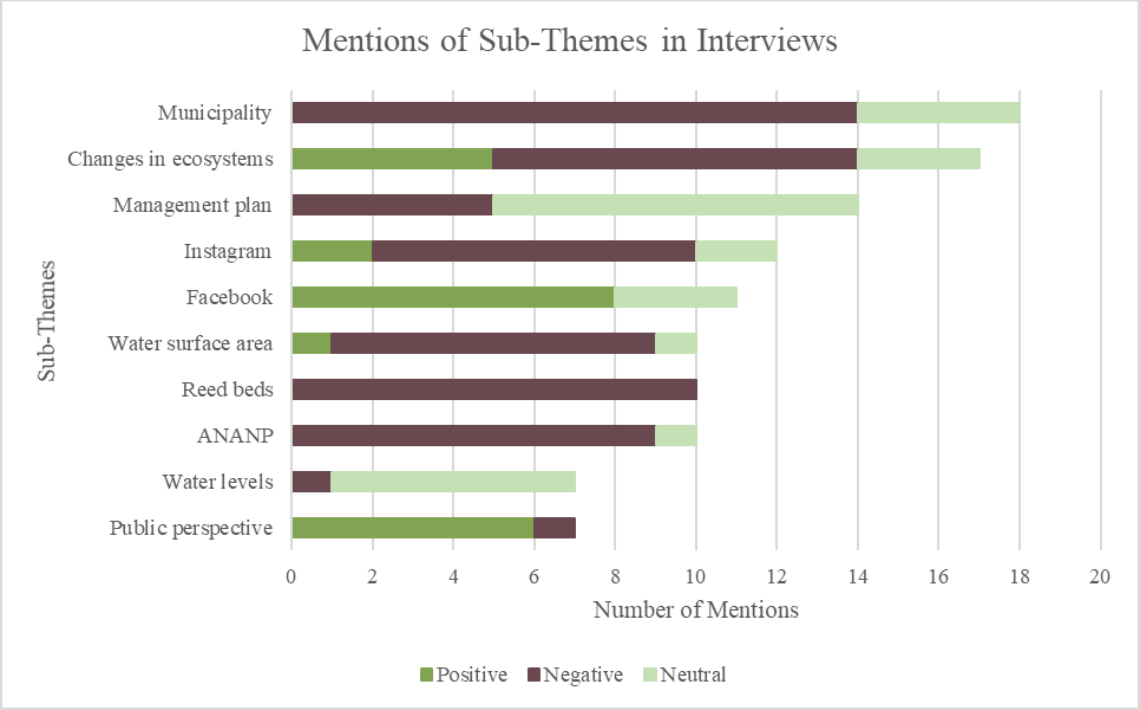


Figure 4.2. Frequency of positive, negative, and neutral mentions of sub-themes in interviews

The high frequency of negative comments regarding the Bucharest Municipality, changes in the park's ecosystem, the lack of a management plan, and the disparity between the VNPA's

opinions on Facebook and Instagram contributed to the team's focus of these topics: disconnect with management authority, deteriorating ecology, and low social media engagement of the community. The team discovered that 82% of the mentions of the ANANP and the Municipality of Bucharest were negative, and none of the comments referring to the park's management plan were positive. This emphasizes a disconnected relationship between the VNPA and its management authorities. 53% of the mentions of changes in the park's ecosystem were negative, and 100% of the comments regarding the reed beds were negative, reinforcing the VNPA's need for active management support. The topic of Instagram had 67% negative comments, while Facebook had no negative comments. This illustrates a disparity between the VNPA's opinions of their social media pages.

These interviews yielded helpful insight into the history of the park's management, the challenges the VNPA faces, the scope and limitations of the project, and the effects of landscape and climate changes on the Wetlands' biodiversity. They provided context for the objectives, as this information connected the current problems the VNPA faces to three major stakeholders: the VNPA, the local community, and the Bucharest Municipality. The following sections detail these connections that serve as the motivation for the project.

4.1.1 The VNPA's Main Authority is the Bucharest Municipality

One of the greater problems the VNPA is currently facing is a lack of support and cooperation from the Romanian government, manifesting as superficial maintenance and a lack of regulations. The team's interviews with the VNPA staff highlighted how this impacts the management situation in the park. In 2018, the Romanian government banned environmental NGOs from managing nature protected areas and shifted this control to a national agency, the

National Agency for Nature Protected Areas (ANANP). This agency is meant to be “dedicated to protected areas management” but has no in-field experience with managing nature protected areas (N. Marin, 2022). Because of this lack of experience, the agency took no concrete action to maintain the VNP during their management period. Within the last year, control of the park shifted again to the Municipality of Bucharest. The interviews revealed that the Municipality lacks the qualifications needed to properly maintain the VNP, and all the maintenance the Municipality has done thus far has been superficial. According to Nicoleta Marin, the Municipality “just started to learn about the park and what is to be done in the park, so I think the maintenance is so superficial because they didn’t actually [understand] what is to be done”.

The park currently lacks both visiting regulations and a means to enforce them. It is the Municipality's job to design and send regulations on leisure activities to the Romanian Ministry of Environment, but they have yet to send them. Dan Bărbulescu mentioned that people are free to smoke or barbecue, walk unleashed pets, and go fishing in the park, as there is no security. Due to the lack of published regulations, the VNPA must work directly with the community to keep the park clean and safe (Bărbulescu, 2022). Dan Bărbulescu points out the disconnect between the community’s needs and the authority’s activity, explaining that the Municipality doesn’t “have specific tools to discuss, to come here and discuss with people”. The VNPA must improve upon this disconnect as Dan Bărbulescu states the park “needs an infrastructure, it needs connection, it needs active management objectives and implementations”.

4.1.2 Changes in the Park’s Ecosystems

The VNPA faces difficulty controlling invasive species such as reed beds, leading to the need for management intervention within the park. During interviews, the VNPA staff shared

firsthand accounts of changes taking place within the park's environment. Dan Bărbulescu and Nicoleta Marin agreed that the invasion of reed beds, which lead to shrinking ponds, is of utmost concern. During the project term, the park suffered from a fire that burned three acres of dry vegetation (Bărbulescu, 2022). Dan Bărbulescu attributed the fire to reed beds infiltrating the park and noted that reed bed growth has been his primary observation since first visiting the Wetlands in 2007 (Bărbulescu, 2022). Nicoleta Marin shared an anecdote about areas once covered in water, saying that in 2022, “No water remains. It’s just ground, just vegetation”. She continued to explain that 2021 had been a very dry year, following the pattern of drought in southeastern Europe. She noted that in previous years, the VNPA made efforts to clear some of the reeds, which uncovered some small ponds. However, due to shallow water levels, the reeds quickly grew back.

Dan Bărbulescu believes that if the lakes and ponds continue to shrink, the ecosystem of the park will change drastically, and an urban forest will overtake the Wetlands. This would be a “huge loss” for the city’s nature and biodiversity. Nicoleta Marin elaborated further and explained the effect that changes to the water surface area would have on the park’s food chain. First, fish species would dwindle, followed by the mammals that feed on them. Small insects that live underwater or on the water’s surface would also die, along with the birds that eat them (N. Marin, 2022). According to Dan Bărbulescu, the goal of the VNPA since its inception has been to maintain a balanced ecosystem with trees, wetlands, and grasslands. Without additional management support for the park, the VNPA will not be able to maintain this balance. Dan Bărbulescu further explains that “we could leave the park like this, not intervening, with no management measure and apply the ‘no intervention’ strategy, but at the end of four or five years we will [have] an urban forest but we will [lose] an incredible [ecosystem]”.

4.4 Objective 1: Expanding the VNPA's Outreach through Web Engagement

The VNPA's online presence spans their Facebook, Instagram, YouTube channel, and website. The team hopes to increase the VNPA's engagement with the community by strengthening this presence. The following sections detail the results of the team's research into social media practices and livestream systems.

4.4.1 Social Media

In hopes of spreading awareness of the Wetlands, the VNPA utilizes social media to highlight the various plant and animal ecosystems in the park. To expand the VNPA's online presence, the team researched techniques to improve their social media. Analysis of the VNPA's social media revealed that they have a very active online presence (as they make new posts almost daily) and that Facebook is the most widely used social media platform in Romania. In parallel, the team completed a case study of the social media pages of other nature parks. Table 4.2 shows important statistics on the online profiles of NGOs and national parks.

Table 4.1. Social Media Statistics Breakdown of NGOs and National Parks

	Media content/special features	Number of Facebook followers	Number of Instagram followers	Organization	Number of posts on Instagram
Văcărești Nature Park Association	**Instagram:** animals in the park **Facebook:** park activities and events	71,298	2,043	Nature Protected Area	161
Romanian Space Initiative	Updates on application deadlines, staff bios, and teaching curriculums	1,451	650	Romanian NGO	75
Plitvice Lakes National Park	**Facebook:** food and hotels, open trails, seasonal events, and park activities **Instagram:** highlighting the park's hidden outlooks, food, activities, and animals	79,391	30,900	National Park in Croatia	696
Piatra Craiului National Park	The hashtag #piatracraiului has gotten popular on Instagram (37,000 posts)	N/A	N/A	National Park in Romania	N/A
Yellowstone National Park	Animals, photo contests, and nature tips (for hiking or camping)	1,422,863	1.3 million	National Park in the United States	2,086

The table contains information on national parks that have a much larger social media following than the VNPA. Yellowstone National Park encourages visitors to follow their social media platforms through nature tips and photo contests, where visitors compete to submit the best photo in the park for a reward. The Piatra Craiului National Park does not have an official social media page, but has gained popularity from their hashtag, #piatracraiului, highlighting the power of popular hashtags.

Focusing on the influence hashtags have on the visibility of social media posts, the team examined the 24 most recent posts from the VNPA's Instagram in order to explore their current usage of hashtags and recommend better posting practices. Figure 4.3 presents the hashtags the VNPA uses on their Instagram.

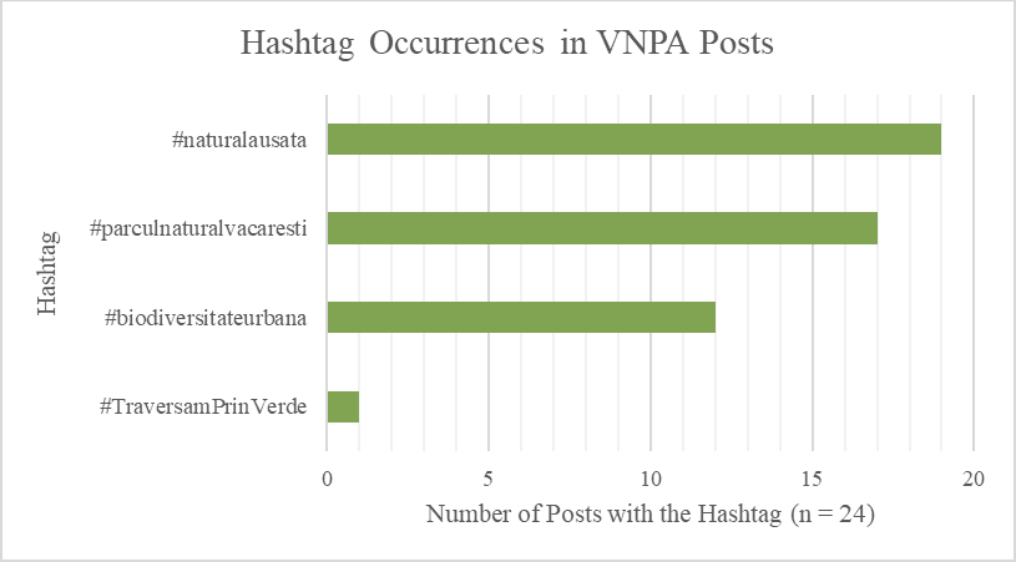


Figure 4.3. Most common hashtags on the VNPA Instagram

The Y-axis indicates the hashtags the VNPA used on their posts, and the X-axis records the number of posts that used the hashtag. The most frequently occurring hashtags are #naturalausata (nature at your door), #parculnaturalvacaresti (Văcărești Nature Park), and

#biodiversitateurbana (urban biodiversity). Figure 4.4 illustrates the number of hashtags per post on the VNPA's Instagram.

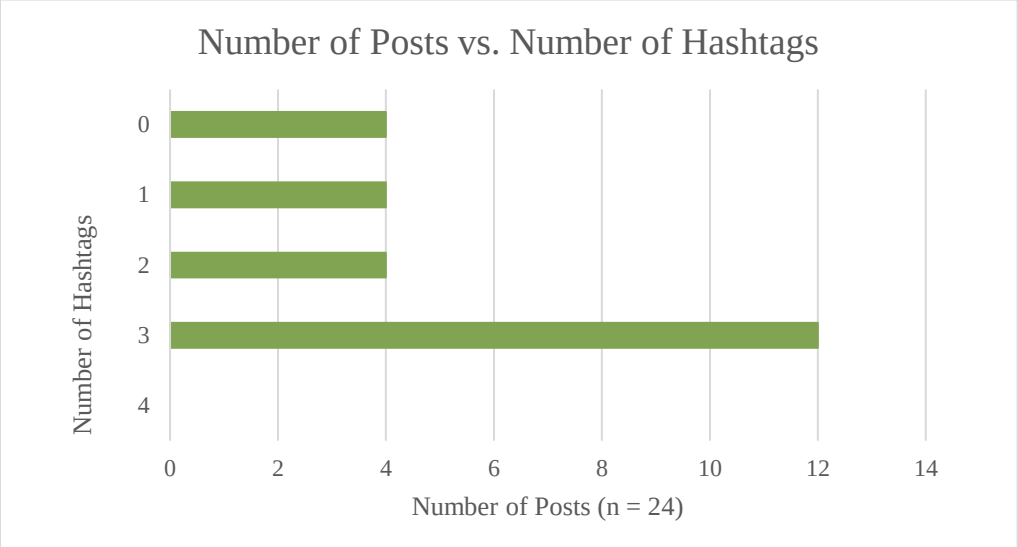


Figure 4.4. Number of Posts vs. Number of Hashtags

Half of the posts included three hashtags, and none had more than three. 1/6th of the posts had no hashtag at all. The VNPA is not optimizing their hashtag use, as more high-traffic (popular) hashtags per post could lead to higher visibility. "High-traffic" refers to hashtags included in a large number of posts on Instagram.

In order to compare the traffic of the VNPA's four hashtags with more common ones, the team searched Instagram for popular hashtags in Romania relating to nature, conservation, Bucharest, and Văcărești. These hashtags are relevant to the content of the VNPA's posts on Instagram. The team chose not to examine English language hashtags because Victor Marin (the VNPA Communications Coordinator) indicated the VNPA was not as concerned in the immediate future about attracting attention from English-speaking foreigners and was more focused on increasing the engagement with citizens in Bucharest or other regions in Romania. However, the VNPA has the option to translate the hashtags into other languages to attract a

diverse audience. Figure 4.5 is a graph of the total number of posts for these popular Romanian hashtags on Instagram with each hashtag.

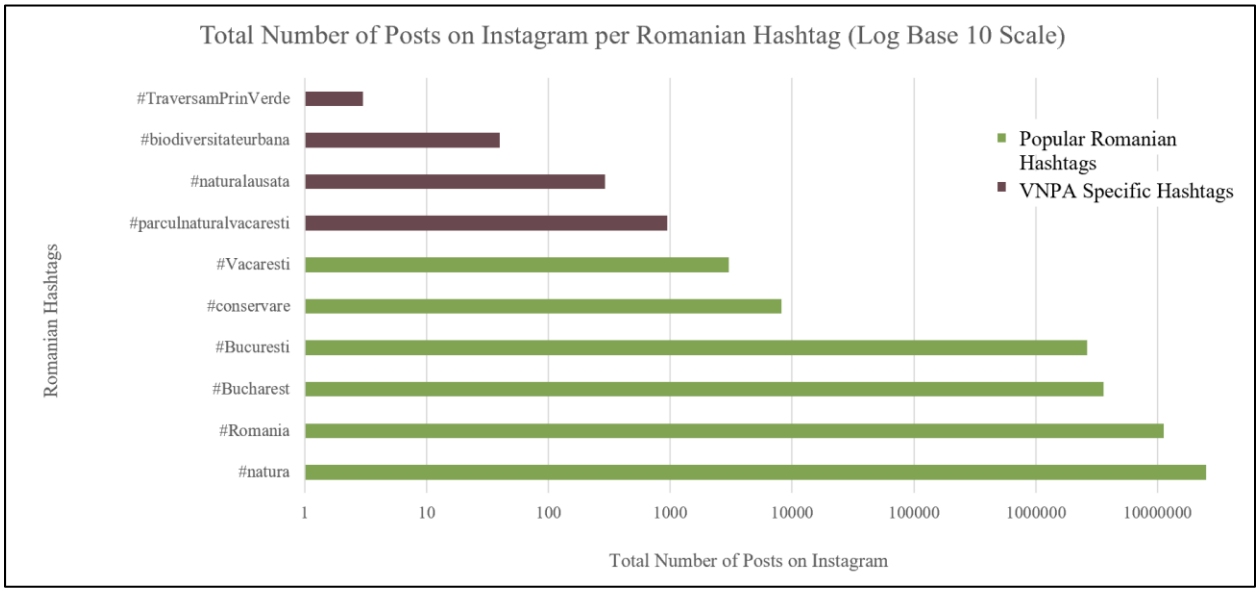


Figure 4.5. Total number of posts on Instagram per Romanian Hashtag

Compared to other popular hashtags in Romania, the VNPA's hashtags have less than 1000 posts. In contrast, #natura has over ten million posts on Instagram. Hashtags relevant to the park's location (#Vacaresti, #Bucuresti, #Bucharest, #Romania) and hashtags relevant to nature and conservation (#natura, #conservare) are popular on Instagram. In the posts the team examined, the VNPA did not use any of these hashtags.

After interviewing Dan Bărbulescu and Victor Marin, the team gained further insight into the VNPA's goals for their social media. Dan Bărbulescu acknowledged that Facebook is the primary social media platform used in Romania. Victor Marin explained that Instagram has become more popular with the younger generation in Romania and hopes to broaden the VNPA's demographic to include them by strengthening the VNPA's Instagram page. As a result

of Facebook being the VNPA's primary social media platform and their hope to reach younger audiences, the team focused on improvements to the VNPA's Instagram.

Based on research of the VNPA's social media profiles, the team concluded that their Instagram lacks the same level of engagement as their Facebook page. Despite following a regular posting schedule on their Instagram, the page does not get the same amount of traffic as other sites. This is in part due to the low popularity of Instagram in Romania as compared to Facebook, as well as the content and hashtag use by the VNPA. Currently, the VNPA Instagram consists mostly of wildlife and nature photographs, while their Facebook has a wider breadth of content, including events, staff profiles, and relevant scientific articles. Through comparison with the social media sites of other organizations, the team found that the VNPA does not post interactive content.

4.4.2 Livestreams Offer a Virtual Look into the Wetlands

Communications with the VNPA staff revealed that they are looking for more ways to connect and engage with the Bucharest community. One option the VNPA is interested in is utilizing a livestream. The park already has a system of trail cameras that capture and store videos of wildlife. Based on comparative research of other nature parks, the team noted the popularity of livestream broadcasts by examining how many viewers they received.

VNPA staff noted that the park does not have sufficient infrastructure to support a wired livestreaming service. There are no power cables or internet access points in the park, so the VNPA will need a wireless solution. The team contacted PixCams, an organization that helps set up wildlife camera systems, to gather information on how to set up a wireless livestreaming system for the VNPA. One option for a wireless network involves the use of a 4G USB module.

This small device connects any USB-enabled camera to a 4G data network. These devices are inexpensive but require purchasing a monthly data plan.

Conversations with PixCams support indicated that such a wireless system was possible to construct in the park but would become expensive in the long term due to the use of 4G networks for data transmission. However, PixCams suggested the use of an EZ Bridge, a point-to-point Wi-Fi transmitter. Point-to-point Wi-Fi transmitters connect existing networks between buildings or to outdoor locations and can provide connectivity over distances of up to three miles, permitting there is a line of sight between each point. PixCams recommended a Wi-Fi transmitter because the flat landscape of the Wetlands and the location of the VNPA's office (a high rise overlooking the park) make a direct line of sight possible. Table C.1 in Appendix C details product specifications for the EZ Bridge and 4G LTE USB module. The following section provides information on camera options to pair with these devices.

4.4.2 Options for a Livestream Camera in the Park

The team evaluated three different cameras to use for a livestream system in the park. The evaluation criteria included power usage, resolution, and weather resistance. This research focused on commonly available IP (internet protocol) cameras, Raspberry Pi cameras, and "all-in-one" security cameras that contain a camera, transmitter, and batteries in one housing. The team compiled information about each camera in Table C.2 in Appendix C.

The Raspberry Pi camera is a special add-on for the Raspberry Pi computer. Figure 4.7 is a Raspberry Pi camera with a computer connected. A Raspberry Pi is a small, inexpensive processor that the Raspberry Pi Foundation produces. The Raspberry Pi Foundation produces 5-megapixel and 12-megapixel versions of their camera, which both support high-definition video.

Together, a Raspberry Pi computer and camera module cost about 60 dollars. To use this camera, the VNPA would also need to construct a weatherproof housing unit for this module.

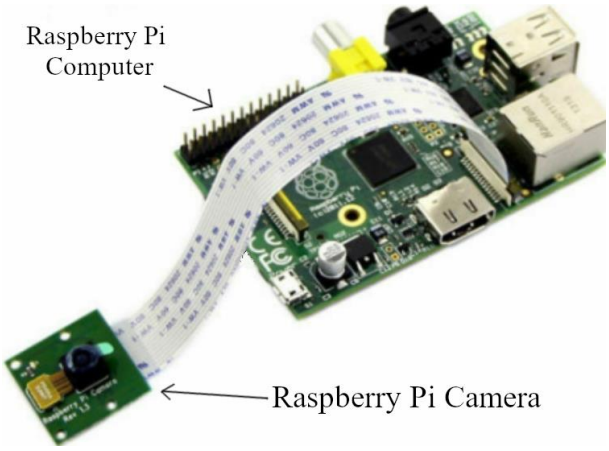


Figure 4.6. Raspberry Pi with Camera Module Addon (Raspberry Pi, n.d.)

IP cameras are commonly available products made for security purposes (see Figure 4.8). There is a wide variety of models on the market, with varying amounts of power consumption and resolution. Prices typically range from 40 to 150 USD. IP cameras also have the benefit of being weatherproof.

Figure 4.7. A common internet protocol camera (Amazon Lorex 1080P IP Camera, n.d.)

The last option our team researched were all-in-one security cameras. All-in-one cameras such as the Reolink wireless camera (see Figure 4.9) contain all the hardware the VNPA would need for running a wildlife livestream. However, Reolink cameras do not have a long-range Wi-

Fi antenna, meaning 4G would be the only option for data transmission. Like IP cameras, Reolink cameras are also weatherproof.

Figure 4.8. Reolink all-in-one security and livestreaming camera (Amazon Reolink Camera, n.d.)

4.6 Objective 2: Citizen Science and Water Depth

From conversation with Dan Bărbulescu, the team determined that the VNPA did not need new ways for their staff to measure water depth in the Wetlands, but instead would like a method for volunteers to complete this task. Dan Bărbulescu hopes to get locals involved in citizen science projects as an activity to stir up interest in conservation, ecology, and biodiversity for citizens and local schools.

To evaluate the two autonomous methods of water depth sensing, the team gathered information on their cost, ease of use, and sensing capabilities. The team obtained a quote for the CEE-USV autonomous boat (see Figure 4.10) which listed a unit cost of 65,380 USD. (Austin, 2021) The DJI Matrice 600 Pro quadcopter (see Figure 4.11) costs between 5,000-10,000 USD on the secondhand market. (*DJI Matrice 600 Pro*, n.d.) Lower cost quadcopters exist, but they are unable to carry heavy LiDAR sensors used for data collection. Of the two autonomous

platforms the team researched, neither was within reasonable cost ranges for the VNPA. Table D.1 in Appendix D details information on these two autonomous platforms.

Figure 4.9. CEE-USV Unmanned Sonar (CEE-USV | CEE Hydrosystems, n.d.)

Figure 4.50. DJI Matrice 600 Pro (Matrice 600 - DJI, n.d.)

Because Romania is part of the EU, drone operators must comply with standards set by the European Union Aviation Safety Agency (EASA) and the Romanian Civil Aviation Authority (AACR) (*Drone Laws in Romania | UAV Coach (2022)*, n.d.). This is not applicable for the CEE USV, as it is waterborne, but for the DJI Matrice 600 pro, volunteers would need to take background courses about drone safety. Due to the urban location of the VNP, drone

operators would also need to apply to the AACR for permission to fly. Training volunteers would be time and cost intensive, making the use of the drones more difficult to pursue as a citizen science project.

The final water depth technology the team researched was commercially available fish finders. Commercial fish finders record water depth and water temperature, and range in cost from 50 to 150 USD. Fish finders consist of a handheld display and a transducer element which emits a sonar ping (see Figure 4.12). The user lowers the transducer into the water and then reads the display to take measurements. Hawkeye Electronics offers fish finders with cables up to 30 feet in length. Volunteers could stand by the edge of lakes in the VNP and throw the transducer into the water to measure depth.

Figure 4.61. Hawkeye Electronics Fish Finder (Hawkeye Electronics, n.d.)

4.7 Objective 3: GIS Analysis

Using the NDWI technique on 34 satellite images from 2015 to 2022 yielded a chronology of water surface area data points. The next step was to generate a trendline that showed the estimated water surface area for the VNP exponentially over time (see Figure 4.13) Each satellite image provided one data point which represents the amount of water surface area in the VNP in meters squared (m^2). Due to the availability of images, some years yielded more

data points than others. It is important to note that NDWI provides an estimate for water surface area, and is not a true measurement of water surface area. The team made another scatterplot without the outlying data points and the trend of decreasing water surface area was still prevalent in the new graph (Figure 4.14).

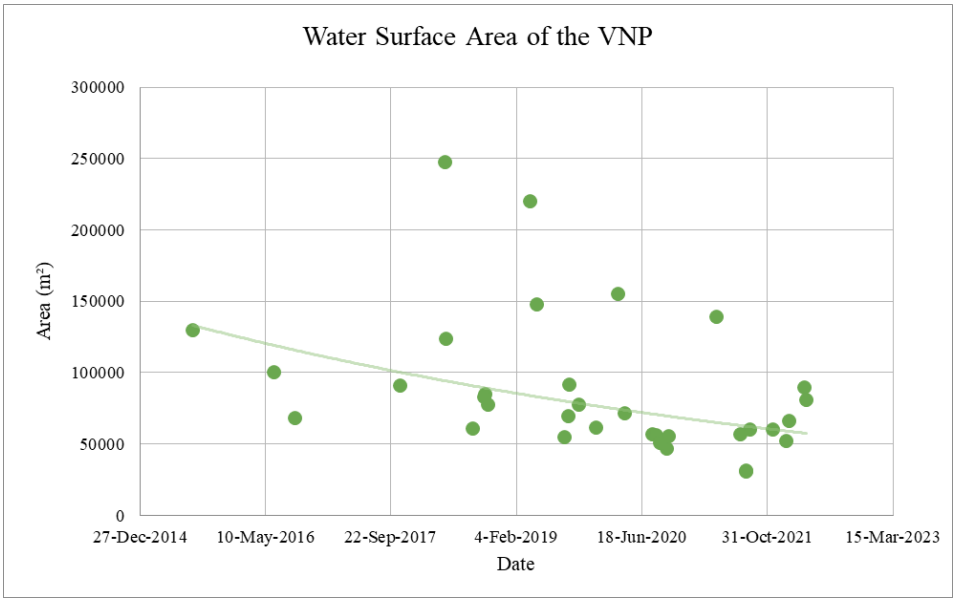


Figure 4.12. Water Surface Area of the VNP

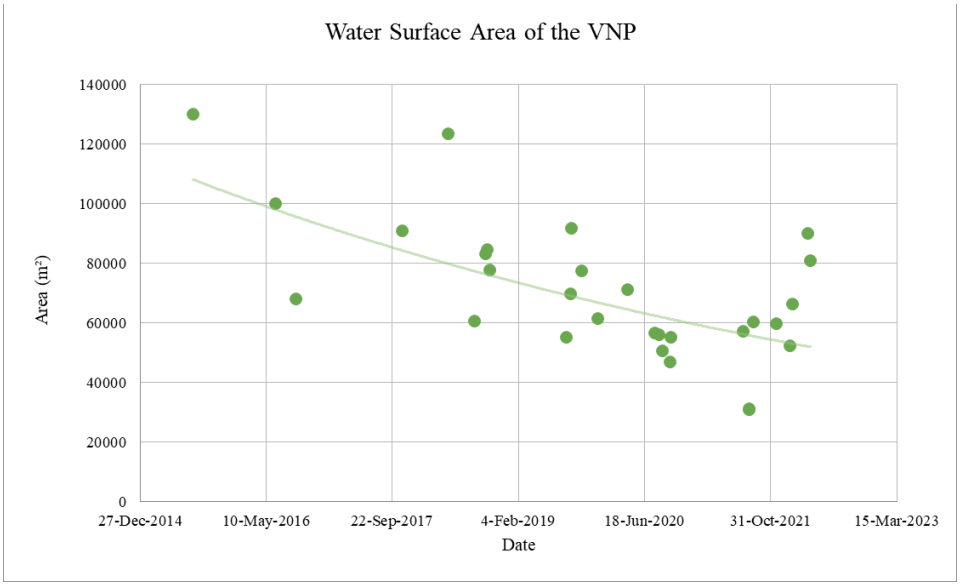


Figure 4.13. Water Surface Area of the VNP (no outliers)

The team determined which data points were outliers by calculating the lower and upper limit of the interquartile range (50% of the data within the 1st and 3rd quartiles). To get this range, the team first computed the first and third quartiles, which are the lower and upper one-fourth of the data set. The team then calculated the limits of the interquartile range and removed five outliers from the data set, all of which were above the upper limit of the range.

Below are satellite images of the VNP spanning three years (see Figures 4.15-4.18). These images provide a visual of the declining water surface area of the park in a short period of time. The water surface area fluctuates periodically depending on the season and amount of precipitation that occurred that year. Figures 4.17 and 4.18 depict this seasonal effect where the VNP water surface area increased between September 2016 to October 2017.

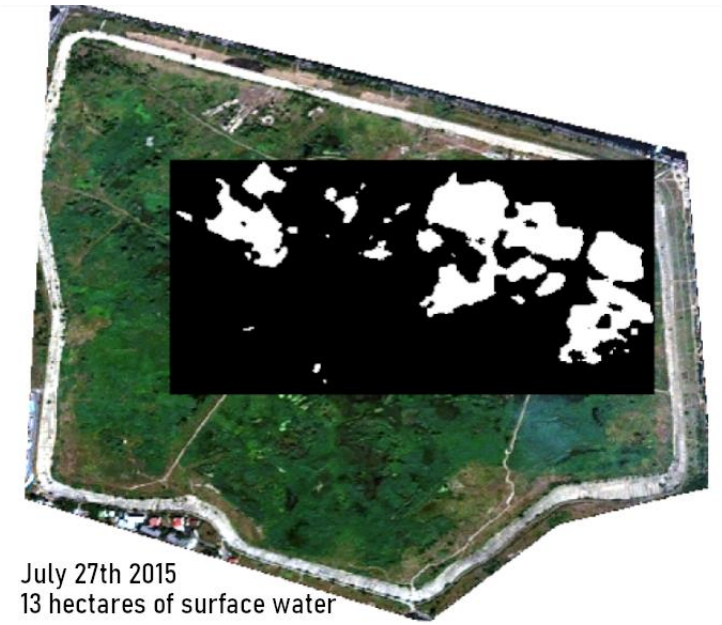


Figure 4.14. Processed satellite image from July 2015

Figure 4.15. Processed satellite image from June 2016

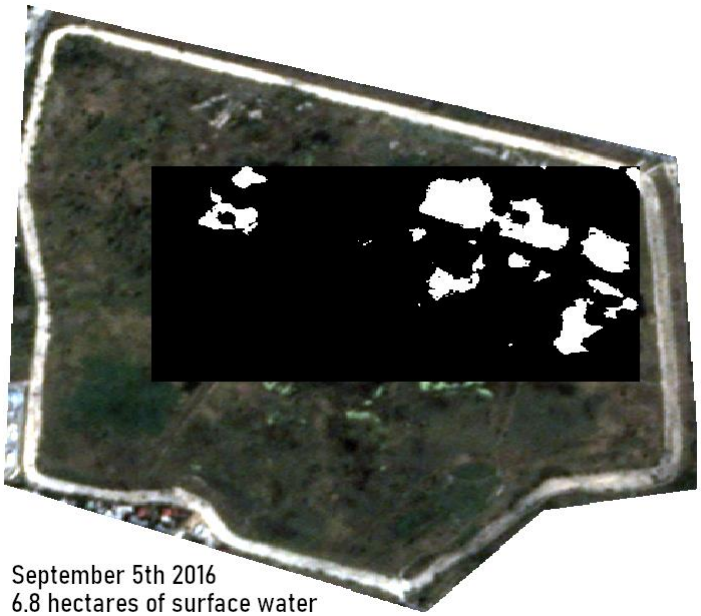


Figure 4.16. Processed satellite image from September 2016

Figure 4.17. Processed satellite image from October 2017

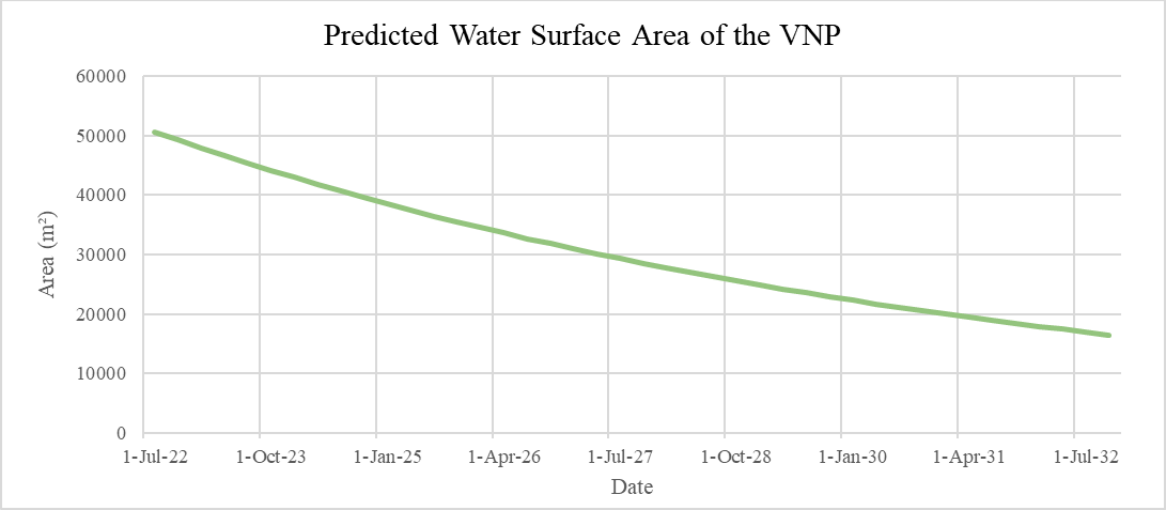


Figure 4.18. Predicted water surface area of the VNP

The curve fit with the highest correlation to the data was exponential decay. This equation predicts the water surface area of the VNP in the upcoming years (see Figure 4.19). If current management policies of the park remain the same, the equation projects that water surface area will decrease by 67% over the next ten years. In comparison, the trendline estimates that the water surface area in the park decreased by 51% from 2015 to 2022. These results

highlight the dire ecological circumstances that the Wetlands could face if the Bucharest Municipality does not provide support to the VNPA.

5.0 Recommendations

The team proposed a set of recommendations to the VNPA that could increase their perceived value and highlight the urgency of their need for management intervention. The VNPA should make the following changes to their Instagram to increase community engagement. The VNPA should post media such as photo contests, Q&A sessions, and recommendations for recreational activities in the park. This would make the Instagram more engaging and dynamic, drawing more interest from the younger demographic the VNPA hopes to attract. Specifically, posts should include:

- An increased use of high-traffic hashtags (see Table E.1 in Appendix E)
- Profiles about VNPA staff
- Park events and activities
- Photo contests, nature trips, Q&A sessions with park staff
- Collaborations with other nature parks or local businesses

The VNPA should also install the necessary hardware to broadcast a wildlife livestream. An IP camera and an EZ Bridge Wi-Fi transmitter would be an appropriate solution. There are many model options for IP cameras, and the VNPA can choose one that is within their budget and available for purchase in Romania. The VNPA should install the IP camera and one end of the Wi-Fi transmitter in an area of the park with a high level of wildlife activity. They should mount the other transmitter on the balcony of the VNPA's office, overlooking the park. The livestream should be accessible either through the VNPA's website or YouTube channel. Lastly, the VNPA should use commercial fish finders in citizen science projects to measure the water depth of lakes and ponds in the Wetlands on account of their ease of use, inexpensive cost, and consumer

accessibility. The VNPA can purchase as many of these as they require to equip their volunteer force. This will allow volunteers to regularly measure water depth in various lakes in the Wetlands, helping the VNPA keep records of the changing water levels.

6.0 Limitations, Impacts and Future Works

This chapter details the limitations the team faced during the project term, impacts of the project, and future works that the VNPA or future WPI project groups could complete.

6.1 Limitations

One of the largest limitations the team faced was working remotely across seven time zones. This limited opportunities for meetings times and restricted the team from having firsthand experience in the park. Due to the remote work, the team had to focus on providing the VNPA with a set of recommendations rather than implementing these solutions in the Wetlands. In the first iteration of the project proposal, the team had a very narrow scope of the project and only focused on technical work, rather than the human-social connection that IQP is supposed to cultivate.

6.2 Impacts

By demonstrating the value of the park to a wider audience, the VNPA can garner the support they need to appeal to the Bucharest Municipality and work towards creating an effective management plan. With the cooperation of the Municipality, the VNPA could achieve proper care and management of the park. This could include establishing visiting regulations, a park

ranger body, or a large-scale operation to remove invasive reed beds. These steps would ensure the longevity of the Văcărești Wetlands for generations to come.

6.3 Future Works

While this IQP team focused on specific areas of improvement of the VNPA, interviews with the VNPA staff provided many more potential avenues for future work. These include subjects such as fire protection and educational services and could evolve into projects for future IQP teams. Table 5.1 elaborates on the possibilities for these projects.

Table 6.1. Possible Future Projects

Subject	Projects
Fire protection	• Identify common causes of vegetation fires and high-risk areas in the park • Design access paths for firefighters
Educational services	• Write environmental curriculum for different age groups • Work to increase outreach to local schools • Organize and host a Nature Day for local children to explore the park

7.0 Conclusions

Based on the results of this project, the team concluded that the main obstacle preventing the VNPA from effectively managing the park is its relationship with the government. The Bucharest Municipality's lack of experience in managing nature protected areas creates a barrier preventing the VNPA from carrying out necessary maintenance. Additionally, the team concluded that while the VNPA's presence on Facebook is very strong, their Instagram lacks the same level of engagement. Improving engagement on their Instagram platform would help reach out to the younger generation and could bring a new demographic to the park. The team found an appropriate system for the VNPA to broadcast a livestream in order to increase their online presence. VNPA staff indicated that involving volunteers in water depth measurement activities could be a worthwhile citizen science project. The team determined that commercial fish finders would be the most suitable option for the VNPA volunteers. Lastly, the results of the GIS analysis supported the VNPA's claim that water surface area in the park has been decreasing over time. The team forecasted that the water surface area will continue to decrease if no management intervention takes place.

By gathering a greater following for their online presence through updating social media, creating livestreams, and launching citizen science projects, the VNPA can demonstrate how important the park is to the local Bucharest community. The VNPA can use the results of the GIS analysis, in which water surface area in the park decreased by 51% in the past seven years, to highlight the urgency of implementing a proper management strategy. Calling attention to the community value the VNP holds and its need for management intervention could influence the Bucharest Municipality to provide the VNPA with the support it needs to maintain the park.

References

1-articol-pe-vale.jpg (2256×1500). (n.d.). Retrieved February 21, 2022, from https://parcnaturalvacaresti.ro/wp-content/uploads/2021/01/1-articol-pe-vale.jpg

3-1.jpg (1250×834). (n.d.). Retrieved February 22, 2022, from https://parcnaturalvacaresti.ro/wp-content/uploads/2021/01/3-1.jpg

264579998_4818932591505387_1436325143031574371_n.jpg (2048×1365). (n.d.). Retrieved February 21, 2022, from https://scontent-bos3-1.xx.fbcdn.net/v/t39.30808-6/264579998_4818932591505387_1436325143031574371_n.jpg?_nc_cat=109&ccb=1-5&_nc_sid=730e14&_nc_ohc=lQ5ZcIVQUwAAX98vePM&_nc_oc=AQmBOTwvzn0tQ6N8ri2JRjxH-IhYXCIUAmA8Jb6dwXodtGVxRDqoHNkaqxQscQlWPhc&_nc_ht=scontent-bos3-1.xx&oh=00_AT_q5FUZCefV-rnmeylkH90fLSpN3ScGhsrYTm9uI_AqIg&oe=6218F429

About Copernicus | Copernicus. (n.d.). Retrieved February 22, 2022, from https://www.copernicus.eu/en/about-copernicus

Ali & Jaber. (2020). Monitoring degradation of wetland areas using satellite imagery and geographic information system techniques. *Iraqi Journal of Agricultural Sciences, 51*(5), 1474–5148. https://doi.org/10.36103/ijas.v51i5.1158

Amazon.com: Lorex 1080P IP POE Bullet Camera for LNR400 and LNR100 NVR Security System LNB3143B, Model: LNB3143B, Tools & Outdoor Store: Electronics. (n.d.).

Retrieved April 21, 2022, from https://www.amazon.com/Lorex-Bullet-Camera-Security-LNB3143B/dp/B016T9J8HQ

Amazon.com: Security Camera Wireless Outdoor, Solar Powered WiFi System, Pan Tilt, 2K Night Vision, 2-Way Talk, Works with Alexa/ Google Assistant/ Cloud for Video Surveillance, REOLINK Argus PT w/ Solar Panel: Electronics. (n.d.). Retrieved April 21, 2022, from https://www.amazon.com/REOLINK-Argus-PT-Solar-Panel/dp/B07W6PXRR8/ref=sr_1_3?keywords=reolink+solar&qid=1650566972&sr=8-3

Amazon.com: The EZ-Bridge-Lite EZBR-0214+ High Power Outdoor Wireless Point to Point System: Electronics. (n.d.). Retrieved April 14, 2022, from https://www.amazon.com/EZ-Bridge-Lite-EZBR-0214-Outdoor-Wireless-System/dp/B002K683V0/ref=asc_df_B002K683V0/?tag=hyprod-20&linkCode=df0&hvadid=309743296044&hvpos=&hvnetw=g&hvrand=17168497202432208922&hvpone=&hvptwo=&hvqmt=&hvdev=c&hvdvcmdl=&hvlocint=&hvlocphy=9001840&hvtargid=pla-568844055066&psc=1

Amdanielski_0.jpg (383×383). (n.d.). Retrieved February 21, 2022, from https://www.wpi.edu/sites/default/files/faculty-image/amdanielski_0.jpg

Andrei_Birsan_Vacaresti_1989_web.jpg (1908×1242). (n.d.-a). Retrieved February 21, 2022, from https://parcnaturalvacaresti.ro/wp-content/uploads/2020/12/Andrei_Birsan_Vacaresti_1989_web.jpg

Andrei_Birsan_Vacaresti_1989_web.jpg (1908×1242). (n.d.-b). Retrieved March 1, 2022, from https://parcnaturalvacaresti.ro/wp-content/uploads/2020/12/Andrei_Birsan_Vacaresti_1989_web.jpg

Angearu, C.-V., Ontel, I., Boldeanu, G., Mihailescu, D., Nertan, A., Craciunescu, V., Catana, S., & Irimescu, A. (2020). Multi-temporal analysis and trends of the drought based on MODIS data in agricultural areas, Romania. *Remote Sensing*, *12*(23), 3940. https://doi.org/10.3390/rs12233940

Ape Cam. (n.d.). San Diego Zoo. Retrieved April 1, 2022, from https://zoo.sandiegozoo.org/cams/ape-cam

Application | Topo-Bathy LiDAR | USA | ASTRALITE. (n.d.). Astralite-Master. Retrieved March 30, 2022, from https://www.astralite.net/applications

ASTRALiTe edge, first small-scale LiDAR for underwater exploration. (2019, October 25). *Inceptive Mind*. https://www.inceptivemind.com/astralite-edge-first-small-scale-lidar-underwater-exploration/9880/

Audubon Puffin Berm Cam—Nesting Puffins in Maine | Explore.org. (n.d.). Retrieved April 1, 2022, from https://explore.org/livecams/puffins/puffin-boulder-berm-cam

Babes Bolyai University, Cluj-Napoca, Voicu, C. I., Raiu, S.-L., & Babes-Bolyai University, Cluj-Napoca, Romania. (2018). Volunteering advantages and difficulties in Romania. *Postmodern Openings*, *9*(4), 122–139. https://doi.org/10.18662/po/48

Biodiversity – Parcul Natural Vacaresti. (n.d.). Retrieved February 1, 2022, from https://parcnaturalvacaresti.ro/en/biodiversity/

Brief history – Parcul Natural Vacaresti. (n.d.). Retrieved February 2, 2022, from https://parcnaturalvacaresti.ro/en/brief-history/

Brotacel_rasaritean_Hyla_orientalis_.jpg (1024×768). (n.d.). Retrieved February 21, 2022, from https://parcnaturalvacaresti.ro/wp-content/uploads/2021/01/Brotacel_rasaritean_Hyla_orientalis_.jpg

BSB Science. (2018, June 20). Vlad, ranger at #Vacaresti, talking to pupils about urban #rewilding and biodiversity https://t.co/rqVOFq9p1q [Tweet]. *@BSB_Science*. https://twitter.com/BSB_Science/status/1009404946926702592

Building Momentum. (2018, January 25). *How to turn a Raspberry Pi into a Deer Cam*. https://www.youtube.com/watch?v=IPirGr8BJ-o

Burkhard Rieck. (2014, April 27). *Performance in operation of an ArduPilot controlled sonar boat*. https://www.youtube.com/watch?v=nGZfktt2NtQ

Carrasco-Polaino, R., Villar-Cirujano, E., & Martín-Cárdaba, M.-A. (n.d.). *Artivism and NGO: Relationship between image and 'engagement' in Instagram*.

Carrasco-Polaino, R., Villar-Cirujano, E., & Martín-Cárdaba, M.-Á. (2018). Artivismo y ONG: Relación entre imagen y «engagement» en Instagram. *Comunicar: Revista Científica de Comunicación y Educación*, *26*(57), 29–38. https://doi.org/10.3916/C57-2018-03

Castle, B. (2021a). Central Park Conservancy 2021 press kit. 7.

Castle, B. (2021b). Gift shops in Central Park. 7.

CEE-USV | CEE Hydrosystems. (n.d.-a). Retrieved March 30, 2022, from https://ceehydrosystems.com/products/unmanned-survey-vessels/cee-usv/

CEE-USV | CEE Hydrosystems. (n.d.-b). Retrieved March 30, 2022, from https://ceehydrosystems.com/products/unmanned-survey-vessels/cee-usv/

CEE-USV | CEE Hydrosystems. (n.d.-c). Retrieved April 21, 2022, from https://ceehydrosystems.com/products/unmanned-survey-vessels/cee-usv/

Chen, S., Johnson, F., Drummond, C., & Glamore, W. (2020). A new method to improve the accuracy of remotely sensed data for wetland water balance estimates. *Journal of Hydrology: Regional Studies*, *29*, 100689. https://doi.org/10.1016/j.ejrh.2020.100689

Cheng, Y. (Daniel). (2019a). Nonprofit Spending and Government Provision of Public Services: Testing Theories of Government–Nonprofit Relationships. *Journal of Public Administration Research and Theory*, *29*(2), 238–254. https://doi.org/10.1093/jopart/muy054

Cheng, Y. (Daniel). (2019b). Nonprofit Spending and Government Provision of Public Services: Testing Theories of Government–Nonprofit Relationships. *Journal of Public Administration Research and Theory*, *29*(2), 238–254. https://doi.org/10.1093/jopart/muy054

Chirileasa, A. (2021, March 17). *Romania loses EUR 1.17 bln in 2020 as fewer foreign tourists visit the country amid COVID-19 pandemic*. Romania Insider. https://www.romania-insider.com/foreign-tourists-spending-romania-2020

Chris. (n.d.-a). How much power a Raspberry Pi uses (36 measurements and results). *Chip Wired*. Retrieved April 19, 2022, from https://chipwired.com/raspberry-pi-power-use/

Constantin, D. L., Goschin, Z., & Danciu, A. R. (n.d.-a). The Romanian economy from transition to crisis. 17.

Copernicus in detail | Copernicus. (n.d.). Retrieved February 22, 2022, from https://www.copernicus.eu/en/about-copernicus/copernicus-detail

COVID-19 Information. (2021, January 14). U.S. Embassy in Romania. https://ro.usembassy.gov/covid-19-information/

CU HABITATELE CURATE. (n.d.). Retrieved March 2, 2022, from https://parcnaturalvacaresti.ro/portfolio-item/2020-02-12-cu-habitatele-curate/

Cuganesan, S., & Floris, M. (2020a). Investigating perspective taking when infrastructure megaproject teams engage local communities: Navigating tensions and balancing perspectives. *International Journal of Project Management*, *38*(3), 153–164. https://doi.org/10.1016/j.ijproman.2020.01.006

Dagan, D. T. (2019). Social media as a means of understanding park visitors: An evaluation of user-generated content related to two low use, remote national parks [Thesis]. https://krex.k-state.edu/dspace/handle/2097/39617

Dempsey, C. (2021, May 1). Types of GIS Data Explored: vector and raster. *GIS Lounge*. https://www.gislounge.com/geodatabases-explored-vector-and-raster-data/

DESPRE PARC – Parcul Natural Vacaresti. (n.d.). Retrieved February 22, 2022, from https://parcnaturalvacaresti.ro/parcul/

dji matrice 600 pro: Search Result. (n.d.). eBay. Retrieved April 14, 2022, from https://www.ebay.com/sch/i.html?_from=R40&_trksid=p2380057.m570.l1313&_nkw=DJI+matrice+600+pro&_sacat=0

Dobri, R.-V., Sfîcă, L., Amihăesei, V.-A., Apostol, L., & Ţîmpu, S. (2021). Drought extent and severity on arable lands in Romania derived from normalized difference drought index (2001–2020). *Remote Sensing*, *13*(8), 1478. https://doi.org/10.3390/rs13081478

Drone Laws in Romania | UAV Coach (2022). (n.d.). UAV Coach. Retrieved April 14, 2022, from https://uavcoach.com/drone-laws-in-romania/

EarthExplorer. (n.d.). Retrieved February 15, 2022, from https://earthexplorer.usgs.gov/

Electronics, H. (n.d.). *FishTrax 1C | Fish Finder*. HawkEye® Electronics. Retrieved April 21, 2022, from https://hawkeyeelectronics.com/products/fishtrax-1c-fish-finder

Erwin, K. L. (2009a). Wetlands and global climate change: The role of wetland restoration in a changing world. *Wetlands Ecology and Management*, *17*(1), 71–84. https://doi.org/10.1007/s11273-008-9119-1

EXVIST 4G LTE Industrial Mini PCIe to USB Adapter W/SIM Card Slot for WWAN/LTE 3G/4G module applicable for M2M & IoT applications like Raspberry Pi industrial router IP camera digital Signage etc. - Newegg.com. (n.d.). Retrieved April 13, 2022, from https://www.newegg.com/p/0XM-04CJ-004D8

Field Fox Cam. (n.d.). WildlifeKate. Retrieved April 1, 2022, from https://www.wildlifekate.co.uk/fieldfoxcam

FotoStefan. (2018a, January 22). Vacaresti Natural Park in Bucharest has a pavilion close to a lake #birdwatching #wildlife #sightseeing #thisisbucharest https://t.co/OPxi1NVyYa [Tweet]. *@FotoStefan*. https://twitter.com/FotoStefan/status/955350559929679872

Geo Guru. (2020, April 13). *Water Body Extraction (NDWI) in QGIS*. https://www.youtube.com/watch?v=y_Ah7Zv-o0k

Geyman, E. C., & Maloof, A. C. (2019). A Simple Method for Extracting Water Depth From Multispectral Satellite Imagery in Regions of Variable Bottom Type. *Earth and Space Science*, *6*(3), 527–537. https://doi.org/10.1029/2018EA000539

Goslee, S. C., Brooks, R. P., & Cole, C. A. (1997). Plants as indicators of wetland water source. *Plant Ecology*, *131*(2), 199–206.

Hamouda, A., El-Gharabawy, S., & Salah, M. (2015). Acoustic survey along Heraklion and East Canopus ancient Greek cities, Abu Quir Bay, Alexandria, Egypt. *Journal of Earth Science & Climatic Change*, *06*. https://doi.org/10.4172/2157-7617.1000289

Hawkeye (n.d.). Retrieved April 21, 2022, from https://hawkeyeelectronics.com/

Hitchins, K. (2013). *A Concise History of Romania*. Cambridge University Press. https://doi.org/10.1017/CBO9781139033954

Home_engl_parc_vacarestis2_pic11.jpg (780×880). (n.d.). Retrieved February 21, 2022, from https://parcnaturalvacaresti.ro/wp-content/uploads/2021/02/home_engl_parc_vacarestis2_pic11.jpg

Homepage_1-scaled.jpg (2560×1919). (n.d.). Retrieved February 21, 2022, from https://parcnaturalvacaresti.ro/wp-content/uploads/2021/01/homepage_1-scaled.jpg

How nature turned a failed communist plan into Bucharest's unique urban park | Cities | The Guardian. (n.d.). Retrieved February 4, 2022, from

https://www.theguardian.com/cities/2016/jun/14/nature-europe-urban-protected-area-vacaresti-nature-park-romania

Hussaini, A., Mahmud, M. R., Tang, K. K. W., & Abubakar, A. G. (2019a). Water level fluctuation assessment of Lake Chad for environmental sustainability using remote sensing and geographic information system techniques. *The International Archives of Photogrammetry, Remote Sensing and Spatial Information Sciences, XLII-4/W16*, 261–266. https://doi.org/10.5194/isprs-archives-XLII-4-W16-261-2019

Ianos, I., Florentina-Cristina, M., George, M., Zamfir, D., Stoica, I., & Vlăsceanu, G. (2014). Unclear perspectives for a specific intra-urban space: Văcăreşti lake area (Bucharest City). *Carpathian Journal of Earth and Environmental Sciences*, *9*, 215–224.

Ianoş, I., Sorensen, A., & Merciu, C. (2017a). Incoherence of urban planning policy in Bucharest: Its potential for land use conflict. *Land Use Policy*, *60*, 101–112. https://doi.org/10.1016/j.landusepol.2016.10.030

Images (283×178). (n.d.). Retrieved February 21, 2022, from https://encrypted-tbn0.gstatic.com/images?q=tbn:ANd9GcT06mV7gvPhM2X43RjuMcmocuNk5rPJyNRJVHcVQLGDxtV4eVhKr4a2V6oWTq51gXX9KhU&usqp=CAU

Images (339×149). (n.d.). Retrieved February 21, 2022, from https://encrypted-tbn0.gstatic.com/images?q=tbn:ANd9GcT9rJ9ppdDJWqcaCl-1EJSgUc3iTgY3Uu1wcmrjSbNL97-0JZIyrcLLVXb8xkndn1x2-8Y&usqp=CAU

Investigating perspective taking when infrastructure megaproject teams engage local communities: Navigating tensions and balancing perspectives | Elsevier Enhanced Reader. (n.d.). https://doi.org/10.1016/j.ijproman.2020.01.006

Keddy, P. A. (2010). *Wetland Ecology: Principles and Conservation* (2nd ed.). Cambridge University Press. https://doi.org/10.1017/CBO9780511778179

Kundu, S., Pal, S., Talukdar, S., Mahato, S., & Singha, P. (2022). Integration of satellite image–derived temperature and water depth for assessing fish habitability in dam controlled flood plain wetland. *Environmental Science and Pollution Research*. https://doi.org/10.1007/s11356-021-17869-6

Lamsal, P., Pant, K. P., Kumar, L., & Atreya, K. (2015). Sustainable livelihoods through conservation of wetland resources: A case of economic benefits from Ghodaghodi Lake, western Nepal. *Ecology and Society*, *20*(1), art10. https://doi.org/10.5751/ES-07172-200110

Landsat Missions | U.S. Geological Survey. (n.d.). Retrieved February 15, 2022, from https://www.usgs.gov/landsat-missions

Lee, A. C. K., & Maheswaran, R. (2011). The health benefits of urban green spaces: A review of the evidence. *Journal of Public Health*, *33*(2), 212–222. https://doi.org/10.1093/pubmed/fdq068

Loveland, T. R., & Dwyer, J. L. (2012). Landsat: Building a strong future. *Remote Sensing of Environment*, *122*, 22–29. https://doi.org/10.1016/j.rse.2011.09.022

Lowrance HOOK2 5 Fish Finder with SplitShot Transducer. (n.d.). Sportsman's Guide. Retrieved March 29, 2022, from https://www.sportsmansguide.com/product/index/lowrance-hook2-5-fish-finder-with-splitshot-transducer?a=2173822

Ltd, R. P. (n.d.). *Raspberry Pi*. Raspberry Pi. Retrieved April 21, 2022, from https://www.raspberrypi.com/

Maddie Moate. (2019, March 22). *How to make a Wildlife Camera (using a Raspberry Pi!) | Maddie Moate*. https://www.youtube.com/watch?v=IiOH5LUVkWo

Manea, G., Matei, E., Vijulie, I., Tîrlă, L., Cuculici, R., Cocoş, O., & Tişcovschi, A. (2016a). Arguments for integrative management of protected areas in the cities – case study in Bucharest city. *Procedia Environmental Sciences*, *32*, 80–96. https://doi.org/10.1016/j.proenv.2016.03.014

Matrice 600—DJI. (n.d.). DJI Official. Retrieved April 21, 2022, from https://www.dji.com/matrice600

Middlebury Remote Sensing. (2020, August 24). *Obtaining + Loading Landsat Imagery in QGIS 3.10 (lab 2- V1)*. https://www.youtube.com/watch?v=mBk2VIMawRE

Most popular national parks in Europe 2021. (n.d.). Statista. Retrieved April 14, 2022, from https://www.statista.com/statistics/1058601/leading-national-parks-europe/

Mulik, S. N. (1999). An Introduction to geographical information systems. *IETE Technical Review*, *16*(5–6), 419–424. https://doi.org/10.1080/02564602.1999.11416861

My Naturewatch - My Naturewatch Project: DIY wildlife cameras and devices. (n.d.). My Naturewatch. Retrieved March 25, 2022, from https://mynaturewatch.net

OB-RA162_danube_G_20111215112341.jpg (553×369). (n.d.). Retrieved February 21, 2022, from https://s.wsj.net/public/resources/images/OB-RA162_danube_G_20111215112341.jpg

Oh, C. Y., Ahn, K., Park, J., & Park, S. W. (2017). Coastal shallow-water bathymetry survey through a drone and optical remote Sensors. *Journal of Korean Society of Coastal and Ocean Engineers*, *29*(3), 162–168. https://doi.org/10.9765/KSCOE.2017.29.3.162

Organizațiile non-guvernamentale din România cer protecție pentru Parcul Natural Văcărești. (n.d.). Retrieved February 22, 2022, from https://parcnaturalvacaresti.ro/2020-09-01-organizatiile-non-guvernamentale-din-romania-cer-protectie-pentru-parcul-natural-vacaresti/

Osprey Nest Camera—Live from Charlo Montana | Explore.org. (n.d.). Retrieved April 1, 2022, from https://explore.org/livecams/ospreys/charlo-montana-osprey-nest

Our Association – Parcul Natural Vacaresti. (n.d.-a). Retrieved February 17, 2022, from https://parcnaturalvacaresti.ro/en/our-association/

Our Association – Parcul Natural Vacaresti. (n.d.-b). Retrieved February 21, 2022, from https://parcnaturalvacaresti.ro/en/our-association/

Palta, M. M., Grimm, N. B., & Groffman, P. M. (2017a). "Accidental" urban wetlands: Ecosystem functions in unexpected places. *Frontiers in Ecology and the Environment*, *15*(5), 248–256. https://doi.org/10.1002/fee.1494

Parcul Natural Văcărești (@parculnaturalvacaresti) • Instagram photos and videos. (n.d.). Retrieved February 28, 2022, from https://www.instagram.com/p/CWvJW24ohMu/

Prepaid SIM Card Romania—Data, SMS & Calls from $24.90. (n.d.). *SimOptions*. Retrieved April 14, 2022, from https://www.simoptions.com/prepaid-sim-card-romania/

Pricing. (n.d.). SkyWatch. Retrieved March 29, 2022, from https://www.skywatch.com/pricing

Protected areas in Romania without custodians and protection? (n.d.). Retrieved January 22, 2022, from https://wwf.panda.org/wwf_news/?332550/Protected-areas-in-Romania-without-custodians-and-protection

Radiometric—Resolutions—Sentinel-2 MSI - User Guides—Sentinel Online—Sentinel Online. (n.d.). Retrieved February 22, 2022, from https://sentinels.copernicus.eu/web/sentinel/user-guides/sentinel-2-msi/resolutions/radiometric

Rădoi, M., & Panait, N. (2021). The Impact of coronavirus pandemic on Romania's economic eevelopment. *Global Economic Observer*, *9*(1), 7–12.

Randy Mackay. (2018, August 29). *Mapping a Lake with ArduPilot*. https://www.youtube.com/watch?v=msX9GsBZDtY

Raster Data. (n.d.). Retrieved February 15, 2022, from https://docs.qgis.org/2.8/en/docs/gentle_gis_introduction/raster_data.html

Reptile_2.jpg (1024×768). (n.d.). Retrieved February 21, 2022, from https://parcnaturalvacaresti.ro/wp-content/uploads/2021/01/reptile_2.jpg

RomanianParliament.jpg (1248×736). (n.d.). Retrieved February 28, 2022, from http://www.worldrecordacademy.com/biggest/img/RomanianParliament.jpg

Romanian-PM-Dacian-Ciolos-picking-up-garbage-in-Bucharests-Vacaresti-Natural-Park.jpg (1024×683). (n.d.). Retrieved February 21, 2022, from https://cdn.romania-insider.com/cdn/ff/h3ON4CbaVrb2vxL9X0UDliI9sx1u8TTWusv8xbYqT8E/162884884

2/public/styles/article_large_image/public/featured_images/Romanian-PM-Dacian-Ciolos-picking-up-garbage-in-Bucharests-Vacaresti-Natural-Park.jpg

Scoala-in-aer-liber-scaled.jpg (2560×1623). (n.d.-a). Retrieved February 21, 2022, from https://parcnaturalvacaresti.ro/wp-content/uploads/2021/01/scoala-in-aer-liber-scaled.jpg

Sentinel-2—Missions—Resolution and Swath—Sentinel Handbook—Sentinel Online. (n.d.). Retrieved February 22, 2022, from https://sentinels.copernicus.eu/web/sentinel/missions/sentinel-2/instrument-payload/resolution-and-swath

SkyWatch+-+Logo+-+Black+and+Blue+-+White+BG.png (1500×843). (n.d.). Retrieved March 29, 2022, from https://images.squarespace-cdn.com/content/5a32e5c3fe54ef2bdccf2e9b/1621471064562-HWYGE7TGZMFZJU844FX0/SkyWatch+-+Logo+-+Black+and+Blue+-+White+BG.png?format=1500w&content-type=image%2Fpng

Smardon, R. (2014). Wetland ecology principles and conservation, second edition. *Water*, *6*(4), 813–817. https://doi.org/10.3390/w6040813

Sources. (n.d.). SkyWatch. Retrieved March 29, 2022, from https://www.skywatch.com/data

SPECIES AND HABITAT - Vacaresti Natural Park. (n.d.-a). Retrieved February 22, 2022, from https://parcnaturalvacaresti.ro/biodiversitate/

Spot+6-7+data+source.jpg (750×563). (n.d.). Retrieved March 29, 2022, from https://images.squarespace-

cdn.com/content/v1/5a32e5c3fe54ef2bdccf2e9b/1621453803025-MTBBBR1P6AJHSGJGTB6T/spot+6-7+data+source.jpg?format=750w

UAV-Based LiDAR Can Measure Shallow Water Depth—IEEE Spectrum. (n.d.). Retrieved March 30, 2022, from https://spectrum.ieee.org/uavbased-lidar-can-measure-shallow-water-depth

von Essen, E., Turnbull, J., Searle, A., Jørgensen, F. A., Hofmeester, T. R., & van der Wal, R. (2021). Wildlife in the digital anthropocene: examining human-animal relations through surveillance technologies. *Environment and Planning E: Nature and Space*, 25148486211061704. https://doi.org/10.1177/25148486211061704

Walking down and by bike - Vacaresti Natural Park. (n.d.). Retrieved February 11, 2022, from https://parcnaturalvacaresti.ro/plimbari-pe-jos-cu-bicicleta/

Welle, D. (n.d.-a). *The expanding desert—climate change in Romania | DW | 14.08.2021*. Retrieved February 11, 2022, from https://www.dw.com/en/the-expanding-desert-climate-change-in-romania/av-56634407

Werner, D. (2020, June 23). *SkyWatch and AgIntegrated offer satellite imagery for precision agriculture*. SpaceNews. https://spacenews.com/skywatch-agintegrated-agreement/

Wetlands disappearing three times faster than forests | UNFCCC. (n.d.). Retrieved January 22, 2022, from https://unfccc.int/news/wetlands-disappearing-three-times-faster-than-forests

What is a geographic information system (GIS)? | U.S. Geological Survey. (n.d.). Retrieved February 15, 2022, from https://www.usgs.gov/faqs/what-geographic-information-system-gis

Who are we? - Vacaresti Natural Park. (n.d.). Retrieved February 24, 2022, from https://parcnaturalvacaresti.ro/echipa/

Zaharia, V., & Găitănaru, D. (2018). Aspects of water budget in Văcăreşti wetland. *Mathematical Modelling in Civil Engineering*, *14*(1), 12–23. https://doi.org/10.2478/mmce-2018-0002

Zbuchea, A., & Bîr, M. (n.d.). The Romanian cultural NGOs and the online citizen: a rendezvous manque*?* 31.

Appendices

Appendix A: Interview Questions

Introduction

We are students from Worcester Polytechnic Institute, Massachusetts, United States, and we are here to talk more in depth about the Văcărești Nature Park Association's (VNPA) current process of park management, financial resources, government relationship, and wetland ecology. The goal of this project was to assist in convincing policymakers to provide the VNPA with managerial assistance by recommending plans to increase the park's perceived value and predicting how water surface area in the Wetlands will change without intervention.

Informed Consent

This interview will take approximately 45-60 minutes. Your participation is completely voluntary, and you may stop the interview at any time or refuse to answer any question that we ask. Your name will remain confidential unless you agree to have your name published. We will publish the results, though the respondent has the option to review the transcript before publication. The team members and advisors are the only parties able to access the full transcript. We can be reached at gr-wetlands-d22@wpi.edu. For more information about this research or about the rights of research participants, in case of research-related injury, contact the WPI IRB Manager Ruth McKeogh at (508) 831-6699 or irb@wpi.edu and the Human Protection Administrator Gabriel Johnson at (508) 831-4989 or gjohnson@wpi.edu.

By verbally consenting to participate in the interview, you acknowledge that you have been informed about and agree to be a participant in the study described above. Make sure that your questions are answered to your satisfaction before continuing.

Interviewee Background

A.1. How long have you lived in Bucharest?

a. How did you become interested in environmental issues?

b. Describe your role at the VNPA.

c. How long have you worked at the VNPA?

d. Why did you first get involved with the organization?

e. What kind of work do you specialize in?

VNPA Resources (Dan and Florin)

A.2. Describe the financial resources of the VNPA

a. Where does the VNPA get its budget from (i.e. government, other organizations, donations, etc.)?

b. How have financial resources impacted VNPA projects?

A.3. Describe the physical resources of the VNPA (i.e., people, equipment, etc.)?

a. How have physical resources impacted VNPA projects?

A.4. What connections does the VNPA have with other organizations?

a. Do the neighboring communities have any influence over park activities?

b. What are common ways in which residents use the park for leisure and recreation?

Wetlands Ecology

A.5. Since beginning working here, have you observed any changes to the bodies of water in the park?

A.6. Have you observed any changes in wildlife in the park?

A.7. Have you observed any changes to vegetation in the park?

A.8. Do you have any concerns about the sustainability of the park's ecosystem?

A.9. What do you think is likely to happen if water levels continue to drop?

A.10. How might predictions about water levels help VNPA protect the park?

VNPA Park Maintenance

A.11. What maintenance is regularly performed at the park?

A.12. Are there any areas of park maintenance that are currently lacking? If so, explain.

a. What kinds of maintenance does the government allow?
b. What kinds of maintenance is prohibited?
c. What method(s) is currently used to measure water levels in the park?

VNPA and Government Relations

A.13. Are you familiar with the National Agency for Protected Natural Areas? If so, are you familiar with its relationship to the VNPA?

*Continue to A.13.a and A.13.b if interviewee responded yes

a. What assistance do you receive from the National Agency for Protected Natural Areas?
b. We understand that the Romanian government has prohibited NGOs from managing protected nature areas since 2018. Has this affected the way you work in the park?

A.14. What would you like to see for the future of the Vacaresti Wetlands?

A.15. What would you like to see for the future of the VNPA?

Social Media

A.16. What social media websites are used by the VNPA?

A.17. How do you decide what content is posted on the respective social media websites?

A.18. Which social media site does the public most interact with?

A.19. What is one improvement you would like to see with the VNPA's social media?

a. What is the main demographic you would like to attract via social media?

Appendix B: Interview Transcripts

B.1 Bogdan Mihalache, Landscape Engineer

Date: 29 March, 2022

Medium: Zoom and email

Interviewer: Ananya Gopalan

Transcriber: Tia Mehta

ANANYA: Ok, first question. How long have you lived in Bucharest?

BOGDAN: 2006, that makes fifteen, no, seventeen years almost.

ANANYA: Oh wow. Describe your role at the VNPA.

BOGDAN: I am a landscape architect, that's my profession. And, so, in in the association that takes care of the […] my job, is mainly based on, monitoring the vegetation. So the projects I was involved in includes the tree inventory, mapping of the vegetation, habitats, and, different local projects that involve the plants, like melliferous plants or trees or planting or anything like that. Oh, we planted almost ten thousand trees in the park.

ANANYA: How...

BOGDAN: Three years I have been here, yes.

ANANYA: Ok, awesome. Why did you first get involved with the organization?

BOGDAN: First I came here through some people that I knew were volunteers or working here, so I came mostly as a volunteer first time. And then, I got to talk to the people that were working here. After a few meetings I was in the team, haha. So yeah, volunteering and knowing this place, since I, since I worked in faculty.

ANANYA: Awesome. What kind of work do you specialize in?

BOGDAN: Sorry?

ANANYA: What kind of work do you specialize in?

BOGDAN: What kind of work do I specialize in?

ANANYA: Mhm.

BOGDAN: As I said, I'm a landscape specialist, so I can say designing, managing the greenspaces in the city usually, or other places but it's a vast domain that includes ecology as well. So, that's why after a few years, when, after I left the college I worked in landscape companies, landscape architect companies, and after this job that involved mostly designing the spaces, the urban spaces, that are private or public, I tend to go in the direction of ecology, and managing natural spaces because I think it is more important for us in this moment.

ANANYA: Ok. Since the beginning working here, have you observed any changes to the bodies of water in the park?

BOGDAN: Yes. A lot of changes.

ANANYA: Have you observed...

BOGDAN: I-

ANANYA: Oh, sorry go ahead, please elaborate.

BOGDAN: I wanted to ask you if you wanted me to describe these changes.

ANANYA: Yes, please describe these changes.

BODGAN: Ok so let's see. I've been working here since the fall of 2018 and that's almost three, let's say three and a half years. Ok, two years ago I think I saw the biggest drop that the park ever faced, as I heard from other people that worked here or even lived here because we had colleagues that lived inside the park. So, yeah, it was a decrease of I would say about at least one and a half meter in the water levels, and last year it came back because we had better quantities of precipitation.

ANANYA: Ok, thank you. Have you observed any changes in, changes in the vegetation specifically versus the wildlife?

BOGDAN: I'm sorry can you repeat the question?

ANANYA: Yeah. So, I know you talked a little about the changes in the water levels, can you talk about any observations in the changes in the wildlife in the park?

BOGDAN: Oh, ok. My, my, special, how can I say, my experience is not very vast in the domain of the wildlife, so I think Vlad, my colleague who is a biologist, can explain more about that. What can I tell you is from the other colleagues' words, that, yes, water birds were affected by the difference of water levels. Like, they don't have places to nest, as well as probably different kinds of insects, mammals like the otter, but that's what I know from their words, I don't have my own observations that I can be based on. I can say yeah, I thought I observed different changes, yeah.

ANANYA: Ok awesome. Similarly, have you observed any changes to the vegetation in the park?

BOGDAN: The vegetation? Yes. One of the biggest differences that also we talked about with your other colleagues was the increase in the amount of reed beds inside the park and since I was here, I estimated that it, grew almost I don't know, 20% of its initial mass, and since we mapped the vegetation inside the park we discovered, that was in 2019, we discovered that the surface of reed covers approximately 70% of the entire surface of the park. And I can send you, if I didn't already send you, I think I sent you the mapping.

ANANYA: Yes.

BOGDAN: Ok.

ANANYA: Ok, thank you. Do you have any concerns about the sustainability of the park's ecosystem?

BOGDAN: About the sustainability of the park...?

ANANYA: Ecosystem.

BOGDAN: Ecosystem, ok. Concerns. I can't say exactly concerns... I mean every natural system that developed itself, even if its inside an artificial infrastructure such as Văcărești's case that is inside the anthropical infrastructure, these spaces develop by themselves, they evolve by themselves, I can say that it is safe as long as humans try to make an interaction with it as minimal as they can. Like, let's say ok, let's maintain the water levels by cutting the reed, m, so we can m help maintain the same equilibrium between birds, insects, vegetation, etcetera. Let's keep the meadows surfaces as they were before like preventing the invasive plants by developing, such as the tree of heaven, or […] maple or other invasive plants that we have in our country. But even if these management solutions weren't implemented let's say we would lose a part of the biodiversity that we have here we would lose a few species inside the park. They wouldn't disappear completely, they would go in other greenspaces in Bucharest but overall it may in the worst-case scenario become an open forest, because the tendency of the trees is to cover most of the surfaces of the park. So that, that's the worst-case scenario. Hmm, yeah from the point of view of ecology of the park, of the zone itself, it may be dangerous if there is zero intervention. But, also too much intervention such as paving the allies or permitting people to access the safe zones would be dangerous as well. So I'd recommend an equilibrium and a management plan, that's what we all recommend here.

ANANYA: Ok, thank you. Going along those lines, I know you touched upon this a little bit, but what do you think is likely to happen if water levels continue to drop?

BOGDAN: If water levels continue to drop, as I said its very probable that, most of the species, of the bird species especially, or mammals like otters will move out of the park and find better ecosystems. And also, it would be a good, how should I say it, a good terrain for the reeds to grow and after the reeds the other dendrological species to develop such as bushes or trees.

ANANYA: Ok, how-

BOGDAN: Sorry, it will be a dramatic change if the water levels will drop, it will be a dramatic change in the landscape of the park. Also the visual landscape, but also the biodiversity landscape.

ANANYA: Ok, awesome. How might predictions help water levels, how might predictions about water levels help the VNPA protect the park?

BOGDAN: How do the predictions of water levels help the association?

ANANYA: Yep, protect the park.

BOGDAN: Ok, so let me see if I understand your question. How are we trying to protect the park having this predictions in our minds?

ANANYA: Yes. It's more along the lines of having predictions of water levels, using that information what can the VNPA do with it ideally or what are you doing right now to benefit the park.

BOGDAN: Oh ok. Yes, it's good question. We are trying to, to do as much as we can with our own forces, which is not too much. It's better than nothing, but mostly trying to control the reed expansion and also to find different sources of water like the Dâmbovița River, which is nearby, which is basically the regulator for the underground water in the park because the park is right in the, I don't know how to say it in English, the place near a river where usually you have bogs like this. But if the underground water has different changes because of the drop than you can

bring water from Dâmbovița River which is now consolidated, it's made out of concrete, again I forgot the term for this, it's made a canal so now you have a sufficient amount of water in the Dâmbovița River, so you can bring it in the park artificially. These are two of the best measures I can think about, bringing water from outside or cutting the reed. Or making rain gardens, collecting rainwater from different surfaces such as the concrete dike or other buildings around and finding a channeling system towards the park. These are the best methods, but we need support, we need a budget for this and especially the administration support. Sorry I think my phone will die in thirty seconds. Is it ok to... [left call]

The rest of the questions were emailed to Bogdan and the responses are below. Refer to Appendix A for the questions.

A.11. *Usually, besides cleaning and maintaining the main pathways for visitors at approximately 2.5 m wide, by trimming the vegetation with mowers, we cut the reeds that cover the surfaces near the lakes. This is done with mowers, or hand scythes. The pathways are also leveled with gravel from time to time, if they become difficult to access, because of mud, bps or pits that form as a result of heavy rains. Sometimes we change the course of some paths, if they are partially flooded, from the change in water levels. Also, we trim the vegetation nearby the main landmarks, such as ornithological observation points, for better accessibility and for fire prevention.*

A.12.a, b. *The maintenance of the park should be minimal as I described it and it should involve only 2 types of areas: the durable management and durable development area (ZDD and ZMD). The integral protection area (ZPI) should only be used for ecological reconstruction, such as maintaining the water levels, or experimental non-invasive studies. Also it is allowed for the invasive species to be kept under control. These measures should be in the Management Plan,*

that every protected area should have. We started to write this plan, but it is momentarily neglected, as well as the Parks regulations, because of the authorities' indifference in the past years.

A.12.c. *We use measuring poles that are put on the main lakes.*

A.13. *Yes, we are aware, we had a partnership with them and the Environment Ministry after 2018 when no NGO's were allowed to administer a protected area in Romania and they took this responsibility. The partnership allowed us to continue with managing the park, but it didn't bring any communication from them. Now the town hall has taken over the administration, but not a lot of things have changed. We were affected by the 2018 decision, of course, because it is difficult now to reach the authorities for permission to do activities in the park, (such as planting trees) or even to sign a partnership with them. Dan can tell you more about this situation.*

A.14. *An education center, a dedicated zone for plant studies and an area where you can visit and find more about the existing plants in the park (like a natural botanical garden). And of course, maintaining the place as it is, in pace with its evolution.*

A.15. *A better communication from the authorities towards us and an understanding that we want the best for the park and it can only be done with their support and openness. With this kind of trust we can build the community around the park, make tours, educate children and maintain the existing biodiversity.*

B.2 Dan Bărbulescu

Date: 8 April, 2022

Medium: Zoom

Interviewer: Douglas Moore

Transcriber: Katherine Jones

DOUG: Okay Dan, how long have you lived in Bucharest?

DAN: Yes, next question! Haha. Since 19... 19... 1998, so twenty, twenty, how long, twenty-four years? Yeah.

DOUG: And how did you become interested in environmental issues?

DAN: Actually, I don't have a clear answer to this question, because my studies, I started to study history in 1998, and then... then I continued with the Master of Science in Public Policy, and during my Master in London, I figured out that, , I'll have a focus on my degree, on my final degree in European Environmental Legislation. So, I think that was the moment when I started to become interested in environmental issues. And after I came back from my studies, I started to work in a nongovernmental, an environmental NGO. Maybe it's something that... comes from my childhood. Because I was born on the Danube River. The Danube is the second largest river in Europe and I was born in a small city on the Danube River. All my childhood was you know, very natural, environment... Going fishing, I don't know, a lot of water birds, all that wetland and landscape. Maybe, you know, and during my faculty studies, I did a trip, a small trip at Văcărești. But from a historical reason, because near the sight, it was a huge monastery. The Văcărești Monastery. Huge and beautiful. I think it was the biggest Orthodox monastery in the central and eastern Europe. And it, this was a part of the Romanian cultural heritage. This building was a church and a monastery, was demolished by a communist regime because

Ceausescu didn't like, didn't love churches. He was against religion and... And he, by a specific legislation, he coordinated the demolish of around, I don't know, thirty historical churches in Bucharest. The Văcărești monastery was one of them. And I think I was in my twenty-one and I made a small trip here to see size of the former monastery and in that moment I looked into the horizon and I saw a huge area of reed beds and willow trees and water and I asked myself, oh my god, what about this place? And someone, a colleague of mine, told me, said "Yeah, this is a former lake. Ceausescu wanted to build this part of the city," and I was a little bit curious and I think, I think I have to check, I mention this plan of Ceausescu's... Ceausescu was the former dictator of Romania, you know already? And I mentioned this plan to build a lake in my degree at the end of the faculty. But I started to work in environmental protection and environmental campaigns as a NGO people in 2008. So it was fourteen years ago. Fourteen? No, not fourteen. Ten... yeah, fourteen years ago.

DOUG: And, could you describe your role at the VNPA.

DAN: I'm the manager of the VNPA association, so I'm also one of the founding members of the association. I asse you ask me about my role in the NGO, not on the park, on the site.

DOUG: Yeah, it's kind of general.

DAN: Okay, so I'm the CEO of the association, so I'm also the coordinator of the park, of the association's program, but also, responsible of the financial policy of the association. I work with the board of advisors, five people, Vlad, Nicoleta, Helmut, Cristian, Florin, you already met Nicoleta and Florin, and I'm the coordinator of the NGO.

DOUG: And how long have you worked at the VNPA?

DAN: 2014. Since the first day of the NGO. December 2014.

DOUG: And why did you first get involved with the organization?

DAN: I worked for an NGO named Save Danube and Delta. Yeah, Save Danube and Delta. A nongovernmental organization working for the Danube and the Danube's delta protection. In 2012, Cristian Lascu, he's a geologist and the former head of National Geographic Romania, called me and asked for thirty minutes meeting. During the meeting, he asked me if I could... if I could coordinate a campaign, to... if I will be able to coordinate a campaign aiming to establish the first nature... urban nature reserve in Romania. And I ask him, where is this place, where is this sight, and he told me he is in the south part of the city, near the former Văcărești monastery. And I remembered, oh my god, that is the area! I visited during my studies! And I said yes. And he invited me, and Helmut Ignat, nature photographer and part of our board of advisors called me to present himself and have a discussion about Văcărești. So I was invited, actually, they proposed me to get involved in this project, and I was completely positive. I didn't need any time to think about it. I was completely positive from the next second.

DOUG: Awesome, so I'm going to go to the next section about VNPA resources. So, could you describe the financial resources of the VNPA

DAN: So... we, right now, all our financial resources are completely independent. So we don't have access to public money, and we didn't, so we are completely independent. Part of our financial, part of our budget comes from, I think, 60%- I'm talking about last year- from company, through their CSR and sponsorship programs, and we also have a project financed by Norway Fund, this is a specific finance, financial support for nongovernmental organizations in Romania from the Norway Government. This is financial deal between European Union and Norway. Norway is not part of the European Union, but this country is connected to the European Union market and they... because they take an advantage as part of the European Union free market, they need to contribute to some specific countries, Romania included,

through financial support programs. So we have a two-years program, financial program coming from the Norway government as financial support. But I would say that 60% of our budget comes from companies, 40%, 37% from Norway, and 3% from individual donations. This is more or less, I don't know, 2 to 5% because I don't gave a clear picture of our budget yet. We have a financial coordinator and I'm waiting to send at the end of April our financial picture for last year.

DOUG: And how have financial resources impacted VNPA projects? If at all.

DAN: We are very connected, we depend actually, to our supporters, our... We are, I mean, this is an issue for our activity because we are very exposed. For example, two years ago, when the pandemic started, we lost two companies as supporters, as sponsors, and it was a very difficult situation for us. So every year we are very dependent to companies for their corporate social responsibilities budgets. We will be having this year another project, it's a project of... institutional development financed by another Norway fund trying to get more... how should I say, to try to find out other financial resources and other financial strategies for us. Trying to focus, for example, individual donations, I don't know, maybe some services we might provide for communities. So, to sum up, yeah, we are very exposed and we are very dependent every year to our financial resources.

DOUG: Could you describe the physical resources of the VNPA? Like, that is, people, any equipment it has, volunteers, that kind of thing.

DAN: Yeah, we have people, haha, and this is the most important resources. Of course we have computers and laptops, and we have two cars, we have tools in the park, we have a... a small house in the park we crafted, we built because we not directly own this place, but we built this, this is a small house, no electricity, no connection, but we are keeping the house our education

materials, our boats, our tools. From this point of view, we are okay... We have some mowing machines, I think two or three, we have, I don't know fifteen bicycles. , coffee maker, hahaha. Books, a lot of books!

DOUG: So do you think you're okay on the equipment front?

DAN: Yeah, yeah. Binoculars, trap cameras, yeah.

DOUG: Great. What connections does the VNPA have, if any, with other organizations?

DAN: This is a positive situation for us! We have a huge potential from this point of view. I mean we have connections in all the nongovernmental sector in Romania, with all the organizations and NGOs and community groups working in environmental protection and community development. We also work with a lot of universities, I mean the University of Bucharest, and other superior education institutions. We have a lot of connections, expect connections in the public authority sector. This is maybe a negative, how should I say, situation for us. This is a minus. We have good connections in the NGO sector and corporates and enterprise and private sectors, education and scientific institutions, but less in the public authority sector. I mean, we have connections but we cannot collaborate because... this is not only our situation. We don't have a continuity. We don't have a stable relationship, because, I don't know. We have a manager of a nature protection agency right now and after five years he will be replaced with another person. So, we can try to imagine trying to get involved, to explain permanently to another person, another people what we are doing here, what our plans are, so on and so forth. From this point of view, yeah.

DOUG: Do the neighboring communities have any influence over park activities?

DAN: Yeah. There are some groups of people, of volunteers, they go in the park, especially during the spring, they organize garbage picking activities, I don't know, visiting activities, so

we succeeded, actually, in getting the local community closer to the park and to our activities. Because in 2013, 14, when we established here, and we established our office here, close to the park, people living in the neighborhoods were very... not reluctant, but very, you know... okay, what about you, so on and so forth. After five years, they are very close and very aware of the parks situation, and I think this is a positive situation.

DOUG: What are common ways in which residents use the park for leisure and recreation?

DAN: Common ways for...? Sorry?

DOUG: Leisure and recreation. Just like, fun activities in the park, that kind of thing. I know two big ones are cycling and birdwatching, at least from the website.

DAN: Yeah, they cycling, they're running in the morning. They go to the park to have a thirty minutes walking, they go in the park with their kids, for example, they go in the park with their pets. I think for the local community, the park is for their recreation. The park has specific recreational profile for the community. They get advantage. They started to go more and more in the park to... receive this service, this benefit coming from the nature. During the pandemic, we had all that restriction, not going outside, the park remained... Bucharest's authorities, the Bucharest mayor's office, closed all the parks in the city, and I think it was a terrible decision! Anyway, the Văcărești Nature Park remained open and you can imagine all the people going in the park and having, I don't know, thirty minutes of walking and they told us last year they started to figure out the park's huge contribution to their good shape and good shape of their mind in a very hard social situation. So yeah, the park is very present for the community.

DOUG: This next section is about wetlands ecology. Since beginning working at the VNPA, have you observed any changes to the bodies of water in the park?

DAN: Yeah. I think I observed the invasion of reed beds. This is the main observation. The first situation I have in my mind since my activity here in 2012. Since I first, actually I think I first visited actually in 2007...8. So 14 years ago, so yeah, I would say that this is the very important observation. The reed beds invading the ponds. And also another observation in terms of trees, permanent increasing of trees number year to year. The park is covered by trees, especially willows, with every year. I think the water shape have remained the same except the reed beds. I mean the eight, five years ago, you could observe the birds while walking on the main trail on the pond, now it's difficult due to the reed beds.

DOUG: Have you observed any changes in wildlife in the park?

DAN: No. The park, the park is in a good shape from this point of view. Its, for example, today I went in the park with people working on the soundscape project. Every spring, the park right now is incredible, lots of noise and songs coming from the birds. They're nesting, you can imagine. Every year with the same happiness I rediscover the park.

DOUG: Do you have any concerns about the sustainability of the park's ecosystem?

DAN: Yes. I have. First, the water. How to keep a good shape and a good balance. How to keep the water and the wetland in a good balance. This is my first question. I have an answer, but it's not in my power, or our power. This is our authority, the management service responsibility. And another concern in terms of biodiversity management is how to connect the park to the green blue space of the city. This is a big question for us. Right now the park for some species is like a trap. It's like a cage. It's surrounded by streets and by permanent traffic, so we cannot have this diffusion of species in and outside of the park and this is compulsory for every nature reserve. So I think after the water situation this should be the second concern for every, for any parks management service. How to connected the park to the outside nature world.

DOUG: What do you think is likely to happen if water levels continue to drop?

DAN: From a natural point of view, I think urban forests will continue to develop, which is not that bad, but in terms of nature and biodiversity, of course, this will be a huge loss for the park and for the city's nature and biodiversity. Yeah we could leave the park like this, not intervening, with no management measure and, you know, apply the "no intervention" strategy, but at the end of four or five years we will be having an urban forest but we will be losing an incredible green blue system. And I think we also will be losing the aim we had when we started to work in this project. To be able to keep a balanced system with wetlands, trees, some forest areas, with grass fields and to have a mixture of habitats. This is more interesting in terms of nature than urban forests.

DOUG: And how might predictions about water levels help VNPA protect the park?

DAN: To raise awareness. To to receive more support from the community, not financial support, but more support coming from the people. We still confront this attitude, or this situation. "Don't intervene in the park because it's a nature reserve. Leave the nature to follow its own way." This is not a good management for our park of course, this is not only me saying this. We have a lot of people working in the field saying that "oh my god you need to start an active management in the park." We will be using your results to raise awareness. To put pressure on the city's authority and on the parks management service to adopt this objective, this aim in the parks management plan. Yeah, we need evidence to support this strategy.

DOUG: Alright, the next section is about park maintenance. So is there any maintenance that's regularly performed at the park?

DAN: Right now except our everyday monitoring in the park, no. And I think there are some police from the local city security service, they, they have one or two police cars and they, every

morning, they stay in front of the main entrance, but no rangers, no police security in the park, and no other service coming from the park's management service.

DOUG: The next question is, are there any areas of park maintenance that are currently lacking?

DAN: Yeah.

DOUG: What kinds of maintenance does the government allow? If any.

DAN: Hahaha, this is a very good question, we asked them permission to plant some trees on the external areas of the park and they didn't want to give this permission, so... I don't think, I don't know. This is, this is... The park doesn't have a regulation, visiting regulation right now. This is a document that could be approved by the Romanian Minister of Environment, and this is the park management service's responsibility to design and to send this regulation to the Romanian Ministry of Environment, but I don't think they did this. So right now if you go in the park and have a smoke, or, I don't know, have a barbecue, you're free to go, to have this activity. Of course we tried to raise awareness, to communicate to the people, I don't know. We posted a lot of infos on our Facebook account saying it's dangerous to go with fires in the park, to smoke, I don't know, to go fishing, go with your pet unleashed, and so on and so forth. So the park situation from this point of view right now, it's not controlled by any regulation, it's just the community common sense, you know? And this is a very interesting observation. This is for you to better understand the situation right now. The Văcărești Nature Park was established as a community request. I mean, we convinced, we lobbied the national authority, to establish the park. This park, erupted, how should I say, from the community's need. And right now it is, it is, it is kept clean, protected, or at least we have a sort of protection just because of us and the community. That's why our authorities do not have the capacity to answer to this situation,

because they're not familiar from in this kind of request coming from the community. In Romania, it's, I don't find the word. It's a disconnection from the community's need and the authority's activity. They don't have, I don't know, specific tools to discuss, to come here and discuss with people, actually. This is, this is, you know, very simply... This is the situation, but unfortunately, the park needs the presence of an authority because it needs an infrastructure, it needs connection, it needs active management objectives and implementations, and so on and so forth. It's a quite difficult situation.

DOUG: What method, or methods, are currently used to measure water levels in the park?

DAN: We have a tool, haha. Two actually, kind of, in the middle of our ponds, and almost every day we measure the water level. This is the only way we measure the water level in the park.

DOUG: That's the short, that's the surface well thing, right? The tube in the ground?

DAN: Mhm.

DOUG: And that measures the water table, right?

DAN: Yeah!

DOUG: Next section is about VNPA and government relations. Are you familiar with the National Agency for Protected Natural Areas? If so, are you familiar with its relationship to the VNPA? We also heard in Nicoleta's interview that the management situation is different, and it's now the municipality of Bucharest that you're dealing with. Is that correct?

DAN: Yeah, so the park is right now on the municipality's responsibility. It's an institution under the municipality umbrella that acts as a management service for the park. They took the park's management from the National Nature Protection Agency. We have this procedure in Romania.

We have this central authority for nature protection. This authority can... I don't find the words, sorry for my English... this agency could give a nature reserve management to a fourth party. So, it's different from your country, of course. You have the parks management service completely responsible for all your national parks and nature reserves. In Romania, it's different, we have our own, actually, I think it's more European way of nature protection and nature management, actually.

DOUG: Let's see... What would you like to see for the future of the Văcărești Wetlands? Either with... in terms of like, managerial future or ecological ...

DAN: I think I want to see that the park, the Văcărești park it's a... viable project, project, from the, from also the municipality point of view. You understand what I mean? I mean, right now, this project, it's very, it's very positive for the community and for the people and for volunteers and nongovernmental organizations. But the authority is not part of this picture yet. So, in the park's future, hopefully, this year or next year, or I don't know. I want to see the municipality and the authority being more present here. And then, all the issues will be solved. Because, as I said, I think last meeting, or whatever, we don't have big issues here. This is a small area. Okay, not so small! It's the biggest park in the city. We working together in partnership with the authority and community, we could find solutions to any issues in the park. And wit ... And it's not that expensive, actually. We're not talking about huge budget projects, or whatever. We just need more responsibility from the local authority and maybe more openness to us and to other NGOs and to other community organizations.

DOUG: And, what would you like to see for the future, specifically, of the VNPA?

DAN: I want to see that, I want to see similar projects opening in Bucharest. I want to see that, I want to see Văcărești park as a model, as a showcase, for other projects, for other countries, in Romania.

DOUG: Cool! This last section is about social media. It will be a little shorter, and I think for Victor's interview I think we'll have more detailed questions, but this is sort of just an introduction. So, what social media websites are used by the VNPA?

DAN: First, Facebook, second Instagram, third YouTube, fourth website. And that's it.

DOUG: How do you decide what content is posted on the respective social media websites?

DAN: We don't have a strategy. We post everything we want and everything is... everything could be information, or a post. I mean, this is something... We need to work on it.

DOUG: Which social media site does the public most interact with?

DAN: Facebook. In Romania, Romania is a Facebook country. I think in the States it's Twitter. I think, but I'm not sure.

DOUG: Yeah, I think it's mostly Instagram and Twitter.

DAN: Yes! Exactly, so you have Instagram and Twitter. In Romania it's Facebook. And, I think Instagram tends to become the same level with Facebook, and the young, the younger generation comes with TikTok. Yeah, I don't have a TikTok account and I don't want to have! Hahah.

DOUG: Haha, me neither. What is one improvement you would like to see with the VNPA's social media?

DAN: Hahaha, a TikTok account. I am joking. Or, I don't know! Maybe a strategy towards social media. And, very important, a person. A person responsible to our social media accounts because right now Victor is a communication officer. So, his position is more like a coordinator. He needs someone to work with, to , to manage social media accounts. And more specific, maybe

an Instagram bigger profile. I think there is an opportunity here because we have a lot of pictures.

DOUG: And the, is there main demographic you would like to attract via social media?

DAN: Yeah, the young. It's a, I think the young between, I don't know, fourteen to eighteen or twenty. This is very important in term of education because we want to save the nature, to protect the ecosystem, to learn about birds and amphibians and wetlands, but I think we need to be more present for young people, for teens, teenagers, and I think there is also an interest coming from their group from their group. I mean, we go in the park with, I don't know, with a group of children or group of teenagers from high schools, and I'm very happy to find out the people are very open, very curious, and close to the nature. They raise questions about frogs, and, and this is something of course very positive, and we need to go to take an advantage from this curiosity.

DOUG: Alright, that is all the questions we have. Thank you very much for taking the time.

B.3 Florin Stoican

Date: 8 April 2022

Medium: Email

Florin's interview was conducted over email. Refer to Appendix A for the questions corresponding to the responses below.

A.1. *2000-2006 and 2011-present*

A.1.a. *I am geologist because I wanted to study limestone mountain from my born region where from 2004 we have the 13th Romanian National Park and the single made as a result of NGO research and advocacy.*

A.1.b. *One of the 4th founders, president and board member.*

A.1.c. *From the beginning as a volunteer and starting to last year as an employee in a project team – national urban protected areas network.*

A.1.d. *To coordinate research team who made the scientifically study for establishment of the park and to contribute with my experience in legal establishment and management of the park.*

A.1.e. *I am expert in biodiversity & geodiversity conservation, management of protected areas, natural resources management, ecotourism, ecological education and sustainability development*

A.2.a. *Private donations and EU and other organisations grants*

A.2.b. *Support of majority of our activities and projects.*

A.3. *People (employees and volunteers), research equipment, park infrastructure made by us.*

A.3.a. *Is impossible to have projects without.*

A.4. *I am member of VNPA.*

A.4.a. *Sure. Some of them are involved as volunteers, some they send us some usefully information, some are haters.*

A.4.b. *Walking, running, sports, families activities, birdwatching, educational activities, picnic etc.*

A.5. *Yes. In the last years, especially 2021, the level of the water was decreasing and some lakes and both springs have completely dried.*

A.6. *Yes. The number of bird species now is 180 from 90 when we start studies. Same with insects, amphibians, reptiles and other groups of species. Generally, biodiversity is increasing.*

A.7. *Now we have more than 5000 trees starting to 0 15 years ago. Generally, biodiversity is increasing. But we have some problems with invasive species.*

A.8. *Yes. Water balance and invasive species control are very important in park management.*

A.9. *The park will be transformed from wetland in a stepic [sic] (grasslands) and forest habitat.*

A.10. *To find the best solution for keeping the water balance. We have 3 possibilities to bring more water in park: pumping from the river, pumping from underground aquiver and collecting, treatment and usage of rain waters from proximities of the park.*

A.11. *Cleaning (historical and new garbage), infrastructure maintenance, visitors' security works (are still a lot of old constructions remaining and dangerous pits).*

A.12. *We have now resources just to maintain actual status at the short time.*

A.12.a. *The park don't has yet regulations and management plan*

A.12.b. *The park don't has yet regulations and management plan*

A.12.c. *We have two monitoring points from where we collect daily information (level measurements).*

A.13. *Yes. I am one of the voices who say from many years that Romania needs foundations of the agency. I was part of the working group for establishment of the agency. I was member of the first scientifical council of the agency. But now we don't see any direct contribution of this agency for nature conservation in Romania. Now is just another bureaucratic and inefficient state institution.*

A.13.a. *0*

A.13.b. *Yes. We are park administrators one year (2017-2018). The Government has decided to give all responsibility to the Agency but this was only theory, on paper. In reality we continue to be park administrator illegally, without any rights and authority just because nobody else care about the park in the last 3 years.*

A.14. *Has possibility to became a space for nature and people, for education, learning, connection, recreation activities, events, health. Văcărești is an example and we already inspire more people, NGOs and authorities to start similar projects in Bucharest and another 10 big cities, as a start of a national network of urban protected areas. All has also big role to promote high rich biodiversity and protected areas of Romania to Romanians and visitors, to connect urban population with rural population around nature conservation and sustainability development base on nature. Is an embassy of our natural heritage.*

A.15. *All relevant stakeholders at the same table, to work together for co-management of the park in the benefit of nature and people.*

B.4 Nicoleta Marin

Date: 30 March 2022

Medium: Zoom

Interviewer: Douglas Moor

Transcriber: Katherine Jones

DOUG: Alright, so I'm going to start off with a section about interviewee background. How long have you lived in Bucharest?

NICOLETA: Oh! Let me count... I came to Bucharest in 2001, yeah? So, twenty-one years ago already, when I started my studies in the faculty.

DOUG: And how did you become interested in environmental issues?

NICOLETA: From the faculty, I mean, even before I made my decision to follow geography, this is where I've been, this is what I've studied, I just had an inner, no, wish and a deep need to spend time outside, and in nature.

DOUG: The faculty, is that, is that at University of Bucharest?

NICOLETA: Exactly.

DOUG: Awesome. Could you describe your role at the VNPA?

NICOLETA: Mhm! I started with... educational activities, basically, with information and education. Mmm, the free guided tours that I have done in the park with schoolchildren, different ages, and students in high schools. Then I participated in, in the teams, in the design and implementation of the project that we've had here for implementation and arrangement of visiting infrastructure, for education, for information, and I also do a lot of smaller tasks that relate to keeping the communication with the, the people that write to us with the authorities. I organize activities for the volunteers that we have in the park, and I currently, I am coordinating

the project, a project, a nice new project, for which we aim to build a national network of urban nature protected areas. I mean, we have the experience in, in Văcărești, which I will show you a bit because, because my window facing the, our office looks directly to the park. So, we have had this experience and we wanted to replicate it in other cities. So, we work with other fifteen organizations in the country to protect natural areas in other ten cities. And basically this is my... this is where all my, almost all my time goes for... for about one year. For the next year also.

DOUG: Alright, the next question was how long have you worked at the VNPA, but you said that was five years?

NICOLETA: Yes, yes, five years ago. I started in 2017.

DOUG: And why did you get, or why did you first get involved with the organization? Like, how did you hear about it, what drew you to it?

NICOLETA: The first project was the one that I, the one through which we, we arranged the first thematic trail in the park. The, the trail that is dedicated to urban biodiversity. And that crosses the main habitats of the park, starting with the young forest, and continuing through reeds area, , passing next to some small lakes, then going through the largest lake in the park, and then continuing further following all the paths, all the streets, from the, from the era when there were small houses towards the periphery in the area. So, we have designed and arranged in the park the, the thematic trails, installing information panels, observation heights, observation towers, and this is the first project I have been involved in.

DOUG: Awesome. So that's like, like a tour through all the major, all the major parts of the park?

NICOLETA: You mean the trail?

DOUG: Yeah, the trail.

NICOLETA: Mhm! Yeah, yeah, yeah, it crosses the main, the main area. Meaning that it, the part of the park that is mostly used or visited by the people.

DOUG: Mm. And, I guess you went into detail, but the next question was, "What kind of work do you specialize in?" and I guess that's communication and organization, kind of? Or would you say something different, maybe?

NICOLETA: Yeah, organization, I mean putting your ideas in projects, how to get an idea to reality. This is how we started the current project, this one on the national network of urban protected areas. So, I started from zero, from scratch, together with the other colleagues, and we started to put our ideas on a plan and draw activities. Okay, first some objectives we want to fulfill, some activities and what would be the result that we would like to achieve with this project. So, basically, this is one of my main activities here, to write project proposals and to submit them in project competitions to get funding for them. To bring the idea to reality in the park. And also, I still have, and I like the free guided tours in the park with schoolchildren and I still have activities with volunteers. I still organize activities with volunteers.

DOUG: Awesome. Alright, and so the next –oh, no- VNPA resources is only for, okay, never mind.

NICOLETA: Have you ever seen the park from our balcony? Maybe Dan already showed you?

DOUG: Yeah, we actually got a tour from the camera you have set up. We thought that was really cool.

NICOLETA: Okay!

DOUG: That was just earlier this morning, or earlier this afternoon for you.

NICOLETA: Okay!

DOUG: So, the next section is about wetlands ecology. Since beginning working at the VNPA, have you observed any changes to the bodies of water in the park?

NICOLETA: Yes, yes, yes. I saw some of the smallest ponds have just disappeared. I saw them disappearing. Two years ago, I saw the water level in the lakes decreasing a lot, more than one meter. So, I saw, and I walked on areas that before were covered with water, and now in 2020, there is nothing. No water remains, it's just ground. Just vegetation. It was a very, very, dry year, and the water throughout the park decreased a lot. And I saw another difference three years ago, or four years ago, four years ago, I don't know exactly, we've made an operation to remove the reeds in the park, and we came, I mean, there was a machine that came and cut the reeds in some areas, and we saw some water surfaces getting out in the light. Areas where we didn't see lakes before. But they soon, very soon, have been covered again by the reeds.

DOUG: So you, that was, like, an excavator dug up some reed beds, and the ponds expanded, sort of? Into new areas? Is that what I'm understanding?

NICOLETA: No, no, the machine just cut the reeds.

DOUG: Oh, okay.

NICOLETA: Yeah, and because the water was covered in vegetation and this big, and... and tall reeds, we couldn't see it.

DOUG: Oh.

NICOLETA: From here, from here, from our balcony, which is about fifty meter high, we couldn't see it, but when the machine passed and cut the reeds, then the water came to light. But because the water depth was very small, then the reeds took over very, very fast. Because it needs, just a depth below one meter or one meter, one-point-five meters to recover again.

DOUG: Mhm, we heard that from Bogdan too. It's like around one to two meters, otherwise the reeds just come back. Next question. Have you observed any changes in wildlife in the park?

NICOLETA: [long pause] I couldn't say that. No.

DOUG: Alright, then have you observed any changes to the vegetation, plant and animals – or, sorry – just plants in the park?

NICOLETA: Mhm, yeah, yeah, yeah, this, this is amazing! For example, some areas of the park, one year, are covered in a particular type of vegetation, right? And the next year was a completely different type of, of species of plants. The reason a particular area, just in front of the largest lake in the park, where a particular type of plant used to grow, it's a medicinal plant... unfortunately I don't remember the name, but in one year it was full of that plant, and in the next year there, there were almost nothing. Other types of plants took the place.

DOUG: Do you have any concerns about the sustainability of the park's ecosystem?

NICOLETA: Yes, one, regards to vegetation fires. And the risk is really high, and response is very difficult, because there is no access path to fight the vegetation fires, when they appear, for example, in the middle of the park. There is no preparation for response in case of a vegetation fire and, from the past, we have observed that it is very difficult to come up with the proper response to limit the damages. This is a first concern and the second one would be the one relating to the maintenance of a constant water level in the lakes. The third one would be the maintenance of the meadows, because there are some parts of the park that are very precious for their species of plants, for meadows. But they are slowly, slowly covered either by the reeds or the tree species, and there are those invasive species of trees.

DOUG: What do you think is likely to happen if water levels were to continue to drop?

NICOLETA: We will lose a lot of species. So, we will lose a part of diversity of the park. It will be affected completely. We will lose fish species, then maybe the mammals that feed on those species, then the birds that feed on small insects that live underwater or on the water. So, I'm afraid if the water will, the water will... surfaces, the lakes, the ponds will disappear, the diversity will be very much affected, will decrease.

DOUG: And then, last question about wetland ecology. How might predictions of water levels or water surface area help the VNPA protect the park?

NICOLETA: Can you repeat please?

DOUG: Yeah, sorry. I guess we haven't talked much about the background of our project. But one of the deliverables that Dan wants to have is a sort of a predicative model that will say, in the next five to ten years, this is like, how much water surface area there is. Like, the pond was this big, and it will be this size in the next five to ten years. We want to know how those predictions might, might be used to help the VNPA either make, make proposals, that kind of thing. How they can help out.

NICOLETA: Okay...

DOUG: It's fine if you don't - we could probably ask that to Dan, that might be more of a question better worded for him, because he was the one asking for it.

NICOLETA: Okay, but just to repeat, to know if I understood well, you want to know my opinion with what would be the scenario that would, would help us to imagine... A management of the park that would make safe the lakes? That would put the lakes in a safety area? That would maintain the water levels in the lakes? [long pause] I don't know how to answer that.

DOUG: That's fine, we can move on.

NICOLETA: Sorry.

DOUG: No, that's fine! Next section is on park maintenance. What kinds of maintenance, if any, are regularly performed at the park?

NICOLETA: Well, basically, the maintenance is, in short, at the very, very, very superficial level, and it consists of cleaning the area, the main path, the main trails, replacing and maintaining the visiting infrastructure, and basically, this, in this moment.

DOUG: Why does it have to remain so much on a superficial level?

NICOLETA: Why it is at the superficial level?

DOUG: Yeah, is that because of the ANANP? The National... I forget the full acronym.

NICOLETA: Yeah, no problem. There were some changes happened in the management of the park in the last four months we have been administrator, the ruler of the park, in 2017, 2018, then we, as an NGO, all the NGOs, actually, in the country, have been removed from the management of protected areas, and those areas, when... were taken over by a national agency. A national agency dedicated to protected areas management, but basically, an agency that actually that never has done an operational management, like concrete action in the field. They just had the authority to control those areas, but nothing happened concrete. And the park went to this agency, but last year, the municipality of Bucharest took administration of this park. It was like this agency organized a bit, a bit, like a bit, and the municipality submitted a proposal for the administration of the park, for the management, supported by us, because we have the knowledge and the experience, so they submitted this proposal, and then their proposal has been evaluated as successful, and this agency, the national agency, signed a contract for the management of the park with the municipality. So, now, the park is under administration of the Bucharest Municipality. They established dedicated service, as required by law, and they, they are the official administrator. Most probably, I mean for sure, this procedure is very

bureaucratic, and they just started to employ people in their structure. They just started to learn about the park and what is to be done in the park, so I think the maintenance is so superficial because they didn't actually understood what is to be done. They don't have yet a strong grip on what the needs of the park are, and what to do as the administrator. Because this is a big problem in all the administration in Romania, the lack of competencies. There are no officialized people, there are no competencies to work in the protection of nature, protection of biodiversity in the city, the city holds, in the municipality. Even if they are open, and they want to do things, they don't know how to make them. It's a general problem.

DOUG: Thank you, that offers us a lot of insight. We hadn't heard about the transition from the national agency to the, to Bucharest's municipality.

NICOLETA: Mhm, and we are now in discussions with Bucharest municipalities to conclude the park... so that we will manage these activities on education, information, conservation, and the municipality will deal with the other actions, the other programs.

DOUG: Alright, our next questions are about, like more specifics on park maintenance. So, what kind of maintenance does the government allow right now?

NICOLETA: Okay, so far, there are some measures. There is a set of rules on what is allowed and what is not allowed to do in the park. And in terms of maintenance, basically you... you are not allowed to come up with, with, how should I say, with stronger actions before having a management plan. So in order to, for example, to go and dig in the lakes, to deepen the water level so the reads will not advance, you need to come with a specific equipment to dig that. You need to have these included in a program that should be improved by the ministry of environment. So the administration currently needs to produce, to develop a management plan that will be put under public consultation and approved by the Minister of Environment and they

need to include in this management plan all the maintenance works, all the conservation measures, all the interventions that they will do in the park, all the installation of thematic trails, building an information center, all of this needs to go in the management plan. And then only after you have, after the park has this management plan, then you would be allowed to do maintenance. Actually, this is another point maybe.

DOUG: No, I think that's good!

NICOLETA: I don't know if I answered the question.

DOUG: No, you did, that was very good. What was it, when you say the administration is developing a plan, is the administration the VNPA proposing to the Ministry of Environment, or is that Bucharest's municipality proposing?

NICOLETA: Second version, Bucharest's municipality, because they have mandatory condition, contractual condition to do that. So they are the only entity to develop and submit the management plan. What we can do, and what we would like to do is discuss with them to keep the connection very tightly because we have already defined the measures to be included in the management plan, so we just need to keep in touch with them to make sure those measures we've defined based on the studies and the research that we've done, they are included in the management plan, but the authority to finalize it, to submit it to the Ministry of Environment, to put it in the public consultation, under Bucharest's municipality because they are the official administrator now.

DOUG: I see, so some of the problem is, like you said, there's no qualification for nature protection, so they have the authority, but not the knowledge, and the VNPA has the knowledge and not the authority.

NICOLETA: Exactly, yeah, yeah.

DOUG: That must be hard to navigate, it sounds like.

NICOLETA: It is, it is. They have another option to externalize the development of the management plan to experts. They can do that ,but the ideal form would be to work all together, so the ideal situation would be the municipality to bring together all the organizations, starting with us, all the specialists that would be able to contribute to the management plan. And then they will collect all the input, all the feedback and then they would produce the final version and put it in public consultation.

DOUG: And this last section is on VNPA and government relations. This might repeat some some questions earlier that you might have already answered. So, are you familiar with the National Agency for Protected Natural Areas, and if so, its relationship to the VNPA?

NICOLETA: Yes, I am. The relationship that we've got, we also have a partnership signed with the National Agency for Nature Protected Areas still in force, but this partnership was rather, like, contract where we've got some obligations and the National Agency has some rights. So actually, it has the name of a partnership agreement, but it was actually not at all a partnership. It was not a moment of working collaboratively, working together. The authority was one that used to control our activity, and to ask, and we were in the position to do the work, which was fine, because we like to do the work, but not so fine was the relationship between controller and doer. The problem was there was no collaboration actually, and this is not just a particular problem with us, it's a general problem also. Because, actually, this agency does not work. They lack also, they lack competent people. They lack a vision for the management of protected areas at the national level. They lack resources. Actually, there is one of those national agencies that ,

that don't justify their establishment and their work. They are not able to bring a value to the management of protected areas in the country.

DOUG: Thank you! Do you receive any assistance from the National Agency for Protected Natural Areas?

NICOLETA: No. No assistance. No support. Zero. Hah!

DOUG: And then, let's see, you've already answered the next question that I was going to ask you, so I'll move on from that. What would you like to see for the future of the Văcărești Wetlands? Whether it be like, management, working with schools, anything really.

NICOLETA: I would like to see a proper partnership between NGOs and the administrator, which is Bucharest municipality. I would like to see a partnership that works with us, with other NGOs in the city, that they are active and do very good job in nature protection and education. I would like to see that a solution for the landscaping of the park is selected and for that, an international competition should be organized. I would like to see that the park has an information and visiting center, that has thematic trails in the park, that has proper infrastructure for the school teachers to come and do their lessons, outdoor lessons independently, not necessarily being accompanied by a guide. I would like to see that the communities of runners, or bicycle riders are encouraged and are offered trails in the park. So I would like to see some bicycle paths, some viewpoints that might be arranged on the dam. I would like to see that the park has a proper system to prevent vegetation fires and to respond very quickly. I would like to see that the park has a guarding system. I would like to see that the volunteers are encouraged and offered opportunities to do what they, what they are good to in the park. I would like to see that the Văcărești welcomes other initiatives in other cities in the

country. And it might do that by offering its own example of a very well managed wetland in the city. And I'm convinced that this might be reached only by partnerships, only by municipality working with NGOs, with the research institution, with the University of Bucharest, because there are teachers, that comes with the students and they do their research here. I would like to see there is a openness from the authority to welcome all the others that might bring valuable input in the management of the park.

DOUG: Thank you, that's awesome! That's a lot. The next question was what you would like to see for the future of the VNPA specifically, but I think you've talked pretty much about everything then. If you have anything specific like, just to the organization, that you'd like to add. It's fine if there's nothing else though, you've already said a lot.

NICOLETA: I would like to see that two particular aspects of Văcărești are put in light, and are more in value. One is that is the most quiet area in the city, and the second is that is where one can enjoy the dark in the city. Because otherwise, almost wherever you go in the night, you have this light spreading everywhere. So I would like to, I would like to take these examples of quiet or dark areas that are in the park and find in the cities other spots that might be enjoyed by the people like that. For the silence and for darkness.

DOUG: Awesome, that's all the questions we had right now. Thank you so much for taking the time to do this. It's been very helpful!

NICOLETA: You are very welcome! I think it's awesome that you do that.

B.5 Victor Marin

Date: 19 April 2022

Medium: Zoom

Interviewer: Douglas Moore

Transcriber: Katherine Jones

DOUG: Alright, so this first section is just about interviewee background. How long have you lived in Bucharest?

VICTOR: Since I was born, 1985.

DOUG: And how did you become interested in environmental issues?

VICTOR: Well, I have loved birds and animals since I was a little boy and I grew up in a neighborhood very close to the outskirts of town, and there used to be a very small pond over there which was surrounded by reeds and willows and there were ducks and egrets and stuff. This is where I spent a lot of time, it just happened. And well, there is another reason too. It's hard to explain to you guys because you didn't live through the communist period… And it's no problem! It's very good that it's this way. During this time, people used to have to traffic cassettes with movies, cartoons, music, you know… for the video? My uncle, who is also my godfather, used to get those cassettes with movies like Terminator and stuff, which was very hard to get by. But between them, there were also some documentaries about wildlife. One of them was… … Wild America? You know? There was a bearded guy who was saying, "Enjoy our wild America!" I'm not sure what the series was called. This is one of the reasons why I came to love nature. It started out in my childhood to be honest. I don't know how much that helps you in your interview, but this is the reason why.

DOUG: No, thank you! That's a pretty cool story. Could you describe your role at the VNPA?

VICTOR: Well, I'm the communication coordinator. That means I write the press releases, I post on Facebook, I put stuff on the website, I talk to journalists, I make the meetings that take place in Bucharest to inform the people what happens to the park, to the network, this is what I do. I communicate with people who have something in common with the park. That would be general public, with the Facebook and the website, and people who are specialized, like, I don't know, journalists, let's say.

DOUG: Does that mean you manage every single social media website?

VICTOR: I'm the one. We have only two social media websites. Well, actually three. To be very, very honest, Instagram doesn't count. We have two Facebook pages. Parc Natural Văcărești, Văcărești Nature Park, and Reţea Pentru Natural Urbana, the Network for Urban Nature. The first one. The first one has attached to it an Instagram account. And pretty much when you post on Facebook, but not all of it, it goes on Instagran. Instagram is like, yeah we'll do it some other point. But we have two Facebook pages at this point. No TikTok and whatever else there might be. And I don't want to do Tik Tok. It's stupid!

DOUG: Haha! Dan said something similar. And how long have you worked at the VNPA?

VICTOR: I started the first of March.

DOUG: Wow, this year?

VICTOR: Yeah, before this I was a reporter for a radio station and a lot of other stuff. This is how I know the guys. From time to time, instead of interviews and investigations I would make some wildlife materials, because from watching – Ah! Marty Stafford was the guy's name! The one who presented Wild America, I thought, yeah, I'm gonna be a biologist, but then I found out

the salary is crap. And then I said, yeah, I'm gonna make documentaries. I didn't do that as well, but yeah, on the radio we had lots of materials about wildlife, and a lot of them regarding Văcărești Natural Park, and this is how I met them. This was, I don't know, maybe five or six years ago. At some point when the opportunity came, they said, "Okay, we have this job opening, communication coordinator." It's new for me, I never worked in communication before, but it has similar stuff to journalism, so… It's okay, I guess.

DOUG: So the next question is, what kind of work do you specialize in?

VICTOR: I couldn't say I have a.. I specialize in everything. At the moment I have to do all that i said before in equal parts. They're all important for us. That would be social media, that would be communication with the press, events organization. I don't specialize in any of those, but have to do all of them.

DOUG: Alright, that's the end of the background questions. We're gonna move down to the social media section. So, what social media websites are used by the VNPA?

VICTOR: Well, we're using Facebook and we also have an Instagram account. Two social media accounts, and one is Instagram.

DOUG: How do you decide what content is posted on the respective social media websites?

VICTOR: Well, it's quite simple really. Just considering what kind of subject a reporter would give to the public. From this point of view it's quite easy. But there's a certain difference. In Văcărești Natural Park Facebook, it has to have about this place and the flora and fauna that live here. Did you know that this bird does this and that and it comes and it goes, so it's specifically about this place and its role to Bucharest. These things go here on the Facebook page. The other is about a lot of things that happen in the other cities where we try to set up

things like Văcărești Natural Park, and this is the main difference between the two. Sometimes, okay, we have shares between the two pages to grow the traffic on the second one, which is new. It has only one year. Văcărești Nature Park Facebook is a lot older. These are the main differences, Văcărești Natural Park posts about things that happened in Bucharest and specifically here, and the one for the network about our partners in the network in our country.

DOUG: And which social media site does the public most interact with?

VICTOR: The social … the Facebook of Văcărești Natural Park. There is seventy-one or seventy-two followers. Seventy-one thousand, sorry. The other is rising steadily. It's one thousand-six hundred. About one hundred per month. And for the Instagram I wouldn't really know. When I look at the results, okay what reach did this post have, what reached the other one, in Meta I can see that Instagram is pretty much… No, it's not there. If you want I can open one of those pages and give you an example. Would that help you?

DOUG: Yeah, sure!

VICTOR: Okay, just wait a second please… Okay, let me see if I can share screen. Is it okay? Is it working?

DOUG: Yeah!

VICTOR: Okay, so, for example this one had an impact of nineteen thousand people, which was okay. They do tend to vary. Five thousand, three thousand. But look at Instagram. Eight hundred. I mean, all of these on Facebook are in the thousands and tens of thousands, and the ones… fourteen thousand. And the ones on the Instagram are like, four hundred. Look at this one. The post is the same. On Facebook it reached eleven thousand people and on Instagram seven hundred. Okay? This is to give you an idea about the difference between the two. Okay! If you want to continue the questions?

DOUG: Sure. What is an improvement you would like to see with the VNPA's social media?

VICTOR: Well, there's a lot of things I don't understand, I'll be very honest. Like I said to Katherine, I'm probably one of the most technically challenged people here. For example, I honestly don't understand a lot of things. Like the heck why can't I tag someone when I posted the day before and I programmed it for the next day. And I do "at" and the person's name and you can't tag it!

DOUG: It doesn't, like, autofill?

VICTOR: No, not necessarily! And once it's posted you can edit it and it works just fine! Why! This is one of the questions. I don't necessarily understand what's the logic between the difference of reach. I mean, why do some posts that are quite similar to others fluctuate a lot. I mean, five thousand to ten thousand, there were examples. Considering the fact that they were pretty much in similar time periods, and in weekdays, Monday to Friday. I would like to find out these things about Facebook, and for Instagram porbanly everything I find out would be something new. I have an Instagram account because it's linked to the Facebook, but I never grew fond of it. I'm not saying that people using Facebook are like, wow, PhDs, but Instagram feels a bit superficial. Oh, whatever. I understand that I have to use it. I'm not saying that I have the ultimate truth.

DOUG: Do people like, not really use Instagram in Romania?

VICTOR: Well I'm not sure, I think younger people… I was born in '85, so I'm thirty seven years old. I think younger people tend to use Instagram, but for our public, the one who grew together with the park, Facebook is the main social media. So, maybe to address the other people, this is the reason I said yes, let's see what I can do. Maybe for younger people, Instagram would be

better, I guess. I don't exactly understand why you would prefer Instagram to Facebook, to be honest, but okay, let's give it a shot, let's see what it's about.

DOUG: Sure! What is the main demographic you would like to attract via social media?

VICTOR: Yeah, generally it's the person from eighteen to maybe forty, forty-five, so young adults, people that are concerned with nature, that's our main target. The ones who care about nature, and are pretty young, active people, with or without college, but preferably yeah, with studies.

DOUG: That's a pretty wide swath.

VICTOR: Yeah, yeah. But for the lower part of this interval, eighteen to twenty-five, let's say, I think Instagram might be better than Facebook.

DOUG: Okay, we've reached the end of the official questions, so I'm just trying to think of anything else we may be wondering about. One of the things we were looking at with regards to things that we might use to get more views would be the usage of hashtags in the Instagram. We hadn't thought about it for Facebook but it might apply. For the Instagram it's only… you only post hashtags in Romanian, right?

VICTOR: Yeah.

DOUG: And most of them are ones that the park or you came up with?

VICTOR: Yeah, we made them up because they're useful, but we use them in Romanian because we address the Romanian people. I'm not saying we shouldn't do it in English, but this is how we did it from the start. So yeah, it might be helpful. I actually never thought about using hashtags in English.

DOUG: Yeah, in looking at other natural parks, usually the Romanian ones will have Romanian ones will have hashtags in Romanian and then will throw on English ones under it, because most of Instagram users are younger and use English more frequently.

VICTOR: Well, to be honest I have never done a case study of what other natural parks use to post regarding their hashtags. But I don't think I saw too many in English, to be honest. It's a pretty good question, I never thought about it, but I'm pretty sure that posting in English hashtags is not necessarily a common thing. But I would like to ask you a question: Okay, we will post English hashtags, no problem. This would mean that the post would go to foreigners. Wouldn't that mean we'd have to translate the post as well? I mean, first it would be in Romanian and then into English.

Doug: Yeah, I was thinking about that. Our main hope was that it would, like, along with foreigners, it would go… You can tag locations on Instagram. If you tag Bucharest, or you can tag the delta, and that also influences which people it's shown to. So, we think that if you tag, if you tag Bucharest as the location, then you also have "hashtag birdwatching" or "hashtag wetlands", and then it would narrow the demographic more…

VICTOR: Okay, people who are interested in stuff like this…

DOUG: That would keep it not completely out of… it doesn't go off to other countries.

VICTOR: Okay, you have the Facebook translation, the automatic one, but for Romanian, it doesn't necessarily work as well. It depends on the type of post. If it's a general one, it's pretty good. But if it's about, I don't know, engineering, let's say, wildlife, it's so and so. People could get the translation from Facebook, so we don't have to necessarily translate everything, but it might not be the best translation ever. There are a lot of words in Romanian that have two or

three meanings, for example. This is only one of the reasons. The artificial intelligence doesn't necessarily know it.

DOUG: That's an issue we hadn't really thought about with regards to social media. I can't think of anything else off the top of my head. Kate, do you have anything else in mind?

KATE: No, I was wondering about the translation, but you covered it.

DOUG: Alright, Victor, thank you for your time to help us.

VICTOR: Thank you!

Appendix C: Livestream System Specifications

Table C.1. Livestream Data Transmission Options

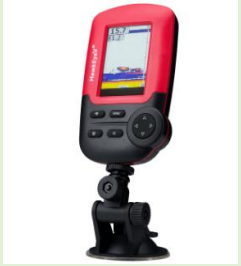
Product name/ description	4G LTE USB module	EZ Bridge point-to-point Wi-Fi system
Image	 (*Newegg*, n.d.)	 (*Amazon*, n.d.)
Upfront cost	~15-30 USD	~250-350 USD
Monthly cost	~30 USD	Free
Power usage	~4-10 Watts	4 Watts
Weather resistant	No	Yes

Table C.2. Livestream Camera Options

Product name/ description	Raspberry Pi with Camera Addon	IP (Internet Protocol) Camera	Reolink 4G enabled security cameras
Image	 (Raspberry Pi, n.d.)	 (Amazon Lorex 1080P IP Camera, n.d.)	 (Amazon Reolink Camera, n.d.)
Cost	~60 USD	~30-100 USD	~40-150 USD
Power usage	5 Watts	1-10 Watts, depends on model	N/A (doesn't need external battery)
Resolution	5 Megapixel or 12 Megapixel	2 Megapixel to 16+ Megapixel, depends on model	2 Megapixels to 8 Megapixels, depends on model
Connection Options	4G and Wi-Fi (built-in ethernet)	4G and Wi-Fi (built-in ethernet)	4G only (no built-in ethernet)
Weather resistant	No	Yes	Yes
Streaming Abilities	Capable of streaming	Requires separate computer to stream	Requires separate computer to stream

Appendix D: Water Depth Measurement System Specifications

Table D.1. Water Depth Sensing Technologies

Product name/description	CEE Hydrosystems unmanned sonar vehicle	Drone with Lidar Sensor	Ultrasonic Fish Finder Depth gauge
Image	 (CEE-USV | CEE Hydrosystems, n.d.)	 (Matrice 600 - DJI, n.d.)	 (Hawkeye Electronics, n.d.)
Cost	~65,000 USD	~5000-10000 USD	~50-150 USD
Sensing depth and accuracy	0.2 to 200 meter sensing range	0 to 5 meter sensing range	0.5 to 240 meter sensing range
Ease of use	Hard (requires operator training)	Hard (requires operator training and knowledge of drone laws	Simple (designed to be easy for everyday consumers to use)

Appendix E: High Traffic Instagram Hashtags

Table E.1. High Traffic Instagram Hashtags

Hashtag	Number of Posts on Instagram
#natura	25,404,238
#Romania	11,327,473
#Bucharest	3,626,408
#Bucuresti	2,659,139
#conservare	8,155
#Vacaresti	3,036

Appendix F: Interview Coding Tables

See file Appendix F.xlsx