Ecological Restoration for Human Wellbeing

The case of wetland restoration in Jablonné v Podještědí, Czech Republic

Jakub Masri

Master Thesis Series in Environmental Studies and Sustainability Science,
No 2021:019

A thesis submitted in partial fulfillment of the requirements of Lund University International Master's Programme in Environmental Studies and Sustainability Science (30hp/credits)

LUCSUS
Lund University Centre for Sustainability Studies

LUND UNIVERSITY

Ecological Restoration for Human Wellbeing

The case of wetland restoration in Jablonné v Podještědí, Czech Republic

Jakub Masri

A thesis submitted in partial fulfillment of the requirements of Lund University International Master's Programme in Environmental Studies and Sustainability Science

Submitted May 11, 2021

Supervisor: Ellinor Isgren, LUCSUS, Lund University

Empty page

Abstract:

Wetland and biodiversity loss affect both ecosystem function and human wellbeing. However, it is argued that the incremental rate of farmland abandonment provides opportunities for ecological restoration to help reverse this negative trend. This thesis applies ecosystem service framework and psychological ownership theory to analyse a wetland restoration project in a semi-urban town of Jablonné v Podještědí, Czech Republic, using mixed methods including survey, modelling tools, and interviews. The results show that the restoration has increased biodiversity and the provision of some ecosystem services, positively affecting local wellbeing. It also demonstrates the importance of including cultural ecosystem services in restoration projects, and the potential of cultural ecosystem services and public involvement to foster environmental stewardship. Although the case can be considered a model for future restoration projects in similar settings, restoring hydrological connectivity, more effective management, and better public involvement could lead to higher multifunctionality and better restoration outcomes.

Key Words: wetlands, ecological restoration, ecosystem services, Czech Republic, WTP, wellbeing

Word Count: 11,997

Acknowledgements

I would like to thank my supervisor Ellinor for her always brilliant insights and understanding. Thank you also belongs to my family, my beloved Daniela, friends, and everyone who believed in me and supported me throughout this process. Lastly, I would like to thank the staff of Čmelák – Společnost přátel přírody and especially its chairman, Jan Korytář, for collaborating with me on this thesis.

Table of Contents

List of Figures

List of Tables

List of Abbreviations

JVP	Jablonné v Podještědí
RQ	Research question
ES	Ecosystem Services
CES	Cultural Ecosystem Services
RES	Regulating Ecosystem Services
MA	Millennium Ecosystem Assessment
TEEB	The Economics of Ecosystems and Biodiversity
WTP	Willingness to pay
GIS	Geographical Information Systems
LULC	Land-use-land-cover
P	Phosphorus
N	Nitrogen

1 Introduction

1.1 Problem Description

1.1.1 Wetlands and Wetland Loss

Wetlands constitute the transitional areas between aquatic and terrestrial ecosystems (Mitsch et al., 2009).[1] They are extremely fertile, and as such they started to be used for agriculture very early in human history (Verhoeven & Setter, 2010). Wetlands are today classified as one of the most threatened ecosystems in the world (Silva & Europäische Kommission, 2007). It is commonly reported that 50% of the natural wetlands have been lost (Finlayson, 2012), and according to Davidson (2014), about 90% of the remaining wetlands were lost since the 1700. Their loss is most evident in regions with intensive agriculture (Biggs et al., 2005; Finlayson & Davidson, 1999; Mitsch & Gosselink, 2000), where extensive drainage took place using a system of pipes, dikes, river channelization, and groundwater level manipulation (Thiere, 2009; Verhoeven & Setter, 2010). Central Europe in particular is a heavily engineered landscape (Mathevet et al., 2015). In the Czech Republic, it is estimated that two thirds of all wetlands have been lost (Life for Mires, n.d.). Wetlands continue to be drained, and developed even today (Zhu et al., 2019), leading to wide-spread loss of natural habitats (Luan & Zhou, 2013), threatening biodiversity and affecting wetlands' important ecological functions (Hassan et al., 2005), such as water purification (Dordio et al., 2008; Hanson et al., 2016), eutrophication prevention (Land et al., 2016), carbon sequestration (Were et al., 2019), and flood regulation (Zedler, 2003).

1.1.2 Conservation and Ecological Restoration

Wetland conservation is stipulated in international agreements such as the Ramsar convention, as well as the EU Water Framework, and Habitats Directives (Scholte et al., 2016). Although wetlands saw their conservational status improved, they continue to be at high risk of reclamation[2] (Čížková et al., 2013; Verhoeven & Setter, 2010).

---

[1] The Ramsar Convention (1971, Article 1.1) defines wetlands as

"…areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres."

Potential solution to at least partially remedy the negative environmental impacts of agricultural intensification and wetland loss can be ecological restoration and wetland creation (Benayas & Bullock, 2012; Chapman & Reed, 2006; Mitsch et al., 2001; Mitsch & Day Jr, 2006; Paludan et al., 2002; Zedler, 2004). Ecological restoration is defined as the "intentional activity that initiates or accelerates the recovery of an ecosystem with respect to its health, integrity and sustainability" (SER, 2004, p. 1). It is strongly related to the concept of ecosystem services (ES), defined as "the benefits that people receive from ecosystems" (MA, 2001, p. 49), where ES are often used to guide the restoration process (Alexander et al., 2016). Evidence suggests that ecological restoration can increase both biodiversity and the provision of ES (Benayas et al., 2009). This is also the case in wetland restoration (Meli et al., 2014; Ramsar Convention, 1971). However, in wetland restoration, the hydrological cycle is often degraded to such a degree that restoration of all hydrological processes cannot be achieved (Acreman et al., 2007).

1.1.4 Farmland Abandonment

According to Isbell et al., farmland abandonment represents "an unprecedented opportunity for ecological restoration efforts to help to mitigate a sixth mass extinction and its consequences for human wellbeing" (2019, p. 1536). Agricultural land is today being abandoned at a higher rate than it is being produced (Isbell et al., 2019). In Europe, for example, farmland abandonment has been a dominant land-use change process for several decades now (Correia, 1993; Fuchs et al., 2015; Renwick et al., 2013), where according to some estimates, the area of abandoned agricultural land could amount to 211.814 km^2 by 2040 (van der Zanden et al., 2017). Farmland abandonment is becoming a global issue (Benayas et al., 2007; Grau & Aide, 2008) that is likely to continue in the future driven by global commodity markets, changes in land productivity, and climate change (Bennett & Balvanera, 2007; G. Busch, 2006; Cramer et al., 2008). However, for this process to help reduce biodiversity loss and promote human wellbeing, significant efforts will have to be expanded to restore the land degraded by intensive agriculture (Suding et al., 2004) otherwise these systems will likely provide little biodiversity or ES benefits (Isbell et al., 2019).

1.2 Research Aim and Contribution to Sustainability Science

Climate change, biodiversity loss, and ill-health represent pressing sustainability challenges (Jerneck et al., 2011) and ecological restoration has the potential to mitigate their negative impacts (Aronson

[2] Land reclamation is most often done to produce agricultural land or land for urban development and involves wetland drainage, and ground level elevation (see e.g. Stauber et al., 2016)

et al., 2016; Brudvig, 2011; von Holle et al., 2020). However, more research on the effectiveness of concrete ecological restoration projects to promote sustainability is needed (Breed et al., 2020; Nilsson et al., 2016; von Holle et al., 2020; Wortley et al., 2013).

The aim of this thesis is to make a stronger case for, as well as to inform the practice of, ecological restoration in semi-urban environments. It does so by analysing a wetland restoration project in Jablonné v Podještědí (JVP) and examining its contribution to societal and citizen wellbeing through the provision of selected ES, as well as by assessing how the ecosystem is valued by the locals and if environmental stewardship has been fostered among the target population.

In this thesis, the following research questions (RQs) are asked:

> *How are the restored wetlands perceived and valued by the local population?*
>
> *How do the restored wetlands contribute to local and societal wellbeing through the provision of ecosystem services?*
>
> *To what extent did the project mange to foster environmental stewardship in the local population?*

This research contributes to the field of sustainability science by looking at a contemporary issue of farmland abandonment from a holistic and interdisciplinary perspective (Jerneck et al., 2011), in the analysis of the social and ecological effects of ecological restoration as an alternative land use to abandoned farmland. The wetland restoration analysed here can be considered a pioneering project in the context of the Czech Republic (Enviweb, 2021; Nadace Partnerství, 2020), with the aim to serve as a model for future restoration works (Čmelák's internal documents, 2021). It is therefore critical that lessons from this project are learned. This thesis also looks at how cultural ecosystem services and psychological ownership contribute to the fostering of environmental stewardship, which is still a relatively unresearched area (Andersson et al., 2015).

1.3 Outline

The rest of this thesis is structured as follows: Section 2 provides background information on the case study. Section 3 presents the philosophical and theoretical entry points in the research. Section 4 is devoted to research methodology. Section 5 presents the research findings. Section 6 discusses the findings, and section 7 concludes the whole research.

2 Background and Case Study Context

2.1 Jablonné v Podještědí

JVP is a small semi-urban municipality located in the Liberec Region in the Northern part of the Czech Republic (Fig.1). It consists of eight cadastral units with a total area of 5788.36 ha (Jablonné v Podještědí, 2018). Forests cover roughly 42,6 % of the area, while pastures and agricultural land cover 25.2% and 20.9% respectively (Jablonné v Podještědí, 2018). In 2019, the municipality had 3667 inhabitants and although the population is aging, the pre-productive component still predominates over the post-productive one. The average age in 2016 was 41.1 years (Jablonné v Podještědí, 2019). Overall, the level of education is low, and there is a relatively high long-term criminality and unemployment rate. The population density is low, and the municipality is affected by rural flight. The dominant employer is the food-processing industry. The employment in tertiary sector is low, despite the tourism sector being relatively developed (Jablonné v Podještědí, 2018). The environmental quality is generally good and according to municipality's reports, floods represent the biggest overall risk (Jablonné v Podještědí, 2019).

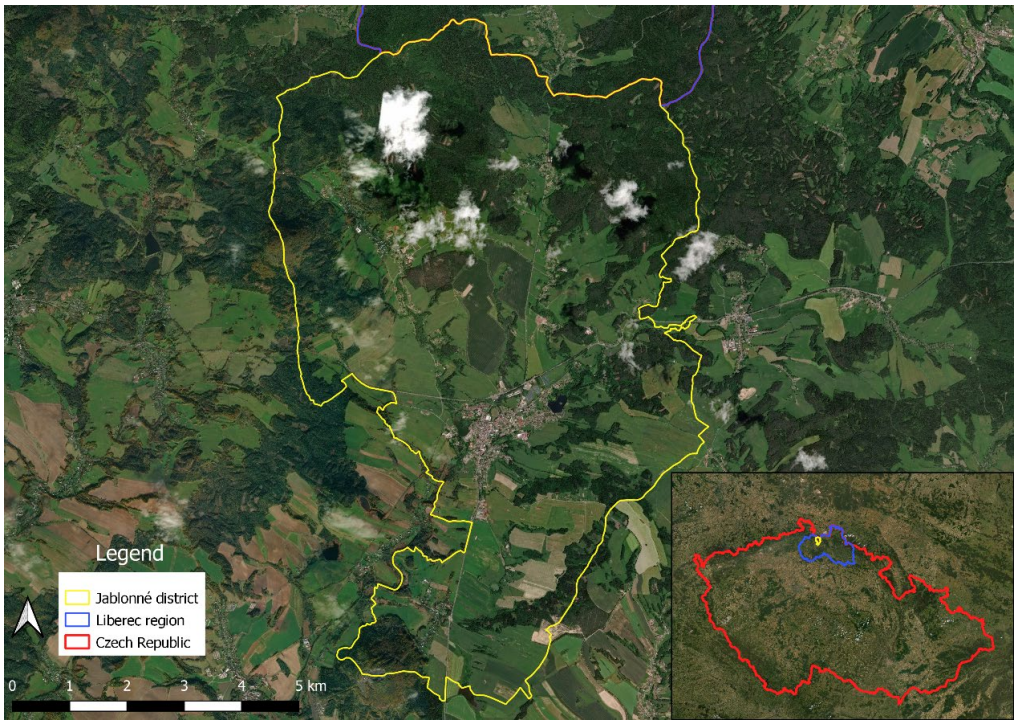


Figure 1 Demarcation of Jablonné v Podještědí. Based on data from *ČÚZK: Geoportál* (n.d.)

2.2 Wetlands in Jablonné v Podještědí

2.1.1 Physical Characteristics

The restored wetlands are located about 500 m from the main square in JVP and cover an area of ca. 7 ha (Schneider, n.d.). As can be seen in Figure 2, the wetlands are bounded by Heřmanický stream in the East which flows into the Panenský stream bordering the site from the South. In the North, the wetlands are bordered by Chateau Nový Falkenburk – present-day orphanage – and in the West by pastures.

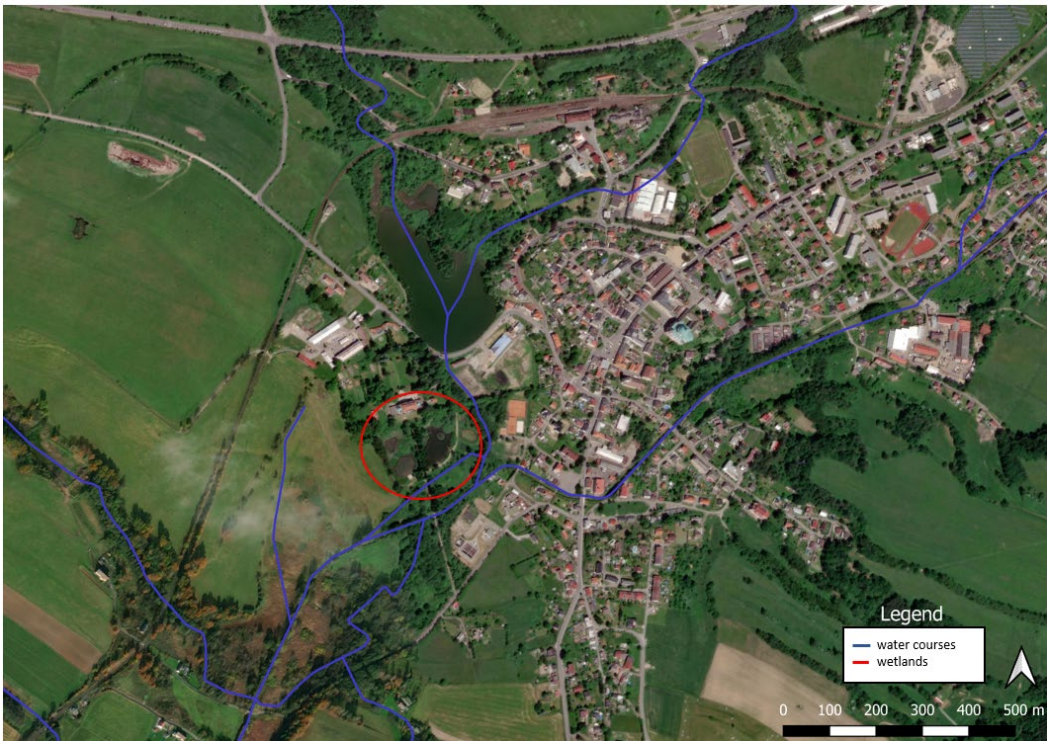


Figure 2 Location of the wetland with highlighted watercourses. Own creation based on data from (*ČÚZK: Geoportál*, n.d.)

The terrain is flat with elevation of 299-303 meters above the sea. The soil is composed of a clayey topsoil, and gravelous sands on a layer of sandstone (Schneider, n.d.). Since the wetlands lie in the floodplain of the Panenský stream, the site is further characterized by fluvial deposits and the presence of hydric soils (Čmelák, n.d.-a).

2.1.2 Historical and Ecological Development of the Site

It is estimated that until the 13th century this area was a floodplain forest which was then cleared and transformed into wet meadows and pastures (Višňák, 2015). From the 16th century it was managed as part of the Nový Falkenburg estate. In the 18th century the site contained a continuous tree cover and was probably used for recreation. Later, the tree cover was reduced to narrow lines along streams and roads and the area served again as pastures (Fig. 3). This was possible due to the

constructed drainage system (Višňák, 2008). The channelization of the streams in the area is also documented from as early as the 19th century (Višňák, 2015).

Figure 3 Photo of the site from the 20th showing it being used as pastures with the adjacent Chateau Nový Falkenburk in the background. Reprinted with permission from Čmelák's internal documents (2021)

After 1945 the land became the property of the State but agricultural production continued until the 1980s-90s. Afterwards, the drainage system clogged up and the site was abandoned (Višňák, 2008). The soils became saturated with water, and the site turned into a degraded ecosystem with low biological diversity, sparse woody vegetation and dominant cover of reeds (Čmelák, n.d.-a; Višňák, 2008). The area quickly deteriorated and began to be used as illegal dumping grounds (Fig. 4).

Figure 4 Photos of the state of the site before restoration. The sign in the upper right-hand corner says that dumping waste on the site is prohibited under penalty of fine of 5000 CZK. Reprinted with permission from Čmelak (n.d.-b) and Čmelák's internal records (2021)

2.1.3 The Process of Restoration

Every restoration project starts with a particular aim which can be hydrological, ecological or other, depending on the organization that is doing the restoration (Covington et al., 2003). The organization responsible for wetland restoration in JVP is ecological non-governmental organization, Čmelák – Společnost přátel přírody (hereafter referred to only as Čmelák or 'the NGO'). The NGO is one of the biggest land trusts[3] in the Czech Republic, owning and managing about 62 ha of land (including the wetlands in JVP). They focus on ecological restoration and environmental management, ecological education, and environmental activism, especially in the Liberec region (Čmelák, 2012). Their aim in

[3] For land trust definition see *ConservationTools* (n.d.)

the case of wetland restoration in JVP was to create an ecosystem that is suitable for recreation while contributing to biodiversity conservation (Čmelák's internal documents, 2021). The timeline of the project is presented in Figure 5 and a list of actors and their roles in the restoration process can be found in Appendix A.

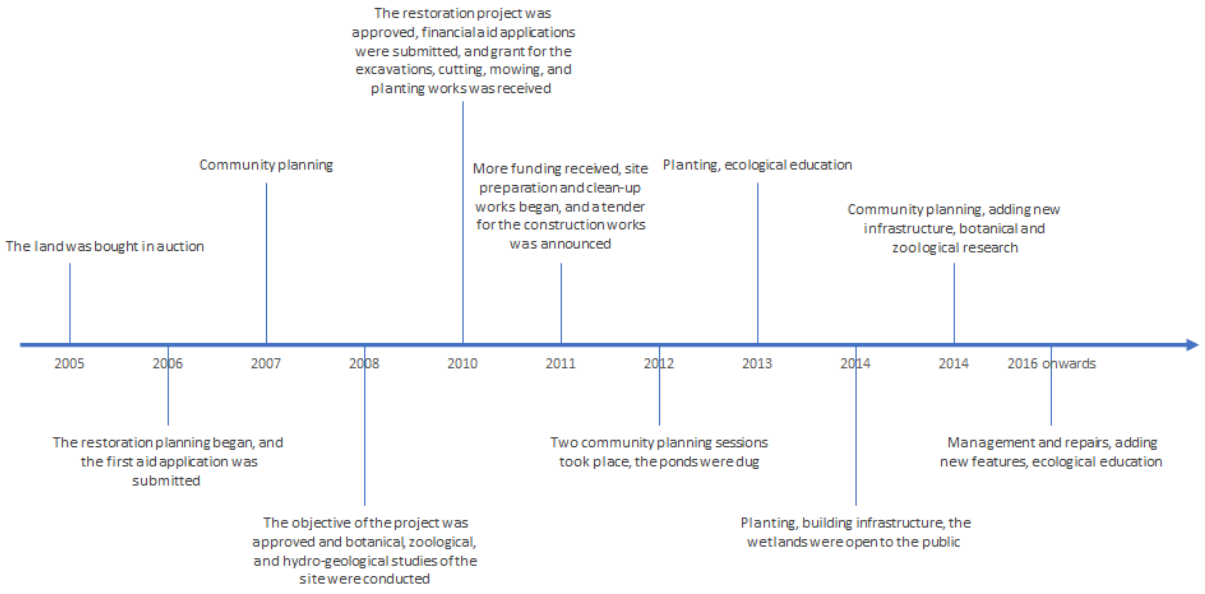


Figure 5 The timeline of the wetland restoration in JVP. Based on data retrieved from Čmelák's internal documents (2021)

Initially, the site was cleaned off the illegal dumping grounds. Afterwards, vast areas of native but invasive plant species, such as reeds or raspberry were cleared, and the remaining areas of wet meadows were mowed. Native trees and bushes were planted to provide nutrition for birds and help isolate the wetlands from the surrounding infrastructure. Figure 6 presents the restoration works prior to pond excavation.

Figure 6 Plan of the restoration process before excavation. Adapted with permission from Čmelák's internal documents (2021)

In 2012, 9 ponds were constructed. According to interviewee 2 (for more information on interviewees see section 4.2.2), the shape, size, and layout of the ponds was based on three parameters 1) terrain (elevation, land cover, water saturation) 2) practicality and ecology (different habitats, resilience) 3) aesthetics (recreation and living environment) – see Appendix B for illustration of pond design. The ponds have low gradient, different shapes and sizes, and the depth of individual ponds is ranging from several centi-metres up to two meters (Višňák, 2015). After the construction, wetland vegetation was planted, and recreational and educational amenities were installed. New features and habitats, such as lizard homes, or bat homes were added subsequently.

2.1.4 Management

Management is necessary for the maintenance of biodiversity and the provision of ES. For the highest biodiversity benefits the meadows (ca. 25 000 m^2) ought to be mowed twice a year, however because of financial constraints the mowing is performed only once a year (interviewee 1). Cattail is removed manually each year to help maintain biodiversity and prevent grounding of the ponds (Čmelák's internal documents 2021; Sojda & Solberg, 1993). Furthermore, the functional amenities of the wetlands need to be maintained, trash collected, infrastructure repaired when necessary, etc. The wetlands also require monitoring for pests and diseases, and management planning and evaluation needs to be carried out on a regular basis (Chatterjee et al., 2008), however the capacity to this is limited (Čmelák's internal documents, 2021).

3 Philosophy and Theory

3.1 Philosophy of the Research

The philosophy of this research is utilitarianism. It is primarily an anthropocentric concept where actions are judged by whether they improve or worsen the lives of people (Kopnina et al., 2018). As Bentham put it, utilitarianism is about achieving "the greatest happiness of the greatest number" (1977, p. 393). This approach is closely linked to the idea of well-being, which can be understood as a psychological state or a level of satisfaction emanating from individual preferences (O'Neill et al., 2012).

Utilitarianism perceives nature and biodiversity conservation not as something that ought to be done for its own sake – intrinsic value – but only as being instrumental in achieving human well-being – instrumental value – (Carr, 1992). Biodiversity is strongly connected to ecosystem functioning (Loreau, 2014; Schulze & Mooney, 1994), resilience (Oliver et al., 2015), and provides a so-called insurance effect against the future impacts of climate change (Yachi & Loreau, 1999). However, the instrumental argument of biodiversity conservation has raised many ethical concerns (McCauley, 2006; Redford & Adams, 2009; Schröter et al., 2014).

Applying environmental pragmatism (Doorn, 2017), the author acknowledges both the intrinsic and the instrumental value of biodiversity. Nevertheless, in this thesis, biodiversity is considered from the perspective of its non-use i.e. existence value, which is a value that does not encompass any direct or indirect physical involvement but where the wellbeing is derived merely from the contemplation of an entity's existence (Goulder & Kennedy, 2011). As Goulder & Kennedy (2011) point out, arguments for biodiversity conservation based on its intrinsic values can in fact be reflective of anthropocentric non-use values of biodiversity.

3.2 Theory

3.2.1 Ecosystem Service Framework

The ES framework applied in this thesis is now widely used in environmental management (Alexander et al., 2011; Kull et al., 2015; TEEB, 2010). It was adopted by the Convention on Biological Diversity in 1995 (McCarthy & Morling, 2014), and it has proved to be useful in providing a common ground for conservationist, policymakers, and the public (TEEB, 2010; Naeem, 2002).

As said, it is an anthropocentric and utilitarian approach, arguing for nature conservation on the basis of its contribution to human well-being (Chan et al., 2012; Loreau, 2014) (Fig. 7).

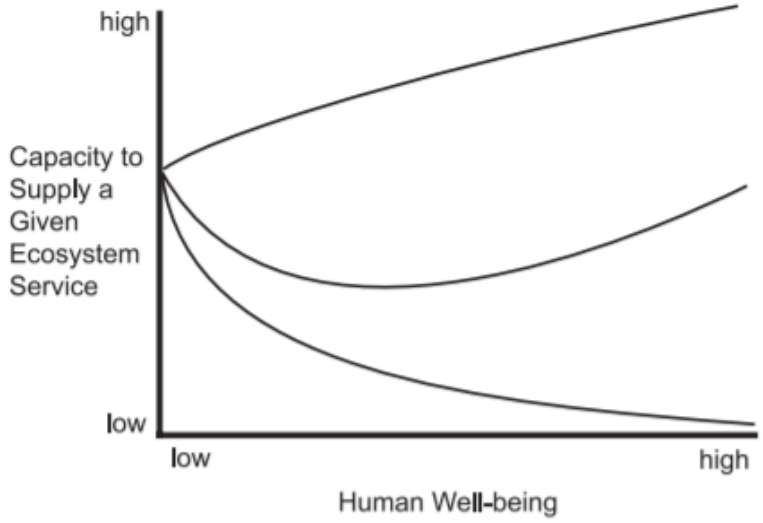


Figure 7. Examples of some possible shapes of the relationship between human well-being and ecosystem service supply. Reprinted with permission from McMichael et al. (2005)

The Millennium Ecosystem Assessment (MA) defines the concept of ES as "the benefits people obtain from ecosystems." (2001, p. 49). There are several classification systems of ES that can be used (see e.g. Brouwer et al., 2013), but in this thesis, the classifications of the MA and the The Economics of Ecosystems and Biodiversity (TEEB) were deemed as the most appropriate. Combining two or more classification approaches is nothing unusual and this practice has been adopted by many European countries (Brouwer et al., 2013). ES are here thus divided into provisioning services, regulating services (RES), cultural services (CES), and habitat services (Table 1).

Table 1 Description of ES based on TEEB (2010) and MA (2001) classifications

Provisioning Services	**Regulating Services**	**Cultural Services**	**Habitat Services**
"the products obtained from ecosystems" (MA, 2001, p. 56)	"the benefits obtained from the regulation of ecosystem processes" (MA, 2001, p. 57)	"the nonmaterial benefits people obtain from ecosystems" (MA, 2001, p. 58)	the maintanance of life cycles and gene pool protection (TEEB, 2010)
these include: • food • fresh water • fuel wood • fiber • biochemichals • genetic resources (MA, 2001)	these include: • climate regulation • disease regulation • water regulation • water purification • pollination (MA, 2001)	these include: • spiritual and religious • recreation and ecotourism • aesthetic • Inspirational • educational • sense of place • cultural heritage (MA, 2001)	these include: • primary production • nutrient cycling • soil formation • habitats (nursery) (TEEB, 2010)

3.2.2 Cultural Ecosystem Services and Environmental Stewardship

Based on the findings of Andersson et al. (2015), it is here assumed that CES can serve as a gateway towards achieving higher levels of environmental stewardship[4] within semi-urban population (Fig. 8). This is, they say, because compared to most other ES, CES can be directly experienced. It is also argued that CES can lead to higher awareness of the importance of other ES (Andersson et al., 2015). The potential of CES to encourage environmental protection has been discussed for example in Daniel et al. (2012), and other studies have highlighted the link between CES and environmental stewardship (Hunter, 2011; Kudryavtsev et al., 2012; Measham & Barnett, 2007). Aesthetics were regarded as the main motivator for woodlots protection in Michigan (US) (Erickson et al., 2002), while according to Ryan et al. (2001), ecological education constitutes a strong driver for volunteering in environmental stewardship programmes. It has been also found that CES can direct landowner decisions towards more ecologically sustainable land-uses (Plieninger et al., 2012). In this

[4] Environmental stewardship is here understood as general behaviours towards the environment (Meyerhoff, 2006), leading to its protection, care and responsible use (N. J. Bennett et al., 2018).

case, the effectiveness of CES to foster environmental stewardship is analysed by using a willingness to pay method (see section 3.2.4), which is an approach also suggested by Andersson et al. (2015).

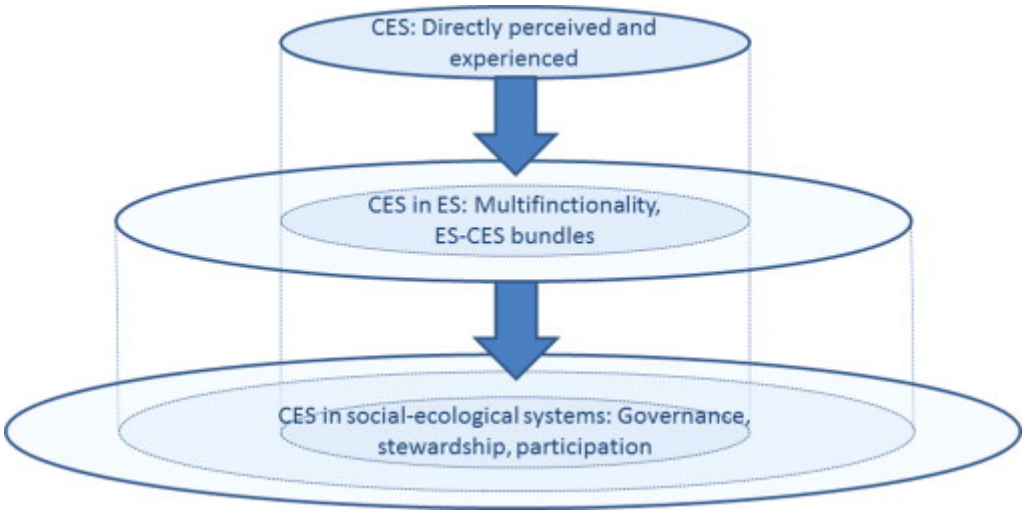


Figure 8 The role of CES in increasing the awareness and appreciation of other ES and leading to environmental stewardship. Reprinted with permission from Andersson et al. (2015)

3.2.3 Psychological Ownership Theory

The restored wetlands are a public good and are therefore prone to neglect and exploitation, a phenomenon described as the "tragedy of the commons" (Hardin, 1968)**.** The psychological ownership theory as put forth by Pierce et al. (2003) postulates that when an object is perceived by individuals as theirs, they exhibit affective sentiment towards it. There is evidence that a sense of ownership increases environmental stewardship both in active stewardship efforts, such as picking up trash, and in financial stewardship, by which is meant for example donating money for environmental conservation (Peck et al., 2020). Moreover, individuals will place higher value on the public good if they feel a certain level of ownership (see e.g. Hammack & Brown Jr, 2016; Rowe et al., 1980; Schulze et al., 1981). The sense of ownership is likely to root in individuals that use the public good frequently and possess good knowledge of it (Peck et al., 2020), or in individuals that have participated in the planning, construction, and management of the public good (Ainsworth, 2020; Hassan et al., 2011).

3.2.4 Application of Contingent Valuation Method

"Contingent Valuation is a method of estimating the value that a person places on a good" (Alberini & Cooper, 2000, p. 8). In this thesis, the respondents were asked directly to report their willingness to pay (WTP) for wetland non-market ES and its existence value, by donating to wetlands' preservation and expansion (Mitchell et al., 1989). There is an ongoing debate over the effectiveness

of using the WTP method to estimate the perceived value of different ES (Pan et al., 2020). It was for example criticized that instrumental values are prioritized over intrinsic and existence ones (Klain et al., 2017). However, new research shows that when conducted with good practice, such as well-designed questionnaire, detailed descriptions of ES, and appropriate payment vehicles, the WTP approach can represent a reliable method for the estimation of the value that individuals place on an ecosystem (Carson, 2012; Pan et al., 2020).

WTP should be here also viewed as indicating attitudes and not economic preferences (Castro Antonio J. et al., 2016). By attitudes is meant the general environmental behaviours to the restored wetlands i.e. environmental stewardship (Meyerhoff, 2006). It was found that general attitudes constitute major determinants of the general tendency to behave in a certain way (Ajzen, 1991; Eagly & Chaiken, 1993; Fulton et al., 1996; Stern, 2000). In their study on environmental attitudes and contingent valuation of endangered species Kotchen and Reiling (2000) found that strong pro-environmental attitudes result in overall higher WTP. This relationship is assumed to apply in this case as well, and even though general attitudes may be weaker predictors of a behaviour than the attitudes to engage in that behaviour, Meyerhoff (2006) claims that it is mainly these general attitudes which are elicited from contingent valuation studies, and not the attitudes towards a specific behaviour, such as towards the payment.

4 Methodology

4.1 Research Design

4.1.1 Case Study

Deductive reasoning was applied in this thesis, meaning that predictions were made using an ES theory, which were then tested by the means of a single case study research (Bryman, 2016). Case study is an "empirical enquiry that investigates a contemporary phenomenon within its real-life context . . . and in which multiple sources of evidence are used" (Yin, 1984, p. 23). Usually only a small geographical area or number of subjects is researched within a single case study (Zainal, 2007). Single case study design is used when detailed analysis of a single case is needed as opposed to a multiple case study which is applied to a selection of cases where the aim is to understand the differences and similarities between them (Baxter & Jack, 2008; Stake, 1995). Case studies are useful in carrying out a highly contextual data analysis (Yin, 1984), acquiring in-depth knowledge of the actual real-life situations (Zainal, 2007), and exploring a previously un-researched subject (Yin, 1984).

Yin (1984) argues that generalization can be made using both single and multiply case studies as the generalization are derived from theory rather than the population. Although qualitative research is prioritized in a case study (Yin; 1994), using both quantitative and qualitative data can provide a better explanation of the outcome as well as the process of the observed phenomena (Tellis, 1997).

4.1.2 Mixed Methods Research

Mixed methods research refers to the combination of quantitative and qualitative methods in data collection, interpretation, and analysis within a single study (Bowers et al., 2013; Creswell & Clark, 2017). According to Lane (2009), the results obtained through mixed methods research are more holistic than when a single method approach is employed. Mixed methods approach was deemed most appropriate for the purposes of this thesis because of its capability to answer multi-faceted and inter-disciplinary research questions, such as RQ2 and RQ3 (Shorten & Smith, 2017). Triangulation, which is a key component of mixed methods research (Mertens & Hesse-Biber, 2012), can be used to eliminate the blind spots of different data collection methods and help deliver more rigorous results (Molina-Azorín & López-Gamero, 2016). Furthermore, the use of mixed method approach can, to a certain degree, solve the issue of data unavailability, where qualitative data can supplement a largely quantitative design and vice versa (Kajamaa et al., 2020). Based on the nature of the research questions, and the data collection constraints encountered, this research is structured to prioritize qualitative analysis (Molina-Azorín & López-Gamero, 2016).

4.2 Data Collection Methods

To deliver a comprehensive ES assessment of the restored wetlands in JVP, as well as to analyse how the restoration project is perceived and valued by the local population, various sources of information were utilised. As stated in McCarthy and Morling (2014), most ES assessments combine different methods and there is no single right way or one-size-fits-all tool to be applied in every case (McCarthy & Morling, 2014). Busch et al. claim that “More flexible qualitative approaches can bridge the gap of limited data availability with well-grounded estimations” (2012, p. 98). Nevertheless, it was beyond the scope of this paper to assess every ES and ultimately a decision was made as to which services to assess. This ES assessment thus focuses mainly on selected regulating, cultural, and habitats services that are either relevant to the respondents or were the desired effect of the NGO, whereas the provisioning services are considered more generally (Table 2).

Table 2 Selection of ecosystem services that this thesis focuses on

Provisioning Services	**Regulating Services**	**Cultural Services**	**Habitat Services**

Provisioning services are considered more generally but mainly the following are considered:
• provision of water
• provision of food
• provision of firewood
	Following regulating services are considered:
	• water quality regulation
	• water retention
	• flood regulation
	• climate regulation
	• air purification
		Following cultural services are considered:
		• recreation
		  ○ interaction with nature
		  ○ physical activity
		  ○ time alone
		  ○ socializing
		• ecological education
		• aesthetics
		• COVID-19[5]
			Habitat services are considered as:
			• species richness

Ideally, all ES would be assessed using primary data. However, this was not always possible. Some ES were assessed by reviewing scientific literature and triangulating it with the characteristics of the wetland ecosystem in JVP. The decision trees by Harrison et al. (2018) provided Important guidance in deciding which data collection methods to use (see Appendix C). Overall, the data collection methods applied in this paper can be grouped into literature review, fieldwork, survey, and GIS mapping and modelling.

4.2.1 Literature Review

Literature review was undertaken throughout the research for the purposes of triangulation and filling information gaps. The review focused primarily on peer-reviewed academic articles dealing with ES, wetlands, wellbeing, and ecological restoration. Snowballing technique was applied to conduct the most extensive literature review possible. In addition, online search for grey literature written by various Czech media outlets was conducted. Literature on ES covered in LUMES programme was a starting point for this research.

4.2.2 Fieldwork

Fieldwork consisted mainly of document analysis, informal interviews, and observations. During my time at the NGO in February 2021, I was given access to their documentation on wetland restoration in JVP. The documentation consisted of various reports, funding applications, evaluations, pay rolls, correspondence, plans, drafts, etc. As Merriam (1988) points out, all types of documents can reveal

[5] COVID-19 is considered under the CES because of the wetlands' potential to mitigate its negative impacts on human wellbeing

important insights relevant to the research. Mills, Bonner, and Francis (2006) claim that non-technical literature can provide important contextual data for case studies. The primary sources were mostly in electronic format and I was not able to obtain copies of the documents except for a few vital reports. The documentation rarely had an author, title, or a date defined, and sometimes the file names were incorrect which complicated the analysis and could have resulted in me obtaining incomplete information. As also pointed out by Nilsson et al. (2016), the documentation of restoration projects often represents a substantial challenge in their proper evaluation.

Informal interviews and email correspondence were conducted with the NGO chairman and a landscape engineer who will be referred to only as “interviewee 1” and “interviewee 2” respectively. Informal interviews were prioritized over classical interviews because of the interviewees’ time constrains. They were used mainly for triangulation with other data sources (Swain & Spire, 2020). This method also allowed me to answer questions spontaneously arising from document analysis, which was referred to by Fujii (2015) as "revelatory moments" (p.527). Additionally, I visited the town of JVP as well as the restored wetlands. This observation helped me to grasp the contextual environment of the whole project and its connection to the rest of JVP as well as to observe how people interact with the site.

4.2.3 Survey

Fieldwork and surveys are complementary methods in social research. As Attewell and Rule claim "Traditional survey work is strong in . . . areas where field methods are weak" (1991, p. 313). Survey questionnaire is used to collect data from a large population with the goal of obtaining a sample that is representative of the whole population (Ponto, 2015). Given the current epidemiological situation of COVID-19, a representative sample was unfortunately not obtained, since as Check and Schutt (2011) point out, distributing the questionnaire over the internet effectively eliminates certain segments of the population. The targeted population was the citizens of JVP and the survey was posted on the official Facebook page of the town of JVP and related community Facebook pages. It was also emailed to local businesses.

Both qualitative and quantitative questions were asked in the survey. The survey was constructed with feedback from a key informant (NGO chairman) and piloted on 4 wetland visitors. The trial showed the weakness of the intermediate survey design and changes were made. Most notably, the questionnaire had to be shortened quite substantially to ensure high response rate. The first part of the questionnaire focused on the level of satisfaction with the restoration project, its contribution to respondent well-being, and community engagement. The second part was devoted to the activities

for which the wetlands are suitable, wetland ES preferences, WTP, and COVID-19. The last section gathered demographic information about the respondents. The complete questionnaire can be found in Appendix D.

4.2.3.1 Stated Preference and Willingness to Pay

Stated preference, which is a method that asks respondents the question directly (Chin & Lee, 2008), was selected, as it is arguably the best approach for estimating WTP (Bamwesigye et al., 2020; Bishop, 1999; Johannesson, 1996; Sawe, 2017). In addition to estimating the non-market and non-use values of ES, and the attitudes towards the restored wetlands, WTP is here also used to triangulate the estimates of wetland-derived individual wellbeing obtained through an open-ended question in the questionnaire (see e.g. Gafni, 1991). Payment scale was used in the questionnaire to make the WTP question easier to understand, however, this can affect the accuracy of the results (Frew et al., 2004). The respondents were asked to donate a percentage of their monthly income as this study is not concerned with exact sums (Pan et al., 2020), this could also help reduce the bias resulting from differences in personal economic wealth (Shao et al., 2018). Other factors can also influence individual's WTP (Pan et al., 2020). These include, distance from home, income, gender, age, education, family size etc. (see Ezebilo, 2016)**.** Questions about some of these factors were asked specifically in the questionnaire, however, some had to be omitted on the account of response rate consideration.

4.2.3.2 Sample Size

Generalization of the survey findings to the population of JVP is problematic given the small sample size. A total of 53 respondents filled out the survey, equalling to roughly 1.5% of the population. Although various social groups in terms of, gender, age, education, occupation etc. are represented in the sample, their relative distribution is not representative of the population (see Appendix E). This can be attributed to the online sampling method used, which was already discussed above.

However, as Seale et al. (2003) point out, the above-mentioned characteristics by which representativeness is commonly established are only a small set of socio-demographic indicators, and most of the characteristics that social research is interested in, such as attitudes, behaviours, and emotions are not considered. As such, "the problem of representativeness is a constant and growing concern of many researchers" (Seale et al., 2003, p. 2). Social research is not concerned with statistical significance as such but with social significance (Seale et al., 2003). The survey thus still provides important insights into some of the beliefs and preferences of the targeted population. As Seale et al. (2003, p. 30) claim, it is the "main structural aspects" of the social phenomena that are

transferable and can be generalized, while Becker argues that 'in every city there is a body of social practices . . . which don't change much, even though the people who perform them are continually replaced' (2000, p. 6).

4.2.4 GIS Mapping and Modelling

Geographical Information System (GIS) was used to map the watershed and categorize the land-use-land-cover (LULC) classes. Spatial data obtained from various databases – will be specified below – were modified and used as inputs for the Integrated Valuation of Environmental Services and Tradeoffs (InVEST) modelling software.[6] It is one of most widely recognized quantitative tools for assessing ES trade-offs of various management strategies (McCarthy & Morling, 2014), which can be applied to managerial programs aiming at improving human wellbeing while maintaining or increasing biodiversity (Sharp et al., 2017). In this thesis, InVEST's nutrient delivery model is used to estimate the role of the restored wetlands in filtering excess nutrients and preventing eutrophication downstream.[7] The model requires data on precipitation, elevation, watershed area, and LULC. In addition, a biophysical table including data for each LULC class is necessary.

4.2.4.1 Precipitation data

I used data from *WorldClim* (n.d.) which I clipped to the watershed, resized, and adjusted it based on the mean annual precipitation in the JVP district which I calculated using the data from ČHMÚ (n.d.).

4.2.4.2 Digital Elevation Model

Coppernicus digital elevation layer was downloaded from Copernicus Land Monitoring Service (n.d.) and clipped to the focus location. Initial resolution 100x100 pixels was resized to 25x25 to match the other layers. Then, I ran the fill sinks function in the SAGA plugin in QGIS after which the Strahler Order function was used to determine the stream dynamics.

4.2.4.3 Watershed Area

The Watershed was determined by pinning the wetland location in the digital elevation layer using coordinates, and calculating the upslope area in QGIS SAGA plugin. Afterwards, the watershed was converted to a shapefile and the area was calculated using a field calculator.

[6] InVEST was developed as part of the Natural Capital project in a partnership between Stanford University, The Nature Conservancy, the World Wildlife Fund, and the University of Minnesota (IEC, 2011)

[7] Information on how the model works can be found in Sharp et al. (2017).

4.2.4.4 Land Use Land Cover

Copernicus CORINE Land Cover (2018) downloaded from Copernicus Land Monitoring Service (n.d.) was resized to 25x25 pixels, clipped, and adapted. Streams and water bodies were added from *ČÚZK: Geoportál* (n.d.). Aerial photographs were used for more accurate LULC representation. When unsure, cadastral maps where consulted.[8]

4.2.4.5 Biophysical Table

The data for each LULC class in the biophysical include, nitrogen (N) and phosphorus (P) loading rates (kg/ha/y), N and P efficiency (%), critical length – a standard constant of one pixel was used (Sharp et al., 2017), and subsurface flow where the constant of 0.8 was assumed for vegetated buffers (Mayer et al., 2007) and a constant of 0 for the non-vegetated LULC classes (Sharp et al., 2017). The rest of the data was sourced from various sources (see Appendix F). Unfortunately, it was not always possible to find local or regional data, therefore, broader scientific literature had to be drawn on as well. This has introduced another layer of uncertainty to the model. Because of the virtual absence of data on the nutrient loading in off-stream wetlands, a loading rate equal to that of forests was assumed after consultation with scientific literature (Hanson et al., 2016; Wolf et al., 2013).

4.3 Limitations

The ES presented in this thesis were selected as being the most important or relevant in this case, thus giving an incomplete account of the full value of ES provided by the wetlands. Furthermore, there are multiple limitations related to each of the data collection methods used.[9] Their respective weaknesses would be ideally offset by triangulation, but this was not always possible as concrete data was often unavailable. To overcome the limitations of a single case study a mixed method research design was implemented, however, the downsides of the mixed method research are that it is more time-consuming and requires the researcher to master multiple methods (Zainal, 2007). Nevertheless, such an approach allowed for the establishment of important systemic linkages while making this research more robust and comprehensive than would otherwise be possible, given the data collection constraints.

[8] Cadastral maps can be accessed through Kurzycz, (n.d.).

[9] For limitations on InVEST NDR model see Redhead et al. (2018); for limitations on informal interviews see Swain and Spire (2020); for limitations on dodcument analysis see Bowen (2009); for limitations on survey questionnaire see Fricker & Schonlau (2002)

5 Findings

The first two RQs are answered rather simultaneously although RQ1 is mainly answered in the sections on general satisfaction and wellbeing, and CES (sections 5.1 and 5.2.3), while RQ2 is answered primarily by looking at the wetland ES and their contribution to respondents' wellbeing (section 5.2). RQ3 is answered by referring to the section on WTP (section 5.1.1) and examining the restoration process in greater detail, mainly from the perspective of public participation and CES (section 5.3 and section 5.2.3).

5.1 General Satisfaction and Wellbeing

From the total of 53 collected questionnaires (see the distribution of different social groups in Table 3), it is evident that the respondents are generally very satisfied with the restoration. On a Likert scale where 0 was "not at all" and 4 was "completely satisfied" the average satisfaction was 3.6 (Fig. 9). The level of satisfaction was highest for women and respondents with tertiary education. Respondents in age of 26-35 and 36-50 had generally high levels of satisfaction, while the satisfaction of respondents under 26 and over 50 was lower.

The wetlands also appear to be contributing substantially to the respondents' perceived individual wellbeing, with the average value of 3.2 (Fig. 9). Female respondents reported overall higher wellbeing benefits than males, and respondents with secondary education reported higher wellbeing benefits than respondents with tertiary education. Finally, respondents in 0-25 and 36-50 age groups reported high wellbeing benefits, while respondents over 50 reported low.

Table 3 **The respondent demographics**

	Sample n (53)	Sample %
Men	22	42%
Women	31	58%
0-25 years	3	5%
26-35 years	10	19%
36-50 years	22	41%
>50 years	18	34%
Primary education	0	0%
Secondary education	32	60%
Tertiary education	21	40%
Student	1	2%
Employed and self-employed	45[10]	85%
Unemployed	1	2%
Pensioner	6	11%

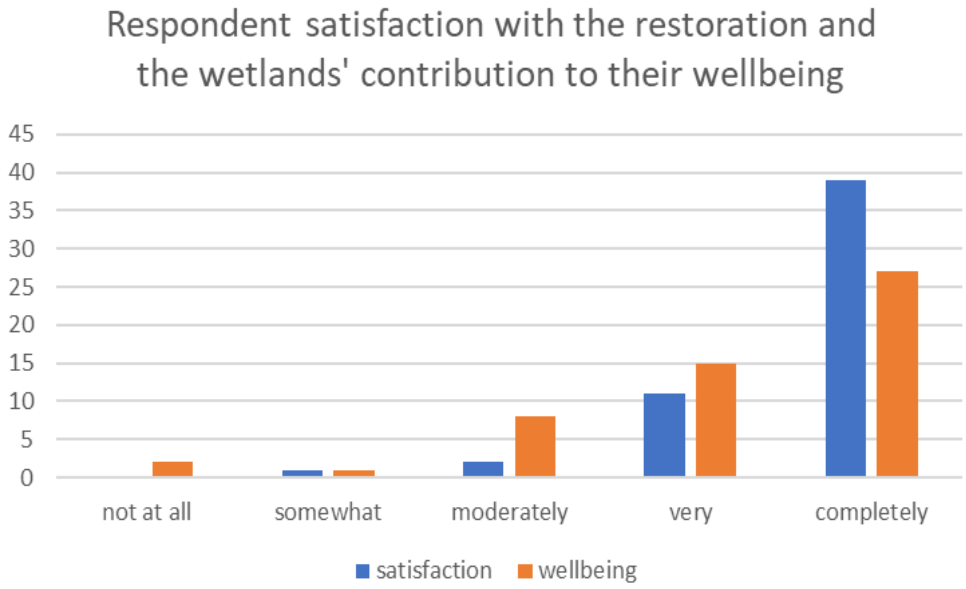


Figure 9 Respondent satisfaction with the restoration and the wetlands' contribution to their self-reported wellbeing. The scale on the vertical axis relates to the number of responses

5.1.1 Willingness to Pay

Respondents answered questions on WTP for a) wetland conservation and b) wetland expansion (Fig. 10). WTP was used to estimate the respondents' values, attitudes, and satisfaction in relation to the restored ecosystem. WTP was overall very high, 91.5% respondents were willing to contribute for the conservation of the ecosystem, slightly less for the wetland expansion. More pronounced was the

[10] Employed 39, self-employed 6

difference in WTP with respect to the amounts contributed where conservation was valued more highly than expansion.

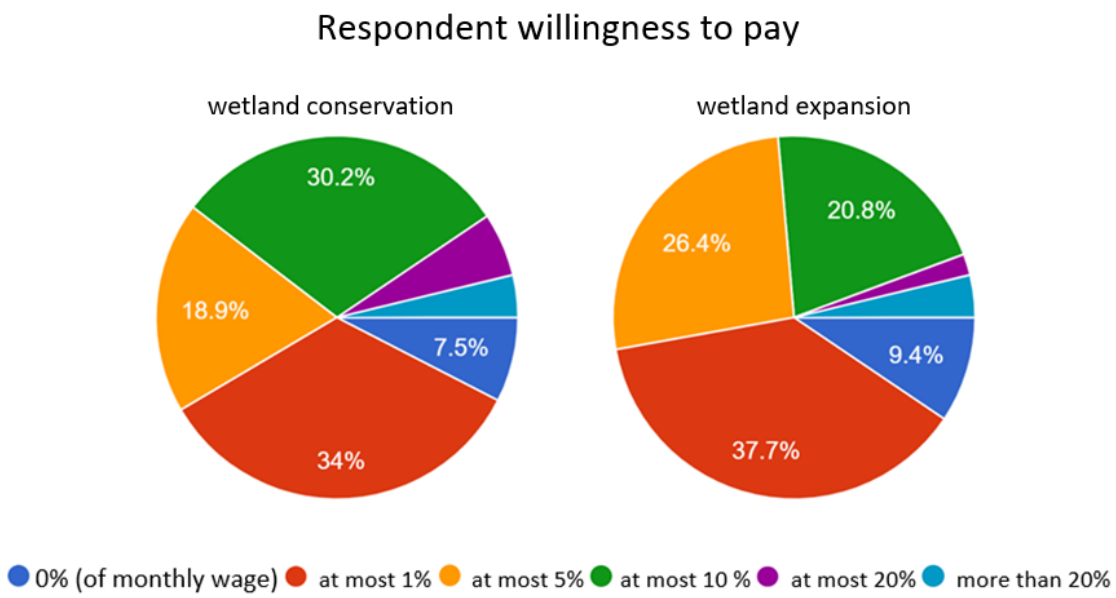


Figure 10 On the left is the distribution of respondents' WTP for wetland conservation and on the right is the distribution of respondents' WTP for wetland expansion

Respondents that were more satisfied with the restoration had higher WTP, but it was hardly if at all affected by the respondents' reported wellbeing benefits. There was a strong correlation between respondents' conviction that landscape restoration is necessary and the level of WTP. Respondents living closer to the wetlands had higher WTP. Family size does not seem to affect WTP in this case. Women on average had higher WTP than men and a correlation was found between higher level of education and the level of WTP. Respondents that were employed had the highest WTP, while pensioners' WTP was the lowest. WTP also seems to be correlated with respondents' preference for CES but no correlation with other ES preferences was found.

5.2 Ecosystem Services and Wellbeing

The NGO's goal was to create a scenic place for recreation, learning, and interaction with nature, while restoring biodiversity and promoting community engagement (Čmelák's internal documents, 2021). To see how the restoration project relates to the preferences of the local population, the respondents were asked to rank their wetland ES preferences. Habitat provision, water retention, recreation, and aesthetics were ranked the highest (Fig. 11).

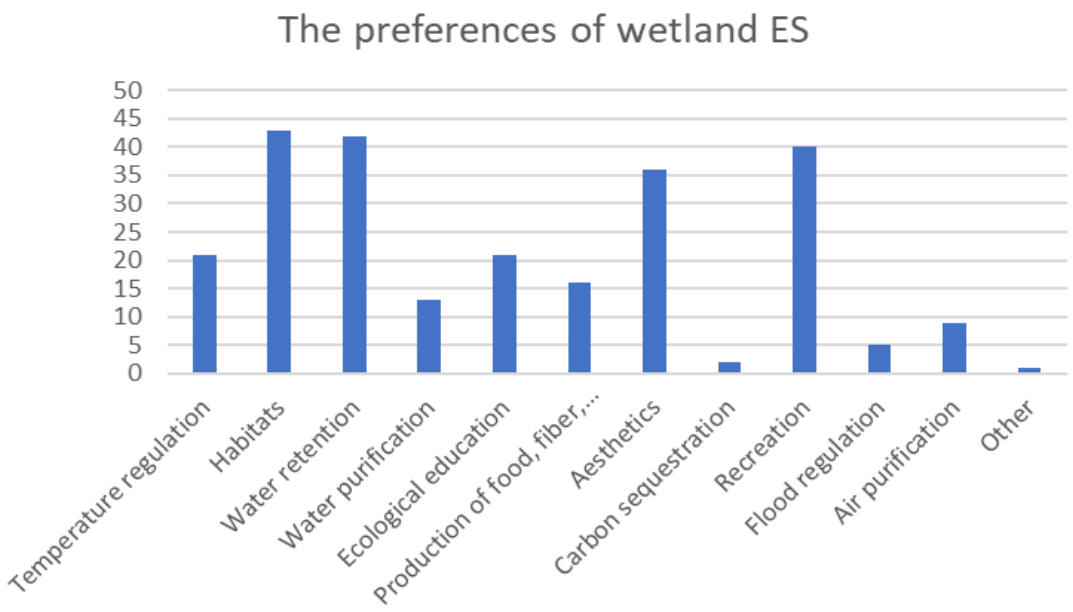


Figure 11 Respondents' wetland ES preferences. The scale on the vertical axis relates to the number of responses

From Figure 12 can be seen that the restoration meets almost perfectly with the sampled population's preferences for wetland ES in recreation, less well in aesthetics, habitat provision, ecological education, and water retention, and least in temperature regulation and air quality regulation. It does not meet the respondents' preferences for ES at all in provisioning services, water quality regulation, and flood regulation. Carbon sequestration was not seen as an important wetland ES, and neither was mentioned as contributing to respondents' wellbeing. Nevertheless, the relationship between many ES and wellbeing is not straightforward. This applies particularly to the regulating services that often do not have direct or visible effect (FAO, n.d.).

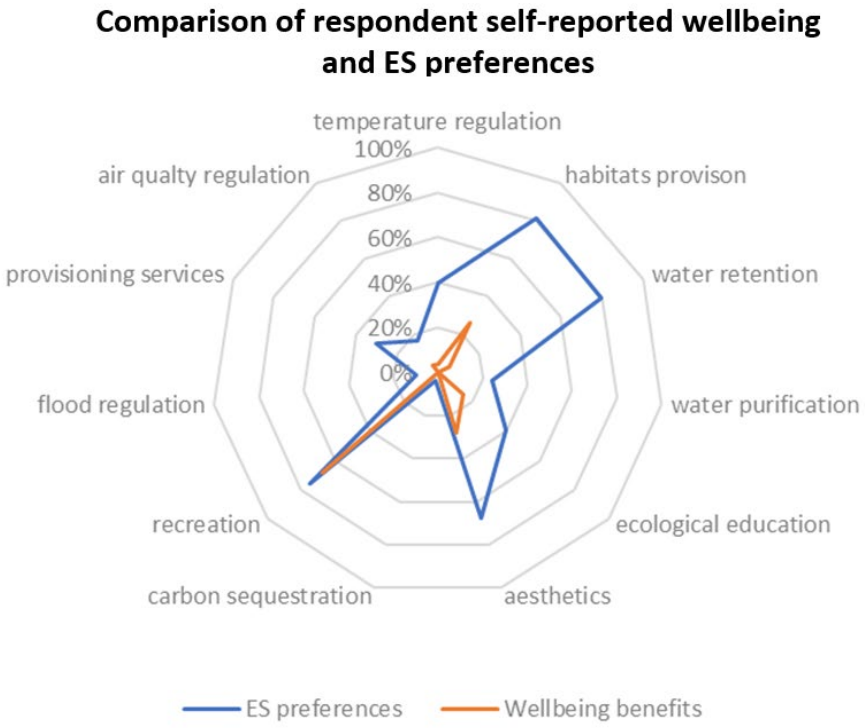


Figure 12 Comparison of general wetland ES preferences and the wellbeing benefits derived from the restored wetlands

5.2.1 Provisioning Services

These wetlands are not designed for productive purposes. Although one respondent stated that a wide variety of mushrooms is growing on the site, the extent to which this site is used for mushroom picking is unknown and probably very low. Another respondent mentioned campfires but again the extent to which this site is used for firewood collection has not been established and is likely very low as well. The water in the ponds themselves is clean, which is evidenced for example by the presence of *Nitella flexilis*[11] (Čmelák's internal documents, 2021). However, it is not used for consumption, or any productive purposes. Groundwater is used for drinking in JVP, however, the extent to which the wetland contributes to the recharge of underground drinking water is unknown. The provisioning services were not mentioned once in the survey as contributing to the well-being of the local population, and overall are not regarded as especially important wetland ES.

5.2.2 Regulating Services

The regulating services considered here are, water and air quality regulation, water retention, flood regulation, and climate regulation. It is important to consider that many of these services are not consumed by the citizens of JVP directly as there are spatial mismatches between the regulating

[11] A bioindicator of clean water

service supply and consumption (Syrbe & Grunewald, 2017). However, they are considered here because of their potential to benefit society at large. Overall, the sampled population of JVP deemed regulating services of wetlands to be quite important (Fig. 11), and regulating services were mentioned 17% of the time as contributing directly to respondents' well-being.

5.2.2.1 Water Quality Regulation

Assessed here is the wetlands ability to filter N and P, which are nutrients increasingly found in water bodies causing wide-spread eutrophication (Okumah et al., 2019; Shen et al., 2020; Withers et al., 2014) The processes through which these nutrients are filtered by wetlands are depicted in Figure 13.

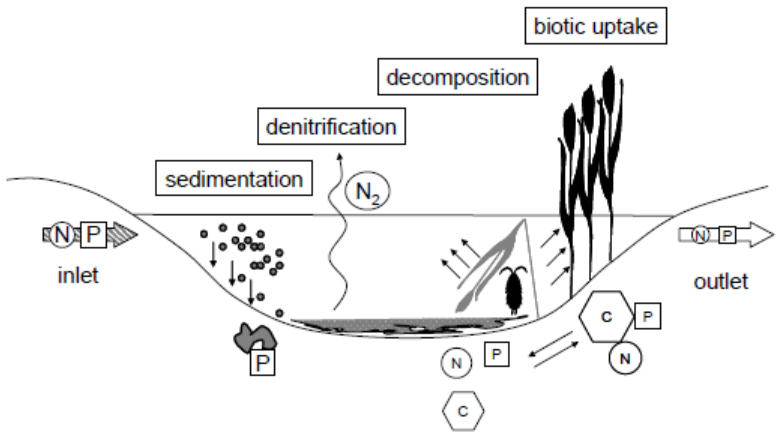


Figure 13 Schematic view of different pathways through which nutrients are processed in wetlands. Reprinted with permission from Thiere (2009)

However, as pointed out by Hanson et al., "If . . . contaminated waters by-pass a wetland (e.g., through concentrated flow channels or deep groundwater), limited retention and associated water quality benefits will occur" (2016, p. i). The wetlands in JVP are situated in the floodplain of the Panensky and Heřmanický stream but the hydrological connectivity to the streams – both surface and subsurface - has been disrupted by artificial channelling and embankment (Višňák, 2015).

Figure 14 depicts the watershed of Panensky stream with different LULC classes**.** Different land uses have different levels of P and N loading and retention, and therefore their N and P exports differ as well. Agricultural land, including pastures constitutes an important non-point source of P and N exports (Gillingham & Thorrold, 2000; Kronvang et al., 1996; Lambert et al., 1985; Nair et al., 2008). Even though large share of the watershed is covered with forest, intensive forestry operations can

also represent significant sources of N and P exports (Bettinger et al., 2017; Nair et al., 2008). The Panenský stream in particular was found to contain above-average volumes of P (Schneider, n.d.).

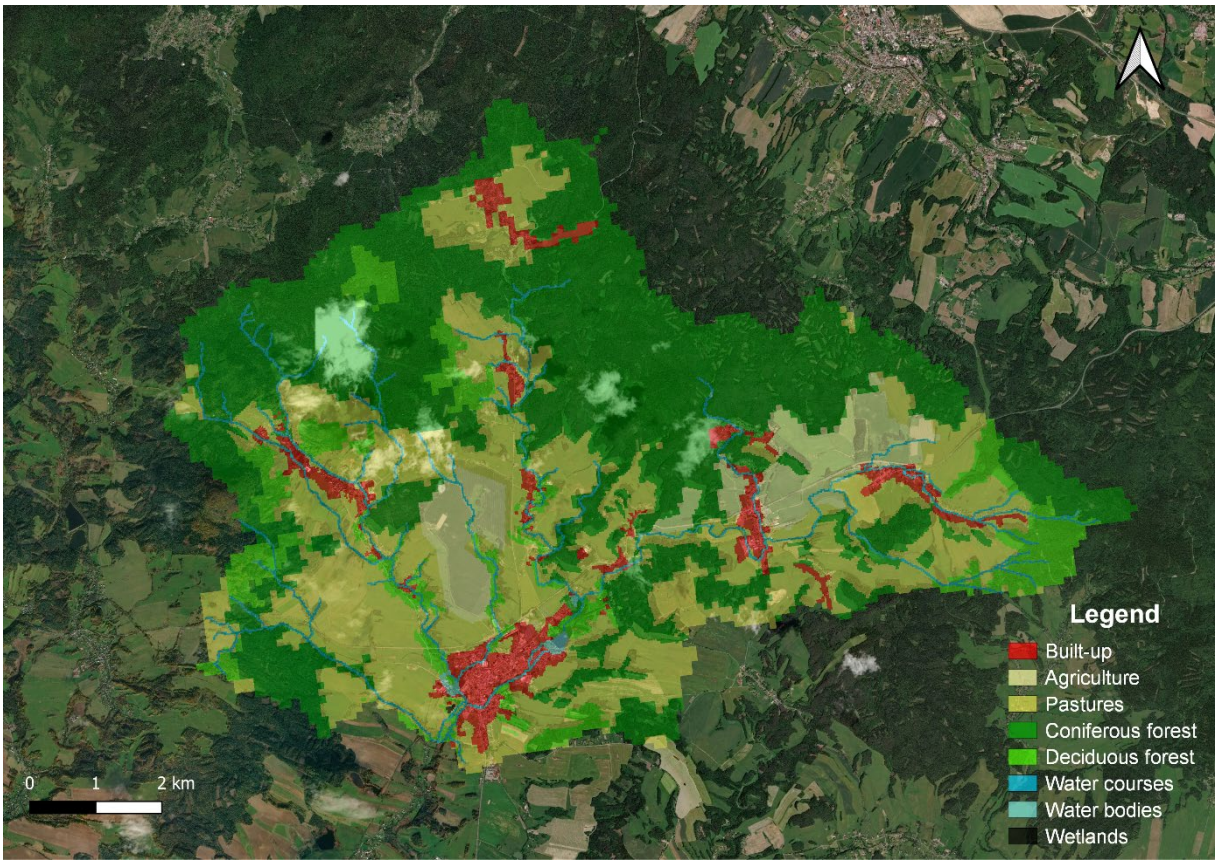


Figure 14 Map of the watershed with specified LULC. The watershed area is 7858 ha and over 50% is covered with forest, 32% is pastures, 6,4% is intensive agriculture, and built-up areas cover about 5%. Based on data from *Copernicus Land Monitoring Service* (n.d.)

The total export of N from the watershed where the wetlands were replaced with pastures is estimated to be 231107.1 kg/year and the export of P is 5481.7 kg/year. In an identical watershed, albeit with the restored wetlands present, the total amount of exported N is 231027.4 kg/year, and the export of P is 5479.9 kg/year. Similar results were obtained using different constants indicating that the level of subsurface flow and critical length is not pivotal. If we consider that this was relative to the state when the site was agriculturally managed, the wetland nutrient retention function is largely negligible.

5.2.2.2 Water Retention

Wetlands slow down the water cycle, retain water and recharge groundwater. The retained water is being gradually released back, providing base surface flow in dry months (Bullock & Acreman, 2003). This is vital for sustaining natural systems in the landscape (CEE, 2015). It is also important for climate adaptation as precipitation in Europe is expected to decrease over summer and increase in winter

(Kundzewicz and Kowalczak 2008; CEE, 2015). Water retention was ranked high by the respondents, 79% of them considered it an important wetland ES, and 6% stated water retention function of wetlands as contributing to their wellbeing.

When the drainage system clogged, water started to accumulate in the area. In the process of restoration, the remaining drainage system was removed, and 9 ponds were dug, raising the water table. As stated by Bring et al. (2020)**,** restoring wetlands increases water storage and recharges groundwater. Some of the shallower ponds dry out in the summer, but the rest – although fluctuating – have water all year round (Interviewee 1). The ponds increased the water storage capacity of the site by 7235 m^3 (AquaKlimax, n.d.). The groundwater recharge and water retention capacity would probably increase as a result of stream overbanking if the hydrological connectivity was restored (Macdonald et al., 2018).

5.2.2.3 Flood Regulation

The area has been historically regularly flooded, which largely formed the wetlands' structure and function (Triska et al., 1989; Ward & Stanford, 1995). The hydrological connectivity was disrupted by the wetland drainage, and the artificial embankment and channelization of the streams, as well as by the construction of artificial ponds upstream (Rosen, 2013; Višňák, 2015)**.** This has massively decreased the frequency of flooding. The official flood zones as depicted in Figure 15 indicate the area that is to be flooded every 20 years (yellow) and 100 years (blue). Most of the wetland area lies in the 100 years flood zone. According to interviewee 1 the wetlands were not flooded once since the NGO acquired the land, not even during the 2010 floods that caused a damage of 45 million CZK in JVP (Liberecký kraj, 2015). It is therefore likely that the largest flood regulation function of the wetlands is the interception of stormwater runoff. The flat elevation and dense vegetation slow down the overland water flow, which then either infiltrates into the ground or slowly trickles down into the stream (Rosen, 2013).

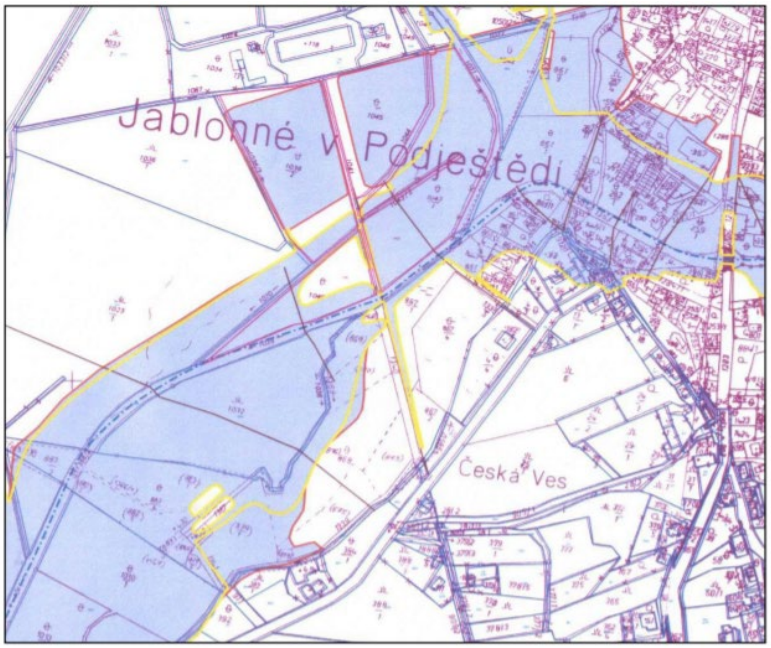


Figure 15 Flood zones in JVP, blue is 100 years flooding, yellow is 20 years. Reprinted with permission from Čmelák (n.d.-a)

5.2.2.4 Climate Regulation

Wetlands influence local climate (Liu et al., 2015; Pokorný et al. 2010). When wetlands are drained, the land's absorption of solar energy increases (Foley et al. 2003), which can lead to higher daytime temperatures and lower rainfall (Pokorný et al. 2010). It also decreases the water content in the air which can lead to the occurrence of late morning frosts causing for example, more frequent damage to the flowers of fruit trees (Eiseltová, 2019). A study from the Czech Republic estimated that croplands transform 60-70% of solar energy into a sensible heat, while in wetlands it is only about 5-10%, and 70-80% is dissipated through evapotranspiration (Pokorný et al. 2010).

The temperature difference between intact and drained wetlands in Central Europe can be over 15°C (Eiseltová, 2019). The differences in temperatures between wetland and agricultural land are presented in Figure 16.

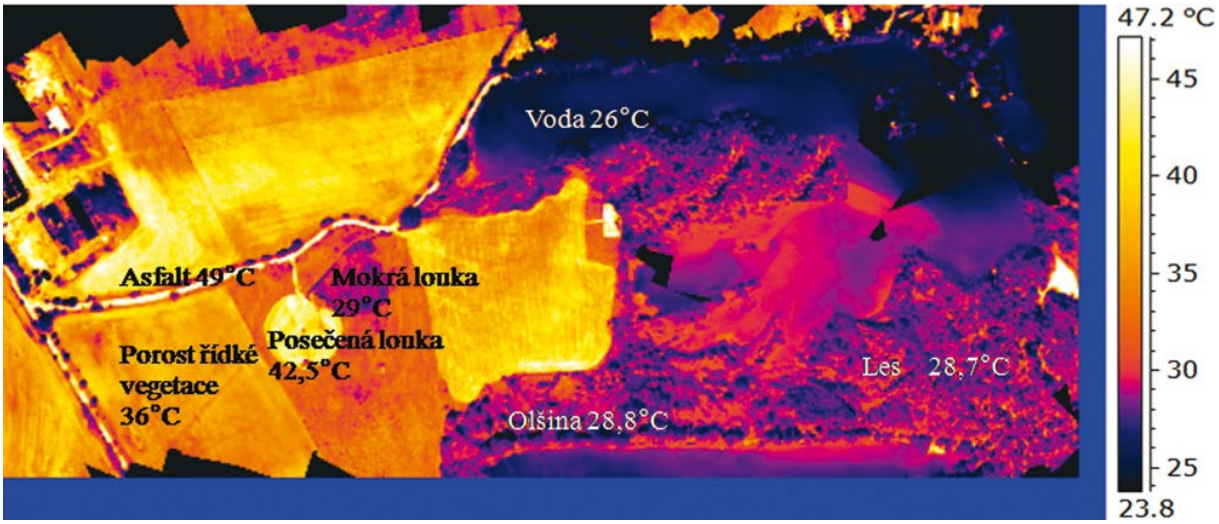


Figure 16 A thermo-vision image of different LULC. "Asfalt" is asphalt, "Porost řídké vegetace" is sparsely vegetated land, "Posečená louka" is mowed meadow, "Mokrá louka" is wet meadow, "Voda" is water, and "Olšina" is alder cover. Reprinted with permission from *(archiv ENKI.ops,)*

In urban settings, the combination of water and vegetation delivers the highest overall comfort through evaporative cooling and low daytime temperatures (Mahmoud, 2011). In JVP, 4% of respondents stated temperature regulation as contributing directly to their wellbeing, and temperature regulation was considered an important wetland ES by 40% of the respondents.

5.2.2.5 Air Purification

As already mentioned, wetlands increase air humidity and lower air temperature which can have positive effect on the local climate and human wellbeing, but they can also reduce the concentration of particulate pollutants in the air, thus improving the air quality (Qiu et al., 2015; Sæbø et al., 2012; Tomašević et al., 2005). Cong et al. (2018) found that the ability of wetlands to remove particulates from the air is highest when the air quality in the location is already quite good. According to Jablonné v Podještědí (2018) the quality in JVP is generally good, influenced mainly by a nearby powerplant (Turow) and household heating. In the survey, 4% of the respondents stated that better air quality contributes directly to their wellbeing, while 17% saw air quality improvement as an important wetland ES.

5.2.3 Cultural Services

Cultural Ecosystem Services (CES) are highly contextual and are likely to be perceived differently in different places depending on people's values and behaviours (Layke et al., 2012). Nonetheless,

strong linkages exist between perceived wellbeing and the usage of urban parks (Godbey et al., 1992).

According to Peschardt et al. (2012), proximity and accessibility of green and blue spaces is the precondition to the enjoyment of nature in everyday life**.** Based on my observation, there do not seem to be any other green and blue public spaces in JVP as suitable for recreation as the restored wetlands. Given the small geographic area of JVP, almost half of the respondents reported living less than 15 minutes away from the wetlands, 21% reported living less than 5 minutes away and 23% less than 30 minutes away (Fig. 17).

The survey showed that roughly one third of the respondents visits the wetlands at least once a week, one third at least once a month, and a third at least once a year (Fig. 18). Respondents that reported living closer to the wetlands tend to visit them more often. Women on average visit the wetlands more frequently than men, and people in 36 – 50 years of age visit the wetlands more frequently than people in 26 – 35 years. The official number of people visiting the wetlands is unknown but according to interviewee 1, thousands of people visit the wetlands each year. The wetlands are visited mostly by the locals, but many tourists come visit the wetlands as well. The average number of visitors from June to September 2016 was 36 on weekends and 42 on weekdays (Čmelák's internal documents, 2021). During special events organized by the NGO it can be several hundred of people in one day (interviewee 1).

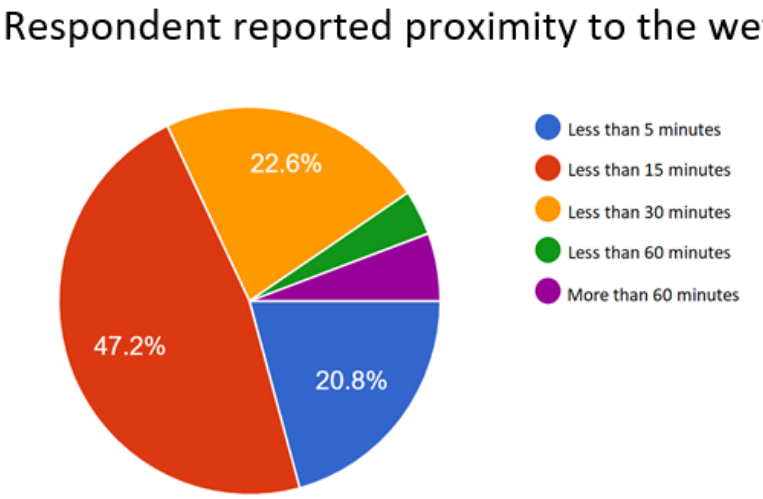


Figure 17 The distribution of respondents' reported proximity to the wetlands

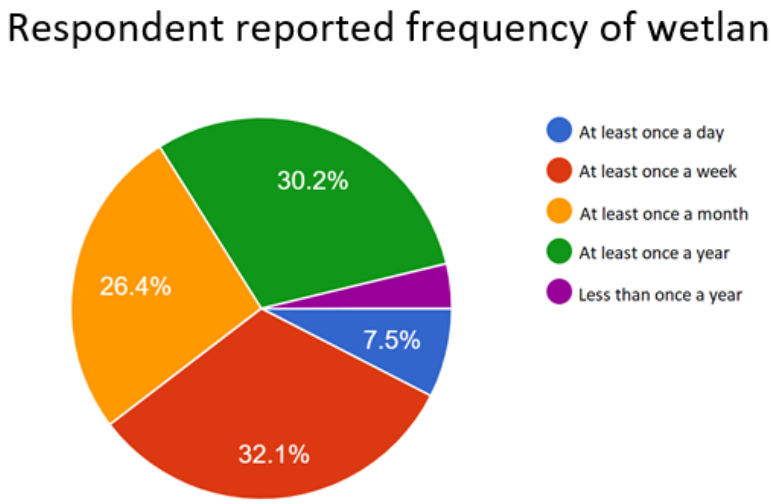


Figure 18 The distribution of respondents' reported frequency of wetland visits

5.2.3.1 Recreation

Nature provides people with opportunities for recreation, contributing positively to their wellbeing (Andersson et al., 2015). This restoration project was designed in a large part for recreational purposes (Čmelák's internal documents, 2021). Thus in addition to spending time in nature, the wetlands are equipped with amenities such as benches, tables, fireplaces, pier, tent, playground, sandpit, gravel beach, and a small lookout tower (Fig. 19). It aims to provide an environment where people can relax, be active, socialize, observe nature as well as interact with it. 75% of the respondents identified wetlands as being suitable for recreation.

Based on a similar research by Pedersen et al. (2019), the respondents were asked to state, how the wetlands are suited for the following activities, interaction with nature, physical activity, spending time alone, and spending time with others. The wetlands were seen as being most suitable for interacting with nature, and spending time alone. They were, however, seen as less suitable for socializing and physical activity (Fig. 20).

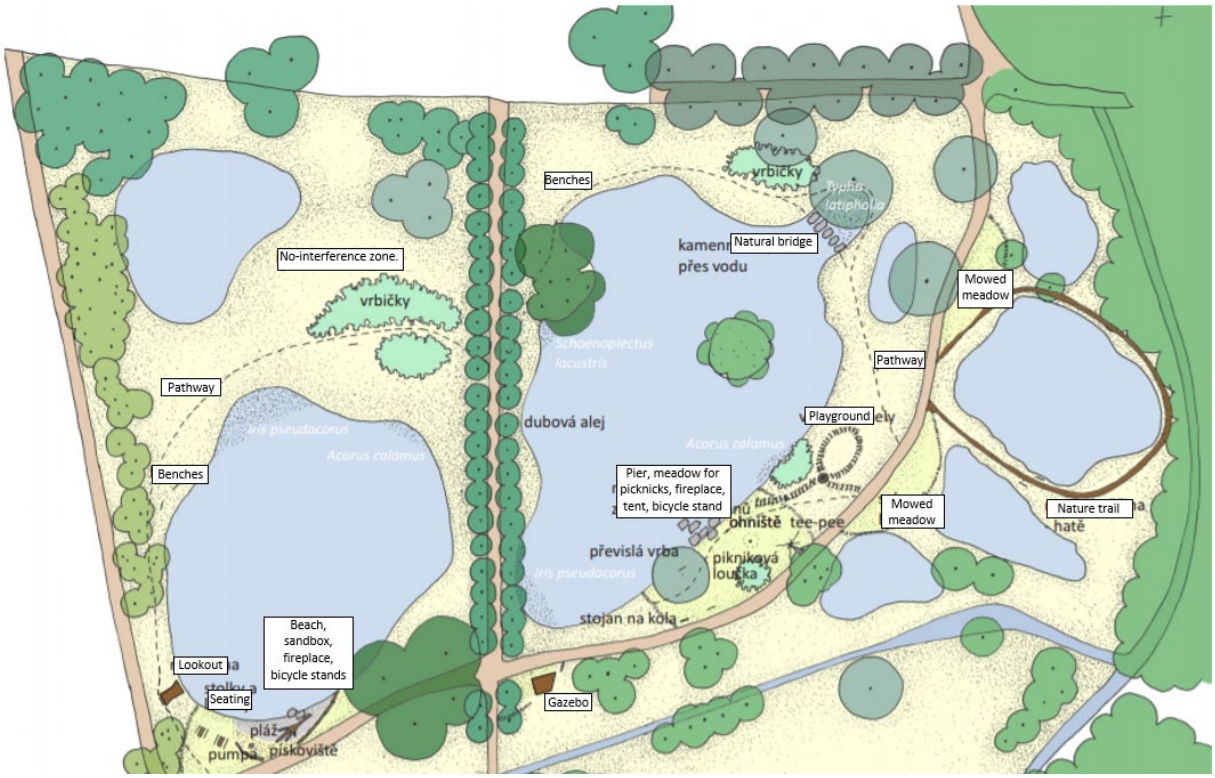


Figure 19 Schematic map of the wetlands in JVP including amenities. Adapted with permission from (Klápšťová & Klápště, 2012)

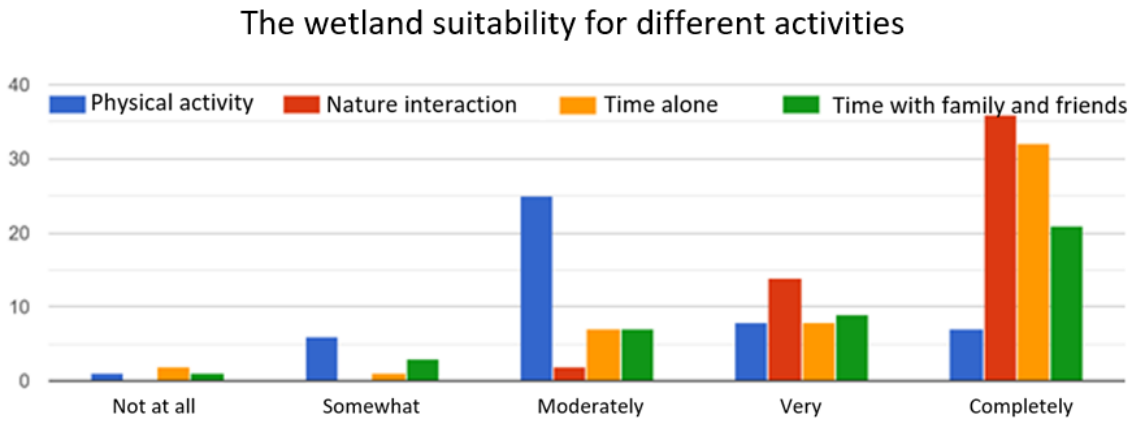


Figure 20 The respondents' reported wetland suitability for physical activity, nature interaction, time alone, and time with family and friends. The scale on the vertical axis relates to the number of responses

Interaction with Nature

The wellbeing benefits of interacting with nature are overwhelming (see e.g. Aldous, 2006; Bowler et al., 2010; Irvine & Warber, 2002; Keniger et al., 2013; Wilson, 2007). They include improvements in physical health (Catanzaro & Ekanem, 2002; Maas et al., 2006; Richardson & Mitchell, 2010), psychological health (Bodin & Hartig, 2003; Fuller et al., 2007), social cohesion (Coley et al., 1997; Shinew et al., 2004) as well as reduction of crime and violence (Kuo & Sullivan, 2001; Moore et al.,

2006). In the survey, 68% respondents deemed the wetlands to be suitable for interacting with nature and 21% responded that interaction with nature contributes directly to their wellbeing.

Physical Activity

There is mounting evidence that physical activity increases individual wellbeing (Petruzzello et al., 1991), and the benefits seem to be greater if performed in a natural environment (Coon et al., 2011), where a simple walk can have larger wellbeing benefits than exercising (Coon et al., 2011; Pretty et al., 2007). Moreover**,** Georgiou et al. (2021) found that living close to blue and green spaces significantly increases physical activity levels. Despite that, only 13% of the respondents perceived the wetlands as suitable for physical activity and the effect of the restored wetlands on the activity levels of respondents was not explored. It is likely, however, that walking was not regarded as physical activity, since 28% of the respondents stated that taking walks in the wetlands contributes directly to their wellbeing.

Time Alone

Although solitude is often regarded as something negative, spending time alone on purpose can have significant positive effect on individual wellbeing (Long et al., 2003). Nguyen et al. (2018) found that when alone, individuals can experience privacy, emotional relief, relaxation, self-reflection, creativity etc., leaving them more relaxed and at peace. The wetlands were perceived as suitable for spending time alone by 53% of respondents and 40% stated that the ability to spend time alone and rest in the wetlands contributes directly to their wellbeing.

Time with Family and Friends

Spending time with family and friends has significant positive effect on individual wellbeing (see e.g., Bhargava et al., 2014; Hudson et al., 2020; Nelson et al., 2012). 40% of the respondents stated that wetlands are well-suited for socializing and 9% of the respondents stated that spending time with friends and family in the wetlands contributes directly to their wellbeing. The NGO also organizes events like an open house, team buildings, and volunteering days that provide additional opportunities for socializing. The site has plenty of amenities that are designed for child play, leisure, and education, however, children were not included in the survey. The socializing aspect of wetlands was mostly appreciated by people in the age of 36-50.

5.2.3.2 Ecological Education

In addition to the information tables, signs, and exhibitions forming an interactive educational trail in the wetlands, the NGO is also actively engaged in ecological education for kindergartens, primary and secondary schools, and the public (Čmelák's internal documents, 2021). The activities that take place in the wetlands are customized to the audience and provide hands-on experience in ecology where the ES framework is an important part of the programs (interviewee 2). There are also special events with additional activities, workcamps, and volunteering days, where the public can learn ecological conservation and restoration in practice. In 2015, the NGO organized about 40 educational activities for schools, companies, and the public. In the survey, 15% of respondents stated that ecological education is directly contributing to their wellbeing and almost 40% deemed it an important wetland ES overall.

5.2.3.3 Aesthetics

According to Galindo & Rodríguez (2000)**,** there is increasing support in environmental psychology that aesthetic environments have a positive effect on wellbeing. Seresinhe et al. (2019) found that even accounting for other factors, such as activity, people are generally happier in more scenic surroundings. People also prefer natural to built-up environments (Calogiuri et al., 2018). A famous study found that medical patients recover faster when having a view on natural scenery (Ulrich, 1984), and Parsons et al. (1998) indicated that nature has a positive effect on stress relieve.

The wetlands in JVP turned from degraded ecosystem filled with illegal dumping grounds into a scenic natural environment (Fig. 21), so that it is now presented as one of the town's touristic highlights (Jablonné v Podještědí, n.d.). In the survey, 28% of the respondents stated that the improved scenery contributes directly to their wellbeing, and in general aesthetics were considered an important wetland ES by 70% of respondents.

Figure 21 Restored wetlands. Reprinted with permission from (Jablonné v Podještědí, n.d.)

5.2.3.4 COVID-19

As a result of the COVID-19 pandemic, strong quarantine measures were adopted in the Czech Republic (*Vlada*, 2021). While helping to reduce the spread of the virus, these measures can have a series of negative effects on the physical, mental, and emotional wellbeing of urban citizens (Fofana et al., 2020; Yang et al., 2020; Zhang et al., 2020). Research has found that young people are the most psychologically affected by the restrictions (Glowacz & Schmits, 2020) exhibiting high levels of depression, sleep deprivation, and anxiety (Huang & Zhao, 2020). A recent study by Xie et al. (2020) found that urban parks play an important role in maintaining the level of citizen wellbeing in extreme situations, such as is the pandemic. In the survey, 35.8% of the respondents stated that they began appreciating the presence of the restored wetlands in JVP more in the time of pandemic while 49.1 % did not (Fig. 22). Most of the respondents in the 0-25 and 26-35 age categories began appreciating the wetlands, more, while most of the respondent over 50 reported did not.

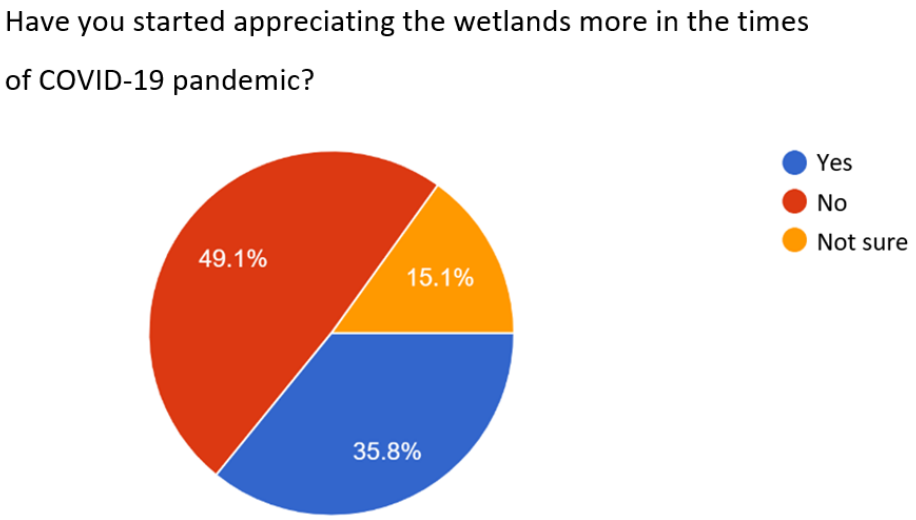


Figure 22 The distribution of respondents' appreciation of the restored wetlands in times of COVID-19 pandemic

5.2.4 Habitat Services

Habitat provision was considered an important wetland ES by 81% of the respondents and 26% stated that habitat provision contributes directly to their individual wellbeing.

5.2.4.1 Before Restoration

Before restoration, the biodiversity of the site was quite low. Plant community consisted mainly of successive reed vegetation. Plant species of conservational importance were not present except for the red-listed *Carex paniculata* and *Epilobium palustre*, which are both quite common regionally (Višňák, 2008). The zoological survey found 39 invertebrate and 52 vertebrate species (Višňák, 2008). Using the invertebrates as bioindicators (see e.g. Gerlach et al., 2013), the survey estimated the level of anthropogenic disturbance as low, and found the site to be a relatively valuable refuge of wetland fauna, despite most of the invertebrate species being quite common regionally (Vonička & Pudil, 2008). The vertebrates included 2 amphibian species, 2 lizard species, 40 species of birds, and 8 species of mammals. However, only 1 species of amphibians, 2 species of lizards, and 2 species of birds are of conservational importance. Moreover, no amphibian breeding or larval stage sites were found (Vonička & Pudil, 2008).

5.2.4.2 After Restoration

The surveys were conducted again after the restoration has been completed. The botanical study found 79 new species of plants, mainly hydrophates. The plant community included 13 species of conservational importance (Višňák, 2015). The zoological study found in total 91 species of

invertebrates, among which were *Hygronoma dimidiate and Tachyporus transversalis* – two representatives of R1 category[12], that are extremely rare and require undisturbed environments. Other species of importance were *Blemus discus, Aleochara ruficornis* and *Rugilus Angustatus* which are rare but not threatened (Špaček et al., 2016). Given the short amount of time that passed between the restoration and the studies, many invertebrate communities did not manage to establish themselves. No aquatic invertebrates were found either, which was attributed to their virtual absence from the wider landscape (Špaček et al., 2016).

A butterfly study found 18 species of daytime butterflies, one of which – *Lycaena dispar* – is enlisted in the European Red List of Threatened Species (Špaček et al., 2016). 72 species of vertebrates were documented which included 3 species of fish, 6 species of amphibians, 5 species of lizards, 50 species of birds, and 8 species of mammals. Amphibians are of special conservational importance and almost all species of amphibians are protected in the Czech Republic (Vojar, 2007). The study concluded that the wetlands provide plenty of natural habitats (Špaček et al., 2016), and additional habitats for lizards, bats, owls, amphibians, bees, etc. were installed subsequently. Nevertheless, Višňák (2008) argues that the relatively high pollution of the Panenský stream might be preventing some organisms from colonizing the wetlands.

Wetlands function as natural refuges (Dzuráková et al., 2018) and the restored wetlands in JVP form a part of natural biological corridor along the Heřmenický stream (Čmelák's internal documents, 2021). According to Rosenberg et al. (1997), conserving natural corridors can be critical for local and regional biodiversity conservation, thus it is possible that the restored wetlands in JVP have a wider, regional conservational impact.

5.3 Environmental Stewardship

The high level of respondent WTP for environmental conservation and expansion indicates that environmental stewardship has been fostered in the area (Kotchen & Reiling, 2000). Given their correlation with WTP this thesis supports the findings that usage of the public spaces (Peck et al., 2020) and preference for CES (Andersson et al., 2015) can act as gateways to environmental stewardship. While these factors were addressed in section 5.2.3, public participation and its role in building psychological ownership and hence fostering environmental stewardship for the restored wetlands has not been addressed so far (LaChapelle & McCool, 2005; Muhamad Khair et al., 2020; Süssenbach & Kamleitner, 2018).

[12] The unique relict (R1) species reflect habitat types least affected by human activities (Špaček et al., 2016)

5.3.1 Public Participation

The NGO organized community planning sessions to involve the public in the restoration process. They informed the citizens of JVP through posters and local municipal newsletter. Each session attended around 30 people including the mayor. See Table 4 for the agenda of each session. Additionally, the locals could participate in the construction of ponds, the repair of roads, and even the final planting of wetland vegetation (Čmelák's internal documents, 2021). The NGO also organizes regular volunteering days, and workcamps in which the locals can participate.

Table 4 Based on information from Čmelák's internal documents (2021) and Klápšťová & Klápště (2012).

Meeting	**Agenda**
1.	At the first meeting (2012) the participants analyzed the site using a method based on Christopher Day's design where they focused on pleasant and unpleasant sensory perceptions, impressions, stories, spirit of the place and put together a program of desirable activities in the locality and priorities between them. (see Day & Parnell, 2003). The participants then decided on activities that they would like to be able to perform in the wetlands, as well as on the character the site should have.
2.	At the second meeting (2012) the participants were presented with three versions of the wetlands that differed in the distribution of the walking and observational zone, the no-interference zone, and the zone for social interaction**.** The version that received the most votes was eventually implemented.
3.	Third community meeting took place in 2015, where the participants discussed how they are satisfied with the restoration, what is missing, what should be addressed next and also how to co-manage the area.

Most respondents were not sure if the level of public involvement was sufficient (Fig. 23). Women were on average more satisfied with the level of public involvement than men, but the difference is small and there does not appear to be correlation with any other of the demographic factors.

Despite 17% of the respondents not deeming the level of public participation sufficient, there were very few suggestions for improvements. When asked what should be done differently, the reactions were mostly positive or neutral but there were also calls for improving the trash collection on the site, involving more the municipality in the management, expanding the wetlands and cleaning the surrounding area, better management, and preventing the local adolescence from occupying the area.

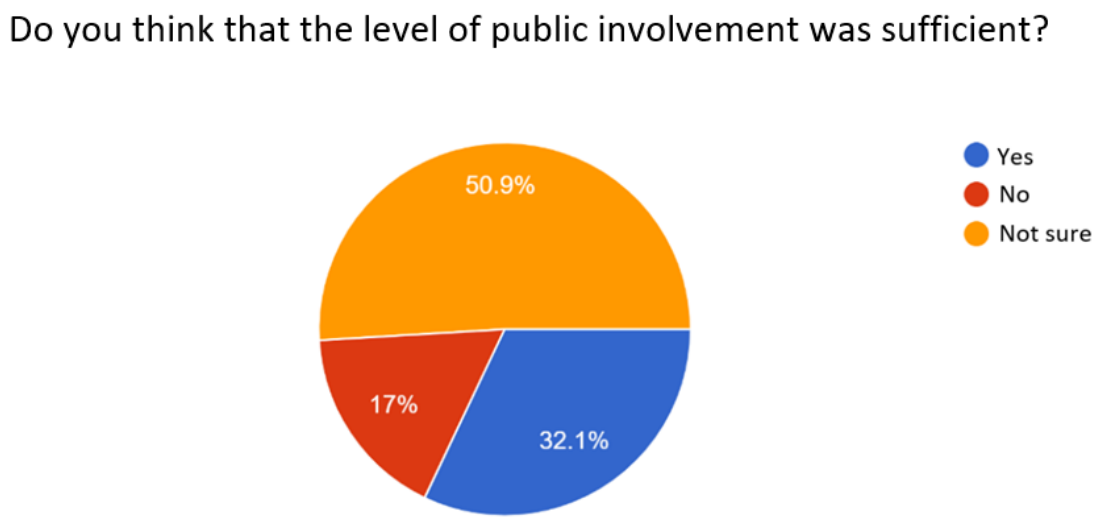


Figure 23 The distribution of respondents' perception of the opportunity for public participation in the restoration

6 Discussion

6.1 Summary and Interpretation

The restoration has significantly increased the accessibility of natural recreational public spaces in JVP, as well as improved the JVP's living environment. The level of self-reported wellbeing benefits derived from the wetlands was high, as well as the WTP for the wetland existence value. Wetland conservation was preferred over expansion which corroborates the findings of Hjerpe et al. (2015) who claim that this could be explained by individuals placing higher value on not losing something compared to gaining something of equal value. They also argue that the difference can stem from the knowledge that restoration cannot fully substitute for lost natural environment, however this does not apply in this case.

The fact that women reported higher derived wellbeing and had on average higher WTP than men is in accordance with previous research on gender and pro-environmental behaviours, which found that women exhibit higher levels of pro-environmental behaviour than men (Dietz et al., 2002; García-Llorente et al., 2011; Martín-López et al., 2012; Martino, 2008; Zelezny et al., 2000). Higher wellbeing benefits were also reported by respondents in 36-50 age category which is likely to be because it is now increasingly common for people to have their first child in their 30s (Livingston, 2018) and the wetlands can be a good place for spending time with them. The wetlands were seen as suitable for interaction with nature, and for spending time alone, they were seen relatively suitable for spending time with family and friends but less suitable for physical activity. The fact that

respondents over 50 years of age reported overall lower derived wellbeing benefits could possibly be explained by the findings of Onose et al. (2020), where urban parks were often regarded as unfriendly to the elderly.

Besides the level of satisfaction with the restoration, education, sex, and age, important determinants of respondents' attitudes towards the wetlands seem to be the preference for CES and the belief that landscape restoration is necessary. The results presented here reveal the relevance of CES, such as recreation, aesthetics, and ecological education to be included in restoration projects not only to increase wellbeing but also to increase the awareness of other ES and foster environmental stewardship (Andersson et al., 2015). The case also shows that ecological education can be both passive and active component of ecological restoration projects, the reach of which may transcend the local population. Possibly important finding is that the respondents' preferences for wetland ES correlate strongly with NGO's ecological focus, indicating the effectiveness of ecological education. In times of COVID-19, especially younger respondents reported higher appreciation of the wetland existence. This is likely caused by the lockdown measures adopted by the government that substantially affect young people's wellbeing.

The wetlands seem to provide important regulating services, such as temperature regulation, air quality regulation, and water retention that also to some extent contribute to respondents' individual wellbeing. However, the wetlands' potential to provide ES such as flood regulation and water quality enhancement that would yield wider societal benefits is limited and restoring hydrology on a landscape scale would be needed. The habitat provision services of the wetlands seems to deliver significant conservational outcomes while contributing substantially to respondent wellbeing. After the restoration, many species of conservational importance found refuge in the wetlands. Moreover, the wetlands' potential to contribute to biodiversity conservation may have a larger regional impact in that they help conserve a natural bio-corridor along the Heřmanický stream.

This thesis also supports the view that CES, and the sense of ownership – which can be the result of public involvement and frequent interaction with the wetlands – play an important role in fostering environmental stewardship, which is evidenced by the respondents' high WTP and possibly also by the high existence value that respondents place on biodiversity.

6.2 Relevance

The NGO's goal with this project was for it to become a model for other restoration initiatives. It is fair to say that given the respondent high satisfaction, their reported wellbeing benefits, high WTP

for both conservation and expansion, and positive conservational outcomes, this project is from many perspectives a restoration success. It highlights the importance of CES to be included in future restoration projects in similar settings and demonstrates that recreation does not have to conflict with conservational goals. It also shows that although the impact of the CES is primarily local, it can invigorate tourism and when combined with active engagement, there is a potential for both recreation and ecological education to have even more profound and wide-reaching effects. This is potentially significant for similar semi-urban municipalities since the spill-over effect of it may also be higher attractiveness and competitiveness.

The wetlands are part of a biological corridor located at the outskirts of JVP, in the floodplain of Heřmanický and Panenský stream with naturally occurring wetland characteristics. Nevertheless, they are still close enough to be reached on foot in maximum 30 minutes for most respondents. As such, this project can deliver both significant recreational and conservational outcomes as well as regulating services, such as temperature and air quality regulation. While closer proximity to the centre would likely improve the delivery of some cultural and regulating services, the conservational benefits would be most likely impaired given the increased fragmentation. In more urbanized environments, the ES provision potential by similar restoration projects would therefore probably differ which would have to be reflected in the restoration design. For example, the results from the survey of ES preferences seem to suggest that ecological education is more relevant in restoration projects where the population is younger, which in the case of Czech Republic is more likely to be in urban environments as the trend of young people leaving the rural areas continues (ČTK, 2017). This thesis thus also indicates that surveying the population ES preferences prior to the restoration could be a useful approach for increasing local wellbeing, and environmental stewardship. The survey also revealed that the wetlands in JVP are not seen as suitable for physical activity, which is an issue that should be addressed in future restorations provided that the locals have preference for this ES.

The case demonstrates that wetland restoration can be a viable option for municipalities to consider as part of their plans towards more resilient cities and communities as it can provide ES such as water retention, air quality improvement, and temperature regulation that are important for climate adaptation. However, the wetlands in JVP would ideally perform better in the provision of regulating services, in particular nutrient retention and flood regulation. Nutrient retention is desirable as the growing amount of dissolved nutrients in waterways is causing wide-spread eutrophication and the Panenský stream was found to contain above-average volumes of P, while flood regulation is relevant as floods remain a dominant risk to the municipality of JVP. Although there may be concerns that nutrient retention function would affect biodiversity (Hansson et al., 2005) a study of 32

multifunctional wetlands in Sweden found no proof that a high nutrient retention function negatively affects biodiversity (Thiere, 2009). Thus, higher multifunctionality of wetlands could be a valid aim of future restorations, however, restored hydrological connectivity is a precondition for the provision of many wetland ES.

To promote biodiversity, the wetlands need to be managed regularly, which can result in substantial financial expense. This case, however, demonstrates that volunteering, and cooperation between NGOs and the public sector can increase the viability of such a project, while fostering environmental stewardship. Although the wetlands have strong recreational focus, the project could benefit from more productive management of the site. For example, instead of manual management and subsequent disposal of biomass, animal grazing could be used. Different restoration projects demonstrate that using animals such as ponies for wetland management could be beneficial for both biodiversity and cost-effectiveness if logistical and conservational aspects are resolved (Metera et al., 2010; Silva & Europäische Kommission, 2007).

Although relatively high percentage of respondents considered the public involvement sufficient, the majority was unsure and 17% disagreed. It may be that respondents were not aware of what sufficient level of involvement is, however, more in-depth interviews would be necessary to estimate this. I therefore argue that while providing important guidance, future restorations should try to improve on this process.

Overall, I claim that this project could be considered a model for future restoration works especially in similar settings where abandoned (agricultural) land borders on a municipality of small geographical area with inadequate opportunity for recreation. However as discussed above, future restoration initiatives in similar settings should try to build and improve on what has been learned from this project.

6.3 Limitations and Future Research

As described in section 4.3, the generalizability of the results to the population of JVP is problematic. Nevertheless, these results are still relevant as they help explain the underlying social phenomena relating to the wetland restoration project. Even though WTP proved to be an extremely useful method, its explanatory power regarding the respondent actual behaviour is limited (Andorfer & Liebe, 2015; Dodds et al., 2018). This is also true regarding WTP and environmental stewardship, since as Meyerhoff (2006) claims, the level of WTP can be reflective of both the attitude towards a target and the attitude towards a behaviour. Data unavailability has led to incomplete ES assessment

and overall limited the accuracy of the ES analysis. It was also beyond the scope of this thesis to look at issues that have occurred after the restoration or may occur in the future, which limits the practical applicability of this research.

Future research should focus on extending the applicability of this restoration model e.g., by adapting its ES focus, while keeping its ecological integrity, and analysing in which municipalities in the Czech Republic or internationally this project could be replicated. Future research should also focus on how arguments, such as the existence value of biodiversity or wetland ES, could convince decision makers to restore wetlands or natural green public spaces in their jurisdictions. Examining how the lessons learned from this project could be implemented and built upon in other projects could also help improve the outcomes of future restorations.

7 Conclusion

Freshwater wetlands are one of the most biodiverse ecosystems in the world, providing important ecosystem services to society. Yet, they are also one of the most threatened. Biodiversity loss is now taking place at a rate unprecedented in human history, which is a growing concern not only from the perspective of ecosystem functioning but also its existence value. At the same time, agricultural land is being abandoned at an increasing rate. This thesis therefore analysed a case of wetland restoration of an abandoned agricultural land in Jablonné v Podještědí, Czech Republic, to see if such an approach could help prevent biodiversity loss while improving citizen wellbeing. It has done so by employing a utilitarian perspective, looking at how the restored wetlands are perceived and valued by the local population, and how they contribute to local and societal wellbeing through the provision of ecosystem services. Furthermore, by applying the theory of psychological ownership and examining the effects of cultural ecosystem services, this thesis explored whether environmental stewardship has been fostered in the local population as the result of both the restoration process, and its outcomes.

This thesis concludes that the restored wetlands contribute significantly to local wellbeing, primarily through the provision of cultural services, and the existence value of biodiversity. Their lesser contribution lies in temperature regulation, air quality regulation, and water retention. Their contribution to biodiversity conservation may be even of a larger regional significance, since the wetlands help conserve a natural biological corridor in the landscape. Their contribution to larger societal wellbeing through the provision of regulating services, such as nutrient retention or flood regulation is limited, which is likely caused by disrupted hydrology in the entire watershed.

Nevertheless, besides biodiversity conservation, the wetlands' larger regional impact lies also in the provision of cultural services, namely recreation and ecological education. This thesis argues that environmental stewardship in the local population has been fostered to a large degree, which is evidenced by high levels of willingness to pay for wetland conservation and high perceived existence value of biodiversity. Overall, this thesis highlights the important role of cultural ecosystem services and public participation in ecological restoration, as well as the potential of ecological restoration of abandoned agricultural land to provide significant positive conservational and wellbeing outcomes.

8 Bibliography

Acreman, M., Fisher, J., Stratford, C., Mould, D., & Mountford, J. (2007). Hydrological science and wetland restoration: Some case studies from Europe. *Hydrology and Earth System Sciences*, *11*(1), 158–169.

Ainsworth, J. (2020). Feelings of ownership and volunteering: Examining psychological ownership as a volunteering motivation for nonprofit service organisations. *Journal of Retailing and Consumer Services*, *52*, 101931. https://doi.org/10.1016/j.jretconser.2019.101931

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, *50*(2), 179–211.

Alberini, A., & Cooper, J. (2000). *Applications of the contingent valuation method in developing countries: A survey* (Vol. 146). Food & Agriculture Org.

Aldous, D. (2006). *Social, environmental, economic, and health benefits of green spaces*. 171–186.

Alexander, S., Aronson, J., Whaley, O., & Lamb, D. (2016). The relationship between ecological restoration and the ecosystem services concept. *Ecology and Society*, *21*(1). https://doi.org/10.5751/ES-08288-210134

Alexander, S., Nelson, C. R., Aronson, J., Lamb, D., Cliquet, A., Erwin, K. L., Finlayson, C. M., De Groot, R. S., Harris, J. A., & Higgs, E. S. (2011). Opportunities and challenges for ecological restoration within REDD+. *Restoration Ecology*, *19*(6), 683–689.

Andersson, E., Tengö, M., McPhearson, T., & Kremer, P. (2015). Cultural ecosystem services as a gateway for improving urban sustainability. *Ecosystem Services*, *12*, 165–168.

Andorfer, V. A., & Liebe, U. (2015). Do information, price, or morals influence ethical consumption? A natural field experiment and customer survey on the purchase of Fair Trade coffee. *Social Science Research*, *52*, 330–350.

Attewell P and Rule J B (1991) Survey and Other Methodologies Applied to IT Impact Research: Experiences From a Comparative Study of Business Computing. In The Information Systems Research Challenge: Survey Research Methods - Volume 3, (Kraemer K L, Ed.), pp.299-315, Harvard Business School Press, Boston, MA.

AquaKlimax. (n.d.). *Tůně Jablonné v Podještědí*. Retrieved 20 April 2021, from https://www.aquaklimax.cz/portfolio-view/tune-jablonne-v-podjestedi/

archiv ENKI.ops. (n.d.). *Termovizní snímek letní krajiny s různými typy pokryvu*. Retrieved 20 April 2021, from https://www.enki.cz/cs/

Aronson, J., Blatt, C., & Aronson, T. (2016). Restoring ecosystem health to improve human health and well-being: Physicians and restoration ecologists unite in a common cause. *Ecology and Society*, *21*. https://doi.org/10.5751/ES-08974-210439

Bamwesigye, D., Hlavackova, P., Sujova, A., Fialova, J., & Kupec, P. (2020). Willingness to pay for forest existence value and sustainability. *Sustainability*, *12*(3), 891.

Baxter, P., & Jack, S. (2008). Qualitative case study methodology: Study design and implementation for novice researchers. *The Qualitative Report*, *13*(4), 544–559.

Becker, H. (2000). Italo Calvino as urbanologist. *L'Année Sociologique*.

Benayas, J. M. R., & Bullock, J. M. (2012). Restoration of biodiversity and ecosystem services on agricultural land. *Ecosystems*, *15*(6), 883–899.

Benayas, J. M. R., Newton, A. C., Diaz, A., & Bullock, J. M. (2009). Enhancement of biodiversity and ecosystem services by ecological restoration: A meta-analysis. *Science*, *325*(5944), 1121–1124.

Benayas, J. R., Martins, A., Nicolau, J. M., & Schulz, J. J. (2007). Abandonment of agricultural land: An overview of drivers and consequences. *CAB Reviews: Perspectives in Agriculture, Veterinary Science, Nutrition and Natural Resources*, *2*(57), 1–14.

Bennett, E. M., & Balvanera, P. (2007). *The future of production systems in a globalized world*.

Bennett, N. J., Whitty, T. S., Finkbeiner, E., Pittman, J., Bassett, H., Gelcich, S., & Allison, E. H. (2018). Environmental Stewardship: A Conceptual Review and Analytical Framework. *Environmental Management*, *61*(4), 597–614. https://doi.org/10.1007/s00267-017-0993-2

Bentham, J. (1977). A Comment on the Commentaries and a Fragment on Government, edited by J. H. Burns and H. L. A. Hart. London: The Athlone Press. p. 393

Bettinger, P., Boston, K., Siry, J. P., & Grebner, D. L. (2017). Chapter 2—Valuing and Characterizing Forest Conditions. In P. Bettinger, K. Boston, J. P. Siry, & D. L. Grebner (Eds.), *Forest Management and Planning (Second Edition)* (pp. 21–63). Academic Press. https://doi.org/10.1016/B978-0-12-809476-1.00002-3

Bhargava, S., Kassam, K. S., & Loewenstein, G. (2014). A reassessment of the defense of parenthood. *Psychological Science*, *25*(1), 299–302.

Biggs, J., Williams, P., Whitfield, M., Nicolet, P., & Weatherby, A. (2005). 15 years of pond assessment in Britain: Results and lessons learned from the work of Pond Conservation. *Aquatic Conservation: Marine and Freshwater Ecosystems*, *15*(6), 693–714.

Bishop, J. T. (1999). Valuing forests: A review of methods and applications in developing countries. *International Institute for Environment and Development, London*, 23–34.

Bodin, M., & Hartig, T. (2003). Does the outdoor environment matter for psychological restoration gained through running? *Psychology of Sport and Exercise*, *4*(2), 141–153.

Bowen, G. (2009). Document Analysis as a Qualitative Research Method. *Qualitative Research Journal*, *9*, 27–40. https://doi.org/10.3316/QRJ0902027

Bowers, B., Cohen, L. W., Elliot, A. E., Grabowski, D. C., Fishman, N. W., Sharkey, S. S., Zimmerman, S., Horn, S. D., & Kemper, P. (2013). Creating and Supporting a Mixed Methods Health Services Research Team. *Health Services Research*, *48*(6pt2), 2157–2180. https://doi.org/10.1111/1475-6773.12118

Bowler, D. E., Buyung-Ali, L. M., Knight, T. M., & Pullin, A. S. (2010). A systematic review of evidence for the added benefits to health of exposure to natural environments. *BMC Public Health*, *10*(1), 1–10.

Breed, M. F., Cross, A. T., Wallace, K., Bradby, K., Flies, E., Goodwin, N., Jones, M., Orlando, L., Skelly, C., Weinstein, P., & Aronson, J. (2020). Ecosystem Restoration: A Public Health Intervention. *EcoHealth*. https://doi.org/10.1007/s10393-020-01480-1

Bring, A., Rosén, L., Thorslund, J., Tonderski, K., Åberg, C., Envall, I., & Laudon, H. (2020). Groundwater storage effects from restoring, constructing or draining wetlands in temperate and boreal climates: A systematic review protocol. *Environmental Evidence*, *9*(1), 26. https://doi.org/10.1186/s13750-020-00209-5

Brouwer, R., Brander, L., Kuik, O., Papyrakis, E., & Bateman, I. (2013). A synthesis of approaches to assess and value ecosystem services in the EU in the context of TEEB. *VU University Amsterdam*.

Brudvig, L. A. (2011). The restoration of biodiversity: Where has research been and where does it need to go? *American Journal of Botany*, *98*(3), 549–558.

Bryman, A. (2016). *Social research methods*. Oxford university press.

Bullock, A., & Acreman, M. (2003). The Role of Wetlands in the Hydrological Cycle. *Hydrology and Earth System Sciences*, *7*. https://doi.org/10.5194/hess-7-358-2003

Busch, G. (2006). Future European agricultural landscapes—What can we learn from existing quantitative land use scenario studies? *Agriculture, Ecosystems & Environment*, *114*(1), 121–140.

Busch, M., La Notte, A., Laporte, V., & Erhard, M. (2012). Potentials of quantitative and qualitative approaches to assessing ecosystem services. *Ecological Indicators*, *21*, 89–103.

Calogiuri, G., Litleskare, S., Fagerheim, K. A., Rydgren, T. L., Brambilla, E., & Thurston, M. (2018). Experiencing Nature through Immersive Virtual Environments: Environmental Perceptions, Physical Engagement, and Affective Responses during a Simulated Nature Walk. *Frontiers in Psychology*, *8*, 2321. https://doi.org/10.3389/fpsyg.2017.02321

Carr, I. M. (1992). Saving the environment—Does utilitarianism provide a justification? *Legal Studies*, *12*(1), 92–102. https://doi.org/10.1111/j.1748-121X.1992.tb00459.x

Carson, R. T. (2012). Contingent valuation: A practical alternative when prices aren't available. *Journal of Economic Perspectives*, *26*(4), 27–42.

Castro Antonio J., Vaughn Caryn C., García-Llorente Marina, Julian Jason P., & Atkinson Carla L. (2016). Willingness to Pay for Ecosystem Services among Stakeholder Groups in a South-Central U.S. Watershed with Regional Conflict. *Journal of Water Resources Planning and Management*, *142*(9), 05016006. https://doi.org/10.1061/(ASCE)WR.1943-5452.0000671

Catanzaro, C., & Ekanem, E. (2002). *Home gardeners value stress reduction and interaction with nature*. 269–275.

CEE, G. (2015). Natural small water retention measures combining drought mitigation, flood protection and biodiversity conservation. Guidelines. *Guidelines, Global Water Partnership Central and Eastern Europe*.

Chan, K. M. A., Guerry, A. D., Balvanera, P., Klain, S., Satterfield, T., Basurto, X., Bostrom, A., Chuenpagdee, R., Gould, R., Halpern, B. S., Hannahs, N., Levine, J., Norton, B., Ruckelshaus, M., Russell, R., Tam, J., & Woodside, U. (2012). Where are Cultural and Social in Ecosystem Services? A Framework for Constructive Engagement. *BioScience*, *62*(8), 744–756. https://doi.org/10.1525/bio.2012.62.8.7

Chapman, P., & Reed, D. (2006). Advances in coastal habitat restoration in the northern Gulf of Mexico. *Ecological Engineering*, *26*(1), 1–5.

Check, J., & Schutt, R. K. (2011). *Research methods in education*. Sage Publications.

Chin, R., & Lee, B. Y. (2008). Chapter 8—Economics and Patient Reported Outcomes. In R. Chin & B. Y. Lee (Eds.), *Principles and Practice of Clinical Trial Medicine* (pp. 145–165). Academic Press. https://doi.org/10.1016/B978-0-12-373695-6.00008-9

ČHMÚ. (n.d.). *Aktuální teplota a počasí, archiv, rekordy | In-počasí*. Retrieved 12 April 2021, from https://www.in-pocasi.cz/archiv/jablonne_v_podjestedi/?typ=srazky

Čížková, H., Květ, J., Comin, F. A., Laiho, R., Pokorný, J., & Pithart, D. (2013). Actual state of European wetlands and their possible future in the context of global climate change. *Aquatic Sciences*, *75*(1), 3–26.

Čmelák. (n.d.-a). *Ochranářský plán péče lokality Mokřady Jablonné* [Conservation plan for care]. Retrieved 12 April 2021, from http://www.csop.cz/docs/up/EHP_OP_Jablonne_v_Podjestedi.pdf

Čmelák. (n.d.-b). *Proč Mokřady Jablonné*. Retrieved 28 April 2021, from https://www.cmelak.cz/proc-mokrady-jablonne/

Čmelák. (2012). *Společně pro přirodu: Pozemkové spolky—Moderní ochrana přírody*. Čmelák - Společnost přátel přírody.

Coley, R. L., Sullivan, W. C., & Kuo, F. E. (1997). Where does community grow? The social context created by nature in urban public housing. *Environment and Behavior*, *29*(4), 468–494.

Cong, L., Zhang, H., Zhai, J., Yan, G., Wu, Y., Wang, Y., Ma, W., Zhang, Z., & Chen, P. (2018). The blocking effect of atmospheric particles by forest and wetland at different air quality grades in Beijing China. *Environmental Technology*.

Coon, J. T., Boddy, K., Stein, K., Whear, R., Barton, J., & Depledge, M. H. (2011). Does participating in physical activity in outdoor natural environments have a greater effect on physical and mental wellbeing than physical activity indoors? A systematic review. *Environmental Science & Technology*, *45*(5), 1761–1772.

ConservationTools. (n.d.). *What Is a Land Trust?* WeConservePA. Retrieved 19 April 2021, from https://conservationtools.org/guides/150-what-is-a-land-trust#_Edn1

Copernicus Land Monitoring Service. (n.d.). *CLC* [Land item]. Retrieved 12 April 2021, from https://land.copernicus.eu/pan-european/corine-land-cover/clc2018

Correia, T. (1993). Land abandonment: Changes in the land use patterns around the Mediterranean basin. *Cahiers Options Méditerranéennes*, *1*(2), 97–112.

Covington, P., Gray, R., Hoag, C., Mattinson, M., Tidwell, M., Rodrigue, P., & Whited, M. (2003). *Wetland Restoration, Enhancement, and Management*.

Cramer, V. A., Hobbs, R. J., & Standish, R. J. (2008). What's new about old fields? Land abandonment and ecosystem assembly. *Trends in Ecology & Evolution*, *23*(2), 104–112.

Creswell, J. W., & Clark, V. L. P. (2017). *Designing and conducting mixed methods research*. Sage publications.

ČTK. (2017, January 26). *Jak stárne a vylidňuje se venkov? Mapy ukazují, kde je to nejhorší*. ČT24 - Nejdůvěryhodnější zpravodajský web v ČR - Česká televize. https://ct24.ceskatelevize.cz/ekonomika/2023468-jak-starne-a-vylidnuje-se-venkov-mapy-ukazuji-kde-je-nejhorsi

ČÚZK: Geoportál. (n.d.). Retrieved 12 April 2021, from https://geoportal.cuzk.cz/(S(m4dbwekfyk2hzw0fok2wenk0))/Default.aspx?mode=TextMeta&side=mapy_data200&text=dSady_mapyData200&head_tab=sekce-02-gp&menu=229

Daniel, T. C., Muhar, A., Arnberger, A., Aznar, O., Boyd, J. W., Chan, K. M. A., Costanza, R., Elmqvist, T., Flint, C. G., Gobster, P. H., Grêt-Regamey, A., Lave, R., Muhar, S., Penker, M., Ribe,

R. G., Schauppenlehner, T., Sikor, T., Soloviy, I., Spierenburg, M., … von der Dunk, A. (2012). Contributions of cultural services to the ecosystem services agenda. *Proceedings of the National Academy of Sciences*, *109*(23), 8812. https://doi.org/10.1073/pnas.1114773109

Davidson, N. C. (2014). How much wetland has the world lost? Long-term and recent trends in global wetland area. *Marine and Freshwater Research*, *65*(10), 934–941.

Day, C., & Parnell, R. (2003). *Consensus design: Socially inclusive process*. Routledge.

Dietz, T., Kalof, L., & Stern, P. C. (2002). Gender, values, and environmentalism. *Social Science Quarterly*, *83*(1), 353–364.

Dodds, R., Jenkins, B., Smith, W., & Pitts, R. E. (2018). Willingness-To-Pay vs actual behavior: Sustainable procurement at festivals. In *Contemporary Challenges of Climate Change, Sustainable Tourism Consumption, and Destination Competitiveness*. Emerald Publishing Limited.

Doorn, N. (2017). Do ecosystems have ethical rights? *Integrated Environmental Assessment and Management*, *13*(5), 952–953.

Dordio, A., Carvalho, A., & Pinto, A. (2008). Wetlands: Water 'living filters'? In *Wetlands Ecology Conservation and Restoration* (pp. 15–71).

Dzuráková, M., Štěpánková, P., & Levitus, V. (2018). Katalog přírodě blízkých opatření pro zadržení vody v krajině a jeho uplatnění ve webové mapové aplikaci pro veřejnost. *Vodohospodářské Technicko-Ekonomické Informace*, *60*(5), 6–11.

Eagly, A. H., & Chaiken, S. (1993). *The psychology of attitudes.* Harcourt brace Jovanovich college publishers.

Eiseltová, E. (2019, February 5). *Výzkum—Význam mokřadů v zemědělské krajině—| ČTPZ*. Česká technologická platforma pro zemědělství. https://www.ctpz.cz/vyzkum/vyznam-mokradu-v-zemedelske-krajine-868

Enviweb. (2021, April 10). *Rozšíření unikátních Mokřadů Jablonné*. EnviWeb.cz. http://www.enviweb.cz/118889

Erickson, D. L., Ryan, R. L., & De Young, R. (2002). Woodlots in the rural landscape: Landowner motivations and management attitudes in a Michigan (USA) case study. *Fragmentation*

and Land Use Planning: Analysis and Beyond?, *58*(2), 101–112. https://doi.org/10.1016/S0169-2046(01)00213-4

Ezebilo, E. (2016). Willingness to pay for maintenance of a nature conservation area: A case of mount Wilhelm, Papua New Guinea. *Asian Social Science*, *12*(9), 149–161.

FAO. (n.d.). *Regulating services*. Food and Agriculture Organization of the United Nations. Retrieved 19 April 2021, from http://www.fao.org/ecosystem-services-biodiversity/background/regulating-services/en/

Finlayson, C. (2012). *Forty years of wetland conservation and wise use*.

Finlayson, C., & Davidson, N. (1999). Global review of wetland resources and priorities for wetland inventory. *Preface Iv Summary Report*, *15*.

Fofana, N. K., Latif, F., Sarfraz, S., Bilal, Bashir, M. F., & Komal, B. (2020). Fear and agony of the pandemic leading to stress and mental illness: An emerging crisis in the novel coronavirus (COVID-19) outbreak. *Psychiatry Research*, *291*, 113230. https://doi.org/10.1016/j.psychres.2020.113230

Foley, J., Costa, M., Delire, C., Ramankutty, N. & Snyder, P. (2003). Green surprise? How terrestrial ecosystems could affect earth's climate. Front. Ecol. Environ. 1: 38-44

Frew, E. J., Wolstenholme, J. L., & Whynes, D. K. (2004). Comparing willingness-to-pay: Bidding game format versus open-ended and payment scale formats. *Health Policy*, *68*(3), 289–298.

Fricker, R. D., & Schonlau, M. (2002). Advantages and Disadvantages of Internet Research Surveys: Evidence from the Literature. *Field Methods*, *14*(4), 347–367. https://doi.org/10.1177/152582202237725

Fuchs, R., Verburg, P. H., Clevers, J. G. P. W., & Herold, M. (2015). The potential of old maps and encyclopaedias for reconstructing historic European land cover/use change. *Applied Geography*, *59*, 43–55. https://doi.org/10.1016/j.apgeog.2015.02.013

Fujii, Lee Ann (2015). Five stories of accidental ethnography: Turning unplanned moments in the field into data. Qualitative Research, 15(4), 525-539.

Fuller, R. A., Irvine, K. N., Devine-Wright, P., Warren, P. H., & Gaston, K. J. (2007). Psychological benefits of greenspace increase with biodiversity. *Biology Letters*, *3*(4), 390–394.

Fulton, D. C., Manfredo, M. J., & Lipscomb, J. (1996). Wildlife value orientations: A conceptual and measurement approach. *Human Dimensions of Wildlife*, *1*(2), 24–47.

Gafni, A. (1991). Willingness-to-Pay as a Measure of Benefits: Relevant Questions in the Context of Public Decisionmaking about Health Care Programs. *Medical Care*, *29*(12), 1246–1252. JSTOR.

Galindo, M. P. G., & Rodríguez, J. A. C. (2000). Environmental aesthetics and psychological wellbeing: Relationships between preference judgements for urban landscapes and other relevant affective responses. *Psychology in Spain*, *4*(1), 13–27.

García-Llorente, M., Martín-López, B., & Montes, C. (2011). Exploring the motivations of protesters in contingent valuation: Insights for conservation policies. *Environmental Science & Policy*, *14*(1), 76–88.

Georgiou, M., Morison, G., Smith, N., Tieges, Z., & Chastin, S. (2021). Mechanisms of Impact of Blue Spaces on Human Health: A Systematic Literature Review and Meta-Analysis. *International Journal of Environmental Research and Public Health*, *18*(5). https://doi.org/10.3390/ijerph18052486

Gerlach, J., Samways, M., & Pryke, J. (2013). Terrestrial invertebrates as bioindicators: An overview of available taxonomic groups. *Journal of Insect Conservation*, *17*(4), 831–850. https://doi.org/10.1007/s10841-013-9565-9

Gillingham, A. G., & Thorrold, B. S. (2000). A review of New Zealand research measuring phosphorus in runoff from pasture. *Journal of Environmental Quality*, *29*(1), 88–96.

Glowacz, F., & Schmits, E. (2020). Psychological distress during the COVID-19 lockdown: The young adults most at risk. *Psychiatry Research*, *293*, 113486. https://doi.org/10.1016/j.psychres.2020.113486

Godbey. G., Graefe, A., and James. S. W. (1992). The benefits of local recreation and park services: A nationwide study of the perceptions of the American public. Washington, DC: National Recreation and Park Association.

Goulder, L. H., & Kennedy, D. (2011). Interpreting and estimating the value of ecosystem services. *Natural Capital: Theory and Practice of Mapping Ecosystem Services*, *15*.

Grau, H. R., & Aide, M. (2008). Globalization and land-use transitions in Latin America. *Ecology and Society*, *13*(2).

Hammack, J., & Brown Jr, G. M. (2016). *Waterfowl and wetlands: Toward bioeconomic analysis*. Routledge.

Hanson, J., Chair, R., Boomer, K., Mason, P., Clearwater, D., Denver, J., Hartranft, J., Henicheck, M., McLaughlin, E., Miller, J., Staver, K., Strano, S., Stubbs, Q., Thompson, J., & Uybarreta, T. (2016). *Wetlands and Wetland Restoration Recommendations of the Wetland Expert Panel for the incorporation of non-tidal wetland best management practices (BMPs) and land uses in the Phase 6 Chesapeake Bay Watershed Model Prepared for With: Additional Contract Support Provided by Wetland Expert Panel iii*. https://doi.org/10.13140/RG.2.2.22016.64005

Hansson, L.-A., Brönmark, C., Nilsson, A., & ÅBJÖRNSSON, K. (2005). Conflicting Demands on Wetland Ecosystem Services: Nutrient Retention, Biodiversity or Both? *Freshwater Biology*, *50*, 705–714. https://doi.org/10.1111/j.1365-2427.2005.01352.x

Hardin, G. (1968). The Tragedy of the Commons. *Science*, *162*(3859), 1243. https://doi.org/10.1126/science.162.3859.1243

Harrison, P. A., Dunford, R., Barton, D. N., Kelemen, E., Martín-López, B., Norton, L., Termansen, M., Saarikoski, H., Hendriks, K., & Gómez-Baggethun, E. (2018). Selecting methods for ecosystem service assessment: A decision tree approach. *Ecosystem Services*, *29*, 481–498.

Hassan, G. F., El Hefnawi, A., & El Refaie, M. (2011). Efficiency of participation in planning. *Alexandria Engineering Journal*, *50*(2), 203–212. https://doi.org/10.1016/j.aej.2011.03.004

Hassan, R., Scholes, R., & Ash, N. (2005). *Ecosystems and human well-being: Current state and trends*.

Hjerpe, E., Hussain, A., & Phillips, S. (2015). Valuing type and scope of ecosystem conservation: A meta-analysis. *Journal of Forest Economics*, *21*(1), 32–50.

Huang, Y., & Zhao, N. (2020). Generalized anxiety disorder, depressive symptoms and sleep quality during COVID-19 outbreak in China: A web-based cross-sectional survey. *Psychiatry Research*, *288*, 112954.

Hudson, N. W., Lucas, R. E., & Donnellan, M. B. (2020). Are we happier with others? An investigation of the links between spending time with others and subjective well-being. *Journal of Personality and Social Psychology*.

Hunter, M. R. (2011). Impact of ecological disturbance on awareness of urban nature and sense of environmental stewardship in residential neighborhoods. *Landscape and Urban Planning*, *101*(2), 131–138. https://doi.org/10.1016/j.landurbplan.2011.02.005

IEC. (2011). *Economic Evaluation of Wetland Ecosystem Services in Delaware*. Industrial Economics Incorporated. http://www.dnrec.delaware.gov/Admin/DelawareWetlands/Documents/Economic%20Evaluation%20of%20Wetland%20Ecosystem%20Services%20in%20Delaware.pdf

Irvine, K. N., & Warber, S. L. (2002). PRACTICIN (, AS IR THE NATURAL ENVIRONMENT REALLY MATTERED). *Alternative Therapies in Health and Medicine*, *8*, 5.

Isbell, F., Tilman, D., Reich, P. B., & Clark, A. T. (2019). Deficits of biodiversity and productivity linger a century after agricultural abandonment. *Nature Ecology & Evolution*, *3*(11), 1533–1538.

Jablonné v Podještědí. (n.d.). *Mokřady: Jablonné v Podještědí*. Retrieved 7 April 2021, from https://www.jablonnevp.cz/mokrady/os-1106

Jablonné v Podještědí. (2018). *Program rozvoje města Jablonné v Podještědí*. https://www.obcepro.cz/pro/14601521537194.pdf

Jablonné v Podještědí. (2019). *JABLONNÉ V PODJEŠTĚDÍ*. https://docs.liberec.cz/odb_ha/uap_2012/prilohy/E_3_Karty_obci/Jablonn%C3%A9%20v%20Podje%C5%A1t%C4%9Bd%C3%AD.pdf

Jerneck, A., Olsson, L., Ness, B., Anderberg, S., Baier, M., Clark, E., Hickler, T., Hornborg, A., Kronsell, A., Lövbrand, E., & Persson, J. (2011). Structuring sustainability science. *Sustainability Science*, *6*(1), 69–82. https://doi.org/10.1007/s11625-010-0117-x

Johannesson, M. (1996). *Theory and methods of economic evaluation of health care* (Vol. 4). Springer Science & Business Media.

Kajamaa, A., Mattick, K., & de la Croix, A. (2020). How to … do mixed-methods research. *The Clinical Teacher*, *17*(3), 267–271. https://doi.org/10.1111/tct.13145

Keniger, L. E., Gaston, K. J., Irvine, K. N., & Fuller, R. A. (2013). What are the benefits of interacting with nature? *International Journal of Environmental Research and Public Health*, *10*(3), 913–935. PubMed. https://doi.org/10.3390/ijerph10030913

Klain, S. C., Olmsted, P., Chan, K. M., & Satterfield, T. (2017). Relational values resonate broadly and differently than intrinsic or instrumental values, or the New Ecological Paradigm. *PloS One*, *12*(8), e0183962.

Klápšťová, E., & Klápště, P. (2012). *MOKŘADY U FALKENBURKU – MÍSTO PRO LIDI I PŘÍRODU - JABLONNÉ V PODJEŠTĚDÍ* [Landscape-architectural study]. https://naturesystems.cz/sites/default/files/mokrady_u_falkenburku_studie_komplet_lq.pdf

Kopnina, H., Washington, H., Taylor, B., & Piccolo, J. J. (2018). Anthropocentrism: More than just a misunderstood problem. *Journal of Agricultural and Environmental Ethics*, *31*(1), 109–127.

Kotchen, M. J., & Reiling, S. D. (2000). Environmental attitudes, motivations, and contingent valuation of nonuse values: A case study involving endangered species. *Ecological Economics*, *32*(1), 93–107. https://doi.org/10.1016/S0921-8009(99)00069-5

Kronvang, B., Græsbøll, P., Larsen, S., Svendsen, L., & Andersen, H. (1996). Diffuse nutrient losses in Denmark. *Water Science and Technology*, *33*(4–5), 81–88.

Kudryavtsev, A., Krasny, M. E., & Stedman, R. C. (2012). The impact of environmental education on sense of place among urban youth. *Ecosphere*, *3*(4), 1–15.

Kull, C. A., Arnauld de Sartre, X., & Castro-Larrañaga, M. (2015). The political ecology of ecosystem services. *Geoforum*, *61*, 122–134. https://doi.org/10.1016/j.geoforum.2015.03.004

Kundzewicz Z.W. and Kowalczak P., (2008). Climate change and its consequences. (in polish) Poznań: Wydaw. Kurpisz S.A

Kuo, F. E., & Sullivan, W. C. (2001). Environment and Crime in the Inner City: Does Vegetation Reduce Crime? *Environment and Behavior*, *33*(3), 343–367. https://doi.org/10.1177/0013916501333002

kurzycz. (n.d.). *Katastrální mapa Jablonné v Podještědí | Kurzy.cz*. Retrieved 12 April 2021, from https://regiony.kurzy.cz/katastr/jablonne-v-podjestedi/mapa/

LACHAPELLE, P. R., & McCOOL, S. F. (2005). Exploring the Concept of “Ownership” in Natural Resource Planning. *Society & Natural Resources*, *18*(3), 279–285. https://doi.org/10.1080/08941920590908141

Lambert, M., Devantler, B., Nes, P., & Penny, P. (1985). Losses of nitrogen, phosphorus, and sediment in runoff from hill country under different fertiliser and grazing management regimes. *New Zealand Journal of Agricultural Research*, *28*(3), 371–379.

Land, M., Granéli, W., Grimvall, A., Hoffmann, C. C., Mitsch, W. J., Tonderski, K. S., & Verhoeven, J. T. A. (2016). How effective are created or restored freshwater wetlands for nitrogen and phosphorus removal? A systematic review. *Environmental Evidence*, *5*(1), 9. https://doi.org/10.1186/s13750-016-0060-0

Lane, B. (2009). Thirty years of sustainable tourism. *Sustainable Tourism Futures Perspectives on Systems, Restructuring and Innovations*, 19–32.

Layke, C., Mapendembe, A., Brown, C., Walpole, M. & Winn, J. (2012). Indicators from the global and sub-global Millennium Ecosystem Assessments: An analysis and next steps.

Liberecký kraj. (2015). *2015: Pět let od ničivé povodně*. https://www.kraj-lbc.cz//pet-let-od-nicive-povodne

Life for Mires. (n.d.). *Proč voda a mokřady*. Retrieved 7 January 2021, from https://life.npsumava.cz/o-projektu/proc-voda-a-mokrady/

Liu, Y., Sheng, L., & Liu, J. (2015). Impact of wetland change on local climate in semi-arid zone of Northeast China. *Chinese Geographical Science*, *25*(3), 309–320. https://doi.org/10.1007/s11769-015-0735-4

Livingston, G. (2018, June 28). US women are having kids earlier than in most developed nations. *Pew Research Center*. https://www.pewresearch.org/fact-tank/2018/06/28/u-s-women-are-postponing-motherhood-but-not-as-much-as-those-in-most-other-developed-nations/

Long, C. R., Seburn, M., Averill, J. R., & More, T. A. (2003). Solitude experiences: Varieties, settings, and individual differences. *Personality and Social Psychology Bulletin*, *29*(5), 578–583.

Loreau, M. (2014). Reconciling utilitarian and non-utilitarian approaches to biodiversity conservation. *Ethics in Science and Environmental Politics*, *14*, 27–32. https://doi.org/10.3354/esep00149

Luan, Z., & Zhou, D. (2013). Impacts of Intensified Agriculture Developments on Marsh Wetlands. *The Scientific World Journal*, *2013*, 409439. https://doi.org/10.1155/2013/409439

MA. (2001). *Millennium ecosystem assessment*. Millennium Ecosystem Assessment.

Maas, J., Verheij, R. A., Groenewegen, P. P., De Vries, S., & Spreeuwenberg, P. (2006). Green space, urbanity, and health: How strong is the relation? *Journal of Epidemiology & Community Health*, *60*(7), 587–592.

Macdonald, D. M., Dixon, A. J., & Gooddy, D. C. (2018). Water and nitrate exchange between a managed river and peri-urban floodplain aquifer: Quantification and management implications. *Ecological Engineering*, *123*, 226–237.

Mahmoud, A. H. A. (2011). Analysis of the microclimatic and human comfort conditions in an urban park in hot and arid regions. *Building and Environment*, *46*(12), 2641–2656.

Martín-López, B., Iniesta-Arandia, I., García-Llorente, M., Palomo, I., Casado-Arzuaga, I., Amo, D. G. D., Gómez-Baggethun, E., Oteros-Rozas, E., Palacios-Agundez, I., Willaarts, B., González, J. A., Santos-Martín, F., Onaindia, M., López-Santiago, C., & Montes, C. (2012). Uncovering Ecosystem Service Bundles through Social Preferences. *PLOS ONE*, *7*(6), 1–11. https://doi.org/10.1371/journal.pone.0038970

Martino, D. (2008). Gender and urban perceptions of nature and protected areas in Bañados del Este Biosphere Reserve. *Environmental Management*, *41*(5), 654.

Mathevet, R., Peluso, N. L., Couespel, A., & Robbins, P. (2015). Using historical political ecology to understand the present: Water, reeds, and biodiversity in the Camargue Biosphere Reserve, southern France. *Ecology and Society*, *20*(4). https://doi.org/10.5751/ES-07787-200417

Mayer, P. M., Reynolds Jr., S. K., McCutchen, M. D., & Canfield, T. J. (2007). Meta-Analysis of Nitrogen Removal in Riparian Buffers. *Journal of Environmental Quality*, *36*(4), 1172–1180. https://doi.org/10.2134/jeq2006.0462

McCarthy, D., & Morling, P. (2014). A Guidance Manual for Assessing Ecosystem Services at Natura 2000 Sites. *Produced as Part of the Natura People Project, Part-Financed by the European Regional Development Fund (ERDF) through the INTERREG IV A*, *2*, 2007–2013.

McCauley, D. J. (2006). Selling out on nature. *Nature*, *443*(7107), 27–28.

McMichael, A., Scholes, R., Hefny, M., Pereira, H., Palm, C., & Foale, S. (2005). *Linking Ecosystem Services and Human Well-being* (Vol. 4, pp. 43–60).

Measham, T., & Barnett, G. (2007). Environmental Volunteering: Motivations, Modes and Outcomes. *Australian Geographer*, *39*. https://doi.org/10.1080/00049180802419237

Meli, P., Rey Benayas, J. M., Balvanera, P., & Martínez Ramos, M. (2014). Restoration enhances wetland biodiversity and ecosystem service supply, but results are context-dependent: A meta-analysis. *PloS One*, *9*(4), e93507–e93507. PubMed. https://doi.org/10.1371/journal.pone.0093507

Mertens, D. M., & Hesse-Biber, S. (2012). *Triangulation and mixed methods research: Provocative positions*.

Metera, E., Sakowski, T., Słoniewski, K., & Romanowicz, B. (2010). Grazing as a tool to maintain biodiversity of grassland-a review. *Animal Science Papers and Reports*, *28*(4), 315–334.

Meyerhoff, J. (2006). Stated willingness to pay as hypothetical behaviour: Can attitudes tell us more? *Journal of Environmental Planning and Management*, *49*(2), 209–226. https://doi.org/10.1080/09640560500507959

Mills, J., Bonner, A. & Francis, K. (2006). The development of constructivist grounded theory. International Journal of Qualitative Methods, 5(1), 25–35. Retrieved 12 January 2009, from http://ejournals.library.ualberta.ca/index.php/IJQM/article/view/4402/3795.

Mitchell, R. C., Carson, R. T., & Carson, R. T. (1989). *Using surveys to value public goods: The contingent valuation method*. Resources for the Future.

Mitsch, W., & Gosselink, J. (2000). The Value of Wetlands: Importance of Scale and Landscape Setting. *Ecological Economics*, *35*, 25–33. https://doi.org/10.1016/S0921-8009(00)00165-8

Mitsch, W. J., Day, J. W., Gilliam, J. W., Groffman, P. M., Hey, D. L., Randall, G. W., & Wang, N. (2001). Reducing Nitrogen Loading to the Gulf of Mexico from the Mississippi River Basin: Strategies to Counter a Persistent Ecological Problem: Ecotechnology—The use of natural ecosystems to solve environmental problems—Should be a part of efforts to shrink the zone of hypoxia in the Gulf of Mexico. *BioScience*, *51*(5), 373–388.

Mitsch, W. J., & Day Jr, J. W. (2006). Restoration of wetlands in the Mississippi–Ohio–Missouri (MOM) River Basin: Experience and needed research. *Ecological Engineering*, *26*(1), 55–69.

Mitsch, W. J., Gosselink, J. G., Zhang, L., & Anderson, C. J. (2009). *Wetland Ecosystems*. John Wiley & Sons.

Molina-Azorín, J. F., & López-Gamero, M. D. (2016). Mixed methods studies in environmental management research: Prevalence, purposes and designs. *Business Strategy and the Environment*, *25*(2), 134–148.

Moore, M., Townsend, M., & Oldroyd, J. (2006). Linking Human and Ecosystem Health: The Benefits of Community Involvement in Conservation Groups. *EcoHealth*, *3*(4), 255–261. https://doi.org/10.1007/s10393-006-0070-4

Muhamad Khair, N. K., Lee, K. E., & Mokhtar, M. (2020). Sustainable City and Community Empowerment through the Implementation of Community-Based Monitoring: A Conceptual Approach. *Sustainability*, *12*(22), 9583.

Nadace Partnerství. (2020). *Adapterra Awards 2020 Zdravá a odolná krajina*. Tiskárna Matula,.

Naeem, S. (2002). ECOSYSTEM CONSEQUENCES OF BIODIVERSITY LOSS: THE EVOLUTION OF A PARADIGM. *Ecology*, *83*(6), 1537–1552. https://doi.org/10.1890/0012-9658(2002)083[1537:ECOBLT]2.0.CO;2

Nair, P. K. R., Gordon, A. M., & Mosquera-Losada, M. R. (2008). Agroforestry. In S. E. Jørgensen & B. D. Fath (Eds.), *Encyclopedia of Ecology* (pp. 101–110). Academic Press. https://doi.org/10.1016/B978-008045405-4.00038-0

Nelson, S. K., Kushlev, K., English, T., Dunn, E. W., & Lyubomirsky, S. (2012). In Defense of Parenthood: Children Are Associated With More Joy Than Misery. *Psychological Science*, *24*(1), 3–10. https://doi.org/10.1177/0956797612447798

Neßhöver, C., Aronson, J., Blignaut, J., Eppink, F., Vakrou, A., Wittmer, H., & de Groot, R. (2011). Investing in ecological infrastructure. In *The economics of ecosystems and biodiversity in national and international policy making*. Earthscan.

Nguyen, T. T., Ryan, R. M., & Deci, E. L. (2018). Solitude as an approach to affective self-regulation. *Personality and Social Psychology Bulletin*, *44*(1), 92–106.

Nilsson, C., Aradottir, A. L., Hagen, D., Halldórsson, G., Høegh, K., Mitchell, R. J., Raulund-Rasmussen, K., Svavarsdóttir, K., Tolvanen, A., & Wilson, S. D. (2016). Evaluating the process of ecological restoration. *Ecology and Society*, *21*(1).

Okumah, M., Chapman, P. J., Martin-Ortega, J., & Novo, P. (2019). Mitigating agricultural diffuse pollution: Uncovering the evidence base of the awareness–behaviour–water quality pathway. *Water*, *11*(1), 29.

Oliver, T. H., Heard, M. S., Isaac, N. J., Roy, D. B., Procter, D., Eigenbrod, F., Freckleton, R., Hector, A., Orme, C. D. L., & Petchey, O. L. (2015). Biodiversity and resilience of ecosystem functions. *Trends in Ecology & Evolution*, *30*(11), 673–684.

O'Neill, J., Light, A., & Holland, A. (2012). Environmental Ethics. *Nature Education Knowledge*, *3*(10), 7.

Onose, D. A., Iojă, I. C., Niță, M. R., Vânău, G. O., & Popa, A. M. (2020). Too Old for Recreation? How Friendly Are Urban Parks for Elderly People? *Sustainability*, *12*(3), 790.

Paludan, C., Alexeyev, F., Drews, H., Fleischer, S., Fuglsang, A., Kindt, T., Kowalski, P., Moos, M., Radlowski, A., & Stromfors, G. (2002). Wetland management to reduce Baltic Sea eutrophication. *Water Science and Technology*, *45*(9), 87–94.

Pan, Y., Che, Y., Marshall, S., & Maltby, L. (2020). Heterogeneity in Ecosystem Service Values: Linking Public Perceptions and Environmental Policies. *Sustainability*, *12*(3), 1217.

Parsons, R., Tassinary, L. G., Ulrich, R. S., Hebl, M. R., & Grossman-Alexander, M. (1998). THE VIEW FROM THE ROAD: IMPLICATIONS FOR STRESS RECOVERY AND IMMUNIZATION. *Journal of Environmental Psychology*, *18*(2), 113–140. https://doi.org/10.1006/jevp.1998.0086

Peck, J., Kirk, C. P., Luangrath, A. W., & Shu, S. B. (2020). Caring for the Commons: Using Psychological Ownership to Enhance Stewardship Behavior for Public Goods. *Journal of Marketing*, *85*(2), 33–49. https://doi.org/10.1177/0022242920952084

Pedersen, E., Weisner, S. E. B., & Johansson, M. (2019). Wetland areas' direct contributions to residents' well-being entitle them to high cultural ecosystem values. *Science of The Total Environment*, *646*, 1315–1326. https://doi.org/10.1016/j.scitotenv.2018.07.236

Peschardt, K. K., Schipperijn, J., & Stigsdotter, U. K. (2012). Use of Small Public Urban Green Spaces (SPUGS). *Urban Forestry & Urban Greening*, *11*(3), 235–244. https://doi.org/10.1016/j.ufug.2012.04.002

Petruzzello, S. J., Landers, D. M., Hatfield, B. D., Kubitz, K. A., & Salazar, W. (1991). A meta-analysis on the anxiety-reducing effects of acute and chronic exercise. *Sports Medicine*, *11*(3), 143–182.

Pierce, J. L., Kostova, T., & Dirks, K. T. (2003). The state of psychological ownership: Integrating and extending a century of research. *Review of General Psychology*, *7*(1), 84–107.

Plieninger, T., Ferranto, S., Huntsinger, L., Kelly, M., & Getz, C. (2012). Appreciation, Use, and Management of Biodiversity and Ecosystem Services in California's Working Landscapes. *Environmental Management*, *50*(3), 427–440. https://doi.org/10.1007/s00267-012-9900-z

Ponto, J. (2015). Understanding and Evaluating Survey Research. *Journal of the Advanced Practitioner in Oncology*, *6*(2), 168–171. PubMed.

Pokorný, J., Květ, J., Rejšková, A. & Brom, J. (2010). Wetlands as energy-dissipating systems. J. Ind. Microbiol. Biotechol., 37 (12), 1299 – 130

Pretty, J., Peacock, J., Hine, R., Sellens, M., South, N., & Griffin, M. (2007). Green exercise in the UK countryside: Effects on health and psychological well-being, and implications for policy and planning. *Journal of Environmental Planning and Management*, *50*(2), 211–231. https://doi.org/10.1080/09640560601156466

Qiu, D., Liu, J., Zhu, L., Mo, L., & Zhang, Z. (2015). Particulate matter assessment of a wetland in Beijing. *Journal of Environmental Sciences*, *36*, 93–101.

Redford, K. H., & Adams, W. M. (2009). *Payment for ecosystem services and the challenge of saving nature*.

Ramsar Convention, (1971). Convention on Wetlands of International Importance especially as Waterfowl Habitat. Ramsar (Iran), 2 February 1971. UN Treaty Series No. 14583. As

amended by the Paris Protocol, 3 December 1982, and Regina Amendments, 28 May 1987.https://www.ramsar.org/about/the-convention-on-wetlands-and-its-mission Accessed 01 April 2021

Redhead, J. W., May, L., Oliver, T. H., Hamel, P., Sharp, R., & Bullock, J. M. (2018). National scale evaluation of the InVEST nutrient retention model in the United Kingdom. *Science of The Total Environment*, *610–611*, 666–677. https://doi.org/10.1016/j.scitotenv.2017.08.092

Renwick, A., Jansson, T., Verburg, P. H., Revoredo-Giha, C., Britz, W., Gocht, A., & McCracken, D. (2013). Policy reform and agricultural land abandonment in the EU. *Land Use Policy*, *30*(1), 446–457.

Richardson, E. A., & Mitchell, R. (2010). Gender differences in relationships between urban green space and health in the United Kingdom. *Social Science & Medicine*, *71*(3), 568–575.

Rosen, R. (2013, July 31). Wetlands—Texas Aquatic Science—Rudolph Rosen. *Texas Aquatic Science*. https://texasaquaticscience.org/wetlands-aquatic-science-texas/

Rosenberg, D. K., Noon, B. R., & Meslow, E. C. (1997). Biological corridors: Form, function, and efficacy. *BioScience*, *47*(10), 677–687.

Rowe, R. D., d'Arge, R. C., & Brookshire, D. S. (1980). An experiment on the economic value of visibility. *Journal of Environmental Economics and Management*, *7*(1), 1–19.

Ryan, R., Kaplan, R., & Grese, R. (2001). Predicting Volunteer Commitment in Environmental Stewardship Programs. *Journal of Environmental Planning and Management*, *44*, 629–648. https://doi.org/10.1080/09640560120079948

Sæbø, A., Popek, R., Nawrot, B., Hanslin, H. M., Gawronska, H., & Gawronski, S. (2012). Plant species differences in particulate matter accumulation on leaf surfaces. *Science of the Total Environment*, *427*, 347–354.

Sawe, N. (2017). Using neuroeconomics to understand environmental valuation. *Ecological Economics*, *135*, 1–9.

Schneider, P. (n.d.). *1.4. Technická dokumentace Heřmanický potok: Dokumentace pro stavební povolení* [Technical documentation]. ČKAIT.

Scholte, S. S. K., Todorova, M., van Teeffelen, A. J. A., & Verburg, P. H. (2016). Public Support for Wetland Restoration: What is the Link With Ecosystem Service Values? *Wetlands*, *36*(3), 467–481. https://doi.org/10.1007/s13157-016-0755-6

Schröter, M., Van der Zanden, E. H., van Oudenhoven, A. P., Remme, R. P., Serna-Chavez, H. M., De Groot, R. S., & Opdam, P. (2014). Ecosystem services as a contested concept: A synthesis of critique and counter-arguments. *Conservation Letters*, *7*(6), 514–523.

Schulze, E.-D., & Mooney, H. A. (1994). *Biodiversity and Ecosystem Function*. https://doi.org/10.1007/978-3-642-58001-7

Schulze, W. D., d'Arge, R. C., & Brookshire, D. S. (1981). Valuing environmental commodities: Some recent experiments. *Land Economics*, *57*(2), 151–172.

Seale, C., Gobo, G., Gubrium, J. F., & Silverman, D. (2003). *Qualitative research practice*. Sage.

Seresinhe, C. I., Preis, T., MacKerron, G., & Moat, H. S. (2019). Happiness is Greater in More Scenic Locations. *Scientific Reports*, *9*(1), 4498. https://doi.org/10.1038/s41598-019-40854-6

Shao, S., Tian, Z., & Fan, M. (2018). Do the rich have stronger willingness to pay for environmental protection? New evidence from a survey in China. *World Development*, *105*, 83–94.

Sharp, R., Tallis, H. T., Ricketts, T., Guerry, A. D., Wood, S. A., Chaplin-Kramer, R., … Sharp, R. (2017). InVEST User Guide. The Natural Capital Project, Stanford University, University of Minnesota, The Nature Conservancy, and World Wildlife Fund. Retrieved from http://data.naturalcapitalproject.org/nightly-build/invest-users-guide/html/#

Shen, L. Q., Amatulli, G., Sethi, T., Raymond, P., & Domisch, S. (2020). Estimating nitrogen and phosphorus concentrations in streams and rivers, within a machine learning framework. *Scientific Data*, *7*(1), 161. https://doi.org/10.1038/s41597-020-0478-7

Shinew, K. J., Glover, T. D., & Parry, D. C. (2004). Leisure spaces as potential sites for interracial interaction: Community gardens in urban areas. *Journal of Leisure Research*, *36*(3), 336–355.

Shorten, A., & Smith, J. (2017). *Mixed methods research: Expanding the evidence base*.

Silva, J. P., & Europäische Kommission (Eds.). (2007). *LIFE and Europe's wetlands: Restoring a vital ecosystem*. Off. for Official Publ. of the Europ. Communities.

SER (2004). The SER Primer on Ecological Restoration, Version 2. Society for Ecological Restoration Science and Policy Working Group

Sojda, R. S., & Solberg, K. L. (1993). *13.4. 13. Management and Control of Cattails*.

Špaček, J., Šťastný, J., Vonička, P., & Pudil, M. (2016). *Zoologický průzkum „FALKENBURSKÝCH MOKŘADŮ" V JABLONNÉM V PODJEŠTĚDÍ* [Zoological survey].

Stake, R. E. (1995). *The art of case study research*. sage.

Stauber, J. L., Chariton, A., & Apte, S. (2016). Chapter 10—Global Change. In J. Blasco, P. M. Chapman, O. Campana, & M. Hampel (Eds.), *Marine Ecotoxicology* (pp. 273–313). Academic Press. https://doi.org/10.1016/B978-0-12-803371-5.00010-2

Stern, P. C. (2000). New environmental theories: Toward a coherent theory of environmentally significant behavior. *Journal of Social Issues*, *56*(3), 407–424.

Suding, K. N., Gross, K. L., & Houseman, G. R. (2004). Alternative states and positive feedbacks in restoration ecology. *Trends in Ecology & Evolution*, *19*(1), 46–53.

Süssenbach, S., & Kamleitner, B. (2018). Psychological ownership as a facilitator of sustainable behaviors. In *Psychological ownership and consumer behavior* (pp. 211–225). Springer.

Swain, J. M., & Spire, Z. D. (2020). The Role of Informal Conversations in Generating Data, and the Ethical and Methodological Issues. *Forum Qualitative Sozialforschung / Forum: Qualitative Social Research*, *Vol 21*, No 1 (2020): Qualitative Content Analysis II. https://doi.org/10.17169/FQS-21.1.3344

Syrbe, R.-U., & Grunewald, K. (2017). Ecosystem service supply and demand – the challenge to balance spatial mismatches. *International Journal of Biodiversity Science, Ecosystem Services & Management*, *13*(2), 148–161. https://doi.org/10.1080/21513732.2017.1407362

TEEB (2010), The Economics of Ecosystems and Biodiversity Ecological and Economic Foundations. Edited by Pushpam Kumar. Earthscan: London and Washington.

Tellis, W. M. (1997). Introduction to Case Study. The Qualitative Report, 3(2), 1-14. https://doi.org/10.46743/2160-3715/1997.2024

Thiere, G. (2009). *Biodiversity and ecosystem functioning in created agricultural wetlands*.

Tomašević, M., Vukmirović, Z., Rajšić, S., Tasić, M., & Stevanović, B. (2005). Characterization of trace metal particles deposited on some deciduous tree leaves in an urban area. *Chemosphere*, *61*(6), 753–760.

Triska, F. J., Kennedy, V. C., Avanzino, R. J., Zellweger, G. W., & Bencala, K. E. (1989). Retention and transport of nutrients in a third-order stream in northwestern California: Hyporheic processes. *Ecology*, *70*(6), 1893–1905.

Ulrich, R. (1984). View through a window may influence recovery from surgery. *Science*, *224*(4647), 420–421. https://doi.org/10.1126/science.6143402

van der Zanden, E. H., Verburg, P. H., Schulp, C. J. E., & Verkerk, P. J. (2017). Trade-offs of European agricultural abandonment. *Land Use Policy*, *62*, 290–301. https://doi.org/10.1016/j.landusepol.2017.01.003

Verhoeven, J. T. A., & Setter, T. L. (2010). Agricultural use of wetlands: Opportunities and limitations. *Annals of Botany*, *105*(1), 155–163. PubMed. https://doi.org/10.1093/aob/mcp172

Višňák, R. (2008). *Botanický průzkum pozemků SPP v Jablonném v Podještědí.* [Botanical Survey].

Višňák, R. (2015). *Botanický průzkum „FALKENBURSKÝCH MOKŘADŮ" V JABLONNÉM V PODJEŠTĚDÍ*.

Vlada. (2021, March 23). *Measures adopted by the Czech Government against the coronavirus | Government of the Czech Republic*. Government of the Czech Republic. https://www.vlada.cz/en/media-centrum/aktualne/measures-adopted-by-the-czech-government-against-coronavirus-180545/

Vojar J. 2007: Ochrana obojživelníků: ohrožení, biologické principy, metody studia, legislativní a praktická ochrana. Doplněk k metodice č. 1 Českého svazu ochránců přírody. ZO ČSOP Hasina Louny

von Holle, B., Yelenik, S., & Gornish, E. S. (2020). Restoration at the landscape scale as a means of mitigation and adaptation to climate change. *Current Landscape Ecology Reports*, *5*(3), 85–97. https://doi.org/10.1007/s40823-020-00056-7

Vonička, P., & Pudil, M. (2008). *Mokřady pod zámkem Nový Falkenburk v Jablonném v Podještědí. Zoologický průzkum.*

Ward, J. V., & Stanford, J. (1995). Ecological connectivity in alluvial river ecosystems and its disruption by flow regulation. *Regulated Rivers: Research & Management*, *11*(1), 105–119.

Were, D., Kansiime, F., Fetahi, T., Cooper, A., & Jjuuko, C. (2019). Carbon Sequestration by Wetlands: A Critical Review of Enhancement Measures for Climate Change Mitigation. *Earth Systems and Environment*, *3*(2), 327–340. https://doi.org/10.1007/s41748-019-00094-0

Wilson, E. O. (2007). Biophilia and the conservation ethic. *Evolutionary Perspectives on Environmental Problems*, 249–257.

Withers, P. J., Neal, C., Jarvie, H. P., & Doody, D. G. (2014). Agriculture and eutrophication: Where do we go from here? *Sustainability*, *6*(9), 5853–5875.

Wolf, K. L., Noe, G. B., & Ahn, C. (2013). Hydrologic connectivity to streams increases nitrogen and phosphorus inputs and cycling in soils of created and natural floodplain wetlands. *Journal of Environmental Quality*, *42*(4), 1245–1255.

WorldClim. (n.d.). Retrieved 19 April 2021, from https://www.worldclim.org/

Wortley, L., Hero, J.-M., & Howes, M. (2013). Evaluating Ecological Restoration Success: A Review of the Literature. *Restoration Ecology*, *21*(5), 537–543. https://doi.org/10.1111/rec.12028

Xie, J., Luo, S., Furuya, K., & Sun, D. (2020). Urban parks as green buffers during the COVID-19 pandemic. *Sustainability*, *12*(17), 6751.

Yachi, S., & Loreau, M. (1999). Biodiversity and ecosystem productivity in a fluctuating environment: The insurance hypothesis. *Proceedings of the National Academy of Sciences*, *96*(4), 1463–1468.

Yang, S., Kwak, S. G., Ko, E. J., & Chang, M. C. (2020). The Mental Health Burden of the COVID-19 Pandemic on Physical Therapists. *International Journal of Environmental Research and Public Health*, *17*(10). https://doi.org/10.3390/ijerph17103723

Yin, R.K., (1984). Case Study Research: Design and Methods. Beverly Hills, Calif: Sage Publications

Zainal, Z. (2007). Case study as a research method. *Jurnal Kemanusiaan*, *5*(1).

Zedler, J. B. (2003). Wetlands at Your Service: Reducing Impacts of Agriculture at the Watershed Scale. *Frontiers in Ecology and the Environment*, *1*(2), 65–72. JSTOR. https://doi.org/10.2307/3868032

Zedler, J. B. (2004). Compensating for wetland losses in the United States. *Ibis*, *146*, 92–100.

Zelezny, L. C., Chua, P., & Aldrich, C. (2000). New ways of thinking about environmentalism: Elaborating on gender differences in environmentalism. *Journal of Social Issues*, *56*(3), 443–457.

Zhang, Y., Zhang, H., Ma, X., & Di, Q. (2020). Mental Health Problems during the COVID-19 Pandemics and the Mitigation Effects of Exercise: A Longitudinal Study of College Students in China. *International Journal of Environmental Research and Public Health*, *17*(10). https://doi.org/10.3390/ijerph17103722

Zhu, X., Jiang, M., Yuan, Y., & Verhoeven, J. (2019). *Case Studies of Ecological Restoration and Conservation Strategies for Marshes and Peatlands* (pp. 219–254). https://doi.org/10.1007/978-3-030-14861-4_9

9 Appendices

Appendix A: The List of Actors and Their Respective Roles in the Restoration

Actors	Role in the restoration
Čmelák – Společnost přátel přírody - An environmental non-profit that also works as a land trust managing around 60 hectares of land among which are forests, meadows, wetlands, streams and more. It has around 600 members and its activities focus on environmental management, restoration, seed collection, and ecological education.	Owner of the land and primary actor and coordinator in the restoration and management of the site.
Town of Jablonné v Podještědí - The municipality where the wetlands are located	Its approval was necessary for the restoration to take place. It also supports the management of the site by annual financial donation, as well as by providing services, such as waste management. And it helped with the promotion of the community planning meetings and the restoration in general.
Regional, National, and European fonds and foundations - The region of Liberec, Czech Ministry of Environment, Czech Ministry of Agriculture, State Environmental Fund, European Fund for Regional Cooperation, Ziel 3, EEA grants, Swiss-Czech Cooperation Fund, Nadace Partnerství, Nadace VIA, Nadace OKD,	Put together these organizations covered about 76% of the restoration costs.
Corporate Donors - Wikow Industries, Nestle, ČSOB	The funding provided by these organizations covered in total about 7% of the restoration costs.
Individual Donors - Mostly members of Čmelák paying a regular contribution, however there also one-time donors	Overall, these donors covered about 5% of the restoration costs. However, there are fundamental for long-term financing of the NGO's activities.
Local Donors Companies and individual from Jablonné v	Material support, such as financial donations, catering, and assistance with playground construction.

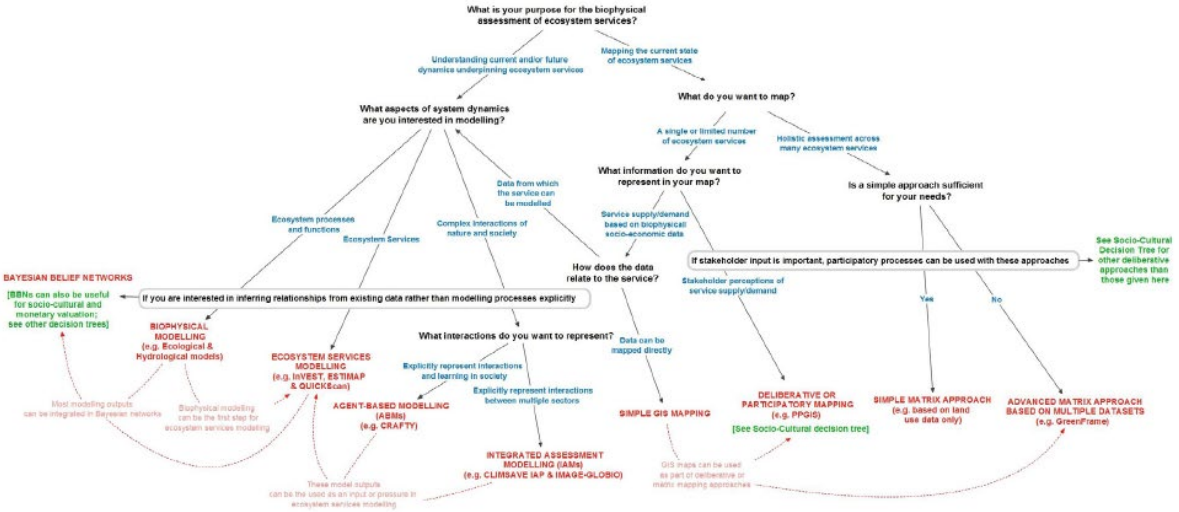
Podještědí	
AOPK - Nature Conservation Agency of the Czech Republic.	AOPK guidelines had to be followed during the restoration.
Volunteers - Members of the Čmelák NGO, but members of general public who offer their help to help improve the environment. Čmelák organizes annual events for Volunteers.	Enlisting the help of volunteers helps to drive down the restoration and management costs, as well as to build a community that actively protects the environment.
Orphanage Chateau Nový Falkenburk - Former estate to which the land of today's wetlands belonged located at the northern edge of the site. Today it operates as an Orphanage.	The children helped clean up the site. Also, the orphanage provided premisses for community planning.
Consultants - CHKO Lužické hory	CHKO Lužické hory is protected landscape area where the wetlands are also located and its staff gave professional advice to the NGO.
Contractors - Epicentrum, Fontes, Nature Systems, AquaKlimax, RNDr. Richard Višňák, North Bohemian Muzeum in Liberec, Technical University in Liberec, Society for Butterfly Conservation (SOM), Tomovy parky, local farmers, Planta Naturalis	biomass deposition, technical work, excavations, cutting clearing, graphics, architectural designs, seedlings, construction materials

Appendix B: The Pond Design

The preliminary pond design based on three paramters as described in text (ecology; aesthetics; terrain)

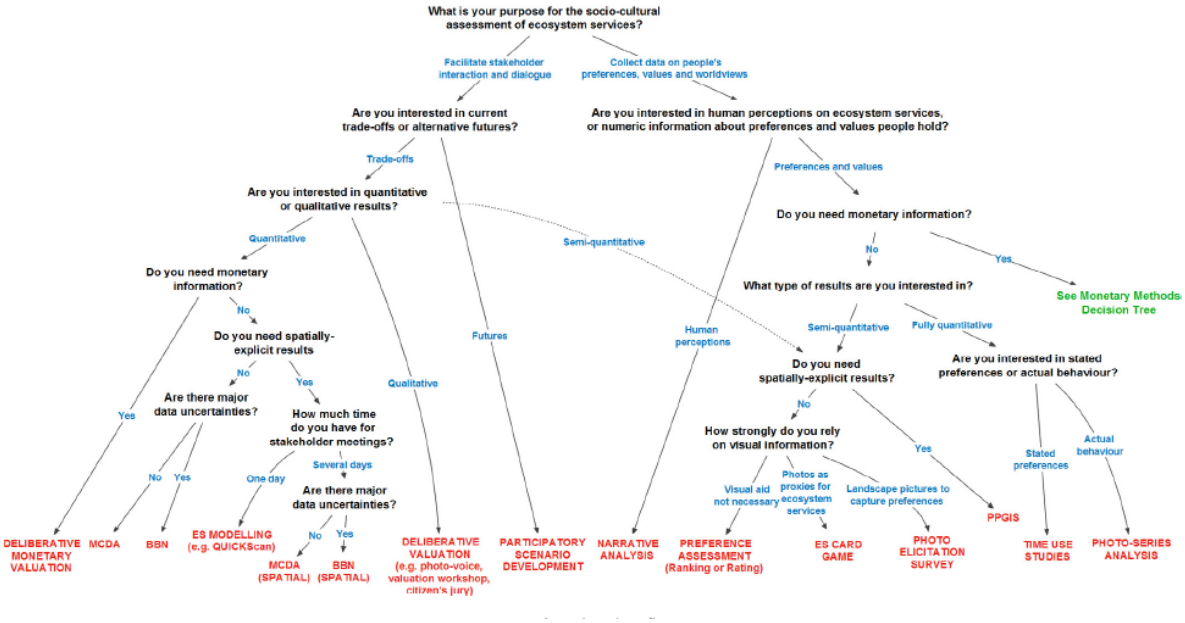
Appendix C: The Decision Trees

Biophysical methods decision tree:



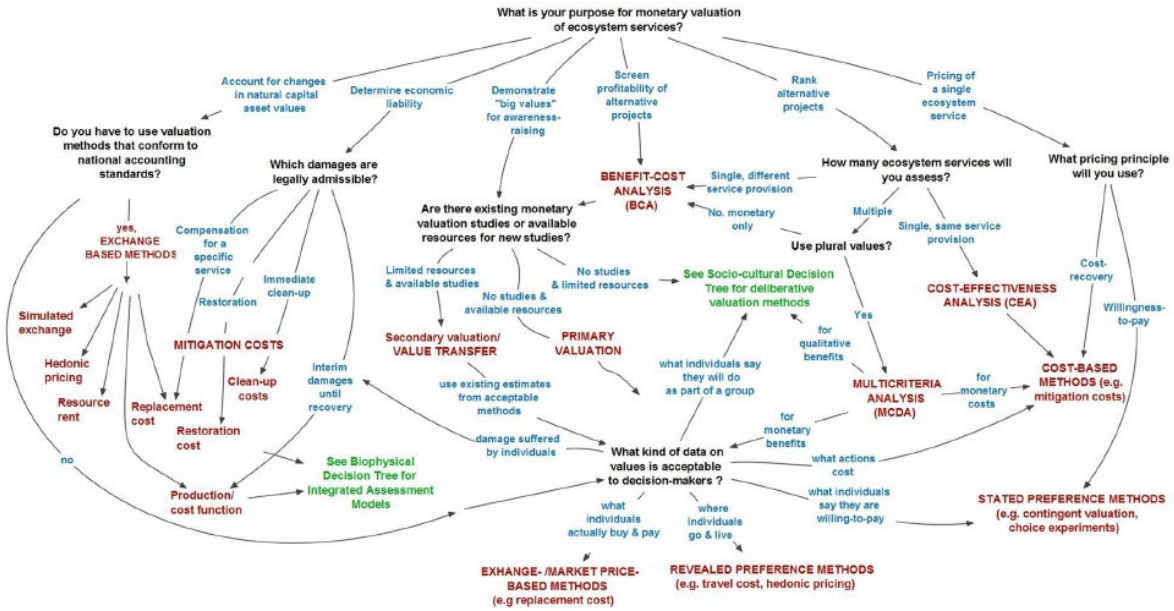
Reprinted with permission from Harrison et al. (2018)

Socio-cultural methods decision tree:



Reprinted with permission from Harrison et al. (2018)

Monetary methods decision tree:



Reprinted with permission from Harrison et al. (2018)

Appendix D: Questionnaire

Social and Ecological Contributions of the restored wetlands in Jablonném v Podještědí

Dear respondents, I am addressing you with a request to fill in this questionnaire, which will serve as a basis for my master thesis. The questionnaire is composed of 18 short questions that will take maximum 5 minutes to complete. The aim of this questionnaire is to find out how the public in Jablonné v Podještědí perceives the services that the wetlands provide and how they value these services. Participation in this research is anonymous and voluntary. Thank you in advance for your time. Please send any questions you might have to ja3165ma-s@student.lu.se
* Required

The first stage of wetland restoration was completed in 2013. Where stood a place used for illegal dumping is now a thriving ecosystem.

1. On a scale from 0 to 4, how satisfied are you with the restoration of wetlands? *
Mark only one oval.

	0	1	2	3	4	
Not at all	○	○	○	○	○	Very

2. Do you think that public involvement in the project was sufficient? *
Mark only one

- ○ Yes
- ○ No
- ○ Not sure

3. On a scale from 0 to 4, how much do the wetlands contribute to your well-being? *
Mark only one oval.

	0	1	2	3	4	
Not at all	○	○	○	○	○	Very

4. Please specify how the wetlands contribute to your well-being. *

5. How are the wetlands suitable for the following activities? *
Check all that apply.

	Physical activity	Interaction with nature	Spending time alone	Spending time with family and friends
Not at all	☐	☐	☐	☐
Negligibly	☐	☐	☐	☐
Moderately	☐	☐	☐	☐
Significatly	☐	☐	☐	☐
Very	☐	☐	☐	☐

6. Wetlands in general provide society with a range of useful services. From the following services, check the ones that are most important to you. *

Check all that apply.

- ☐ Temperature regulation
- ☐ Provision of habitats
- ☐ Water retention
- ☐ Water purification
- ☐ Ecological education
- ☐ Aesthetics
- ☐ Carbon sequestration
- ☐ Recreation
- ☐ Flood regulation
- ☐ Production of food, fiber, and genetic material
- ☐ Air purification
- ☐ Other:

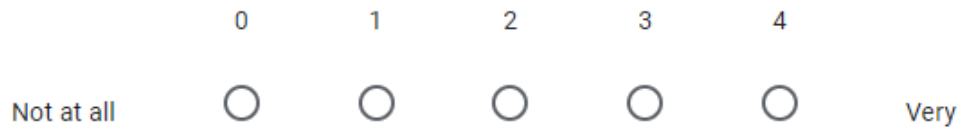
7. Imagine that the wetlands in Jablonné v Podještědí should return to their pre-restoration state. How much would you be willing to contribute to their preservation? *
Mark only one oval.

- ○ 0% of the monthly salary
- ○ at most 1% of the monthly salary
- ○ at most 5% of the monthly salary
- ○ at most 10% of the monthly salary
- ○ at most 20% of the monthly salary
- ○ more than 20% of the monthly salary

8. How much would you be willing to contribute to the expansion of wetlands? *
Mark only one oval.

- ○ 0% of the monthly salary
- ○ at most 1% of the monthly salary
- ○ at most 5% of the monthly salary
- ○ at most 10% of the monthly salary
- ○ at most 20% of the monthly salary
- ○ more than 20% of the monthly salary

9. On a scale of 0 to 4, how much do you agree that landscape restoration is necessary? *
Mark only one oval.



10. Did you start appreciating the presence of wetlands more during the COVID-19pandemic? *
Mark only one.

- ○ Yes
- ○ No

- Not sure

11. How often do you visit wetlands? *
Mark only one.

- at most once a day
- at most once a week
- at most once a month
- at most once a year
- less than once a year

12. How long does it usually take you to travel from home to the wetlands? *
Mark only one.

- at most 5 minutes
- at most 15 minutes
- at most 30 minutes
- at most 60 minutes
- more than 60 minutes

13. What is your age? *
Mark only one.

- less than 26
- less than 36
- less than 50
- more than 50

14. What is your highest level of education? *
Mark only one.

- elementary education
- secondary education
- tertiary education
- Other:

15. What is your occupation? *
Mark only one oval.

- student
- employed
- self-employed
- unemployed

Appendix E: Comparison of Demographics of the Sample and the Population

Table 5 Data retrieved via questionnaire and from Jablonné v Podještědí (2018)

	Sample n	**Sample %**	**Population n**	**Population %**
Distribution of men	22	42%	1800	50%
Distribution of women	31	58%	1810	50%
Average age	49[13]	N/A	41,1	N/A
Primary education	0	0%	749[14]	25%
Secondary (without final exam)	10	18%	1263	43%
Secondary education (with final exam)	22	42%	754	26%
Post-secondary education	2	4%	23	1%
University education	19	36%	163	5%
Student	1	2%	585	17%
Employed and self-employed	45[15]	85%	1723	51%
Unemployed	1	2%	197	6%
Pensioner	6	11%	839	25%

[13] mean age for each category, multiplied by distribution and divided by total number of respondents
[14] primary and no education
[15] Employed 39, self-employed 6

Appendix F: Biophysical Table

Description	Load_p	Source	Eff_p	Source	Load_n	Source	Eff_n	Source
Urban	**0.83**	May, L., House, W.A., Bowes, M., McEvoy, J. (2001). Seasonal export of phosphorus from a lowland catchment: upper River Cherwell in Oxfordshire, England. The Science of the Total Environment 269: 117-130.	**0.05**	Zhang, X., Liu, X., Zhang, M., and Dahlgren, R.A. 2010. A review of vegetated buffers and a meta-analysis of their mitigation efficacy in reducing nonpoint source pollution. J. Environ. Qual. 39:76-84. Original paper's citation: Syversen, N. 2005. Effec	**6.9**	Reckhow, K.H., Beaulac, M.N, & Simpson, J.T. (1980). "Modeling phosphorus loading and lake response under uncertainty: A manual and compilation of export coefficients," U.S. EPA Report No. EPA-440/5-80-011, Office of Water Regulations, USEPA	**0.05**	Zhang, X., Liu, X., Zhang, M., and Dahlgren, R.A. 2010. A review of vegetated buffers and a meta-analysis of their mitigation efficacy in reducing nonpoint source pollution. J. Environ. Qual. 39:76-84. Original paper's citation: Syversen, N. 2005. Effec
Agriculture	**12.6**	van Dijk, K. C., Lesschen, J. P., & Oenema, O. (2016). Phosphorus flows and balances of the European Union Member States. *Science of the Total Environment*, *542*, 1078-1093.	**0.7**	van Dijk, K. C., Lesschen, J. P., & Oenema, O. (2016). Phosphorus flows and balances of the European Union Member States. *Science of the Total Environment*, *542*, 1078-1093.	**180**	Švihla, V., Černohous, V., Šach, F., & Kacálek, D. (2017). Principy řešení zátěže povrchových vod dusičnany z plošných zdrojů. *Zemědělec*, *5*(12). Retrieved from https://www.cazv.cz/wp-content/uploads/2017/02/zemed	**0.58**	Švihla, V., Černohous, V., Šach, F., & Kacálek, D. (2017). Principy řešení zátěže povrchových vod dusičnany z plošných zdrojů. *Zemědělec*, *5*(12). Retrieved from https://www.cazv.cz/wp

						elec05strana12.pdf		-content/uploads/2017/02/zemedelec05strana12.pdf
Pastures	**12.6**	van Dijk, K. C., Lesschen, J. P., & Oenema, O. (2016). Phosphorus flows and balances of the European Union Member States. *Science of the Total Environment*, *542*, 1078-1093.	**0.7**	van Dijk, K. C., Lesschen, J. P., & Oenema, O. (2016). Phosphorus flows and balances of the European Union Member States. *Science of the Total Environment*, *542*, 1078-1093.	**113**	Švihla, V., Černohous, V., Šach, F., & Kacálek, D. (2017). Principy řešení zátěže povrchových vod dusičnany z plošných zdrojů. *Zemědělec*, *5*(12). Retrieved from https://www.cazv.cz/wp-content/uploads/2017/02/zemedelec05strana12.pdf	**0.7**	Švihla, V., Černohous, V., Šach, F., & Kacálek, D. (2017). Principy řešení zátěže povrchových vod dusičnany z plošných zdrojů. *Zemědělec*, *5*(12). Retrieved from https://www.cazv.cz/wp-content/uploads/2017/02/zemedelec05strana12.pdf
Coniferous forest	**0.162**	Han, B., Reidy, A., & Li, A. (2021). Modeling nutrient release with compiled data in a typical Midwest watershed. *Ecological indicators*, *121*, 107213.	**0.7**	Han, B., Reidy, A., & Li, A. (2021). Modeling nutrient release with compiled data in a typical Midwest watershed. *Ecological indicators*, *121*, 107213.	**17.4**	Han, B., Reidy, A., & Li, A. (2021). Modeling nutrient release with compiled data in a typical Midwest watershed. *Ecological indicators*, *121*, 107213.	**0.7**	Han, B., Reidy, A., & Li, A. (2021). Modeling nutrient release with compiled data in a typical Midwest watershed. *Ecological indicators*, *121*, 107213.

Deciduous Forest	**0.162**	Han, B., Reidy, A., & Li, A. (2021). Modeling nutrient release with compiled data in a typical Midwest watershed. *Ecological indicators*, *121*, 107213.	**0.7**	Han, B., Reidy, A., & Li, A. (2021). Modeling nutrient release with compiled data in a typical Midwest watershed. *Ecological indicators*, *121*, 107213.	**17.4**	Han, B., Reidy, A., & Li, A. (2021). Modeling nutrient release with compiled data in a typical Midwest watershed. *Ecological indicators*, *121*, 107213.	**0.7**	Han, B., Reidy, A., & Li, A. (2021). Modeling nutrient release with compiled data in a typical Midwest watershed. *Ecological indicators*, *121*, 107213.
Water Courses	**0.093**	Alamanos, A., & Papaioannou, G. (2020). A GIS Multi-Criteria Analysis Tool for a Low-Cost, Preliminary Evaluation of Wetland Effectiveness for Nutrient Buffering at Watershed Scale: The Case Study of Grand River, Ontario, Canada. *Water*, *12*(11), 3134.	**0**	Alamanos, A., & Papaioannou, G. (2020). A GIS Multi-Criteria Analysis Tool for a Low-Cost, Preliminary Evaluation of Wetland Effectiveness for Nutrient Buffering at Watershed Scale: The Case Study of Grand River, Ontario, Canada. *Water*, *12*(11), 3134.	**6.6**	Alamanos, A., & Papaioannou, G. (2020). A GIS Multi-Criteria Analysis Tool for a Low-Cost, Preliminary Evaluation of Wetland Effectiveness for Nutrient Buffering at Watershed Scale: The Case Study of Grand River, Ontario, Canada. *Water*, *12*(11), 3134.	**0**	Saunders, D. L., & Kalff, J. (2001). Nitrogen retention in wetlands, lakes and rivers. *Hydrobiologia*, *44 3*(1), 205-212.
Water Bodies	**0.0292**	Rosendorf, P., Vyskoč, P., Prchalova, H., & Fiala, D. (2016). Estimated contribution of selected non-point pollution sources to the phosphorus and nitrogen loads in water bodies of the Vltava river	**0.5**	Reddy, K. R., Kadlec, R. H., Flaig, E., & Gale, P. M. (1999). Phosphorus retention in streams and wetlands: a review. *Critical reviews in environmental science and technology*, *29*(1), 83-146.	**3.9**	Rosendorf, P., Vyskoč, P., Prchalova, H., & Fiala, D. (2016). Estimated contribution of selected non-point pollution sources to the phosphorus and nitrogen loads in water bodies of	**0.34**	Saunders, D. L., & Kalff, J. (2001). Nitrogen retention in wetlands, lakes and rivers. *Hydrobiologia*, *44 3*(1), 205-212.

		basin. *Soil and Water Research*, *11*(3), 196-204..pdf				the Vltava river basin. *Soil and Water Research*, *11*(3), 196-204.		
Wetlands	**0.162**	Wolf, K. L., Noe, G. B., & Ahn, C. (2013). Hydrologic connectivity to streams increases nitrogen and phosphorus inputs and cycling in soils of created and natural floodplain wetlands. *Journal of Environmental Quality*, *42*(4), 1245-1255.	**0.46**	Land, M., Granéli, W., Grimvall, A. *et al.* (2016). How effective are created or restored freshwater wetlands for nitrogen and phosphorus removal? A systematic review. *Environ Evid* **5,** 9 (2016). https://doi.org/10.1186/s13750-016-0060-0	**17.4**	Wolf, K. L., Noe, G. B., & Ahn, C. (2013). Hydrologic connectivity to streams increases nitrogen and phosphorus inputs and cycling in soils of created and natural floodplain wetlands. *Journal of Environmental Quality*, *42*(4), 1245-1255.	**0.64**	Saunders, D. L., & Kalff, J. (2001). Nitrogen retention in wetlands, lakes and rivers. *Hydrobiologia*, *44 3*(1), 205-212.