

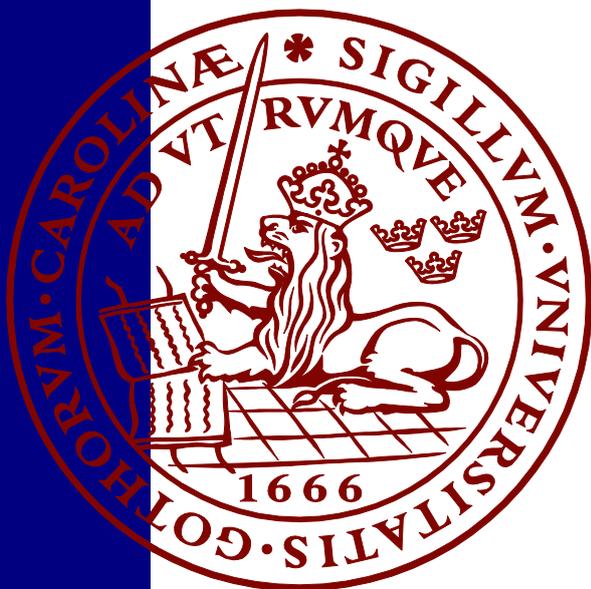
From philosophy to practice

Enhancement of future management practices via the analysis of the concept Natures Contribution to People in the Biosphere Reserve Bačko Podunavlje, Serbia

Olivera Stojilović

Master Thesis Series in Environmental Studies and Sustainability Science,
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A thesis submitted in partial fulfillment of the requirements of Lund University
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Abstract

Biosphere Reserves have been seen as ways to merge human existence with nature conservation, but they face challenges related to efficient and equitable management. This thesis explores the use of the concept of Nature's Contribution to People (NCP) for more inclusive communication and idea sharing among stakeholders in the Serbian biosphere reserve Bačko Podunavlje. NCPs and their conceptualizations were identified through an analysis of environmental documents and a survey responded by 19 key stakeholders. The generalized perspective showed a range of NCPs present in documents. When asked to rank the NCPs according to their relevance, regulating NCPs were seen as most vital. Conversely, through open-ended descriptions of a 'good quality of life', nature was mainly associated with psychological benefits. There was an agreement that the NCP concept can potentially help in guiding better management practices and resolve conflicts. To do so, stakeholders should incorporate identified NCP values and knowledge into management objectives.

Keywords: protected areas, Serbia, NCP, nature management, Backo Podunavlje , socio-cultural valuation

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To the universe, and in such thank you to everyone that has shaped, inspired, and influenced me.

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“The perennial cry to ‘Save Earth’ is odd. Planet Earth survives massive asteroid strikes—it’ll survive anything we throw at it. But life on Earth will not.” – Niel deGrasse Tyson

“The real problem of humanity is the following: we have paleolithic emotions, medieval institutions, and God-like technology” – Edward O Wilson

What is man’s is not man’s, it is simply borrowed from the universe effortlessly seeking balance. – the author

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Acronyms

ES	Ecosystem Services
NCP	Nature’s Contribution to People
BioReserve	Biosphere Reserve

1 Introduction

1.1 Protection or use?

The current anthropogenic regime of overexploitation of nature and overuse of natural resources calls for a change in human-nature interactions (Lewis & Maslin, 2015). However, win-win situations between nature and human development are challenging to achieve (McShane et al., 2011). For more than a century (1860-1980s), nature and development were placed on opposite ends of a spectrum and viewed as in a constant conflict with each other (Bodin et al., 2019; Borsdorf et al., 2014). In this paradigm humans were perceived as destructive, and therefore nature governance was aimed towards an exclusion-based approach with nature conservation at its core, allowing for Nature Parks as concepts to emerge (Borsdorf et al., 2014). However, this often entailed that local populations were 'cut off' and 'excluded' from the protected area, and such state-led conservation practices focusing on nature sanctuaries were not beneficial to society as a whole (Aubertin & Rodary, 2011). This style of nature stewardship was critiqued, which led to a shift in paradigms of nature conservation *from* people to *for* people (Borsdorf et al., 2014), emphasizing the need for balanced nature use and conservation, while producing benefits for both sides (van Cuong, Dart & Hockings, 2017). The paradigm change was further supported when protected areas were noted to not only support local market activities (such as traditional craftsmanship and ecotourism) but also support global processes through ecosystem services (carbon storage and biodiversity) (Aubertin & Rodary, 2011). This would allow populations to benefit from conservation efforts in diverse ways.

This conceptual shift and the need to mainstream conservation across different sectors was heightened and anchored at the Rio Earth Summit of 1992 (Borsdorf et al., 2014) when the UNESCO Man and Biosphere programme defined the conceptual term Biosphere Reserve. The newly formed term and management concept was identified as: "sites of excellence to explore and demonstrate approaches to conservation and sustainable development on a regional scale" (see UNESCO, 1996, p.16). Conservation was now focusing on ecosystem connectivity, importance of networks, and flows, where protected areas are laid out by society and integrated into occupied territories (Aubertin & Rodary, 2011). This holistic view on nature (Heinrup & Schultz, 2017) was able to renew the view of operating models for conservation (Aubertin & Rodary, 2011). Such a model set out to improve the relationship between people and the planet by addressing challenges of both cultural diversity, dependence on nature use, and biological conservation (Heinrup & Schultz, 2017) through integrated approaches (Aubertin & Rodary, 2011).

1.2. Key functions and zones of biosphere reserves

The Seville Strategy (UNESCO, 1996), the Madrid Action Plan (UNESCO, 2008), and the Lima Action Plan (UNESCO, 2016) described three mutually reinforcing and complementary functions that were assigned to a biosphere reserve: 1. conservation, 2. sustainable development, and 3. logistic support. Conservation refers to the protection and restoration of genetic resources, species, ecosystems, and landscapes. Sustainable development entails promoting and fostering a healthy and equitable society. Logistic support manifests in providing ecological training, education, research, and monitoring through local, national, and global projects that address issues of conservation and sustainable development (UNESCO 1996). In order to carry out the three functions the distinctive zonation concept was adopted (Hedden-Dunkhorst & Schmitt, 2020) (Fig. 1). A biosphere reserve has three zones: *core*, *buffer*, and *transition zone* (Ishwaran, Persic, & Tri, 2008), each connected to a function of the biosphere reserve. The *core zone* represents a legally protected area designated for long-term conservation of biodiversity and limits activities to education and research only (Hedden-Dunkhorst & Schmitt, 2020), and is directly linked to the conservation function. Pre-existing protected areas are often integrated as core areas of many biosphere reserves and are mutually connected through buffer zones (van Cuong, Dart & Hockings, 2017). The *buffer zone* encircles the core zone and promotes activities that are compatible with conservation and are ecologically sound and is directly linked to the logistic function. Whereas the *outermost zone*, the transition zone, is where most of human development takes place (Borsdorf et al., 2014) and such a zone leans on the sustainable development function. Aspiring to achieve regional sustainability, many countries are looking to establish biosphere reserves (Shaw et al., 2017) (hereafter BioReserves) and currently there are 714 biosphere reserves in 129 countries (UNESCO, 2019) including the BioReserve Bačko Podunavlje in Serbia.



Figure 1. Zonation system of a biosphere reserve. The image illustrates the three zonation areas as well as the functions that are allowed in each zone. Illustration by: O. Stojilovic

1.3. Conflicting views on defining management success of biosphere reserves

Merging environmental protection and human use through BioReserves is quite challenging to achieve in practice (Coetzer et al., 2014) and several gaps between theory and practice have been highlighted (Ferreira et al., 2020; Price et al., 2010; Reed & Egunyu, 2013). While some management plans were successfully implemented based on the BioReserve model's criteria (Coetzer et al., 2014; Kratzer & Ammering, 2019), related research has generally been aimed towards the design and process dimensions of BioReserve management (Reed & Egunyu, 2013), rather than a holistic view on the delivery of its functions (Ferreira et al., 2020) and quality control (Coetzer et al., 2014). As such, studies focus mostly on the analysis of the opinion of experts (scientist and managers)(Schultz et al., 2011) excluding other forms of conceptualization of success (Ferreira et al., 2020). This exclusion is of great importance since social interaction between stakeholders and institutions that govern BioReserve management oftentimes create wicked challenges because of conflicting trade-offs (Ellis et al., 2019). To fully determine the success of a BioReserve, research needs to include functioning performance as well (Reed & Egunyu, 2013) by looking into the extent of criteria fulfilment. In such a way, information on BioReserves can be gathered on a continuous timeline, from design and implementation to observing and monitoring. This is of importance since reporting and

monitoring information and data is scarce and often not-existent in BioReserves. Limiting our understanding of what factors lead to success or failures of stewardship (Ferreira et al., 2018).

To successfully move from the nature sanctuary to human-oriented conservational paradigm, methods of management must also adhere. Collaborative problem-solving and adaptive management approaches are listed as ways to address issues of current management practices in BioReserves (Baird et al., 2018; Zscheischler et al., 2019). Successful implementation and governance can be measured by diverse stakeholder participation and collaboration as well as culturally acceptable awareness raising and communication (Cuong et al., 2017; García-Amado et al., 2012). Mainly because communication, connectivity of people, as well as leadership shape group decision-making (Speelman et al., 2014). Schliep & Stoll-Kleemann (2010) also noted that weaknesses in the BioReserve concept implementation can be corrected through the enhancement of communication among stakeholders.

Another notion often interconnected with the enhancement of management practices in BioReserves, is that of ecosystem services (Birgé et al., 2016; Ruhl, 2016). The concept of ecosystem services is seen as a way to manage BioReserves since direct goods and services that come from nature are intertwined with human well-being (Kermagoret & Dupras, 2018). Ecosystem services assessments can be carried out locally and globally (Costanza et al., 2014; Goodness & Anderson, 2013) and are predominantly used for technical or informative purposes (Laurans et al., 2013). Even though scientific development is reinforcing the ecosystem services approach (Dick et al., 2014; Kermagoret & Dupras, 2018), the concept itself provokes critiques. Notably, its strong focus on economic valuation coupled with the instrumental and individualistic perspective is argued to make it incapable of capturing aspects of social values (Massenberg, 2019). With this being mentioned, there is a need to reconceptualize management practices beyond their economic value, since BioReserves are characterized by unique and context-specific interactions of conservation and society (Borsdorf et al., 2014). A research gap regarding management plans of BioReserves can be conceptualized as the lack and need for local and traditional knowledge integration (Aubertin & Rodary, 2011). Thus, there is a need for consistent and easily accessible communication between different stakeholders that integrates a variety of components into management objectives. Especially since managers need to communicate the values of a protected area not only with their local community, but also with external stakeholders (Newman et al., 2019) and vice versa.

The concept of Nature's Contribution to People (NCP) offers an inclusive way to address human-nature interactions (Ellis et al., 2019) beyond that of ecosystem services, but knowledge on application is still emerging. Ellis et al. (2019) noted that the NCP lens can help guide management

towards a more efficient and equitable governance. This is of particular importance since people should be placed at the center of BioReserve management to enhance its success (Borsdorf et al., 2014; Stoll-Kleemann and O’Riordan, 2017). Addressing conflict and miscommunication challenges requires better understanding of multiple values associated with nature (Managi et al., 2019) since they shape the structure of our policies and projects (Fischer et al., 2007; Riechers et al., 2020). Embracing these multiple values associated with nature aids in communication between different audiences for decision making (Ainscough et al., 2019; Bennett et al., 2015) and can be done through an NCP approach. All this fosters better stakeholder interaction and engagement that can lead to successful execution of management plans, in the aspects where such plans are the weakest.

1.4. Research questions and contributions

To address the mentioned research gaps the overall aim of this thesis is to lean on the conceptual framework of IPBES – Natures Contribution to People (NCP) to produce a more holistic understanding of a biosphere reserve and its management. This thesis also acknowledges the contrasting nature protection view such as ‘back to barriers’ where the best way to conserve nature is in areas completely free of human influence (see Hutton et al., 2005); however the boundaries of this research are set on those focused on BioReserve enhancement.

NCP was chosen because it can be an important lens for ecologically, culturally, and historically sensitive environments (Coetzer et al., 2014). Coetzer et al. (2014) noted that encouraging development, even if conceptualized as sustainable, in such sensitive environments can have negative consequences both ecologically and socially. This is particularly interesting for Serbia, which has noted challenges related to its BioReserve Bačko Podunavlje. The nomination form that the BioReserve submitted to UNESCO (PZZP, 2016) highlights some challenges with different stakeholder interactions. In the area there is also a strong push for development without proper implementation for monitoring and knowledge of BioReserve stability (Stojanovic & Savic, 2013). Lastly, the ‘Council of Stakeholders’, conceptualized as a transparent decision-making body that would serve as a platform for knowledge exchange between relevant stakeholders in the area, never saw implementation. This causes mismanagement issues and problems with monitoring and conservation that come to no surprise for developing countries; as development and poverty alleviation are prioritized over nature conservation (Coetzer et al., 2014). All of which make Serbia a good case study for the application of the NCP concept. Consequently, the overarching research question for this study is:

RQ: How can the concept of nature's contribution to people (NCP) be used to inspire better cooperation and management plans in the Biosphere Reserve Bačko Podnavlje?

In order to explore the research question four sub-questions were created in regard to the BioReserve Bačko Podnavlje:

SRQ1: Which potential NCPs does the BioReserve possess?

SRQ2: What reporting categories from the generalized perspective of NCPs do interest organizations of the BioReserve find most important?

SRQ3: How do interest organizations view nature and nature contributions in relation to beneficial and detrimental aspects of the good quality of life?

SRQ4: What are the management preferences and opinions of interested organizations in the BioReserve?

By answering these questions, this thesis makes key contributions to two fields. The first contribution to research and practice on conservation management is to highlight diversity of what is perceived as a NCP through a framework. Additionally, this thesis will shed light on which NCPs could be highlighted for management from perceptions of interested institutions in order to aid decision-making, solve conflicts and enhance communication.

The second contribution is to sustainability science, which is the conceptual home of this thesis. Sustainability science (SS), a field that is concerned with human-nature systems (Clark & Dickson, 2003), operates on an agenda to translate science into planning and policy processes (Jerneck et al., 2011) towards a more resilient society (Rokaya et al., 2017). Just like SS, this thesis utilizes a problem-driven research focus in hopes of translating knowledge towards societal action (Miller, 2013). In such, this thesis highlights urgencies of detrimental human-nature interactions while attempting, similarly to SS, to increase dialogues between academia and policymakers (Jerneck et al., 2011). Many scientists position the field as providing crucial knowledge for societal decision-making (Miller, 2013; Polk, 2014) through the involvement of actors outside of academia (Lang et al., 2012). By doing so the best available knowledge, preferences, and values are integrated into research to produce solution options and ownership (Lang et al., 2012). Since SS tries to bring development and environments together (Kates, 2016) with a focus on solving management problems through co-production of knowledge (Cash et al., 2006), this research is directly beneficiary to the field as it investigates how NCP can be used in management. More importantly, NCP opens up a possibility to add multiple interpretations of nature that extend the realm of environmental engagement (Lövbrand et al., 2015) towards better human-nature interactions.

This thesis is structured as follows: 2) an overview of the theoretical assumptions and pillars used for this research, 3) the background description of case study 4) the methodological sections explaining the procedures and execution of the thesis 5) a results and analysis sections followed by 6) discussion and conclusion where also limitations and recommendations will be addressed.

2 Theoretical framework

In this section, the theory and concepts that structure, support, and inform the composition of this thesis are described. First, the ontological and epistemological entry points are presented in relation to the study. Secondly, the concept of 'nature's contribution to people' with the acknowledgment of 'ecosystem services' is described, and lastly social choice theory is introduced.

2.1 Ontology and epistemology

In terms of ontology, this thesis leans on post-positivism critical realism. In such, critical realism tries to explain social events through causal mechanisms and their effects on the reality while suggesting practical recommendations to address social problems (Cruickshank, 2021; Fletcher, 2017). Consequently, critical realism acknowledges that human knowledge captures only a small portion of the whole reality, and that observations have errors and are imperfect (Fletcher, 2017; Patomäki & Wight, 2000). Thus, this thesis would in such try to structure one of the layers of reality explained by critical realism, mainly the empirical layer. This will be done by accepting the assumption of critical realism; mainly that there is a need for a pragmatic and pluralistic stance (Haigh et al., 2019) allowing for multiple observations and measures to structure reality.

Epistemologically speaking, in terms of the origin and scope of knowledge, this thesis is interested in examining knowledge created by words, expressions, and predilections used to describe contributions of BioReserve Bačko Podunavlje and those associated with values and preferences of relative stakeholders in the same context. The social and communicative sphere are thus essential, structuring the method of reasoning for this thesis to be both inductive (bottom-up) and deductive (top-down). The top-down research method of reasoning is used for departing from existing frameworks and the bottom-up lens is applicable when analyzing the meaning behind perceptions and conceptualization when highlighting new themes emerging from related issues.

2.2 The IPBES ‘nature’s contribution to people’ concept

2.2.1. Nature’s contribution to people and ecosystem services

The ecosystem services (ES) concept started with an utilitarian framing of ecological functions in order to enhance public engagement with biological conservation (Gómez-Baggethun et al., 2010). The most common definition used to describe ES is the “benefits people obtain from ecosystems and [that] are co-produced by the interaction between ecosystems and society” (Balvanera et al., 2016, p.42). Since the Millennium Ecosystem Assessment placed the concept in policy targets, the research around ES has grown (Gómez-Baggethun et al., 2010). Initially envisioned as a metaphor (Norgaard, 2010), it has become a pillar for multiple studies that seek to measure, quantify, and value aspects of nature that influence social dependence (Lele et al., 2013). Even though the production of knowledge has yielded benefits (e.g. Maes et al., 2016), the ES concept has been criticized. As briefly mentioned in the introduction, such critique has challenged some ES scholars to think in a different direction than of the commodification of nature (see section 1.2.).

Thus, the Intergovernmental Science Policy Platform on Biodiversity and Ecosystem Services (IPBES) introduced a concept first titled nature’s benefits to people (Díaz, Demissew, Carabias, et al., 2015; Díaz, Demissew, Joly, et al., 2015) and then re-named to nature’s contributions to people (hereafter NCP) which refers to “all the positive contributions, or benefits, and occasionally negative contributions, losses or detriments, that people obtain from nature” (Pascual et al., 2017, p.9). Díaz et al. (2018, p. 270) solidified the definition to be the following: “the contributions, both positive and negative, of living nature (diversity of organisms, ecosystems and their associated ecological and evolutionary processes) to people’s quality of life”. The concept of NCP builds on the ES concept, but extends beyond it, as it acknowledges the central role that culture plays in understanding links between nature and people as well as elevating, emphasizing, and operationalizing NCP understanding (Díaz et al., 2018). In such a way, it requires a broad range of stakeholder engagement. The NCP definition re-frames ES by 1. replacing ‘services’ with ‘contributions’, 2. substituting ‘well-being’ with ‘quality of life’ (Kadykalo et al., 2019), and 3. broadening the term ‘ecosystem services’ to ‘nature’ (Fig. 2).

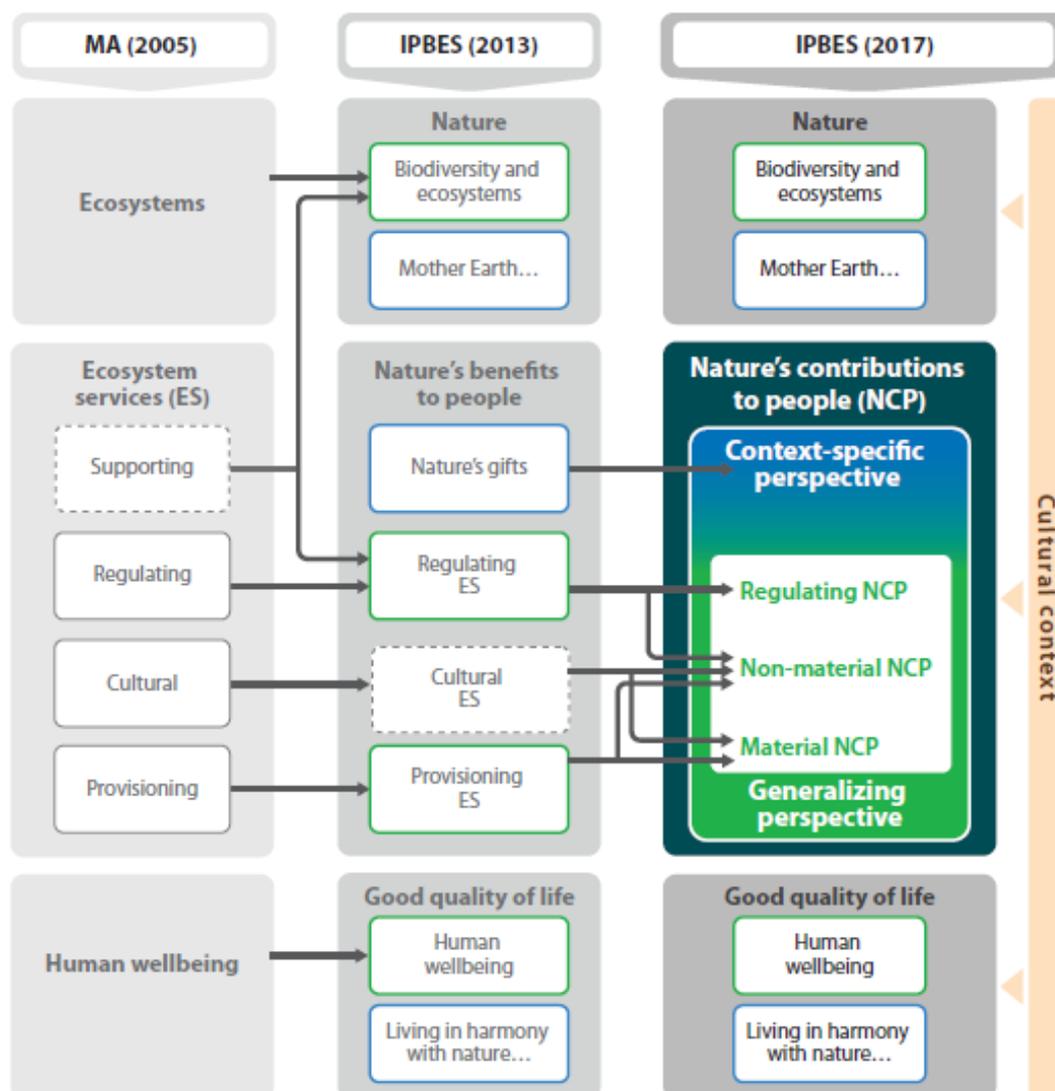


Figure 2. Evolution of nature's contributions to people (NCP, IPBS (2013) and IPBS (2017)) from the concept of ecosystem services (MA, 2005) with respect to each other. Black arrows point to concepts that have been changed and adapted to fit better with the holistic perception of nature and its components. Concepts that are in dotted-line boxes are no longer used but are integrated into others as such: supporting ecosystem services are now components of nature or regulating NCP and cultural ecosystem services are recognized as mediates in the relationship between people and all NCP. Found in Díaz et al. (2018).

In order to document and recognize that there are ranges in world views, the NCP perspective described two lenses on how to view nature's contributions: the generalized perspective and the context-specific perspective (Díaz et al., 2018). The generalized perspective, similarly, to ES, has an analytical purpose to apply universal categories to viewing NCPs and for that generates 18 reporting categories (Díaz et al., 2018). These reporting categories are organized in three groups: regulating, material, and nonmaterial (Fig. 3). The distinction between them was made based on the type of contribution they entail; however, NCP acknowledges that they in some contexts overlap and often influence one another. In short, material contributions are objects, substances and physical elements

from nature that directly maintain material assets and physical existence. Nonmaterial contributions are psychological and subjective aspects of nature that influence the quality of life from an individual or community perspective. Regulating contributions are those shaping the quality of live indirectly, such as pollination of plants or regulation of floods (Díaz et al., 2018). The cultural services in the NCP perspective are incorporated through all three groups rather than being isolated. The context-specific perspective, in contrast, conceptualized NCPs through local and indigenous knowledge that is often interconnected with the notion of nature’s gifts. Through such a lens, the understanding of NCPs doesn’t seek validation beyond the region of its conceptualization (Díaz et al., 2018). The presence of two perspectives shows that both are needed to produce a holistic understanding of nature-human interactions.

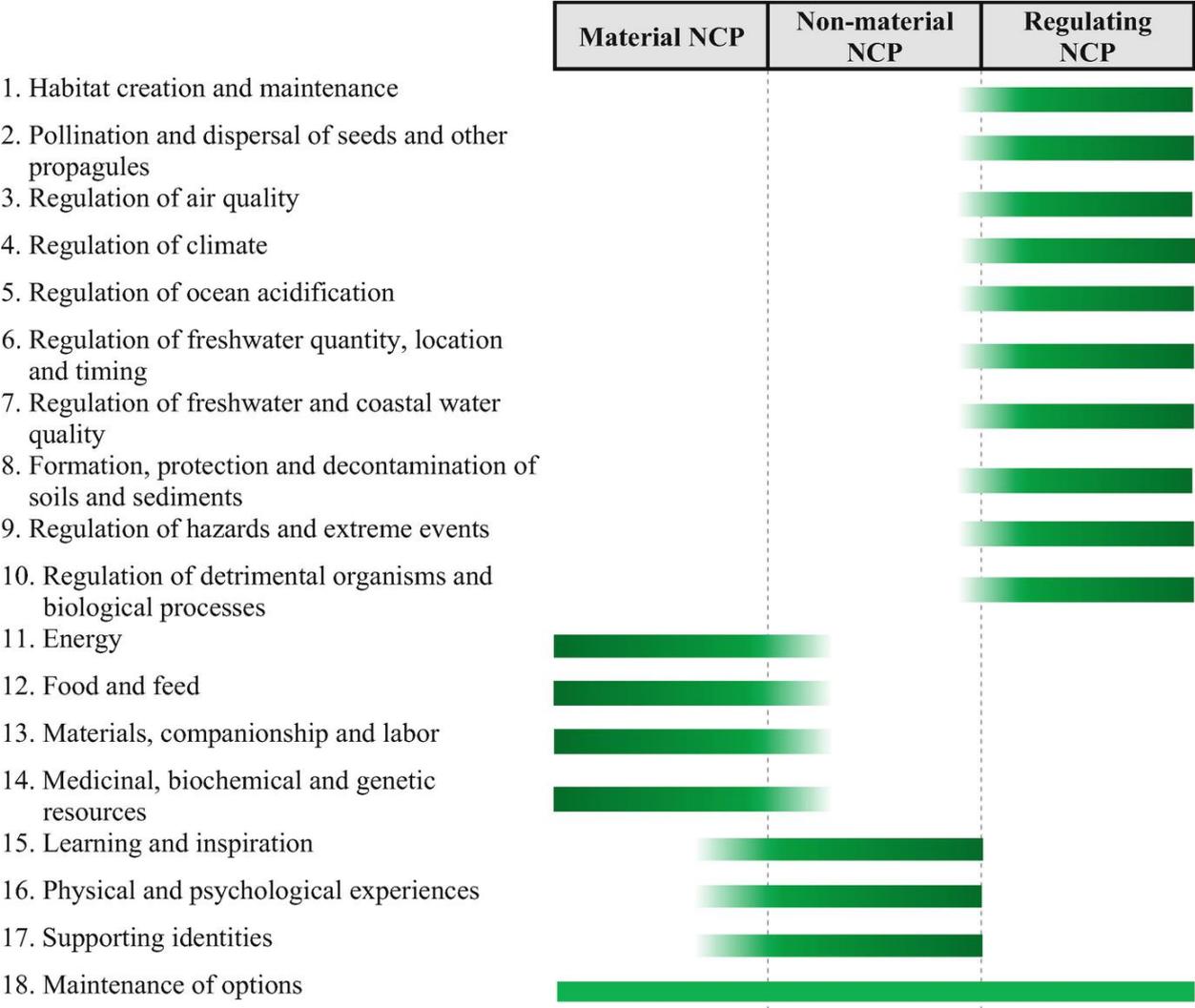


Figure 3. List of the 18 NCP reporting categories used in IPBES generalized perspective. NCPs are grouped in three broad categories (regulation, material, and non-material). NCP are linked across groups to some extent, indication the degree of their connectedness across other NCPs. Found in Díaz et al. (2018).

Even though NCP seems like a new paradigm completely, it is not entirely true. Six themes thought to be fully unique to NCPs - culture, social sciences and humanities inclusion, indigenous and local knowledge, negative contributions of nature, generalizing perspective, non-instrumental values, and valuation - are represented in ES literature (Kadykalo et al., 2019). A small portion of studies was found assessing the role of culture across and through ES categories/classifications as well as engaging local and traditional knowledge to identify benefits from pests (Kadykalo et al., 2019) or those of sacred swamps (Hegde et al., 2018). ES literature was found to value recreational services across unique cultural dimensions (Hynes et al., 2018), weigh ES differently based on land-use preferences of various groups of people (Schmidt et al., 2017), define ecosystem disservices, and incorporate humanities and social sciences through participatory mapping and transdisciplinary approaches (Kadykalo et al., 2019). Arguing that ES science, practice, and policy progressed beyond basic ecological and economic rationales (Seppelt et al., 2011; Maes et al., 2018). Even with these similarities, NCP perspective does bring some unique characteristics to the nature-human interaction paradigm.

2.2.2. Uniqueness of 'nature's contribution to people' concept

Even with the critique of NCP, five conceptual claims were attributed to be unique, and these include: diverse worldview, fuzzy and fluid reporting categories and groups, relational values, context-specific perspective, and inclusive language and framing (Kadykalo et al., 2019). These unique claims may provide a more comprehensive perspective on human-nature interaction (Bruley et al., 2021; Kadykalo et al., 2019) as fluid classification across NCP categories and inclusive language can act as a communication 'boundary object' for easier co-production of knowledge (Kadykalo et al., 2019). The importance of highlighting diverse worldviews comes from the dominance of western science, that isolates its objects of study from the contextual setting that they are found in and thus separating the knowledge from its local conditions and nature (Mazzocchi, 2006). These understandings and worldviews, as mentioned before, don't seek validation beyond the region of their conceptualization (Díaz et al., 2018) they simply extend our understanding of nature (Kohler et al., 2019; Schneider & Popovici, 2019). The context-specific perspective further highlights the importance of nature framing across different communities and places around the world (Peterson et al., 2018), showing how unique and cultural worldviews may hold their own meaning and importance of the ecological environment that are not necessarily universal (Kadykalo et al., 2019). NCP is capable of accommodating values beyond intrinsic and instrumental, mainly relation values defined as "values relative to the meaningfulness of relationships, including the relationships between individuals or societies and other animals and aspects of the lifeworld, as well as those among

individuals and articulated by formal and informal institutions” (Pascual et al., 2017, p. 15). This capacity of NCP to extend towards value pluralism and their valuation is essential for recognizing and respecting diversity of values for equitable and effective value bridging and social learning; emphasizing that NCP values are also fluid and don’t necessarily fit only into one category (e.g., only instrumental) (Pascual et al., 2017). Lastly, maintenance of options type of NCP, referred to as “the capacity of ecosystems to keep options open in order to support a good quality of life” (Díaz et al., 2018, supplementary Table 1), was also highlighted as a uniqueness of the concept. Since this NCP category investigates current and future benefits and/or threats that can contribute to the good quality of life, it can allow people to better navigate the future. Through this navigation the NCP category can provide a better fit for planning processes since it easily connects research to other fields such as resilience, vulnerability, and transformation (Peterson et al., 2018). To fully understand this, importance lies in the definition of good quality of life as “the achievement of a fulfilled human life, the criteria for which may vary greatly across different societies and groups within societies” (Pascual et al., 2017; p.14). Here again the importance of variation in perceptions and experiences is highlighted. Exactly this uniqueness has sparked the interest of this research to utilize NCP in a protected area.

2.3. Social choice theory

When dealing with group decision making one can lean on the social choice theory (Srdjevic, 2007) for a form of valuation. Social choice or social choice theory is viewed as a theoretical framework for the analysis of individuals opinions, preferences, needs, and interests to reach a collective decision for social welfare (Austen-Smith & Banks, 1998). The theory studies collective decision procedures and processes for the sake of aggregation of individuals’ inputs into a collective output. Thus, the social choice is intuitive when given an alternative based preference list producing the ‘winner(s)’ of the set (Taylor & Pacelli, 2008, p.6). Most predominant is the application of social choice theory with voting systems that are preferable in group-decision making when the information presented is largely qualitative and minimal (Srdjevic, 2007). Voting systems have been proven to be efficient tools for choice making among alternative decisions and such systems have been used in forest management practices (Kangas et al., 2006) and in natural resource management (Laukkanen et al., 2002). Voting methods thus serve as support when looking for the best decision under conflicting preferences of interested groups to better define objectives and priorities that need to be included in decision making (Srdjevic, 2007).

3 Empirical background

3.1. Previous research related to the study area

From a national Serbian perspective, research on ecosystem services or nature's contribution to people is limited, such that NCP literature is absent from Serbian research, while ES is present. One study conducted forest management assessments through an ES lens (Marta et al., 2020). Another examined the presence of water-related payments for ES in the forest sector (Vuletić et al., 2020) or even how pollutants can affect different ES (Kašanin-Grubin et al., 2019). Other studies looked at using InVEST SDR model to examine land use change (Perović et al., 2018) or even simply assessing what ES are provided from Jackals in human-dominated environments (Ćirović et al., 2016). Most studies just mention ES as important components of ecosystems and functions to human well-being (Ćirić et al., 2017; Gajić et al., 2020; Janković et al., 2017; Kicošev et al., 2015; Lukić et al., 2019; Pudar et al., 2020; Trifunov et al., 2013; Vasiljević et al., 2018) but extend little on it. One study hints at NCP conceptualization by proposing ES-sensitive perception on urban green lands (Vranic et al. 2016), however only one study refers to NCP as a framework but does not use it (Srdjevic et al., 2019), all in all highlighting the research gap that can be filled by utilizing NCP.

Research related to the BioReserves in Serbia and its corresponding protected area can fit into two themes. The first theme is that of research focusing on natural sciences such as leaf morphology (Miljkovic & Cortan, 2020), genetic diversity of forests (Čortan & Tubić, 2017), bird life cycle (Tucakov et al., 2006), and bioclimate characteristics (Basarin et al., 2014). Where the second theme is structures around tourism and development (e.g. Stojanović et al., 2003, Stojanović et al., 2014, Stojanović et al., 2018). There are papers outside of these themes such that focus on management of wastewater (Grabic et al., 2020) and land management (Banjac et al., 2019), however they are few. This research setting further supports the need for new knowledge synthesis related to protected areas in Serbia.

3.2. Case study description - Bačko Podunavlje biosphere reserve

Bačko Podunavlje BioReserve stretches along the left bank of the Danube River in north-western Serbia covering an area of 176,635 ha (Grabic et al., 2020) (Fig. 4). Bačko Podunavlje BioReserve was included in the World List of Biosphere Reserves on June 6, 2017 by The International Coordination Council of the UNESCO Man and Biosphere program (Obradović et al., 2020). The territory of the BioReserve borders with Hungary in the north and Croatia in the west and south. The Bačko Podunavlje BioReserve also borders with municipalities of Sombor, Odžaci, Bač, Bačka Palanka and

Apatin that includes 21 villages in its Serbian interior (Stojanovic, 2018a). The area has interesting combination of ecological conditions and human development. The primary habitats in the BioReserve are salt marshes, Pannian salt steppes, alluvial forests and wetlands, mesotrophic standing waters, natural eutrophic lakes (Tikvara lake), wet meadows, sand deposits and shores, abandoned river beds, and meanders as well as floodplains (Apatin swamp) (Obradović et al., 2020). This specific ecological layout of different habitat types is to a large degree because of the direct influences of the Danube River flow and natural variations of water level (Stojanovic, 2018b). This flooding and hydrographic characteristic of the area has direct influence on biodiversity making it an important center for plant diversity as well as home to a large number of species of national and international importance such as the otter (*Lutra lutra*). It should also be noted that the Bačko Podunavlje BioReserve includes five protected nature areas: 'Gornje Podunavlje', special nature reserve 'Karadjordjevo', nature park 'Tikvara', natural monument 'Šuma Junakovic'', and regional nature park 'Bikinski hrastik' (Obradović et al., 2020).

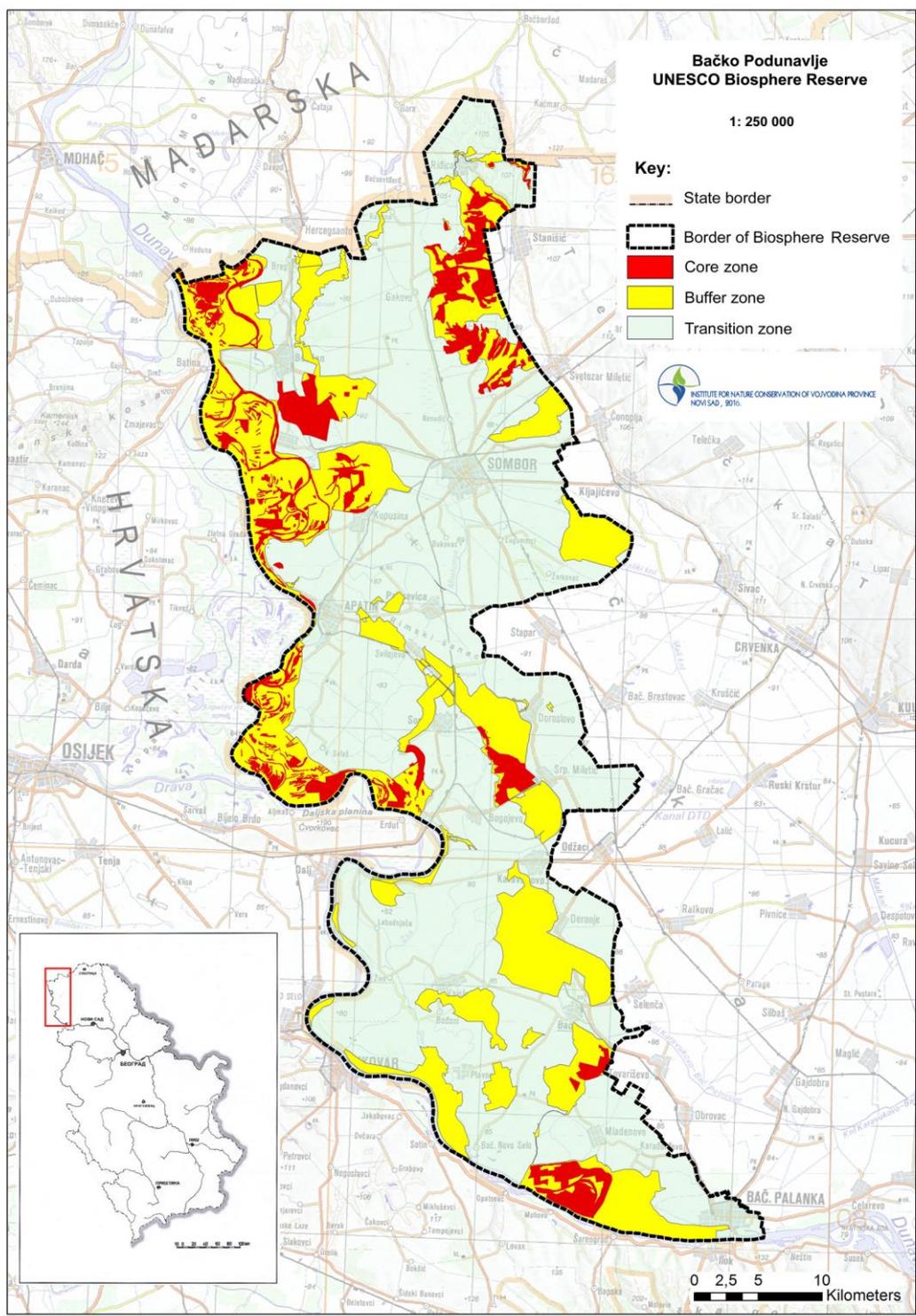


Figure 4. Zonation system of Biosphere Reserve Bačko Podunavlje in Serbia. In the bottom left corner, the location of the reserve is shown in relation to the country. In the top right corner, the legend is provided. Taken from http://www.unesco.org/new/fileadmin/MULTIMEDIA/HQ/SC/images/zonation_backo_podunavlje.jpg

When it comes to nature-human interactions, the area is rich in history. Since the Danube River represents the main waterway through Serbian territory, the area of Bačko Podunavlje BioReserve housed the development of transport, trade, and other industries (Obradović et al., 2020). The ethnic

structure of the area is extremely versatile, housing about 20 nationalities and ethnic groups. The interaction with nature in this area has produced a culture that centers around fishing, crafts, music, and festivals that display its interconnectivity (Janjusevic, 2018). However, these same practices that are central to culture have been noted to cause changes to the landscape due to resource overexploitation. Land cultivation, cattle breeding, and forestry have made significant detriments to the environment (Stojanovic & Savic, 2013, Trišić et al., 2018). Stojanovic & Savic (2013) noted that even before the proclamation of the BioReserve the protected areas saw problems in management of economic activities. This is mainly due to the lack of adequate information on Bačko Podunavlje BioReserve as a whole to allow for adequate delivery of its three core principles (Ranković, 2014), which, in turn, limits its abilities to maintain sustainable development (Stojanović, & Savić, 2013). Lack of adequate information is of big importance since Zagorac (2018) designated a large portion of a book to potential benefits of different aspects of sustainable development in the region. Petrović (2014) noted that currently there is a knowledge gap that needs to be explored to properly integrate the concept of sustainability into Bačko Podunavlje BioReserve and adequately manage the area.

4 Methodology

Different methodological approaches were used in this case study research. The methodology is explained in accordance with the research questions. A collaboration with the Institute of Nature Conservation of Vojvodina Province in Novi Sad, Serbia (Serbian: *Pokrajinski zavod za zaštitu prirode*) provided the basis for this thesis in the form of access to documents and stakeholders, and the potential for its results to be implemented in practice.

SRQ₁: To identify the possible NCPs provided by the Bačko Podunavlje BioReserve this study looked at 'Environmental assessments' (Serbian: *Studije Zaštite*) of the four protected areas within the reserve ('Gornje Podunavlje' (PZZP, 2000), 'Karadjordjevo' (PZZP, 2011), 'Tikvara' (PZZP, 2015), 'Šuma Junakovic' (PZZP, 2005) and the BioReserve Nomination form Submitted to UNESCO (PZZP, 2016). Relevance of documents lies in the topics covered: social, environmental, and management. Documents were selected based on availability and accessibility. To answer SRQ₁, the generalized perspective of the NCP conceptual framework was used in combination with content analysis, a more closely thematic analysis that has its stance with symbolic interactionism (Tuckett, 2005). To capture themes (patterns) across qualitative datasets (Braun et al., 2019) 18 nodes (corresponding to NCP reporting categories) and one main node were created in NVivo 12 (QSR International Pty Ltd.

V.12, 2018). Within the NCP reporting category thematic grouping was conducted to illustrate the diversity of what is viewed as NCP.

SRQ₂, SRQ₃, and SRQ₄: To answer these sub-research questions a written survey was sent out to interest organizations for the BioReserve. The interest organizations were selected based on stakeholder criteria previously set out by the BioReserve Nomination Form (PZZP, 2016, p.47) and contacts were provided by the Institute of Nature Conservation of Vojvodina Province. The survey, which was in Serbian, had five sections and included a description of what NCPs are (Serbian: *doprinoci prirode ljudima*) and what they can include (Appendix 1). The survey was conducted online via Google Forms (©2021 Google) in the period of 2nd week of March until the 1st week of April 2021. The email sent out to interest organizations contained a brief description of the thesis, the collaboration, and instructions on how to fill out the survey including the survey link. From a total of 27 addressees across 21 organizations, 19 people responded, representing 17 organizations (individual response rate 70%) (Table 1). All calculations and visualizations were performed in Excel v.2103 (Microsoft, inc).

A questionnaire was selected mainly because of cultural sensitivity as impersonal analysis gives people a sense of detachment and safety. Many people in Serbia are reluctant to cooperate regardless of my Serbian origin and may perceive me as invasive. Also, a questionnaire allowed collecting data regardless of the COVID-19 pandemic. While it is important to acknowledge the lack of representation from local people and marginalized groups, surveying local populations would have required an altogether different methodology and mainly face-to-face contact. Since the situation in Serbia was not stable during the time of this thesis, a way to ensure data collection without endangering people's safety was considered the most ethical thing to do. Similarly, surveying local population at the same time was time consuming and would not fit to the time frame of the thesis.

Table 1. List of interest organization of the BioReserve Bačko Podunavlje. Table shows intended contacted organization and what organization were included in the analysis of the thesis. Organization placed in the last two rows represent interest organization of different origin.

Organization	# of Email Contacts	# of Responses
Vojvodinašume Public Enterprise (provincial forestry company)	2	1
Sports and Recreation Center of Tikvara Park	1	1
Military Institution Morovic	1	1
Municipality of Оџаци (Odzaci)	1	1
Municipality of Сомбор (Sombor)	2	2
Municipality of Бач (Bac)	1	1
Municipality of Бачка Паланка (Bачка Palanka)	2	1
Municipality of Апатин (Apatin)	1	1
The Provincial Institute for the Protection of Cultural Monuments	1	0
Global NGO organizations- World Wildlife Fund	2	1
Institute of Nature Conservation Of Vojvodina Province	2	1
Public Water Management Company	1	2
Faculty of Sciences and Faculty of Agricultures of the University of Novi Sad	1	1
Ministry of Environmental Protection of Serbia	1	0
Provincial Secretariat for Urban Planning, Construction and Environmental Protection	1	1
Civil society organizations and local NGOs	3	3
Companies whose jobs are related to the BioReserve	3	1

To further answer SRQ₂ and SRQ₃, an adapted methodology for valuing NCP was used (Pascual et al., 2017). The purpose of the selected methodology was to aid in decision-making on a bioregional level (BioReserve Bačko Podunavlje). The boundaries (*scope*) for these two research questions are similar yet different. The *worldviews* that are represented are the same since analysis is based on survey responses; the difference is the *value foci* used to answer the question. For SRQ₂ the foci that looked at NCPs in general was used and for SRQ₃ the foci that connected to the good quality of life was utilized.

SRQ₂: To understand people's preferences towards different NCP categories from a generalized perspective, participants were asked to rank categories from the least to the most important in different scenarios. The analysis of the data is supported by the social choice theory, more concretely the voting system for decision making; thus the study utilized the The Borda Count method that looks into individual intensity of preferences by looking at how high up the given alternative choice lies in the preference list (Taylor & Pacelli, 2008, p.7). The Borda Count has been used in group preferences for forest management and use (Burgman et al., 2014), showing its relevant application here.

SRQ₃: To identify the different ways selected stakeholders view the capacity of 'nature' to keep options open to support to the 'good quality of life', open ended questions were used to facilitate a small narrative of nature interaction (Serbian: *odnosi sa prirodom*). Since narrative analysis is directly linked to thematic analysis, a combination of two was used to capture NCP conceptualization. Narratives with open ended questions help make sense of the past, present, and make plausible forecasts about the future that are directly linked to people's values and preferences (Satterfield, 2001), in such creating possible plans for actions (Beach, 2009).

SRQ₄: The data from the questionnaire related to management were analyzed based on frequency of selected responses of participants. This method can be attributed to approval voting within social choice theory where individuals select alternatives of which they approve and the alternative(s) with the most votes is(are) selected (Burgman et al., 2014).

5 Results and analysis

This section answers the four research questions of the thesis, namely which NCPs the BioReserve Bačko Podunavlje might provide (Section 5.1.1), which NCPs stakeholders deem most important (Section 5.2.1), how is 'nature' seen to influence the 'good quality of life' (5.2.2.) and what are management preferences and opinions of stakeholders (5.2.3).

5.1. Document analysis

5.1.1 Answering sub-research question 1: possible NCPs provided by the Bačko Podunavlje BioReserve

The document analysis showed every NCP category from the generalized perspective had at least one mention, except the 5th reporting category regulation of ocean acidification, which is logical to be omitted, as Serbia is a land-locked country. NCP categories with the most diversity of

contributions from the analyzed documents were: materials, companionship and labor (NCP#13, n=10), physical and physiological experiences (NCP#16, n=10), and supporting identities (NCP#17, n=6) (Table 2, for a full list of statements used see NVivo NCP file and for an example of analysis see Appendix 2).

Since **NCP#13** is tangible in nature it included materials such black poplar wood used for furniture called mazer(D5) and reed plant materials - *Phragmites australis* (D1) for baskets, brooms, and decorations. Within the NCP there were many labor uses identified (Table 2) of which the production of rakia brandy from fermented fruit, wine production, of fruits, vegetables, and grains such as the watermelon in Deronje (D1) are very traditional practices of utilizing nature contributions. **NCP#16** diversity implies an overall understanding of human-nature experiences, what activities are needed to enhance them, and how to cultivate culture through those experiences (Table 2), summed up nicely with this sentence:

Na relativno malom prostoru smenjuju šume, čistine, tršćaci, vodene i suve površine, koje daju posebnu čar pejzažu (D2) (Serbian for: “in an area, forests, clearings, reeds, water and dry surfaces change, which give a special charm to the landscape”)

One negative contribution was also found in this category, mainly mosquito bites and flies as vectors for disease(D4). **NCP#17** diversity showed unique attributes, for example: the annual harvest celebration in Dužionica, Sombor distinctive to Croats (D1), Danube Ball, Beer fields, and Gajdobra summer game(D5) as local festivals of tradition, music, culture, and old crafts and even locations of “holy wells” where groundwater is considered to have miraculous effects (D1). In the area heritage can be conserved through nature using oak branches to celebrate and announce Christmas Day (D1). Identity was found to be preserved via food such as the Danube spicy fish stew with homemade noodles and the lifestyle characterized by the “slow” traditional rural life, with tambura music (D1).

Food and feed (NCP#12, n=5), habitat creation and maintenance (NCP#1, n=4), pollination and dispersal of seeds and other propagation (NCP#2, n=4), and regulation of detrimental organisms and biological processes (#10, n=4) were described quite well in the documents (Table 2). **NCP#12** to some degree overlaps with NCP#13 as they co-produce and influence each other; however, it is evident that mainly food and feed can be obtained either directly from the environment via hunting, fishing, or gathering or from man-made systems such as those of agriculture and domestication (Table 2). A good example is the *Trapa natans* plant that can be used for starch flour and for feeding livestock, humans, wild and domestic pigs, poultry, wild geese, and wild ducks (D5). **NCP#1** has mostly been understood as sites in nature that allows for the normal functioning of the complete life

cycle of living things (Table 2). In such, habitats created by plants have been highlighted (e.g., marsh willow for nesting (D4), shrub vegetation for refuge (D5), forest-steppe vegetation cover (D4) and ponds and wetlands (D2) for reproductive life cycle) or those serving as food sources (e.g., algae are primary organic producers in aquatic biotopes(D2)). The white-tailed eagle and black stork were specifically mentioned to use the area as an overwintering site (D1) as these birds are of important conservation value. This NCP category also had a unique contribution attribute to it mainly due to the specificity of the BioReserve itself; this was the alluvial wetland habitats specificities that allow butterflies to rest, sunbathe, and extract needed minerals from the wet mud (D4). In **NCP#2** the dispersal and pollination mechanism were not described in detail, as this NCP mainly included the presence of such knowledge in forms of statements (Table 2). The only dispersal mechanism that was very clear was done via insects, more so flies(D4) and honeybees (D1). **NCP#10** had a similar pattern when dragonflies were described as key regulators of insect populations (D4) and hoverflies as key contributors to the decaying biological process (D4). However, this NCP highlighted the importance of reptiles and lizards in insect and invertebrate regulation as well as almond willow shrubby groups that trap humidity and prevent invasive woody species from infiltrating (D2).

N equal to 3 was present in regulation of freshwater quantity, location, and timing (NCP#6), regulation of freshwater quality (NCP#7), formation, protection, and decontamination of soils and sediments (NCP#8), medicinal, biochemical, and genetic resources (NCP#14) and learning and inspiration (NCP#15). In **NCP#6** the regulation was attributed to the soil and sediment composition (D2) as well as the vegetation density and structure such as the water nut (D5) that slow down and regulate the amount of water found in different area and levels of the BioReserve (Table 2). **NCP#7** attributed water quality contributions to both vegetation and vertebrates (Table 2) as forms of biofilter. In **NCP#8** soil transportation and turning were just mentioned as contribution, whereas vegetation contribution in this NCP reporting category were easily understood (Table 2). **NCP#14** showed for example that pheasant's eye plant and white-water lily rhizome are important both for traditional and commercial medicine (D4). This NCP served as a good example to highlight the genetic diversity of both domesticated (e.g., Sombor Crested Chicken and Kupusina Onion (D1)) and natural species (e.g., Otter and Great White Egret (D1)) found in the area. With **NCP#15** the core zone contributions of the BioReserve were easily observable. This non-material use of nature is essential as it nurtures the enjoyment of open spaces and nature's beauty, establishes of contacts with the living world, and the search for spiritual freshness and peace is achieved (D4) while feeding curiosity through research and education (Table 2).

Regulation of climate (NCP#4), regulation of hazards and extreme events (NCP#9), and energy (NCP#11) categories had an n equal to 2. And the NCP category with the least amount contribution diversity (n=1) was regulation of air quality (NCP#3) and maintenance of options (NCP#18) (Table 2).

Table 2. Nature's Contributions to People in Bačko Podunavlje BioReserve based on analysis of five key documents. The color scheme is associated with the broader grouping of NCPs in the generalized perspective: blue is regulating NCPs, green is non-material NCPs, yellow is material NCPs and orange/red represents an NCP that is interconnected with all of the other reporting categories. See Diaz et al., 2017 for more detail of reporting categories. Made by O. Stojilovic.

NCP Type	NCP Reporting Category from the Generalized Perspective	NCP Themes found in the analyzed documents
Regulating NCPs	1. <i>Habitat creation and maintenance (N=4)</i>	Documents: 1. UNESCO Nomination Form Bačko Podunavlje BioReserve (PZZP, 2016) 2. EIA Tikvara (PZZP, 2015) 3. EIA Šuma Junaković (PZZP, 2005) ; 4. EIA Gornje Pđunavlje (PZZP, 2000) 5. EIA Karadjordjevo (PZZP, 2011) Growing site for plants, nesting, feeding and mating sites for animals (1;2;3;4;5) Resting and overwintering sites for migratory species (birds) (1) Nurseries for juvenile fish and animals (2; 4) Aluvial wetland habitats specificities (4)
	2. <i>Pollination and dispersal of seeds and other propagation (N=4)</i>	Dispersal of edible plants by animals (3; 4; 5) Plants serving as pollen and nectar sources (honeybees; 1) Invasive species and aggressive (autochthonous) species (1) Pollination dispersal via insects (4)
	3. <i>Regulation of air quality (N=1)</i>	Filtration of air by trees and all vegetation type (1)
	4. <i>Regulation of climate (N=2)</i>	Climate change regulation, mitigation, and adaptation (1; 2) Climate regulation properties of wetlands (5)
	6. <i>Regulation of freshwater quantity, location, and timing (N=3)</i>	Regulation of hydrological processes (1;2) Groundwater formation (2; 5) Regulation of flow through ecosystem (5)
	7. <i>Regulation of freshwater quality (N=3)</i>	Water supply to rural wells (1) Regulation through filtration of particles, pathogens, harmful chemicals, and excess nutrients via aquatic vegetation (1; 2; 5) Elimination of rotting flesh before it enters the water by carnivorous wetland turtles (4)
	8. <i>Formation, protection, and decontamination of soils and sediments (N=3)</i>	Soil transport and turning (1; 2) Formation of different soil condition based on vegetation structure (2) Wind-breaking tree lines protect soil from blowing away (1)
	9. <i>Regulation of hazards and extreme events (N=2)</i>	Protection from floods (1; 2; 5) via trees (4) Protection from erosion (1;2) via the marshy-wetland structure (5)
	10. <i>Regulation of detrimental organisms and biological processes (N=4)</i>	high biodiversity (1; 2; 4) maintain biological processes Limiting dispersal of invasive species because of soil moisture from habitat (2) Regulation of insect and invertebrate populations by amphibians and reptiles (2; 5) Regulation of insect population by invertebrates (4)
	Material NCPs	11. <i>Energy (N=2)</i>
12. <i>Food and feed (N=5)</i>		Food from fish man-made fish farm and consumption of fish from natural habitats (1;2;4) Consumption of wild edible animals (e.g. hunted meat, 1) by humans Consumption of edible mollusks, plants, fruits, barriers , honey and mushrooms (1; 5) by humans and animals Crop and vegetable production from agricultural ecosystems (1; 4) Consumption of domesticated grazing animals that feed in the area and their derivatives (1) such as cheese
13. <i>Materials, companionship and labor (N=10)</i>		Timber from natural forests and from wood plantations (1;3; 5) Reed plant materials - <i>Phragmites australis</i> (1) such as basket, brooms and decorations Ethno- and eco-tourism (1; 4; 5) Honey from honey production (1) Fishing (1; 4; 5) Trophy hunting on game manages species (1;4; 5) Production of rakia brandy from fermented fruit, wine production and sweets

		production (1) Production of agricultural goods (1) Hay-making on natural grasslands (1) Mushroom collection (1)
	14. Medicinal, biochemical and genetic resources (N=3)	Medicinal plants (1; 4; 5) Genetic resources of local races and breeds of domestic animals and plants (1) Endemic, rare and biologically important species (1,2,3,4; 5)
Non-material NCPs	15. Learning and inspiration (N=3)	Research and biodiversity monitoring/conservation conducted in the area (1;2) Natures beauty for inspiration and esthetics (3; 4) Nature schools and camps for education (2; 5)
	16. Physical and physiological experiences (N=10)	Walking paths with information signs (1) Bird observation towers for bird watching (2;5) Organizing youth working camps (1;2) Recreational fishing (1;2;5) Eco-tourism nautical and rural tourism (3) Etno villages (1) Hikes, canoeing , cycling routs, sports and recreation (1;2;3;4;5) Sites for bathing and swimming (1) Ice skating in winter (1) Mosquito bites and flies as vectors for disease (4)
	17. Supporting identities (N=6)	Cultural diversity (1) Spiritual and religious values (1) Cultural heritage in terms of festivals/events/celebrations/small rural villages with traditional architecture (1;5) Presence of religious events/attractions/festivities/pilgrimage with language conservation (1;4) Heritage conservation trough nature interactions (1) Preservation of identity (1)
	18. Maintenance of opinion (N=1)	Presence wide variety of species, populations and genotypes (1,2,3,4,5)

5.2 Questionnaire analysis

Out of the total respondents, roughly half stated that before this study they have not been included in valuation processes of the area (see Appendix 3 for an sample of filled out survey). All respondents hold a minimum of a bachelor's degree, in a range of agronomy, agriculture, law, environmental protection, economy, biology, ecology, tourism, physiology, resilience, and forestry. 11 people hold a master's degree, and one holds a PhD and is a university professor, showing that the participants of the survey are educated and capable of understanding the survey in the first place. When asked about the overall concern about the degradation of the BioReserve, the majority stated that they were significantly concerned (Fig. 5, a). To better understand the connection participants felt with the area they were asked to state how much they enjoyed being in nature, and almost all participants strongly enjoy being in and around nature (Fig. 5, b).

Feeling towards Bačko Podunavlje BioReserve

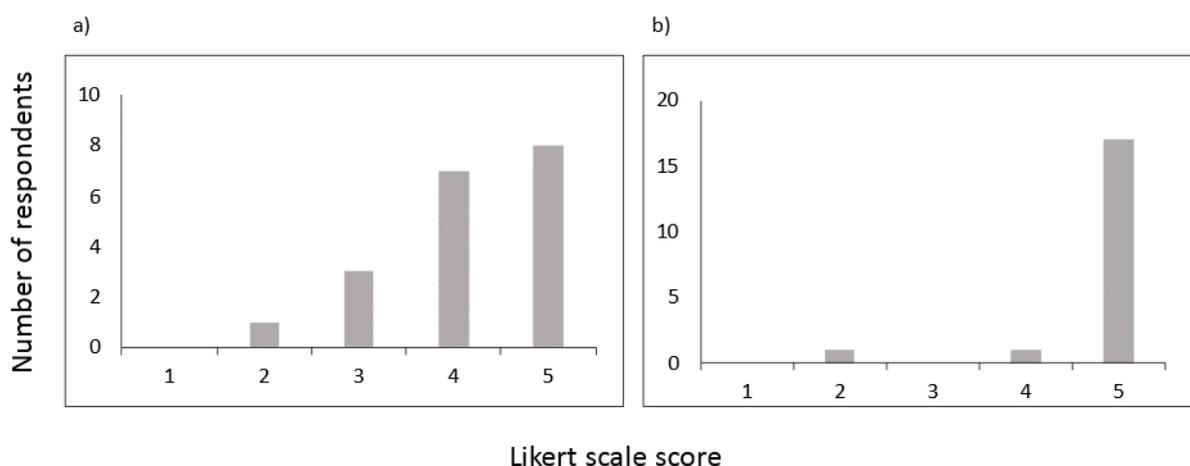


Figure 5. Responses of the survey to question a) when asked how concerned you are with the degradation of the BioReserve and b) to what extent are you satisfied being in and around nature. X axis is the same for both graphs, on a scale of 1-5 one indicating the least agreement with the asked question and 5 the most agreement. Y axis for both indicated the number of responses. Made by O. Stojilovic

5.2.1. Answering sub-research question 2: stakeholders' ranking of NCP reporting categories

When asked to rank the most important NCPs provided by the BioReserve, stakeholders tended to choose NCPs that fall into the regulating category. More specifically, as seen in Table 3, the Bourda count identified the most important NCPs to be regulation of air quality (NCP#3), followed by regulation of climate (NCP#4), and habitat creation and maintenance (NCP#1) (Table 3 displays the 8 most highly ranked NCPs). In general, less importance was given to non-material and material NCPs.

In terms of selecting the five most important NCPs provided for local population, material and non-material NCPs were given slightly more importance by participants. Table 3 summarizes these ranked values (some NCPs gained the same number of points). Again, regulating NCPs dominated the preference in the first four, but material and non-material start to gain importance going down the ordering. Not included in Table 3 but worth noting is physical and physiology experiences (NCP#16) in 9th place (9 points) that lost by one count compared to 8th place (10 points). Overall, however, non-material NCP outweighed material ones, indicating the importance identities, experiences, and most importantly learning can have in this area to local populations.

Table 3. Ranking results based on interest organization preferences of the most important NCP categories provided by the BioReserve in general (left) and ranking results based on interest organization preferences of the most important NCP categories provided by the BioReserve to local populations (right).

Place	Most important NCPs provided by the BioReserve	Most important NCPs provided by the BioReserve to local population	
1	Regulation of air quality (NCP#3)	Regulation of water quality (NCP#7)	Regulation of climate (NCP#4)
2	Regulation of climate (NCP#4)	Habitat creation and maintenance (NCP#1)	
3	Habitat creation and maintenance (NCP#1)	Regulation of air quality (NCP#3)	
4	Regulation of freshwater quality (NCP#7)	Regulation of hazards and extremes (NCP#9)	
5	Pollination and dispersal of seeds and other propagules (NCP#2)	Learning and inspiration (NCP#15)	Regulation of freshwater, quantity, location and timing (NCP#6)
6	Formation, protection and decontamination of soils and sediments (NCP#8)	Food and feed (NCP#12)	
7	Regulation of freshwater, quantity, location and timing (NCP#6)	Pollination and dispersal of seeds and other propagules (NCP#2)	
8	Regulation of detrimental organism and biological processes (NCP#10)	Formation, protection and decontamination of soils and sediments (NCP#8)	Supporting identities (NCP#17)

When asked to rank the five NCP categories most in-need of restoration and enhancement, participants ranked by far the highest habitat creation and maintenance (NCP#1) (see Fig. 6), signaling a need for better protection of that key NCP. It was followed by four regulating NCPs, namely regulation of climate (NCP#4), regulation of air (NCP#3), regulation of soils and sediments (NCP#7), and regulation of detrimental organisms and biological processes (NCP#9). Again, we have a dominance of regulating NCPs; however, non-material NCP learning and inspiration (NCP#15) was ranked right after regulating NCPs signaling a need of enhancement compared to other in its category.

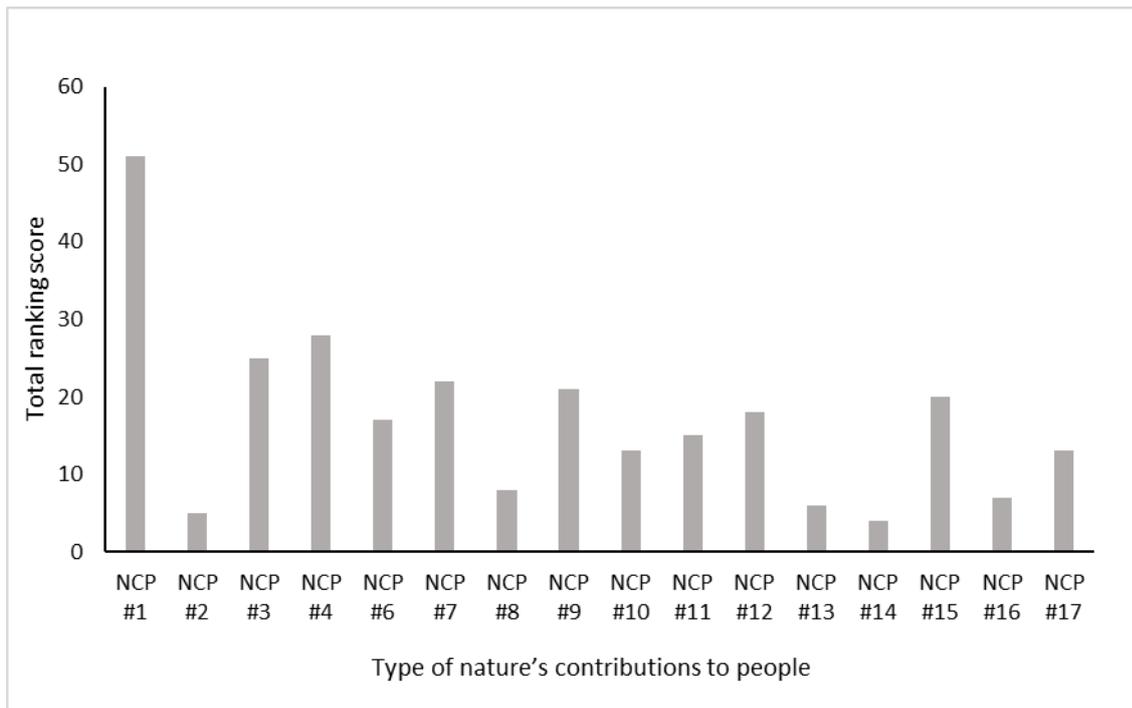


Figure 6. Results obtained after participants ranked 5 NCP categories in need of the most restoration and enhancement in the BioReserve Bačko Podunavlje. The scale of ranking was from 1-5 where 5 was the NCP that needed the most enhancement and restoration and 1 was an NCP least in need of enhancement and restoration. The # corresponds to the order of listing of the NCP generalized perspective and can be found in Diaz, et al. (2018). For clarity the order from #1 to #17 is the following: Habitat creation and maintenance, Pollination and dispersal of seeds and other propagules, Regulation of air quality, Regulation of climate, Regulation of freshwater quantity, Location and timing, Regulation of freshwater water quality, Formation, Protection and decontamination of soils and sediments, Regulation of hazards and extreme events, Regulation of detrimental organisms and biological processes, Energy, Food and feed, Materials, Companionship and labor, Medicinal, Biochemical and genetic resource, Learning and inspiration, Physical and psychological experience, Supporting identities. Made by: O. Stojilovic.

To better understand land use over time, the survey also had participants select which five NCPs had undergone most degradation in certain time intervals. Figure 7 a) shows that in the last 10 years NCP#1 and NCP#7 have been degraded the most, potentially showing a correlation with habitats and their soil and sediments structure change. Another potential correlation to this degradation can be attributed to food and feed (NCP#12), as food production and, agriculture and can have effects on the area. Overall, over the last 10 years most of the NCPs that have been degraded fall into regulating ones. When asked to speculate what NCPs will be degraded the most in the next 5 years (Fig. 7 b) regulation of water quality (NCP#7), followed by regulation of climate (NCP#4) and habitat creation and maintenance (NCP#1) stood out the most. However, when asked to explain why participants made such speculation in the future, the answers mainly focused on inadequate and improper management (Serbian: *upravljanje*) and degradation (Serbia: *degradacije*) of the BioReserve. Themes were related to insufficient legal regulation in Serbia, modernization of life, industry development and global processes such as climate change and forest degradation. Another

important theme mentioned is that of interests (Serbian: *interesi*), explained through people's lack of interest in improving the quality of nature, inadequate attitudes towards NCPs, public influence in the area that is detrimental, unwillingness to invest in the area, and the misrepresentation that business interests will serve and benefit the public.

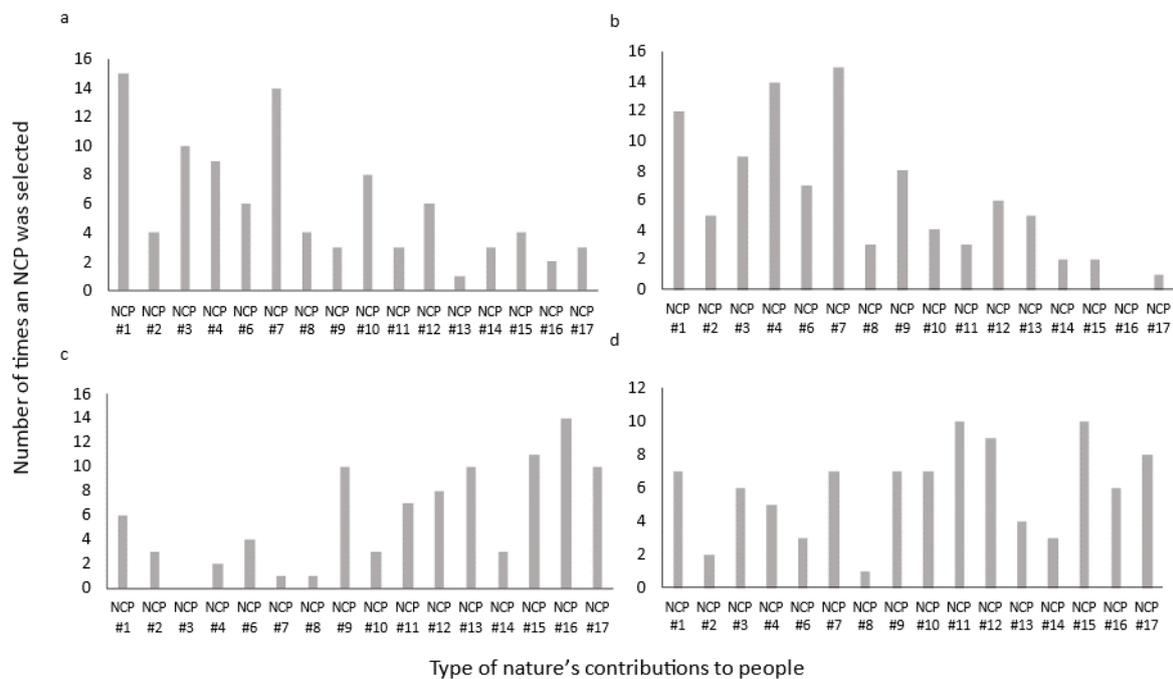


Figure 7. Results obtained after stakeholders' selection of NCP reporting categories in various time scenarios. a) refers to choice of NCP category that was most degraded in the last 10 years in the area, b) refers to choice of NCP category that is expected to decrease the most in the next 5 years, c) refers to choice of NCP category that was the most improved over the last 10 years and d) refers to choice of NCP category that will potentially see the most improvement in the next 5 year. Participants had to selected 5 NCPs. The # corresponds to the order of listing of the NCP generalized perspective and can be found in Diaz, et al. (2018). For clarity the order from #1 to #17 is the following: Habitat creation and maintenance, Pollination and dispersal of seeds and other propagules, Regulation of air quality, Regulation of climate, Regulation of freshwater quantity, Location and timing , Regulation of freshwater water quality, Formation, Protection and decontamination of soils and sediments, Regulation of hazards and extreme events, Regulation of detrimental organisms and biological processes, Energy, Food and feed, Materials, Companionship and labor, Medicinal, Biochemical and genetic resource, Learning and inspiration, Physical and psychological experience, Supporting identities. Made by: O. Stojilovic.

Similar to the previous section, participants selected 5 NCPs that have been most improved over the last 10 years in the BioReserve and, mainly non-material NCPs were given importance (Fig. 7 c); and when asked to speculate what NCPs might be enhanced in the next 5 years, results were scattered all over the place as participants selected various NCPs (Fig. 7 d). Thus, the best way to illustrate the findings of these questions is based on justification of such selection shown in Figure 8. Stakeholders believe that new projects and funds, technological and scientific innovations, enhancements, and new strategies closely related to EU standards and other international standards will provide the solution (Fig. 8). However, there is no direct mention of how management plans will do so, rather

there is a trend of leaning on civil organization and local population to catalyze change through increase consensus and interest for environmental protection (Fig. 8). Two quotes have been translated to further illustrate the justification:

If we change our own awareness of the importance of the above [NCPs], from individuals to decision makers we can expect improvement- R10

With public participation in resource management and an integrated approach to resource management, the state[Serbia] will be forced to rank the importance of all impacts and improve legislation that is a key issue for reserve management.- R12

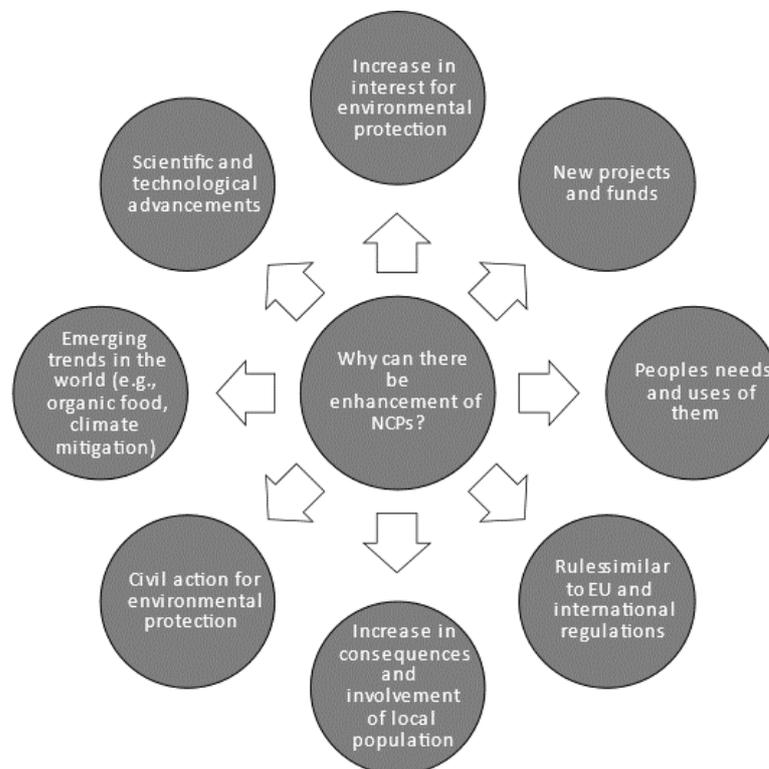


Figure 8. Explanation provided by participants as to why some NCPs will see improvements and enhancements in the next 5 years in the BioReserve Bačko Podunavlje.

5.2.2. Answering sub-research question 3: context-specific lens on the correlation of nature and good quality of life

When asked to describe how nature contributes to the good quality of live to participants, their work, and population in general, participants tended to describe more non-material contributions,

such as psychological sanctuary, compared to the structured part of the survey. To describe this, participants used the Serbian word *blagostanje* that lacks direct translation but is similar to well-being and was used in the context of surrounding oneself with a pleasant environment (Serbian: *prijatno okruženje*). Others used synonyms to the word such as stress relief, peace, calmness, and positive energy. Another important notion to their understanding of a good quality of life was that of clean and uncontaminated air that is pleasant (mentioned the most) and clean water. Learning, productivity, and creativity were connected to concepts such as excursions (Serbian: *izleti*). This theme was closely related to the theme of connectivity and hope, mainly described by participants as nature awakens the wish to protect it (R3) and awakens hope (R15). A good example of such connectivity can be expressed by this quote:

We work for nature and with nature- R12

Livelihood and living conditions were something mentioned by participants in such that nature provides all that is necessary to life and the best description of what this means can be summarized by R15:

The population in Apatin relies on the reserve in economic, traffic, tourist, and recreational terms. Through each of these activities, the quality of life of both the resident and me personally is manifested.

Lastly, nature was seen to contribute to the good quality of life by its own existence as a source of life/origin (Serbian: *izvor života*) and as a cure for illness and disease. Overall, participants' understanding of nature and its contributions to the good quality of life were all directly related to nature being healthy and protected (Serbian: *ocuvana/zdrava životna sredina*); showing an understanding and differentiation of healthy and unhealthy states of nature and their corresponding effects.

When asked how nature can be detrimental to the quality of life, almost half of the participants stated that nature cannot be detrimental and that viewing nature as such is a misconception. This understanding of nature was justified by views similar to this one:

I believe that nature cannot impair the quality of life, but only improve it. – R3

Mostly negative contributions of nature were attributed to damaged environments (Serbian: *narušena životna sredina*) used in the context of degradation of nature and its components (R7) polluted and devastated natural areas (R10, R12, R14 and R19). Such understandings were linked to

spread of diseases, creation of wild landfills, disappearance of species, breathing in contaminated air, drinking infected water, consuming polluted food and can be best summarized by these quotes:

Disturbed relationships in nature have many negative effects on all spheres of life. – R11

Degradation of nature and all its components contribute to a poorer environment and survival of all living beings, including man himself.- R12

A small portion of participants described that nature could decrease and negatively affect the quality of life via natural disasters as floods, torrents (best translation of Serbian word *bujice*), landslides, earthquakes, allergens, and climate change as a global process.

Answers were similar when participants were asked to describe how nature can contribute to future generations' quality of life, although what was mentioned often was the importance of positive nature experiences in childhood. This was understood as proper development and recreation mainly in terms of enjoying what nature offers, growing up in healthier surroundings, and gaining positive experiences. Such an understanding is best linked to this statement:

It [nature] encourages creativity, allows for people to let off steam and excess energy, develops certain abilities and skills, acquires awareness of the importance of the environment ...- R13

Stakeholders also noted that for future generations nature will be essential in terms of renewable energy, climate mitigation, protection from hazards, use of NCPs in different industries, and even as an escape from modernity and its stressful way of living. In terms of direct management applications, other than resilience application, four stakeholders gave insights (R1, R11, R12 and R19). Mainly the protection of biodiversity, healthy forests (Serbian word used to define all green areas: *zelenilo*), need for clean air, and water were expressed to be essential for the good quality of life for future generations. However, most of the stakeholders did not give any concrete information on how specifically nature can contribute to the quality of life of future generations. Namely, the question was restated in answer format with some respondents highlighting the need for change in human-nature interactions. Such understandings show the connectivity of healthy nature to good living conditions with expressions such as protected nature (Serbian: *očuvana životna sredina*) and clean nature (Serbian: *čista životna sredina*) attributed to them. The relationship explained here can be expressed by these quotes:

Preservation of resources is important for future generations and care for the future through their rational use. It is necessary to return to nature approximately or as much as we take from it. – R17

It will provide them [future generations] with conditions for life, without nature there is no life, their future can be worsened only by human behavior.-R4

5.2.3. Answering sub-research question 4: management results

When asked what future management plans should be the focus of the BioReserve participants chose enhancement of the reserve and its sustainable use as the top priority compared to other options (Fig.9). More than half of the participants also selected the need for cooperation and dialogue between key stakeholders as well as increase of the budget (Fig. 8 shows all the options). The first mentioned target came as a surprise when only two stakeholders selected that there should be equal distribution on NCPs among stakeholders, since it can be hard to achieve cooperation without equality. Other management criteria selected (Fig. 9) can be used to define the response 'enhancement and sustainable use of the Reserve' such as 'monitoring the state'.

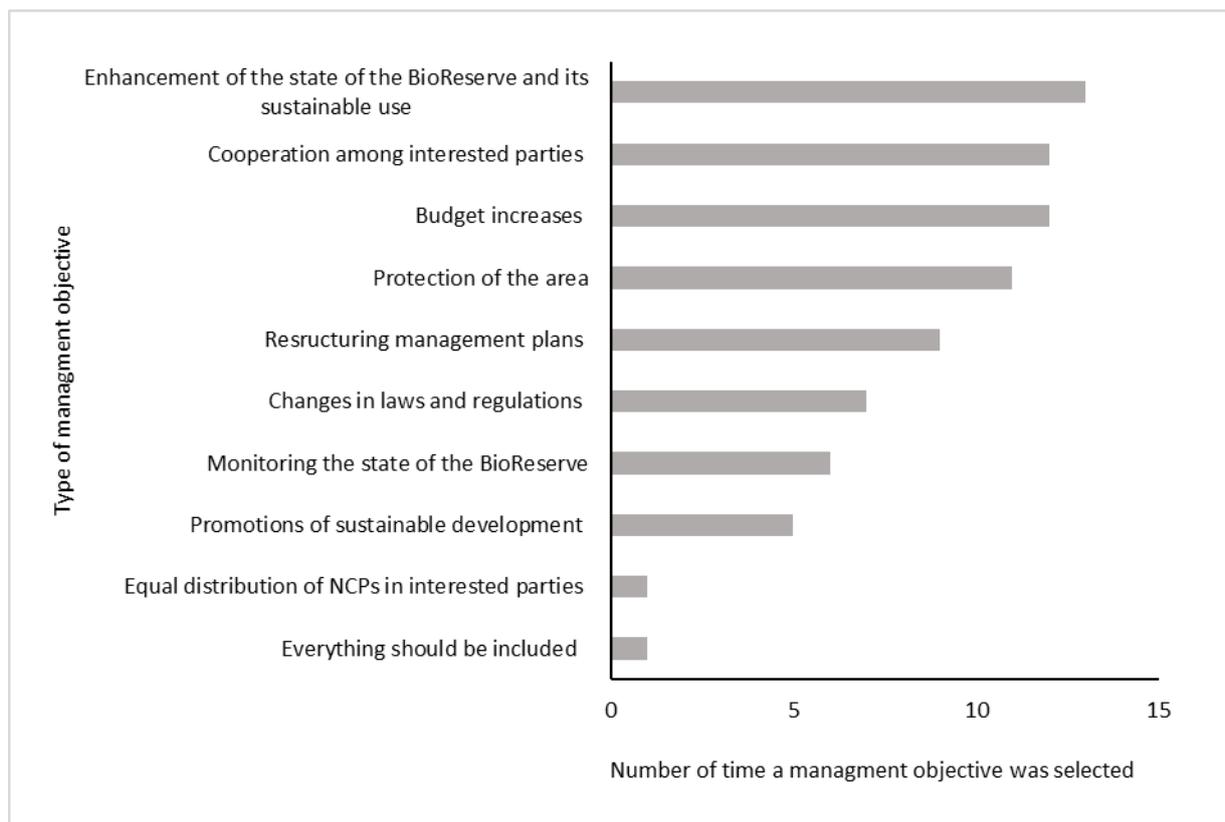


Figure 9. Survey responses of interested organization in the BioReserve Backo Podunavlje to the question that focused on selecting four managed objectives that should be included in future management plans of the area.

In terms of conflict among all actors of the BioReserve participants believe that forestry (Serbian *šumarstvo*) and protection (Serbian: *zaštita*) have the most conflict in the area (Fig 10). Such a conflict was explained by mentioning the degradation of biodiversity (R19) and native species (R8).

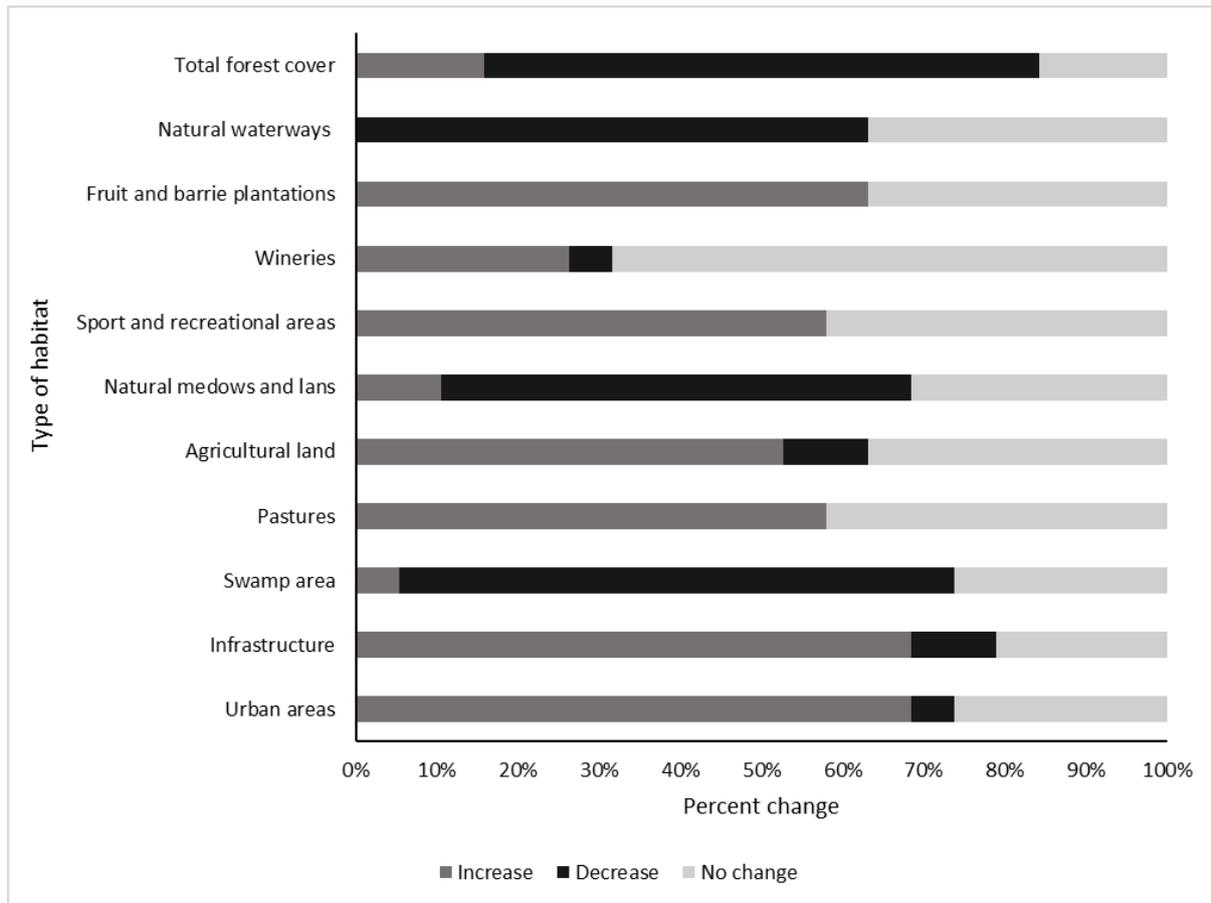


Figure 11. Responses based on participants perspective and knowledge (seen, heard, and read) on what type of habitat (human and natural) has seen a trend in change in the last decade in the area of Bačko Podunavlje BioReserve.

In designing future management plans, respondents of the survey selected that priority should be given to NCPs that are related to habitats and NCPs of special importance to nature conservation (Fig. 12). 21% stated that management plans should focus on NCPs that give direct benefits to local population and 16% stated that management plans should have a holistic view and include NCPs that benefits the greater population. No participants selected that in management plans priority should be given to NCPs that can create direct economic profit.

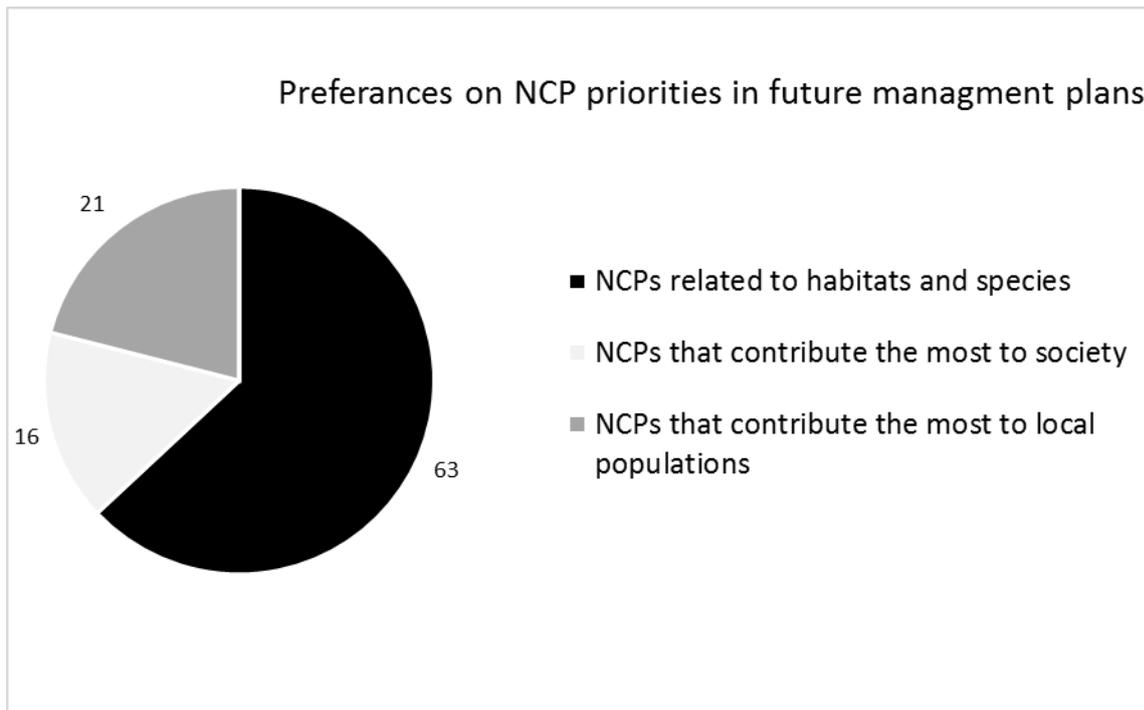


Figure 12. Survey responses of interested organization in the BioReserve Backo Podunavlje in relation to selection of NCPs that should be given priority in the creation of future management plans. Numbers represent the corresponding percentage. Made by O.Stojilovic

In connection with the previous asked question, mainly in terms of evaluating potential indicators for future management plans, stakeholders selected that NCPs related to habitat creation and maintenance (NCP#1), regulation of air quality (NCP#3), and regulation of water quality (NCP#7) should be used (Fig. 13). The first selected response was logical since it is the one that most easily fits with the above category selected. Since the question asked for top 5 indicators, regulation of hazardous extremes (NCP#9) and climate regulation (NCP#4) were also indicators selected to ensure the best form of monitoring (Fig. 13 shows all the selected responses).

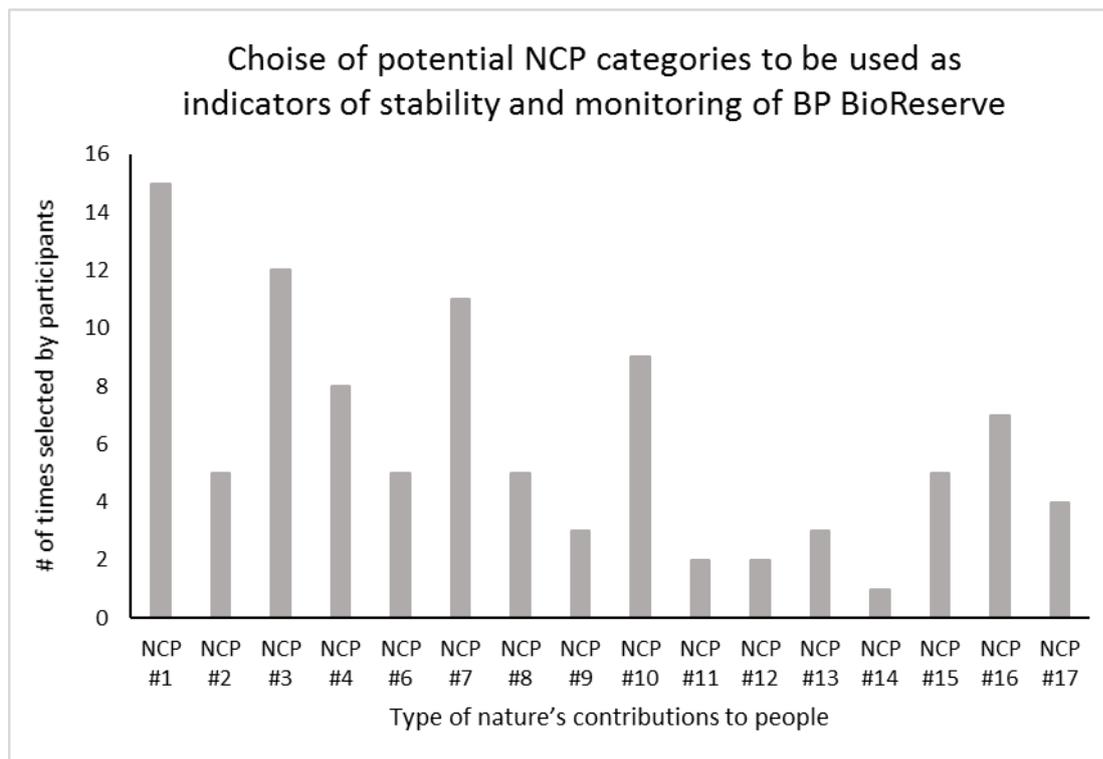


Figure 13. Responses of selected options for potential NCP reporting categories for the Bačko Podunavlje BioReserv to be used as indicators. The # corresponds to the order of listing of the NCP generalized perspective and can be found in Diaz, et al. (2018). For clarity the order from #1 to #17 is the following: Habitat creation and maintenance, Pollination and dispersal of seeds and other propagules, Regulation of air quality, Regulation of climate, Regulation of freshwater quantity, Location and timing , Regulation of freshwater water quality, Formation, Protection and decontamination of soils and sediments, Regulation of hazards and extreme events, Regulation of detrimental organisms and biological processes, Energy, Food and feed, Materials, Companionship and labor, Medicinal, Biochemical and genetic resource, Learning and inspiration, Physical and psychological experience, Supporting identities. Made by: O. Stojilovic.

Lastly, to understand the degree that the NCP concept (Serbia: *doprinosi prorode ljudima*) can be applied in a Serbian decision-making environment, participants were asked to choose the degree by which they agree or disagree with several statements. Results illustrated in Fig. 14 a) show that the majority of participants agreed that the NCP concept can be used to increase education of local population in the reserve. When asked for the direct application of the NCP concept in management plans (Fig. 14 sub-figure b), more so its understanding and then application, the majority again agreed. When asked to what extent they agree that the NCP concept can be used to resolve and mitigate conflicts between stakeholders of the BioReserve, answers were not that skewed towards a dominant answer as seen in Fig. 14 c). Sub-figure d) give a bit more insights into the potential application of the NCP concept, as more than half of the participants agreed that common values can be used to guide management plans in the domain of what to sustain, protect, and use. And lastly, sub-figure e) represents responses to the statement to what extent are their (stakeholder’s) values related to nature understood by other stakeholders in the BioReserve; and here, more than half of

participants gave an indifferent or neutral score (3/5), indicating that there is a potential lack of value understanding in the area.

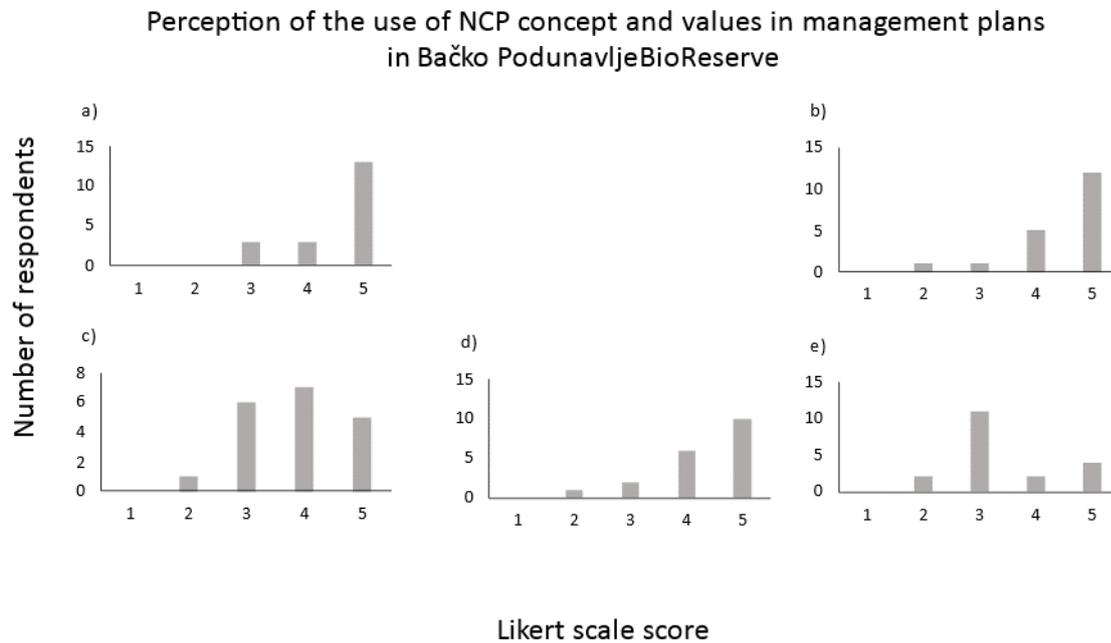


Figure 14. Results of stakeholder’s agreement/disagreement with statements related to the use of NCP concept and values in future management plans of the Bačko Podunavlje BioReserve. The graphs are related to the following statements: a) NCP concept can be used to increase the level of local populations education, b) understanding NCP concepts can help management plans, c) understanding other perspectives related to the concept of NCP can reduce conflict between stakeholders, d) common values can be used as indicators of what needs to be managed and sustained and e) other stakeholders within the reserve understand my values related to nature. X axis is the same for both graphs, on a scale of 1-5 one indicating the least agreement with the asked question and 5 the most agreement. Y axis for both indicated the number or responses. Made by: O. Stojilovic.

6 Discussion and conclusion

This section of the thesis will first briefly discuss key findings in relation to the nature’s contributions in the area, then move into practical application of findings and lastly conclude and reflect on the study in general.

6.1. Highlighted findings

Based on document analysis this study found a range of contributions provided by the Bačko Podunavlje BioReserve. Specifically, the documents showed materials, companionship and labor (NCP#13, n=10), physical and physiological experiences (NCP#16, n=10) and supporting identities (NCP#17, n=6) to be better described and, showing a greater diversity compared to the rest (see section 5.1.1., Table 2). One of the main reasons for this may be the fact that such NCPs are easily

quantified, described, and tangible in terms of direct human use. Other explanation for the diversity of contribution within these NCPs can be attributed to the strong connection to human use and presence, demographic diversity, strong cultural and religious importance in the area (see section 3.2). On the other hand, the current state of research in Serbia mostly focuses on ecological and biological observation of protected areas (see section 3.1.) influencing contribution such as habitat creation and maintenance (NCP#1) to be well described in documents. Interestingly maintenance of options (NCP#18) was understood and identified mainly in terms of phylogenetic diversity, previously viewed the same by IPBES (IPBES, 2019). However, this presence of diversity of NCPs doesn't indicate importance, it more so indicates better understanding and articulation of some NCP categories and should signal a need for better understanding of others, such as that of regulation of air quality (NCP#3) that was only mentioned in documents but barely described. Regulation of air was also emphasized in other studies to be one of the least explored in comparison to other NCPs (Christie, et al., 2019). Apart from signaling understanding and articulation of NCPs in documents, this form of classification of NCPs further supported the fuzzy reporting categories contribution of the NCP framework. This can be observed from the degree of overlap of some contribution (Table 2, section 5.1.1.), however a clear example would be the overlap (to some degree) of food and feed (NCP#12) with materials and, companionship and labor (NCP#13) as they co-produce and influence each other. Another is the example of the contribution attained from carnivorous wetland turtles that through elimination of rotten flesh falls into regulation of freshwater quality (NCP#7) and regulation of detrimental organisms and biological processes (NCP#10).

In terms of survey analysis, different methods showed different contributions to be stressed as important; as pre-designed questions with selected answers showed that regulation NCPs, more concretely regulation of air, climate, water quality, (NCP#3, NCP#4, NCP#7), habitat creation and maintenance (NCP#1), to be most favorable in both ranking scenarios but in different orders (see section 5.2.1. Table 3). These NCPs were identified as important by other studies as well (Anderson et al., 2019; Wood et al., 2018). Regulating NCPs for pollination (NCP#2), water quantity (NCP#6), and soil (NCP#8) were also identified as important for both rankings. These NCPs were also the ones selected in need of most enhancement in the area, with NCP#1 standing out the most (Fig. 6; 7). Brauman et al. (2020) noted in his global NCP trend assessment that specifically these NCPs are on a decline even with such massive importance to society. In the case of Serbia their selection can most likely be attributed to the current state of alarming air pollution, habitat destruction, and contamination (Fuller et al., 2019; WHO, 2009). The emphasis placed on regulating NCPs potentially implies an understanding of the importance of system stability, to allow for its utilization. In the ranking system related to local population benefits, material and non-material contribution were

given little bit more importance; however, non-material NCP outweighed material ones, indicating the importance that identities, experiences, and most importantly learning can have in this area to local populations. And even when a material contribution was chosen it was one associated with the most historical presence (see section 3.2.). These results were similar to when stakeholders were asked to select NCPs that were most enhanced in the last 10 years (Fig. 7). Furthermore, this selection of ranking preferences in decision-making is one way of narrowing down areas of interests to mobilize awareness, however, other NCPs not selected as top preferences must not be neglected. Studies have noted that similarities in values and preferences in such voting processes can have positive impacts on effectiveness on decision-making (Marta et al., 2020) in an effort to build consensus.

In a context-specific understanding through open-ended questions participants tended to attribute mainly non-material contributes and those associated with clean air and water to nature and the good quality of life. This attempt to understand the maintenance of options (NCP#18) from a context specific perspective showed an overlap with what was chosen in ranking outcomes (see section 5.2.1.), concretely the importance of clean air and water. Nevertheless, physiological benefits referred to as relational values (Christie et al., 2019), such as psychological sanctuary, nature as a source of life/origin, learning, productivity, creativity, hope, and connectivity to nature were mostly expressed to be essential for current generations (see section 5.2.2.). Similarly, future generation contribution to the good quality of life focused on proper development and positive experiences and nature as an escape from modernity. These benefits and values were found in other studies as well (Arias-Arévalo et al., 2017; de Juan et al., 2021) indicating their importance in human-nature relationships. Others found that such relational values are usually uncovered by the use of socio-cultural valuation methods (Christie et al., 2019). However, the narrative around the context of future generations, were a bit broader and included insights into the importance of resilience (e.g. climate mitigation) and direct conservation (e.g. biodiversity and forests/green spaces) (see section 5.2.2.). Findings like this indicate a direct application to future management plans. Comparably to Stålhammar & Brink (2020), this study also identified that participants mainly believed that nature cannot be detrimental to the good quality of life and that detrimental influences are only those related to the first degraded environment caused by people. Nevertheless, a small portion of participants described that nature could decrease and negatively affect the quality of life via natural disasters, allergens, and global processes out of our control.

6.2. Application to management

Within the pre-designed survey questions, participants selected that future management plans should focus on the enhancement of the reserve and its sustainable use compared to other options (Fig.9; section 5.2.3.). Even though the enhancement and sustainable use management objective is not concrete in terms of specific target setting, it shows that the concept of sustainability and the importance of enhancing the BioReserve is anchored in selected participants. This is further supported by the finding showing that priority in management plans should be given to NCPs related to habitat and species (Fig. 12) and the level of concern expressed by participants (Fig. 5). Such findings can signalize a potential failure of the core zone legislations, as that zone is the ones responsible for nature protection. Other options present in Figure 9, such as those related to the need for cooperation and dialogue between key stakeholders, increase of the budget, and protection of the area, can be used to define what sustainability is for actors of the reserve. Importantly the selection of the need for restructuring current management plans correlates with findings as to what is the reason for the degradation of NCPs in the future (see section 5.2.1.). With an overlap of these findings restructuring current management plans should be concentrated towards conflicting stakeholders identified (see section 5.3.2.) while incorporating speculated reasons for NCP improvement and enhancement in Figure 8. Since participants attributed importance for local population and civil organization to be catalysts of change (Fig. 8.) there might be a possibility for community-based management as it focusses on sustaining the flow of NCPs while improving livelihoods (Martín-López et al., 2019). More so, these shared social values described in 6.1. (regulation of air and water quality; (NCP#3,NCP#7), habitat creation and maintenance (NCP#1) and phycological benefits) should be the pillars through witch indicator NCPs (Fig. 13), habitats restauration (e.g. forest, natural waterways and meadows, Fig. 11), and conflict resolution (protection and forestry, fishing and cattle grazing; Fig. 10) are incorporated into management objectives. A clear example of all the stated above can be to start with NCP#1 and NCP#7 as indicators for habitat stability and restauration of natural waterways and swamp areas while incorporating community-based management for illegal fishing activities. Relational and shared values such as these can be essential stepping-stones for management as they increase social acceptance of environmental policies (Arias-Arévalo et al., 2017) and thus may influence the success of community based-management and other management targets. Additionally, the identification of these different values and knowledge creations may reveal how and why certain topics are hindered and conserved in a decision-making context (Topp et al., 2021), such as those associated with conflicts and predictions. These diverse knowledge types and benefits and their corresponding

implementations can insure proper management, potential reframing of the decision-making context (Topp et al., 2021) and even push for societal change (Stålhammar, 2021). Consequently, there must be an understanding of all values and knowledge types, ranging from generalized to context specific ones. Mainly, because values overlap and influence each other (Schröter et al., 2020); thus an exclusion and limited evaluation doesn't produce a holistic state of an area and can limit management success.

6.3. Reflection and recommendations

In conclusion, the overarching research question in terms of application of NCPs to management and communication can be promising; mainly because of findings in Figure 14. The NCP concept was well understood by the selected participants in Serbia and has been noted to have potential to enhance communication and management practices. Also, this study identified that people could have different value preferences to nature in different context (structured vs open-ended questions). Studies such as this serve as the first ideas regarding preferences, management objectives, inclusion (Marta et al., 2020) awareness rising (Walz et al., 2019) of human-nature interactions. The next step, as recommended by (Keller et al., 2018) and the author of this paper, should be to implement these finding in management objectives, future projects and dialogues between stakeholders of the reserve, showing concrete policy uptake strategies of the area. Since learning, inspiration, and experiences were selected to be important for local populations (5.2.1), understanding the importance of shared NCP values trough those lenses can provide more and deeper understanding of selected contributions. In such, connectivity and patterns currently unidentified can be obtained. The application of NCPs in informing management plans is growing in interest and since communicating NCP importance and integrate them in management starts with identifying possible NCPs (Newman et al, 2019) this study serves as a starting point for future research in the area. Socio-cultural methods such as this can provide the necessary flexibility to uncover different societal values of NCPs (Christie et al., 2019). A methodological contribution of this thesis can be viewed as an attempt to parallely use different valuation methods to produce as comprehensive as possible the values and benefits provided by the BioReserve Backo Podunavlje, suggested by Christie et al. (2019).

To the authors knowledge a study such as this is the first of its kind in relation to the NCP concept in this region, thus limitations are expected to be present. Mainly the limitations of the study are centered around the un-involvement of local population outside organized institutions. This study acknowledges that the results may be different if more civil organizations or local population was involved; however, many civil organizations in Serbia were also hard to locate online, and even when

located, lacked contact information. Also, the justifications for not selecting local populations is present in section 4. Other limitation includes the limited interaction with selected participants, as interviews could have provided better context specific understandings of the area, and that of sample size as participants who did not respond potentially could have led to different findings. One of the limitations of this study was also the under assessment of value differences and diversity of choices. The author acknowledges that such an assessment is also needed for better understanding of human-nature relationship; however, that was not the scope nor intent of this study. As implied through the results and the thesis body the intent of this study was to focus on consensus regarding options.

In terms of future research, criteria identified from this study should be further applied in studies that utilized multicriteria decision-making (MCDM ;see for example Saarikoski et al., 2016) or even those using fuzzy Borda Count (see for example Qiu et al., 2016). Studies in the area should also focus on incorporating local populations outside these selected institutions and incorporate mapping, awareness rising (Topp et al., 2021), models (Ghodsi et al., 2016), power sharing studies (Matuk et al., 2020) and scenario analysis (Walz et al., 2019). Only by furthering the research presented here can a true and holistic understanding of the BioReserve Bačko Podunavlje be possible.

Lastly, in this thesis the intention was not to argue as to which concept (NCP or ES) is best nor to fuel the existing debate around the concepts (see for example Kenter, 2018), but to demonstrate the insights that can be provided by looking to values and preferences as well as contributions obtained from an area.

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Appendix 1 – Survey information

Section of the Survey	Questions it had
Introduction to the area and concept	No questions
General information	On what day did you complete the questionnaire? What is the full name of the company / institution / institution you work for? What is your professional title and highest level of education? Is there a person in your organization / institution who deals with nature contributions or ecosystem services? If so, what is the job called? Describe in a few sentences what is the connection of your activity / institution with the reserve (eg do you sell caught fish, do you work in forestry)? Do you participated in some kind of survey related to the biosphere reserve? How concerned are you about environmental degradation within the reserve? How much do you enjoy being in or surrounded by nature?
Relationship with nature	How do you think that nature provides a good quality of life for you, your business and the environment? How do you think nature can impair the quality of life for you, your business and the environment? * How do you think nature provides a quality life for future generations?
Ranking contributions	What are the most important contributions of biosphere reserves from your point of view? What are the most important contributions provided by the reserve for the local population? What contributions are most needed for improvements? Which 5 contributions, from your perspective, have been most degraded over the past 10 years? For which 5 contributions do you expect the biggest reduction in the next 5 years? Why? Which 5 contributions from your perspective have improved the most over the past 10 years? For which 5 contributions do you expect the biggest improvement in the next 5 years? Why? Have you participated in the last 5 years in the assessment related to the contributions and services of nature in the protected area?
Management	In your opinion, what are the most effective measures for achieving the optimal condition of the protected area? You also have the 'other' option where you can write a reply if you do not agree with what is offered. Among which users, in your opinion, are there the biggest disagreements about the use of resources (eg livestock grazing and forestry; nature protection and tourism, water management and fisheries)? Give up to THREE examples! From your perspective (seen, heard and read) which of the following habitat types have increased / decreased during the last decade in the reserve? In your opinion, which activities in protected areas have provided the greatest financial benefit to society? Future management plans should focus on (select up to 4 answers and have an 'other' option where you can write an answer if you do not agree with what is offered): When establishing and managing a reserve, you should have as a priority: You also have the option 'other' where you can write an answer if you do not agree with what is offered. Which 5 contributions from your perspective are the most effective as indicators for monitoring the sustainability and stability of the reserve? The concept of 'nature's contribution to man' can raise the level of education of the local population Understanding the contribution of nature can help manage plans. Understanding other perspectives related to the concept of 'NCP' can reduce conflict between stakeholders. Common values can be used as indicators of what needs to be managed and maintained. Other stakeholders within the reserve understand my values related to nature. Do you have any suggestions or comments regarding the questionnaire and research in which you participated?

Appendix 2 – Examples of NVivo coding

NCPAssesment1.nvp - NVivo 12 Plus

Node Tools

Import Create Explore Share Node

Content Zoom Quick Coding Layout Annotations See Also Links Relationships Coding Stripes Highlight Code Uncode from This Node Spread Coding Auto Code Uncode New Annotation Annotations Word Cloud Chart Compare With Explore Diagram Query This Node Find

Nodes Search Project

Name	Files	References
NCP #3	1	2
NCP #11	1	3
NCP #8	2	5
NCP #4	3	6
NCP #6	3	10
NCP #17	3	19
NCP	4	121
nije istrazivano	4	13
NCP #1	4	19
NCP #2	4	7
NCP #7	4	10
NCP #9	4	10
NCP #10	4	18
NCP #12	4	13
NCP #13	4	28
NCP #14	5	14
NCP #15	5	28
NCP #16	5	23

Drag selection here to code to a new node

NCP #3

<Files\Backo Podunavlje BR Nomination form 2016> - 5 2 references coded [0.01% Coverage]

Reference 1 - 0.01% Coverage

Air quality regulations

Reference 2 - 0.01% Coverage

All vegetation in vegetation cycle

Screen-shot of Nvivo 12 File related to NCP document assessment.

Appendix 3 – Sample of filled out survey by one respondent

Doprinosi prirode ljudima u Rezervatu Biosfere "Bačko Podunavlje" ☆

Questions Responses 19

Responses cannot be edited

Doprinosi prirode ljudima u Rezervatu Biosfere "Bačko Podunavlje"

Ovaj upitnik je stvoren sa namerom da identifikuje percepcije zainteresovanih strana vezane za raznovrsne doprinose od strane prirode čoveku u rezervatu biosfere "Bačko Podunavlje".

Rezervat biosfere Bačko Podunavlje, je smešten u severozapadnom delu Srbije. Sastoji se od ostataka poplavnih područja Dunava i pejzaža koje je stvorio čovek pod uticajem poljoprivrede i urbanizacije. Poplavno područje obuhvata močvare, trske, slatkovodna staništa, aluvijalne močvare, kao i šume. Prostor je bogat dugotrajnom kulturom i tradicijom.

Cilj ovog naučno-istraživačkog rada je da stvori sistem transparentnog i održivog upravljanja. Kako bi se ovo postiglo koristiće se koncept po imenu 'natures contribution to people (NCP)' prevedeno kao 'doprinosi prirode ljudima'. Ovdje spadaju svi doprinosi žive prirode (tj. raznolikosti organizama, ekosistema i njihovih povezanih ekoloških i evolucionih procesa)koji doprinose kvalitetu života ljudi. Korisni doprinosi prirode uključuju stvari kao što su snabdevanje hranom, prečišćavanje vode, kontrola poplava, grejanje na drva i umetnička inspiracija, dok štetni doprinosi uključuju prenos bolesti i uništenje imovine od strane vremenskih nepogoda.

Ovaj upitnik se sastoji iz četiri dela i za popunjavanje upitnika Vam nije potrebno više od dvadeset minuta. Takođe, Vaša anonimnost će biti zadržana i svi podaci sa ovog upitnika se strogo koriste za izradu master rada.

* Required

Doprinosi prirode ljudima u Rezervatu Biosfere "Bačko Podunavlje" ☆

Questions Responses 19

Email *

ekoloskoudruzenjezelenisad@gmail.com



LUNDS
UNIVERSITET

Doprinosi prirode ljudima u Rezervatu Biosfere "Bako Podunavlje" ☆

Questions Responses 19



ПОКРАЈИНСКИ ЗАВОД
ЗА ЗАШТИТУ ПРИРОДЕ

Uopštene informacije

Na koji dan ste popunili upitnik? *

MM DD YYYY

02 / 20 / 2021

Doprinosi prirode ljudima u Rezervatu Biosfere "Bako Podunavlje" ☆

Questions Responses 19

Koji je pun naziv firme/ustanove/institucije za koju radite? *

Ekološko udruženje "Zeleni Sad"

Koje je Vaše strukovno zvanje i najviši stepen obrazovanja? *

diplomirani ekolog

Postoji li u vašoj organizaciji/ustanovi osoba koja se bavi doprinosima prirode ili ekosistemskim uslugama? Ako je odgovor potvrđan, kako se zove to radno mesto? *

Savetca ministra za zaštitu životne sredine

Opišite u par rečenica koja je povezanost Vaše delatnosti/institucije sa rezervatom (npr. da li prodajete upecanu ribu, da li radite u šumarstvu)? *

Udruženje se bavi promocijom ekologije i zaštitom životne sredine

Doprinosi prirode ljudima u Rezervatu Biosfere "Bako Podunavlje" ☆

Questions Responses 19

Da li ste već učestvovali u nekoj vrsti anketiranja vezanom za rezervat biosfere? *

Da

Ne

Koliko ste zabrinuti zbog degradacije životne sredine u okviru rezervata? *

1 2 3 4 5

Nisam zabrinut/a Veoma sam zabrinut/a

Koliko Vam prija da budete u prirodi ili njome okruženi? *

1 2 3 4 5

Ne prija mi Veoma mi prija

Doprinosi prirode ljudima u Rezervatu Biosfere "Bako Podunavlje" ☆

Questions Responses 19

Odnos sa prirodom

Kako smatrate da priroda omogućava dobar kvalitet života Vama, Vašem poslu i okruženju? *

Zdrava životna sredina pruža jedno opšte blagostanje.

Kako smatrate da priroda može da naruši kvalitet života Vama, Vašem poslu i okruženju? *

Narušena životna sredina utiče pre svega na zdravlje ljudi, preko zagađenja voda, vazduha, nestanak vrsta izaziva lančanu reakciju koja direktno utiče i na čoveka.

Kako smatrate da priroda omogućava kvalitetan život za buduće generacije? *

Ostavljanjem čiste životne sredine buduće generacije će takođe moći da uživaju u dobitima prirode.

Rangiranje doprinosa prirode

Koji su najvažniji doprinosi rezervata biosfere sa Vaše tačke gledišta? Rangirajte svih 16 pocev od 1

Doprinosi prirode ljudima u Rezervatu Biosfere "Bako Podunavlje" ☆

Questions Responses 19

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
Stvaranje i održavanje staništa	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Oprašivanje i širenje semena i klica	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>					
Regulacija kvaliteta vazduha	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Regulacija klime	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Regulacija količine vode	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Regulacija kvaliteta vode	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Formiranje, zaštita i dekontaminacija zemljišta i sedimenata	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>				