

LIKE A SQUIRREL, BUT BIGGER: APPLYING HUMAN DIMENSIONS  
RESEARCH TO A EUROPEAN BISON REINTRODUCTION PROJECT IN  
THE NETHERLANDS.

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## **Abstract**

Managing wildlife and natural resources is no longer an insular issue of managing the natural sciences and processes involved. With an increasingly human dominated landscape, managers must now consider the social element of all management decisions. Incorporating the Human Dimensions of Wildlife Management (HDWM) is more commonplace in management decisions in North America but is still a relatively emerging concept for European decision-makers. The more human-dominated a landscape, the more intertwined social sciences become to natural resource decision-making. Incorporating HDWM to natural resource and wildlife management decisions can increase public participation in the planning and decision-making process. This thesis studies a European bison reintroduction in The Netherlands, the most human-dominated landscape in western Europe, through a human dimension lens. HDWM is an important element for reintroduction projects as this information can help managers gain public trust and ownership towards them. Recreational users of the reintroduction area were surveyed to determine base knowledge levels, perceptions, attitudes, and values towards European bison and ecosystem services provided by their presence on the landscape. Through the information gathered, this study determined that recreational users were generally supportive of bison on the landscape and understood there was some value in the species being present. However, it also shows knowledge gaps towards European bison themselves and the ecosystem services they provide.

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## Glossary – Terminology

The terms used in the research are defined below. Some terminologies are described within the relevant chapters as well.

|      |  |
|------|--|
| HDWM | Human Dimensions of Wildlife Management      |
| PES  | Payments for Ecosystem Services              |
| SBB  | Staatsbosbeheer (Dutch State Forest Service) |
| WSAC | Wildlife Acceptance Stakeholder Capacity     |

## Chapter 1: General Introduction

European bison (*Bison bonasus*) is one of Europe's only remaining native mega-fauna. Originally having a range spreading across most of continental Europe European bison range is now reduced to marginalised fragmented populations (Van de Vlasakker, 2014; Krasíńska & Krasíńska, 2013; Pucek *et al*, 2004). The European bison is similar in size and appearance to the North American but slightly less heavy yet taller with longer horns and tail (Van de Vlasakker, 2014; Krasíńska & Krasíńska, 2013; Pucek *et al*, 2004). The European bison procures most of its food through browsing as opposed to grazing, which impacts local vegetation development, and is why they are considered a keystone species in addition to their contributions to nutrient cycling (Ripple *et al*, 2015; Eycott *et al*, 2013).

The European bison has been critically endangered since the early 1900s due to multiple population stressors including over-hunting and habitat loss (Pucek *et al*, 2004). The last remaining wild bison was killed in 1927 with all other individuals existing in captivity (Pucek *et al*, 2004). Following massive recovery efforts that began in 1927 the population has rebounded to approximately 3,200 individuals (Ripple *et al*, 2015; Pucek *et al*, 2004). Over the last two decades this successful recovery has lead from being held solely in captivity to reintroduction on the landscape (Plumb *et al*., 2020; Ripple *et al*, 2015; Pucek *et al*, 2004). Current populations estimate for European bison are approximately 6,200 individuals (Plumb *et al*., 2020). While this is promising, it is important for the species to maintain distinct genetic islands to support genetic diversity among the global population (Plumb *et al*., 2020).

Restoring bison on the European landscape has been proven to strengthen ecosystem services, namely nutrient cycling and seed dispersal, in the areas of reintroduction (Ripple *et al*, 2015; Eycott *et al*, 2013). Re-wilding movements have placed the European bison as the flagship species for the large herbivore reintroduction movement (Van de Vlasakker, 2014). The main impediment to these



re-introduction projects is the availability of suitable habitat and the need to reconcile the introduction of a large-range mega-fauna in a human-dominated environment. For long-term efficacy of the re-introduction programs, the species has a need to inhabit optimal landscapes instead of marginal environments, and this requires public uptake to the movement due to the limited natural areas available in the Netherlands.

Conservation efforts which re-designate land-use from a cultural landscape, where people can recreate and use the land for more utilitarian purposes, to one of conservation and restoring a non-agricultural state is of key importance in The Netherlands. Although the modern concept of protected areas and landscapes began in western Europe during the early 1900s, this was seemingly halted in The Netherlands during the post-war years when the focus shifted to re-developing agricultural lands (Renes, 2011; Renes, 2018; Secretariat of the Convention on Biological Diversity, 2022). Due to the small land area of the country and the high population density, redeveloping these lands hinge on understanding the needs and values of the mostly urban population (Renes, 2011; Renes, 2018). Although there is a noted shift towards making commitments to protected landscapes and re-wilding green spaces, the contexts of limited space and population increase will remain present for decision-makers in the future (Renes, 2011; Root-Bernstein et al., 2018).

Restoring natural landscapes from managed, agricultural spaces and those flora and fauna found within them can contribute to renewing ecosystem services, such as nutrient cycling and pollination, which were disrupted through human usage and cultural landscapes. With a reintroduction of European bison into the Veluwe region of the Netherlands, the Staatsbosbeher (SBB – Dutch State Forest Service) endeavoured to restore some of these ecosystem functions and services to an area long-impacted by human use. The Veluwe region represents the largest

interconnected area of natural landscape left in the Netherlands at approximately 100,000ha and is a highly visited area inhabited by many different wildlife species, particularly medium-sized ungulates such as multiple species of deer, boar, and mouflon (Van Wieren & Groot-Bruinderink, 2010). Despite being a large natural landscape it is still a highly human dominated area with towns in the region and along the periphery and a high visitation rate of approximately two million tourists a year (Statistics Netherlands, 2012). Returning bison to the landscape in the area will not be unnoticed by residents and recreational users of the Veluwe alike; employing a human dimensions lens to gain an understanding the perceptions, attitudes, values, and knowledge levels of stakeholder groups associated with reintroduction, would be integral to a successful outcome.

## **1.2 Protected Areas in the Netherlands**

National parks in the Netherlands started in the 1930s, with the creation of private parks, including De Hoge Veluwe (Gerritsen et al., 2006; Secretariat of the Convention on Biological Diversity, 2022). Government-funded and managed national parks would not be founded until the late 1980s, although iterations of other forms of protected areas existed throughout the country (Gerritsen et al., 2006; Government of the Netherlands, 2022). A change to modern management of national parks and protected areas in the Netherlands can be seen in the 1970s through international agreements which would eventually become European Union Directives (Gerritsen et al., 2006). A large focus of protected area management and creation in the 1980s was on “developing wilderness”, and actively attempting to return agrarian landscapes to a more natural, unmanaged state (Gerritsen et al., 2006; Renes, 2011; Verduijin et al., 2015). This led into the 1990s with the Dutch National Nature Policy Plan drafted to enact protection of select areas across the country which was developed in conjunction with the burgeoning Natura 2000 movement (Gerritsen et al., 2006; Renes, 2011; Verduijin et al., 2015). The Natura 2000 movement focused

concerns on ecological fragmentation and isolation of protected areas amongst the broader cultural landscape of the country and EU as a whole (Gerritsen et al., 2006; Government of the Netherlands, 2022; Ministry of Agriculture, Nature and Food Quality, 2005; Renes, 2011; Secretariat of the Convention on Biological Diversity, 2022). Within the Netherlands, the EU-championed Natura 2000 movement created the National Ecological Network (NEN) of natural areas (Gerritsen et al., 2006; Ministry of Agriculture, Nature and Food Quality, 2005; Renes, 2011; Secretariat of the Convention on Biological Diversity, 2022). Note that developing protected areas under the NEN is distinct from the system of national parks managed within the Netherlands. While the national parks are considered part of the NEN, not all protected areas under the NEN are National Parks (Government of the Netherlands, 2022). Since the passing of the Wet natuurbescherming, or Dutch Nature Conservation Act in 2017, developing the NEN and other protected area legislation now falls on provincial governments within the Netherlands (Government of the Netherlands, 2022; Secretariat of the Convention on Biological Diversity, 2022).

Managing this network of protected areas in the Netherlands are three main organisations: Naturmonumenten, Provinciale Landschappen, and the Staatsbosbeheer. Management and governance of national parks in the Netherlands can oftentimes be co-management or delegated efforts by any combination of these parties or other private landholders (Heslinga & Hartman, 2021). The Natuurmonumenten is a nationally focused nature-conservancy NGO managing protected areas in the Netherlands receiving grants and subsidies from the government to administer and manage lands owned by Naturmonumenten or landowners in association with them (Gerritsen et al., 2006; Secretariat of the Commission on Biological Diversity, 2022). Similarly, Provinciale Landschappen is an amalgated group of Dutch provincial conservancy organisations which focus conservation efforts at the provincial level mainly through individual donations and

regional regulation (Gerritsen et al., 2006; Secretariat of the Commission on Biological Diversity, 2022). As these latter two organisations were outside the scope of the research conducted, they will not be addressed or discussed in this paper.

The Staatsbosbeheer is a federal Dutch government agency mandated to, among other things, manage the Netherlands' protected areas at a federal level including the federal national parks (Gerritsen et al., 2006; Government of the Netherlands, 2022; Secretariat of the Commission on Biological Diversity, 2022). Founded in 1899, the SBB now manages over 270,000 ha (2,700km<sup>2</sup>) of land across the Netherlands (Staatsbosbeheer, 2022). The SBB on behalf of the Ministry of Agriculture, Nature and Food Quality has many delegated authorities including managing forest resources for timber and achieving international conservation targets such as the EU-driven Natura 2000 and Nature Protection Act (Secretariat of the Commission on Biological Diversity, 2022; Staatsbosbeheer, 2022). The SBB also manages some parcels of provincially protected NEN on behalf of the provinces (Staatsbosbeheer, 2022).

### **1.3 Problem and Research Statement**

Successful reintroduction of large herbivores in a highly human dominated landscape will require consideration of public opinion and an understanding thereof. Managers cannot act in a vacuum without this input. The area of reintroduction is located in the Veluwe region, the most interconnected patch of natural landscape in the Netherlands. This region draws many tourists to the area throughout the year and any negative impacts stemming from the reintroduction could result in a decrease in recreational usage, which may deter public opinion from supporting similar projects in the future. As a government agency and proponents of this project, the SBB has an onus to fully understand the ramifications of reintroducing a large herbivore to a human-dominated landscape from which it has been absent from for hundreds of years. Conducting human

dimensions research is integral to that commitment. The first paper presented in this thesis is focused on gaining an understand of the extent to which recreational users of the Veluwe region accept the plan to reintroduce bison to the landscape. The second paper presented here provides an analysis of any knowledge gaps held by recreational users regarding the contributions of European bison to the landscape.

#### **1.4 General Methodology**

Data for this study were collected from a convenience sample (n = 306) of recreational users utilizing the Veluwe area of Gelderland province in The Netherlands (Figure 2.1). A convenience sample was used for this study as more-rigorous, probability sampling techniques could not effectively be employed due to contextual factors of the study area and due to study constraints. A convenience sample is a non-probability sampling technique which selects participants due to their accessibility to the researcher (Haan, 2013; Berg, 2007). Although, as Yin (2016) notes, convenience sampling is prone to information bias and insufficiencies, it is suitable for special circumstances when a more representative and intensive sampling is not possible. Another appropriate circumstance for convenience sampling is through its use as a means of gathering preliminary information in a cost-effective manner (Berg, 2007). Convenience sampling was identified as the best research method for this situation due to the temporal and fiscal constraints of the study faced by the researchers and the nature of the study area. Efforts were made to select participants during various times of the day, various days of the week, and at various geographical locations within the study area to help mitigate shortcomings of the convenience sampling technique. Regardless, this study was not designed with the intent of being statistically representative of the visitors to the Veluwe area. Rather, this study was designed solely to garner an understanding of the perceptions, attitudes, and values of a limited sample of recreational users

regarding management efforts associated with a proposed bison restoration and related ecosystem services. The research study design and questionnaire used for this study were reviewed and approved by Memorial University's Grenfell Campus Research Ethics Board on July 30<sup>th</sup>, 2014. The reference number 20150340 was assigned to the research.

These manuscripts presented in this thesis employ both quantitative and qualitative approaches to data collection. Simple descriptive analyses were performed on the data sets and supplemented through limited qualitative information garnered from a selection of open-ended survey questions. Survey questions can be reviewed in full in Appendix A. Examples of open-ended questions used to garner qualitative data are: "What kind of image do you have of a bison?"; "What do you see as the positive points of E. Bison on the Veluwe and what as the negative points?"; and "How would you react if you saw a European bison in the wild?". The use of a combined quantitative and qualitative approach to data analysis make the findings of the study more robust and thorough. Eight out of the 16 survey questions were open-ended responses. These open-ended questions typically involve a brief opinion from the respondent. As acknowledged by Yin (2006), mixed-method approaches are synergistic to research questions requiring qualitative and quantitative evidence.

#### **1.4.1 Survey Structure and Administration**

Data were collected using a researcher-administered survey consisting of nineteen questions. Questionnaire items were designed to address issues such as recreational users' perceptions; knowledge levels; management considerations (e.g: where the reintroduction should take place, whether or not the Veluwe should develop more naturally); values regarding European bison; and, what positive or negative impacts they felt a European bison reintroduction would have. There were also standard demographic questions regarding gender, age, residency, frequency

of visitation to the Veluwe, and what activities visitors usually partook in when in the Veluwe. The questionnaire was constructed with Dillman's (2007; 1978) Total Design Method (TDM) in mind. Following the TDM, similar survey questions were grouped together; simple questions (e.g.: "Do you know what a European bison or wisent is?"; "Have you ever seen European bison? If yes, where?") were placed at the beginning of the survey and more contentious questions pertaining to the reintroduction and potential impacts were placed at the end (Dillman, 2007; Crosby et al, 1989; Dillman,1978). Response options for the different survey questions – except the demographic questions – consisted of five questions with binary response options (i.e.: either yes/no or true/false); two questions consisting of a three-point scale (i.e.: avoid/favour/no change or yes/no/neutral); and nine questions had open-ended response options. The survey was conducted from October 5-8<sup>th</sup>, 2014; however, questionnaire items were pilot tested during an earlier study (which utilized the same study design as the current study) which gathered data from 77 visitors to the Veluwe area.

#### **1.4.2 Survey Analysis**

Compilation and analysis of the data was completed using IBM's Statistical Package for the Social Sciences (SPSS) program. Simple descriptive analyses were performed on the data sets and supplemented through information garnered from a selection of open-ended survey questions. The use of a combined quantitative and qualitative approach to data analysis will make the findings of the study more robust and thorough. Qualitative research allows researchers to answer questions through more than amassing data; it focuses on exploring the social dimensions of the research setting and the humans who interact with it (Berg, 2007). Considering the emphasis on social information in human dimensions research, qualitative research provides insight essential to

researchers. As acknowledged by Yin (2016; 2006), mixed-method approaches are synergistic to research questions requiring qualitative and quantitative evidence.

## **1.5 Manuscript Overviews**

The following manuscripts explore a European bison reintroduction project in the Netherlands through a human dimensions lens focusing on recreational users to the area. Incorporating human dimensions considerations into wildlife management efforts allows decision makers to more competently address public concern with a proposed project or issue; understand discrepancies of knowledge gaps between researchers and the public; and, seek to restore public trust in the decision-making process through more public consultation. By addressing these issues through a human dimensions approach, the resource management decision-making process becomes that much more holistic and inclusive of public wants and concerns.

The first manuscript is focused on the general perceptions, attitudes, values and knowledge of recreational users in the Veluwe towards a European bison reintroduction project. The survey questions focused on in this study surround a theme of public acceptance towards bison on the landscape in the Veluwe, if they know what a bison is, and what impact it would have on their visitation and enjoyment of the landscape. In a country as human dominated as the Netherlands, reintroduction of a large-range herbivore absent from the landscape for over a century cannot be done effectively without understanding the publics' answers to these questions.

The second manuscript presents an analysis of the perceptions and knowledge of recreational users regarding the ecosystem services performed by bison and the importance of decision makers communicating those impacts to recreational users to the area. Using public outreach to identify areas where knowledge gaps exist between project proponents and the public is an important part of understanding where public opinion towards a project is derived from. Such an understanding



can also help reveal opportunities for decision makers to reevaluate any communication and education strategy with the public. This manuscript also evaluates the “cost” of the reintroduction project to recreational users beyond a monetary value and looks to inform the decision makers towards a more holistic understanding of what recreational users are willing to pay for purported project benefits.

The author of this manuscript offered feedback on the survey design, conducted data collection in the Veluwe region of The Netherlands, performed all data analysis and manuscript writing.

## **Chapter 2: Perceptions, Attitudes, & Values towards European Bison**

### **2.1 Introduction**

#### **2.1.1 Large Herbivore loss**

Since the 2002 Convention of Biological Diversity, biodiversity loss has been acknowledged as a global issue by the world community, and has even been included in the United Nation's Millennium Development Goals (Butchart *et al*, 2010). Despite global efforts, biodiversity loss is increasing. A recent review supports this assertion indicating that rates of biodiversity loss are not slowing and that major drivers of loss are increasing in severity (WWF, 2020). The rate of growth for the International Union for the Conservation of Nature's (IUCN) Red List has also been increasing over the last three decades, which translates into an increasing number of threatened, endangered, or extinct species (Dirzo *et al*, 2014; Butchart *et al*, 2010; WWF, 2020).

A specific facet of global biodiversity loss is the diminishing number of larger herbivores across the world. Large herbivore loss is not continental or regional in scope; it is global issue with large herbivores facing threats across the world due to exploitation (Ripple *et al*, 2015; Brashares *et al*, 2014; Dirzo *et al*, 2014; Butchart *et al*, 2010), land-use change (Ripple *et al*, 2015; Dirzo *et al*, 2014; Pim *et al*, 2014; Butchart *et al*, 2010) and geopolitical conflicts (Ripple *et al*, 2015; Brashares *et al*, 2014; Douglas & Alie, 2014; Francis & Krishnamurthy, 2014). Their extirpation from regional ecosystems is particularly concerning given a large majority of large herbivores act as keystone species; frequently contributing to an ecosystem's nutrient cycling, soil nutrient profile, seed dispersal, and providing habitat for meso-herbivores as well as a diverse range of smaller species (Ripple *et al*, 2015; Wallis De Vries, 1995). The removal of large herbivores from regional ecosystems has been shown to have complex and unpredictable consequences that cause corresponding changes in critical biotic and abiotic ecosystem components fundamentally altering

original ecosystem dynamics (Ripple *et al*, 2015; Palmer *et al*, 2008). Under such altered conditions the distinct ecological needs of large herbivores allow them to be managed as an umbrella species (Caro & Girling, 2010; Wallis De Vries, 1995). Umbrella species are species requiring large home ranges and wide habitat requirements that if they are given adequate space, they will also protect a number of other species living within the area (Caro & Girling, 2010; Heywood & Watson, 1995). By managing the specific ecological requirements of umbrella species, other species living in the regional area will be afforded protection through specific conservation measures (Caro & Girling, 2010; Heywood & Watson, 1995; Wallis De Vries, 1995). For example, managing the needs of one species (e.g., creation of a protected areas around home ranges) will in turn ensure that habitat requirements for other species are also being met (Caro & Girling, 2010; Wallis De Vries, 1995). The ability to choose specific conservation measures for large herbivore management is a complex choice which is affected by a range of public values including economic, socio-cultural, institutional, and ecological factors defining these as “wicked” natural resource problems (Decker *et al*, 2012).

### **2.1.2 Wicked problems**

Natural resource problems can be categorized as “complex” (or “technical”) in nature, and those which are “wicked” (Decker *et al*, 2012; Allen and Gould, 1986; Rittel and Webber, 1973). Complex problems are defined as those which require systems analysis, such as economic efficiency, empirical analysis and scientific rationality, and solutions based upon a rational-comprehensive model (Lachapelle *et al*, 2003; Allen and Gould, 1986). These technical problems assume consensus on a singular objective and will have an optimal solution, the interaction between system components involved in complex problems allow managers to minimize uncertainty when predicting management outcomes (Decker *et al*, 2012; Balint *et al*, 2011;

Lachapelle *et al*, 2003). Solving wicked problems in the same fashion as technical problems will leave managers with a missing dimension; that of the values held by the public and stakeholders which influences their perceptions of the resource and impacts as well as their preferred response to the problem (Balint *et al*, 2011; Decker *et al*, 2012). To overcome this barrier – which in many instances fails to even be recognized by managers adjusted to operating under a “technical” management mind-set – traditional wildlife management needs a paradigm shift (Balint *et al*, 2011; Lachapelle *et al*, 2003). A large part of this paradigm shift is acknowledging the difference between complex and wicked problems. In contrast to complex problems, wicked problems reflect real-world decision making in a pluralistic society defined by no one undisputable objective, public good, a multitude of conflicting stakeholder values and high scientific uncertainty of alternatives which create conflicts surrounding problem definition as well as goals and alternatives; as a result, there will not be an objective optimal management solution (Decker *et al*, 2012; Balint *et al*, 2011; Allen and Gould, 1986; Rittel and Webber, 1973). This new paradigm in managing wicked problems has been identified by some as a shift of focus towards more ecosystem-based management approaches.

The shift to applying ecosystem-based approaches towards large ungulate management only addresses some issues presented by wicked problems, as such approaches are primarily focused on natural processes and relationships of ecosystems, hence an emphasis on the natural sciences (Sandström, 2012). More recent applications of ecosystem-based management, particularly in the fields of forestry and fisheries, have approached issues through a multi-perspective lens through the application of Structured Decision Making (SDM) (Gregory *et al*, 2012). However, managing ungulates in the context of broad ecosystem functions and processes in more human-dominated landscapes can be especially difficult, forcing managers to work with how the landscape is

currently – and historically – shaped by socio-economic forces (Sandström, 2012; Sxaro *et al*, 1998). Oftentimes this means managing a small parcel of land in context to the broader landscape outside of the management area (Sxaro *et al*, 1998). For regions such as western Europe, where natural areas are seated within human dominated environments managing for aspects of culturally significant landscapes often takes precedence. Instead of focusing management efforts on fostering ecological functions and processes, the human dimensions involved with decision making become more prominent as decisions need to reflect the public’s values and cultural perceptions of the area in question. This is especially true for the Netherlands as the mosaic of landscapes involved in managing wildlife and natural areas becomes extremely crowded with various actors and human-dominated areas (Ministry of Agriculture, Nature and Food Quality, 2005; Renes, 2011; Renes, 2018). These two different approaches to management – as Sandström (2012) notes – can nevertheless be applied in a complementary fashion, instead of competitively, to enhance a region’s management framework to ensure a more holistic inclusion of the ecological, economic, and social spheres. Despite these new management approaches, there is still a necessity for resource managers to elicit stakeholder values to be subsequently integrated into more holistic management decisions (Decker *et al*, 2012). As noted by Allen and Gould (1986, p.4) “Wicked problems require nontraditional solutions”; the non-traditional solution in this case, is Integrated Resource and Environmental Management (IREM). The field of IREM incorporates non-traditional solutions through a variety of means, such as acknowledging the necessity of traditional resource management to expand past the natural science, single discipline focus as well as including different government agencies and interest groups (Hanna & Slocombe, 2007). Not only does IREM address the oftentimes fragmented and isolated disciplines and institutions within management, it also shifts the problem definition phase from a strictly expert-dominated field to

include input from “non-expert” actors such as the general public and stakeholder groups (Hanna & Slocombe, 2007). By incorporating new sources and means of analyzing information, IREM provides the appropriate, non-traditional lens with which to view and solve wicked problems.

### **2.1.3 Integrated Resource and Environmental Management**

Integrated resource and environmental management (IREM) is the result of a paradigm shift in resource management from traditional “command-and-control” decision-making<sup>1</sup> to one that places a larger emphasis on integrative solutions (Hanna & Slocombe, 2007). This new emphasis on integrative solutions is the result of an effort by natural resource managers attempt to resolve wicked resource problems without over-simplifying the solution and also avoiding management analysis paralysis (Defries & Nagendra, 2017). Instead of compartmentalized, single discipline and technical analysis attempts to solve high-uncertainty, multi-faceted issues, IREM supports a more interdisciplinary, learning-focused, participatory approach. This paradigm employs concepts of adaptive, ecosystem-based, and co-management styles to resource management institutions (Hanna & Slocombe, 2007). Instead of managing for a single resource in the ecosystem, an IREM approach considers the entire system supporting the resource as well as the resource-users and those impacted by resource use. Another major change under the IREM paradigm is a shift to incorporate stakeholder values into management decisions, as well as the entire management process, such as in the monitoring and evaluation phase (Hanna & Slocombe, 2007). Integrated resource and environmental management’s system-level focus and attention to the integration of stakeholder values into management decisions coincides well with the needs of wildlife managers (Decker *et al*, 2012). Wildlife managers are frequently required to solicit public values and

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<sup>1</sup> A management approach which perceives a problem solution to be “...the control of the processes that lead to the problem...or through amelioration of the problem after it occurs...” (Holling & Meffe, 1996, p.1). This approach assumes that problems are “complex” instead of “wicked” in nature; meaning well-defined and relatively linear between cause and effect (Holling & Meffe, 1996).

incorporate these perspectives into ecological management efforts factors (Decker *et al*, 2012). Integrating stakeholder values in the decision making process (particularly in the problem definition stage) and also fostering a sense of public and stakeholder ownership – similar to Lachapelle *et al*'s 2003 concept - for the final management decision, requires a focus on the human dimensions involved. Although IREM attempts to integrate public participation into the resource management decision-making process, applying this concept has been fraught with challenges as to the manner and degree of participation (Lawrence & Deagen, 2007). Despite the increased focus IREM has towards managing natural resources at the ecosystem level, there is still a technical, science-based process involved in decision making (McCool & Guthrie, 2001). The traditional scientific-based wildlife management paradigm not only struggled to incorporate these social values into decision-making, but also what the public and stakeholders wanted from this increased participation (McCool & Guthrie, 2001).

#### **2.1.4 Human Dimensions of Wildlife Management**

Wildlife management in North America was originally concerned with conserving game species. This gradually changed throughout the early 20<sup>th</sup> century when the paradigm eventually gave way to a larger management focus on game and furbearing species; applying a command-and-control approach which primarily only considered stakeholder values of hunters, trappers, and anglers (Gigliotti *et al*, 2009). To a large extent this management approach left socio-cultural and institutional factors out of the equation (Gigliotti *et al*, 2009). The focus of this paradigm was on game species, failing to capture non-consumptive values and the pluralistic ideals of the general populace (Gigliotti *et al*, 2009; McCool & Guthrie, 2001). Failure to incorporate these social factors as well as a general growing lack of public trust in governments and their agencies that developed in the 1960s made it significantly more difficult to apply a technical scientific approach

to wildlife management (Gigliotti *et al*, 2009). Due to the interconnectedness of social and ecological systems, by the late 1960s and throughout the 1970s it was becoming impossible to effectively manage them separately (Gigliotti *et al*, 2009). Human and wildlife considerations needed to be considered in tandem as both directly and indirectly affect one another (Gigliotti *et al*, 2009). This led to what is now known as human dimensions of wildlife management (HDWM); managers equally considering human, wildlife, and habitat impacts on the management environment (Decker *et al*, 2012). The early human dimensions work of the 1960s focused on hunter and fisher satisfaction as well as human-wildlife public relations issues (Bath, 1998). This focus later broadened to include non-consumptive versus consumptive values along with research into urban wildlife (Bath, 1998). Studies into public attitudes towards wildlife, in particular large predators, was the next increment of the management paradigm. Subsequently, this was followed with applied work by management agencies to solve the wicked problems of the natural-science based paradigm (Bath, 1998). In a European context, however, the field of human dimensions of wildlife management research is still not as well developed, and not widely practiced by many resource management agencies across the continent (Glikman & Frank, 2011). European interest towards human dimensions research coincided with a surge in large carnivore populations across Scandinavia in the late 1970s and throughout the 1980s (Glikman & Frank, 2011). These early studies focused primarily on public attitudes towards the increasing number of large carnivores; which eventually led to the creation of the Large Carnivore Initiative for Europe (Glikman & Frank, 2011). The predominant theme of HDWM research in Europe focused on attitudinal studies of either the general public or stakeholder groups towards large carnivores or herbivores, and nuisance species (Glikman & Frank, 2011). However, human dimensions research in Europe is still significantly less well developed when compared to the amount of research conducted in North



America, and still struggles for recognition as a legitimate field of research yet alone being accepted and applied by regional resource management agencies (Glikman & Frank, 2011).

Applying human dimensions research to management requires managers to become aware of perceived stakeholder impacts and values in order to facilitate informed decision-making. Of particular importance is how the public views wildlife and reacts to management efforts; whether they support, or oppose, efforts and to explore the reasoning behind those viewpoints (Decker, Brown, & Siemer, 2001). Enabling a process to incorporate this stakeholder information and collaboration is essential when defining wicked problems and attempting to foster public ownership of management actions (Lachappelle *et al*, 2003). By drawing upon this stakeholder information early in the management process, managers can begin the arduous task of promoting understanding between polarizing viewpoints.

To properly solicit and incorporate stakeholder information is essential to the management of wicked resource problems; human dimensions research concentrates on values, attitudes, and perceptions. With information on these human dimensions, wildlife managers can better predict public behavior towards not only wildlife species, but also management efforts. An individual's or organization's values shape their respective attitudes and perceptions towards wildlife and management decisions. Values are typically defined as desired end states or qualities of life individuals or collectives hold dear (Decker *et al*, 2012). Directly influenced by an individual's or organization's values are attitudes (Decker *et al*, 2012). Attitude is an individual's evaluation of an object, concept, or action whether that evaluation is positive or negative (Decker *et al*, 2012). Stakeholder attitudes are particularly linked to behaviors, through explicit and implicit means. Explicit attitudes form from deliberative thought processes; implicit attitudes, however, are more automatic and subconscious in nature (Decker *et al*, 2012). Lastly, perceptions are what contribute

to stakeholder and public knowledge levels. They are the preconceived notions, which an individual or stakeholder group has - whether they are based in fact or not - towards the resource management issue at hand. Understanding perceptions can highlight areas managers should focus educational efforts towards to facilitate well-informed decision making and discussion among stakeholders and the public. Human dimensions are important to integrate when formulating policy solutions for wicked problems, and even more so when they involve threatened species.

### **2.1.5 Scarce wildlife**

Most threatened species are considered scarce wildlife species; defined as a species whose population was once abundant but has been greatly diminished and threatened with extinction throughout their original range (Decker et al, 2012). Scarce wildlife management is prone to the inherent difficulties of any wicked resource problem, especially if reintroductions are to occur in human-dominated landscapes. Kellert (1996) emphasizes the necessity for decision makers to recognize these issues as the multi-dimensional and integrative problems they are in order to both properly frame and address these challenges. If a scarce wildlife management problem is approached as “complex” instead of “wicked”, stakeholder values – especially competing, polarized values - may be overlooked and ineffectively accounted for in management efforts (Kellert, 1996). Human dimensions studies can become an asset for wildlife managers by facilitating responsible reintroduction of scarce wildlife by ensuring related management decisions are informed by local public or stakeholder opinions. As Decker *et al* (2012) notes, most of the interactions the public will have with scarce wildlife will be through second-hand accounts, creating high probability they will be misinformed about wildlife impacts. This speaks to the need of managers to explore what the local public already knows (or does not know) about the species;

which will focus educational efforts and facilitate informed public and stakeholder discussion and decision making (Kellert, 1996).

Involving local stakeholders and the public at large in the problem definition stage as well as the decision making process can also serve to increase a sense of community ownership and support towards the management efforts (Lachapelle *et al*, 2003; Kellert, 1996). Human dimensions research can also be used to gauge levels of social feasibility of reintroducing an endangered species to an area (Morzillo *et al*, 2007). Soliciting public and stakeholder opinion regarding scarce wildlife reintroductions is common, and examples of previous European bison reintroductions soliciting this involvement can be found in Germany, Lithuania and Poland (Balčiauskas & Kazlauskas, 2014; Decker *et al.*, 2010; Hermann *et al.*, 2013). Reintroduction efforts may complicate and increase tensions regarding property rights and perceived threats towards the traditional use and access of resources on public and private lands, public and stakeholder values, beliefs, and attitudes can determine the success of a reintroduction effort (Kellert, 1996). Kellert (1996, p.182) notes most scarce wildlife conservation efforts “...will ultimately depend on decisions made by ordinary people pursuing their daily lives.” Managing scarce wildlife while considering and adhering to the tenets of human dimensions research is essential for a sustainable threatened species reintroduction, such as the European Bison, the only threatened large-herbivore species found in developed countries (Ripple *et al*, 2015).

### 2.1.6 European Bison

European bison were one of Europe's original mega fauna, initially having home ranges that spanned across western, central, and south-eastern Europe (Van de Vlasakker, 2014; Krasínska & Krasínska, 2013; Pucek *et al*, 2004) (Figure 1.1). Multiple population stressors such as depredation, fragmentation, and overall habitat loss contributed to their continental population decline and by the



Figure 2.1: Original range of European bison (*Bison bonasus*) (As adapted from Krasinska & Krasinska, 2013, p.41)

end of the 19<sup>th</sup> century only two populations were left (Pucek *et al*, 2004). European bison population decline would continue until 1927, when the species nearly faced extinction with the last remaining wild population extirpated from its habitat (Pucek *et al*, 2004). At the time of data collection, through extensive conservation efforts, wild populations were established in Poland and Germany with a global population of approximately 3,200 individuals (Ripple *et al*, 2015; Pucek *et al*, 2004). Currently the IUCN estimates an approximate global population of 6,200 bison with 47 free-living sub-populations (Plumb *et al.*, 2020). The presence of European bison in an area is important, as they act as keystone species in the regional ecosystem and have various direct and indirect impacts on the system. Notably, they promote certain ecosystem services, such as: the maintenance and expansion of grasslands; nutrient cycling via direct and indirect mechanisms; their wallows provide habitat diversity for both plants and animals (e.g.: amphibians and birds through creation of ephemeral pools); synergy between bison and smaller herbivore grazing opportunities; and, as a flagship fauna it can draw tourists to the region as well as promoting wildlife conservation efforts (Ripple *et al*, 2015; Eycott *et al*, 2013). Due to European bison being

a keystone and umbrella species, their status as Europe's only threatened large herbivore, and their expansive original continental home range they have become the flagship species for the European rewilding campaign. Beginning in the 2000s, the rewilding movement focuses on restoring natural processes and species to landscapes and decreasing human-management of the site (Rewilding Europe, 2015). In Europe, the movement is spear-headed by the Rewilding Europe foundation, established in 2011 (Rewilding Europe, 2015). There have been multiple reintroduction sites across Europe and the Staatsbosbeheer (SBB - the Dutch State Forest Service) started reintroduction effort in The Netherlands, an extremely high-density human dominated landscape.

### **2.1.7 Ungulate & Bison Management in The Netherlands**

The SBB is responsible for wildlife management only on SBB-managed lands, such as the Oostvaardersplassen and Kraansvlak protected areas and portions of the Veluwe region (Staatsbosbeheer, 2022). Although the overall wildlife management policies of the SBB are outside the scope of this paper, there are noted instances of intensive management occurring at the Oostvaardersplassen protected area (ICMO2, 2010). The resident populations of deer and Konik horses have been artificially managed by both feeding and large population culls due to a lack of a significant predator population (ICMO2, 2010; Van Wieren & Groot-Bruinderink, 2010). This has resulted in occasional incidents of negative media, and public concern during particularly harsh winters or culls of herbivores (ICMO2, 2010; Jacobs 2007; Van Wieren & Groot-Bruinderink, 2010). This has resulted in public debate over the SBB's chosen management paradigm of a "hands-off" approach that continually involves intensive management action (ICMO2, 2010; Jacobs, 2007; Van Wieren & Groot-Bruinderink, 2010).

Specific SBB policies regarding bison management were unable to be found by the author in English text-format regarding the Veluwe reintroduction site. Based on a similar bison

reintroduction area in the Kraansvlak region of the Netherlands, it can reasonably be assumed the Veluwe herd will be managed as a research herd and used to increase the genetic diversity of the overall European bison breeding population (Cromsigt et al., 2017; Ramos et al., 2018; Ramos et al., 2019; Valdes et al., 2018). This management plan is also in the spirit and overview of Rewilding Europe's Bison Rewilding Plan 2014-2024 (Van de Vlasakker, 2014).

### **2.1.8 Problem Statement**

Through a European bison reintroduction, the SBB hopes to restore ecosystem functions and services in the Veluwe region. However, the Netherlands is the most densely populated country in western Europe. With a total population slightly under 17 million people and a population density of 489 people per square kilometer, the Netherlands is an extremely human dominated landscape (Statistics Netherlands, 2015). This particular reintroduction project was planned for the eastern province of Gelderland; specifically in the Veluwe region, a 100,000ha area known for its landscapes of woodland, heath, moraines, and sand dunes (Van Wieren & Groot-Bruinderink, 2010). As well as having a unique landscape, the Veluwe region also supports the largest habitat range for many different wildlife species, including several different species of deer, wild boar, and mouflon (Van Wieren & Groot-Bruinderink, 2010). The Veluwe presents one of the most interconnected natural areas in the whole country. As a result of the Veluwe's unique landscape and wealth of natural areas, it is a high-traffic tourist destination; seeing approximately two million visitors to the region's many bungalow parks, hiking trails, and heritage sites annually (Statistics Netherlands, 2012). As the Veluwe is such a highly utilized recreational area, public acceptance of the European bison reintroduction project will be a strong factor in determining the legitimacy and success of the project. Further complicating matters, Veluwe region is an amalgamation of multiple parcels of protected areas managed by twenty different organisations, a mix of all levels

of governments and their respective agencies, the Natuurmonumenten, and some private landowners (Provincie Gelderland, 2017).

The SBB were unsure of public acceptance levels regarding these reintroduction plans, and overall public reception and knowledge towards European bison in general (Staatsbosbeheer, personal communication, October 6, 2014). In order to increase the legitimacy and transparency of the decision-making process, the SBB identified a need for a larger public involvement consultation process through human dimension research. The SBB pursued this engagement through consultations with local politicians and community groups representing the area (such as Hoog Buurloo, the nearest community to the proposed reintroduction site) to garner information from some stakeholder groups. In addition to these consultations, the SBB decided to pursue a survey of recreational users the stakeholder group perhaps most directly affected by the reintroduction (Staatsbosbeheer, personal communication, October 6, 2014). This study of recreational users is the focus of the current research. This study found that in 2014, a majority of recreational users to the Veluwe supported a bison reintroduction, albeit knowledge levels of bison were ultimately low. Information on recreational users to the area is significant to managers as they will need to integrate recreational user's perceptions, attitudes, values, and support levels into their decision making process.

### **2.1.9 Purpose Statement**

This research will identify recreational users' perceptions, attitudes, values, knowledge, and support levels regarding the European bison reintroduction to the Veluwe region. Understanding recreational users' values will give managers a baseline as to what the public find important; be it the environmental/ ecological, economic, intrinsic, aesthetic, tourism value, or otherwise. This information will provide managers with a greater understanding of the levels of support or

opposition for the proposed reintroduction as well as information on knowledge gaps, which can be used to design targeted outreach efforts. Integrating this information into decision-making will make the SBB aware of potential management impacts of the reintroduction project; whether it is through general support for the decision or value conflicts. Ultimately, this will be used to enlighten public discussion and management decisions; allowing for greater informed decision making by recreational users and the SBB alike. This inherently leads to more transparency and accountability at the institutional level, making decisions subjectively and objectively better. In the interest of providing direct public feedback on proposed management decisions, the survey results will be presented to the SBB. As these research findings offer insight into recreational user opinions and support in 2014, managers can then use it in conjunction with other similar studies to measure change between sampling periods. The aim of presenting the research findings is to facilitate open discussion regarding the proposed reintroduction project and increase public involvement in management decisions.

## **2.2 Methods**

Data for this study were collected from a convenience sample (n = 306) of recreational users utilizing the Veluwe area of Gelderland province in The Netherlands (Figure 2.2). A convenience sample was used for this study as more-rigorous, probability sampling techniques could not



effectively be employed due to contextual factors of the study area and due to study constraints. A convenience sample is a non-probability sampling technique, which selects participants due to their accessibility to the researcher (Haan, 2013). Although, as Yin (2016) notes, convenience sampling is prone to information bias and insufficiencies, it is suitable for special circumstances when a more representative and intensive sampling is not possible. Considering both the time constraints of the study period available to the researchers and the nature of the study area, it was decided as the best research

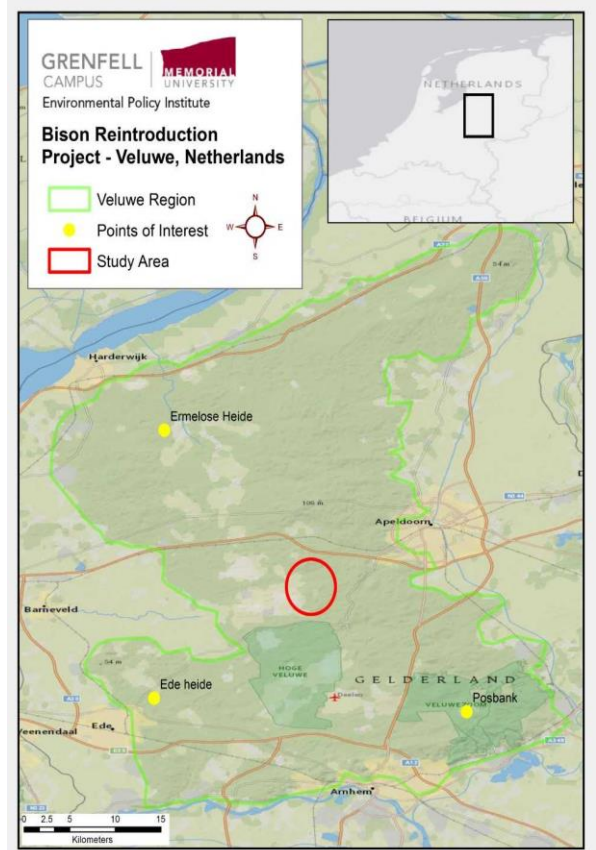


Figure 2.2: Map of study area

method for this situation. In an effort to account for the shortcomings of the convenience sampling technique, efforts were made to select participants during various times of the day, various days of the week, and at various geographical locations within the study area. Regardless, this study was not designed with the intent of being statistically representative of the visitors to the Veluwe area. Rather, this study was designed solely to garner an understanding of the perceptions, attitudes, and values of a limited sample of recreational users regarding management efforts associated with a proposed bison restoration and related ecosystem services. The research study design and questionnaire used for this study were reviewed and approved by Memorial University's Grenfell Campus Research Ethics Board on July 30<sup>th</sup>, 2014. The reference number 20150340 was assigned to the research.

### **2.2.1 Survey Structure and Administration**

Data were collected using a researcher-administered survey consisting of nineteen questions. All survey questions were translated in both English and Dutch, and research assistants speaking both languages were on-hand to mitigate possible language barriers for non-Dutch speaking recreational users. Survey questions were developed using as much plain language as possible for ease of translation. Questionnaire items were designed to address issues such as recreational users' perceptions; knowledge levels; management considerations (e.g.: where the reintroduction should take place, whether or not the Veluwe should develop more naturally); and, values regarding European bison. Questions involving knowledge were designed so as not to exclude recreational users without a technical or scientific background. The questionnaire was constructed with Dillman's (1978) Total Design Method (TDM) in mind. Following the TDM, similar survey questions were grouped together; simple questions (e.g. "Do you know what a European bison or wisent is?" "Have you ever seen European bison? If yes, where?") were placed at the beginning of the survey and more contentious questions pertaining to the reintroduction were placed at the end (Crosby *et al*, 1989; Dillman, 1978). The survey was conducted from October 5-8<sup>th</sup>, 2014; however, questionnaire items were pilot tested during an earlier study (which utilized the same study design as the current study), which gathered data from 77 visitors to the Veluwe area.

### **2.2.2 Survey Analysis**

Compilation and analysis of the data was completed using IBM's Statistical Package for the Social Sciences (SPSS) program. Simple descriptive analyses were performed on the data sets and supplemented through anecdotal information garnered from a selection of open-ended survey questions. The use of a combined quantitative and qualitative approach to data analysis will make

the findings of the study more robust and thorough. As acknowledged by Yin (2006), mixed-method approaches are synergistic to research questions requiring qualitative and quantitative evidence.

## **2.3 Results**

During the course of the study, researchers recruited 229 recreational users to complete the survey. Of these 229 participants, 102 (44.5%) respondents lived within or on the border of the Veluwe region, the other 127 (55.5%) were from outside the Veluwe region; Figure 2.1 provides a map of the study area. For the purpose of this study, those living within the region were considered “local” and those outside of the Veluwe borders were categorized as “non-local”. Male and female distribution was almost even, with 48% (110) of respondents being female and 51.5% (118) identifying as male. There was one missing entry that contributed to a 0.4% discrepancy in the total findings. Lastly, age demographics were separated into three categories: 18-25; 26-40; 41-55; and, 56+ with the distribution being 5.2% (12); 16.6% (38); 34.1% (78); and, 44.1% (101) respectively. This suggests survey results were skewed for those in older demographics, as 78.2% of respondents (179) were from the 41-55 and 56+ age categories.

### **2.3.1 Perceptions**

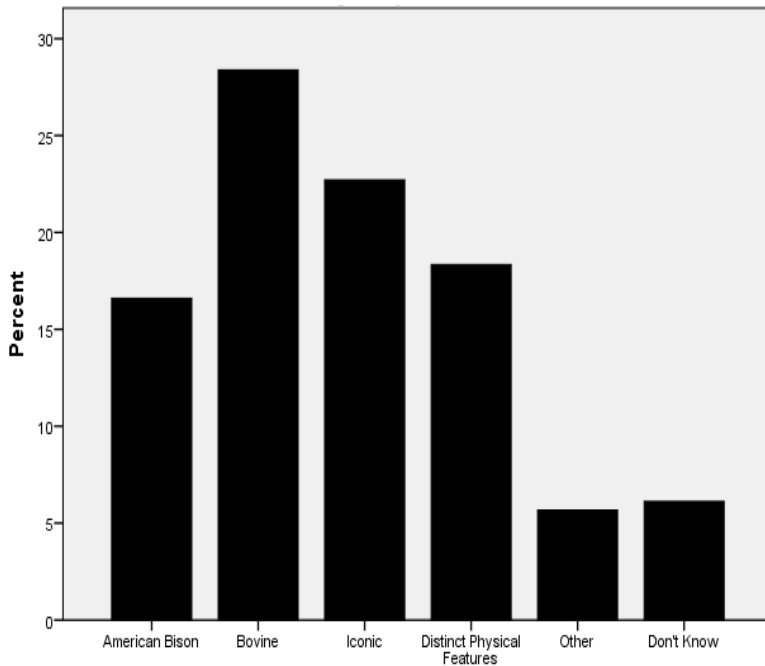
To gauge recreational users’ perceptions of European bison; participant responses to five of nineteen questions were taken together to assess perceptions. Respondents were asked whether they knew what a European bison (or wisent) was; if they had ever seen one before; if they knew there were European Bison in a nature reserve in the Netherlands; what image of European bison they had; and, if in their opinion European bison played an important role in nature. All questions had Yes/No response options except for the question regarding image, which was open ended.

This qualitative information was later categorized into distinct perception categories (as outlined in the section below).

Of the recreational users' surveyed, 61.6% stated that they knew what a European Bison was. When asked if they had ever seen one, only close to two-fifths (38.9%) of respondents had first-hand encounters with one. It is important to note, however, that a considerable number of participants displayed difficulty distinguishing between a European bison and the Scottish Highland Cattle – another large ungulate with somewhat similar shape and size characteristics which can be found throughout the Netherlands. When asked if they were aware that European bison are present in another nature reserve in The Netherlands (the Kraansvlak dune region); almost two-thirds of respondents (63.3%) were not. Only 36.7% of survey participants were aware of the pre-existing European bison in The Netherlands.

When asked to identify what image came to mind regarding European bison (Figure 2.3),

**Figure 2.3– Rec users' image of a European Bison**



participants identified a range of images that were grouped into the following categories: American bison; Bovine; Iconic Image; Distinct Physical Features; and, Other. Most prominent were Bovine images (e.g.: cow-like; Scottish Highland Cattle; bull; etc.), with 28.4% of respondents providing answers that fell into this category. The second-most prominent image of bison identified by recreational users (at 22.7%) was an

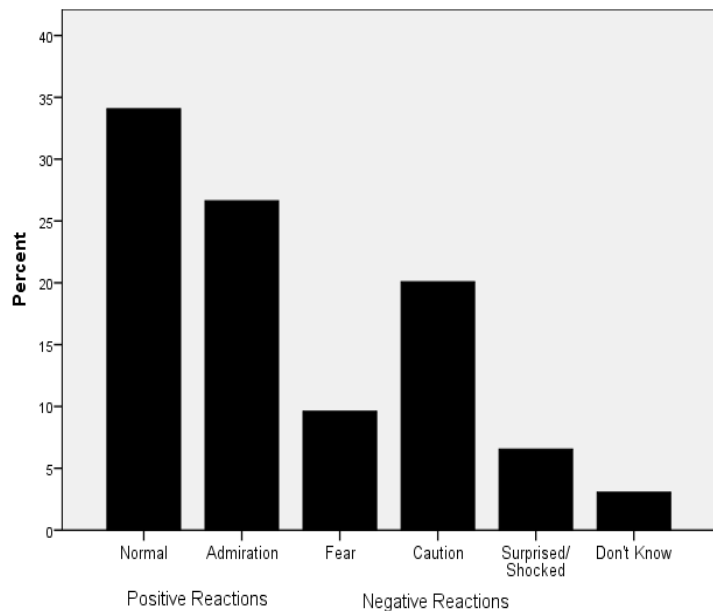
Iconic image of European bison (e.g.: aurochs; primeval; wild; powerful; huge; etc.). Images of both Distinct Physical Features (e.g.: horns; hairy; brown; big; etc.) and American bison (e.g.: bison; buffalo; etc.) were almost equal answers among respondents, with 18.3% and 16.6% respectively. A small group of participants (5.7%) identified “Other” images; which consisted of answers such as a food source or other non-sequitur responses (e.g.: Like a squirrel, but bigger). This last specific non-sequitur response is the name-sake of the thesis, as the author felt it representative of knowledge gaps held by some recreational users towards European bison.

Finally, in the last question used to gauge perception levels, participants were asked whether they feel European bison play an important role in nature. This question provides information regarding recreational users’ perceptions of European bison on a wider scope and in relation to the surrounding ecosystem. Most respondents (70.3%) felt that European bison did indeed have a role in nature, while only 7.4% stated this was false. A considerable portion of those surveyed (19.7%) said they did not know whether European bison played a role in nature.

### 2.3.2 Attitudes

Recreational users’ attitudes towards a proposed European bison reintroduction were assessed using two of the nineteen survey questions: whether they would avoid or favour an area with European bison, and how they would react to encountering European bison in the wild (Figure 2.4). When asked if they would avoid or favour an area with

Figure 2.4 – Wild European Bison Reactions

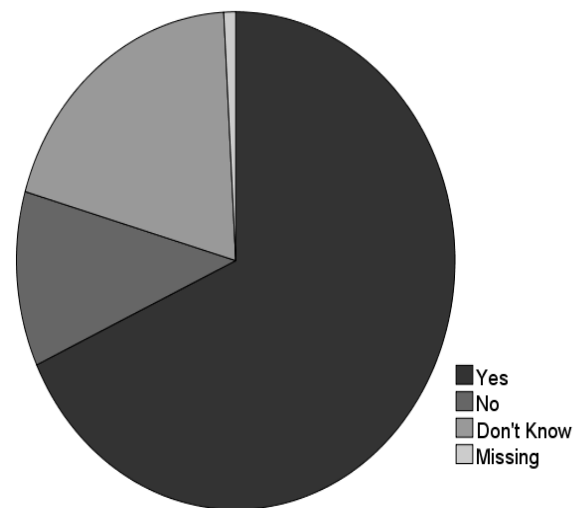


European Bison, a large majority of recreational users (87.4%) stated they would either favour (35.4%) an area (i.e.: visit it more frequently) or it would not change (52%) their visitation patterns. Conversely, 11.8% of recreational users stated they would actively avoid an area with European bison (i.e.: visit it less frequently). Survey participants were also asked how they would react upon meeting a European bison in the wild. Answers were classified into six categories: Fear; Caution; Admiration; Normal; Surprised/Shocked; and, Don't Know. Negative reactions to a wild European bison encounter were categorized as any response of Fear (9.6%), Caution (20.1%), or Surprised/Shocked (6.6%). Alternatively, a positive response to a wild European bison encounter was categorized as responses falling under Normally (34.1%), or with Admiration (26.6%). In summation, to compare recreational users' reactions to a wild European bison encounter, 60.7% of respondents stated they would react positively while 36.3% of participants would react negatively to such an event.

### 2.3.3 Values

In order to determine recreational users' values, four of the nineteen questions were combined together. Respondents were first asked if they would like to see more wildlife on the Veluwe, to which a large majority (78.2%) said yes, and only 19.2% said no. Participants were then asked if they feel the Veluwe region should develop more naturally (i.e.: through natural means and ecosystem processes without human interference or management), to which an almost identical percentage of respondents (77.3%) felt it should while 17.9% felt it should not. Participants, when asked if European bison would have added value for the Veluwe (Figure 2.5),

Figure 2.5 – Do you think European Bison have an added value for the Veluwe



predominantly thought they did, with 68.1% of people responding yes; in contrast, 11.4% responded no and 19.7% said they did not know whether they added value or not.

When asked what values would be added by the reintroduction of European bison to the Veluwe, grazing (17%) and biodiversity (16.6%) ranked as the top two answers (Figure 2.6). Other significant values noted by participants were intrinsic worth (8.7%), tourism potential (7.4%), and ecosystem maintenance (7%).

**Figure 2.6 - Added values from European Bison Reintroduction**

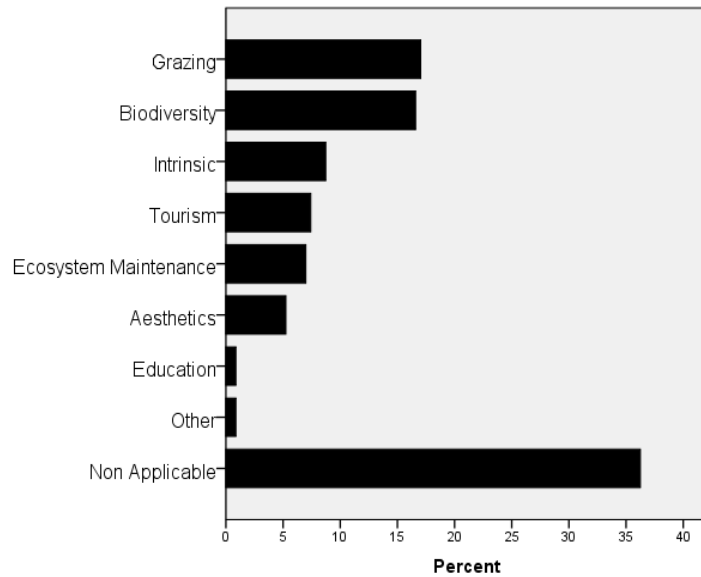
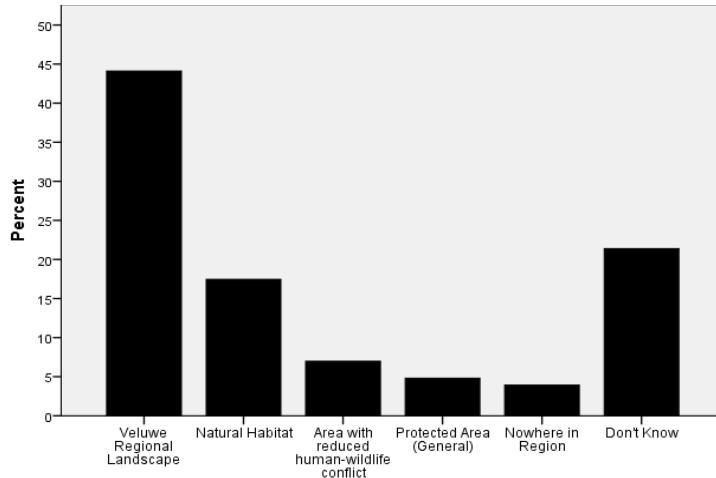


Figure 2.6 shows the various values recreational users believe European bison will add to the Veluwe region, the “Non-applicable” category is constituted of those who either answered “No” to the first part of the question and those who were unsure if the bison would add any value. This indicates a lack of awareness by recreational users in recognizing the value of bison on the landscape. This is an important result for the SBB if they want to increase public support for their reintroduction campaign by educating on the values gained from their presence. Where sampling occurred in 2014, future studies can be used to measure any changes in baseline knowledge or the effectiveness of any knowledge campaigns conducted by SBB.

Recreational users were also asked where a European bison reintroduction should occur. Such information allows managers to get a sense of whether such a project is consistent with what recreational users’ value for the Veluwe region and if, in users’ opinions, a European bison

reintroduction is feasible in this area. Almost half (44.1%) of participants identified the Veluwe Regional Landscape (typified by woodlands, open grasslands, heath-covered moraines, and large

**Figure 2.7 – Where do you think this introduction could best take place?**



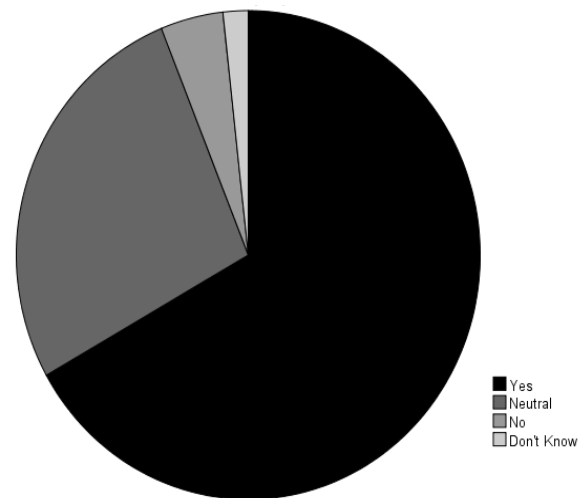
sand drifts or specific locations within the Veluwe region) as an ideal reintroduction site for the bison; this is more than double the next highest response (Unsure – 21.4%). Almost one-fifth (17.5%) of recreational users believed the reintroduction should occur in the best habitat for the

bison itself. A small proportion of the respondents (3.9%) felt the reintroduction should not occur anywhere in the region. Figure 2.7 has the entirety of locations suggested by respondents.

### 2.3.4 Support

Finally, to measure general levels of support towards the proposed reintroduction, survey participants were asked if they would be a proponent, opponent, or neutral towards the project (Figure 2.8). Just over two-thirds (66.8%) of recreational users surveyed said they would be proponents; with 4.4% saying they would be against it and 27.1% neutral towards the decision. Of all survey respondents, only 1.7% said they were unsure where they would stand on the proposed project.

**Figure 2.8 - Would you be a proponent of a European bison reintroduction**





## **2.4 Discussion**

The purpose of this study was to provide managers with a better understanding of recreational users' opinions and knowledge levels regarding this proposed reintroduction in the Veluwe region. With these goals in mind, a human dimensions survey of Veluwe recreational users' perceptions, attitudes, and values along with the general levels of support for a European bison reintroduction was conducted. The resulting information will better inform the public discussion surrounding this decision; while also providing a means to focus future responsible management efforts regarding the European bison.

### **2.4.1 Levels of support**

Levels of support expressed by the recreational users surveyed coincided with previous studies into wildlife value orientations of the Dutch public. Previous studies conducted by Vaske *et al* (2010), and Jacobs (2007) found a general shift in values from materialism towards mutualism; supporting coexistence between humans and wildlife in The Netherlands. Another factor contributing to levels of support found by the survey results aligning with a mutualistic value orientation could be the activities of participants involved with the study. All participants were engaged in non-consumptive forms of recreation regarding natural resources (e.g.: survey participants were not angling, hunting, foraging, etc...); which is more closely associated with a mutualistic orientation. As this study did not inquire as to the profession of respondents, professional biases for value orientations could not be deduced (e.g.: farmers identifying more closely with materialist orientations) (Hermann *et al*, 2013). Monitoring stakeholder and public wildlife value orientations is important for managers as such values shape how management issues and decisions are received and perceived. Understanding these value orientations and how they will influence public opinion can become key for understanding what management issues will be

supported during high-profile decisions (Jacobs, 2007). This is highlighted during a previous large herbivore management issue surrounding another popular nature reserve in the country, De Oostvaardersplassen. A public debate developed over whether to feed the animals during a particularly harsh winter, during which time food sources became scarce within the park enclosure (ICMO2, 2010). Polarized groups formed adhering to management ideologies influenced by value orientations. A study into wildlife value orientations in Germany found that values contribute significantly towards an individual's stance regarding scarce wildlife reintroduction projects (in this case wolves and European bison) (Hermann *et al*, 2013). Hermann *et al*'s study (2013) notes that an understanding of stakeholder and public wildlife value orientations can help managers predict reactions (e.g.: support; opposition, etc...) to management decisions. Public discussion surrounding stakeholder wildlife value orientation can also create an environment for trust building between polarized groups and institutions (Hermann *et al*, 2013).

When compared to other European bison conservation projects, the level of general support for a European bison reintroduction (66.8%) found in this study was in line with survey responses in other parts of Europe concerning European bison. A 2010 human dimensions study which preceded a reintroduction project in Germany by Decker *et al*, surveyed two regions with a notable difference in levels of support between the two. In the Siegen-Wittgenstein region there was 73.5% support among survey participants, compared to only 44.8% in neighbouring Hochsauerlandkreis region (Decker, *et al*, 2010). The study concluded that fear was a predominant factor in the negative levels of support and attitudes towards the European bison, as well as the variances between the two regions; as not only concern for personal safety became apparent, but residents' livelihood as well. Another interesting conclusion from the study was that knowledge levels and contributed heavily into an individual's attitudes towards European bison (Decker *et al*, 2010).

Considering this was a planned reintroduction of a scarce wildlife species, the respondents would have little first-hand experience with the bison; which can lead to misinformation surrounding public discussion of the management decisions. It was suggested by Decker *et al* (2010) that sound, accurate information could not only lead to better subjective decision-making but also allay fears surrounding the European bison based on misinformation and second-hand accounts.

A study conducted in Lithuania found generally high levels (i.e.: 78.8-87.7% depending on age) of support towards European bison in the country; it should be noted, however, that this was not a reintroduction project, but an attitudinal study conducted forty years after their initial reintroduction (Balčiauskas & Kazlauskas, 2014). However, these support levels changed dramatically depending on the proximity of European bison to a respondent's home (Balčiauskas & Kazlauskas, 2014). Two key findings from this Lithuanian study have relevance to the Veluwe reintroduction project. Firstly, respondents with lower knowledge levels about European bison tended to be opposed to having European bison in the regions surveyed (Balčiauskas & Kazlauskas, 2014). This is important due to the poor knowledge baselines discovered in the Veluwe study (e.g.: unaware of existing European bison in The Netherlands; confusion between Scottish Highland Cattle and European bison). If managers can increase knowledge levels of the local public and recreational users, discussion surrounding management concerns with the reintroduction will be more relevant and reduce those concerns informed by misinformation. The second key finding from the Lithuania study is the decrease in support for European bison as proximity to participants increase (Balčiauskas & Kazlauskas, 2014). Considering the human-dominated landscape in The Netherlands, willingness to have European bison living in close proximity to the public may be a determining factor in the success of the proposed reintroduction.

As suggested by Balčiauskas & Kazlauskas (2013), this tolerance could very well be a limiting factor for future reintroduction projects.

#### **2.4.2 Confusing Ungulates: Scottish Highland Cattle and European Bison**

Many participants had difficulty distinguishing between European bison and Scottish Highland Cattle, another large ungulate residing in The Netherlands possessing similar characteristics as the European bison. This phenomenon is likely an effect of European bison's status as "scarce wildlife"; like Decker *et al* (2012) note, public interaction with scarce wildlife will predominantly be second-hand and prone to misinformation. This became apparent to researchers during the investigation of recreational users' perceptions; specifically the questions of whether respondents had seen European bison before (and if so, where), and what images of a European bison they held. When asked where they had seen European bison before many respondents responded with locations where, in fact, there were no European bison present; but, did have populations of Scottish Highland Cattle in the area. This was a frequent discrepancy for responses to this survey question. Confusion surrounding this issue could potentially be linked to noted difficulty distinguishing between the two animals when asking recreational users' what image they had of bison. Many respondents answered with physical characteristics belonging to Scottish Highland Cattle and not bison, such as orange hair; long "shaggy" hair; and, wide-set, long horns. Unfortunately researchers did not anticipate this discovery, and therefore the questionnaire was not adequately developed to fully explore this potential confusion between the two species. Nonetheless, wildlife managers should be acutely aware of this potential for public confusion when undertaking scarce wildlife management efforts in regions with "aesthetically-similar" species. This also emphasizes the need for educational efforts when attempting reintroduction or conservation projects involving scarce wildlife to educate public or stakeholder

groups on the differences these species have with their non-scarce counterparts. This distinction is especially important to make when the scarce wildlife in question is a keystone species and vital to certain ecosystem functions and processes; as is the European bison, and unlike the Scottish Highland Cattle. Future studies delving into the Scottish Highland Cattle – European bison confusion issue would contribute to a better understanding of this topic for managers. This should be incorporated into any future monitoring or evaluation studies for management efforts surrounding this particular proposed European bison effort. Another educational aspect pertaining to the proposed reintroduction managers should focus attention towards is the lack of awareness regarding European bison already existing in The Netherlands. As almost two-thirds of respondents were unaware of previous reintroduction efforts, it would be reasonable to assume they are also unaware of the impacts from this reintroduction. Managers can use this similar, previous conservation project to inform recreational users and other interested groups on how such reintroductions are conducted and can then use this to adapt management to incorporate concerns of recreational users. The Scottish Highland Cattle and European bison educational discrepancies may also be alleviated if managers can use a pre-existing reintroduction site to base informational material on.

### **2.4.3 Research Significance and Future Directions**

Human dimensions of wildlife management research is still an emerging field in Europe; especially in The Netherlands. A literature review conducted in 2011 found less than ten English publications of human dimensions studies (Glikman & Frank, 2011). Since the data collection involved in this paper, European HDWM publications have grown, but mainly centred on hunter attitudes and public attitudes, values and perceptions towards carnivores (Breisjoberget et al., 2017; Heel et al. 2017; Mykra et al., 2017; Peterson et al., 2021; Stauder et al., 2019). While any

research promoting the application and utility of HDWM in a European context is important to advance the field, Literature reviews conducted by the author for published English papers regarding European bison overwhelmingly resulted in mainly biological or ecological research with little consideration of HDWM principles. Application of social sciences or HDWM relating to re-wildling or reintroduction efforts for European bison are lacking. Since the date of data collection for this research and time of writing, only two other publications have advanced that field (Balčiauskas et al., 2017; Klich et al., 2021). While this does not strictly imply a lack of human dimensions application in management actions, it does signify an environment where research may be less prevalent. Therefore, any study that demonstrates the applicability and utility of using human dimensions in a wildlife management setting furthers the field through a pragmatic approach. Advancing the field of human dimensions in a real-world setting in addition to contributing to the academic literature is as important if this management style is expected to be applied to resource issues by existing state institutions. The impetus on this pragmatic approach to human dimensions research is especially true in the Netherlands, where uptake by institutions can be increased with more examples of it leading to more informed decision making on the ground. An example of human dimensions being applied to a wicked problem can encourage more resource managers to use this more integrative approach to decision-making.

From a management perspective applying human dimensions research leads to a more holistic problem definition phase of the resource management issue. A holistic problem definition will include more public opinions that can then be carried through the decision-making process and be reflected in the final management alternatives and solutions. Illuminating areas of concern or knowledge gaps held by the general public during a pluralistic problem-definition stage can then be addressed through educational efforts or specific altered management plans. These

inclusive management alternatives and solutions are how human dimensions leads to objectively and subjectively better decision-making. It is more representative of a pluralistic society as a whole. A sense of ownership towards, and transparency of, management decisions are also by-products of conducting decision-making in this manner.

While the SBB has acknowledged and facilitated greater public engagement into their management efforts for the proposed reintroduction – as this study is an example of – there is still a need for a larger survey of the general public. This larger survey should target not only recreational users to the Veluwe, but also residents closer to the proposed reintroduction site (e.g.: community of Hoog Buurlo). This would not only give managers a greater sense of public opinion towards the reintroduction from local residents, but also lead to a more comprehensive knowledge baseline of values and attitudes held by the public. This lack of baseline knowledge towards bison is epitomised by one response from a survey respondent when asked what image comes to mind when thinking of bison, “Like a squirrel, but bigger.” Well both animals share some similarities, there are obviously more differences between the two. If recreational users believe the SBB will be reintroducing squirrel-like animals instead of formidable-sized bison, their opinion towards and levels of support for a reintroduction may differ drastically. This lack of knowledge could be expected regarding local recreational users as bison have been absent from the landscape for a considerable time in the Netherlands. On a broader scale, before even considering soliciting public opinion on this issue, the SBB should feel a due diligence in informing the public at a bare minimum regarding bison and their ecology. This should especially be done in areas around reintroduction sites from a public safety point-of-view as safety considerations differ drastically between bison and squirrels.

The SBB should also consider an ongoing human dimensions research program in the region to measure recreational users' perceptions, attitudes, and values, as well as support levels over time to identify any shift over a longer temporal scale. This can also lead to study larger shifts in wildlife value orientations towards large ungulate conservation projects in The Netherlands and in particular, European bison. As noted above, any future study should include questions to probe respondents' knowledge levels regarding the differences between Scottish Highland Cattle and European bison as well. Adopting and practicing credible human dimensions research and fostering actual public involvement in decision making by managers will ensure that future decisions are subjectively, and objectively better; a pleasant solution to a wicked problem.



## **Chapter 3: Ecosystem Services, Knowledge Gaps, and European Bison**

### **3.1 Introduction**

#### **3.1.1 Ecosystem Services**

Ecosystems are a dynamic collection of complex interrelationships between their organic and inorganic components, and as such, have emergent properties greater than any one individual part. These emergent properties form ecosystem processes (e.g. nutrient cycling) or functions (e.g. pollination), which ultimately support the systems which rely on them. Together, these are referred to as “ecosystem services”, and many of these are found to benefit social systems. As ecosystems provide the natural source for resources and sinks for waste, social systems are bound by ecosystems’ capabilities to do both. The Millennium Ecosystem Assessment (MEA) describes the concept of an ecosystem service quite concisely as: “the benefits people obtain from ecosystems” (Millennium Ecosystem Assessment, 2005, p.v). As Costanza *et al* (1997) notes, the benefits human populations experience from ecosystem services can either be direct or indirect. For example, the benefits humans receive from fiber production or recreational or water purification are direct; whereas benefits experienced from pollination or nutrient cycling are more indirect. The MEA divides these services into four categories: supporting, provisioning, regulating, and cultural (MEA, 2005). Supporting services are those which “...are necessary for the production of all other ecosystem services.”; examples of these would be soil formation, photosynthesis, water cycling, and nutrient cycling (MEA, 2005, p.40). Provisioning services can be described as “...the products obtained from the ecosystems...”; such as food, fiber, genetic resources, and fresh water (MEA, 2005, p.40). Regulating services are defined as “...benefits obtained from the regulation of ecosystem processes...”; these include pollination, air quality regulation, pest regulation, and erosion regulation (MEA, 2005, p.40). Lastly, cultural services are “...nonmaterial benefits people

obtain from ecosystems through spiritual enrichment, cognitive development, reflection, recreation, and aesthetic experiences...”; these are generally more abstract and consist of services such as recreation and ecotourism, spiritual and religious values, cultural heritage values, and aesthetic values (MEA, 2005, p.40). Although there remains an academic debate surrounding the explicit definition of ecosystem services (Derissen & Latacz-Lohmann, 2013; Barbier, 2011; Fisher *et al*, 2009; Wallace, 2007; de Groot *et al*, 2002; Costanza *et al*, 1997) the above definition provided by the MEA is generally accepted as the working definition (Derissen & Latacz-Lohmann, 2013). For the intents and purposes of this paper, the generally accepted definition of ecosystem services provided by the MEA will be used.

Specific to this research, the proposed European bison (*Bison bonasus*) reintroduction in the Veluwe region of the Netherlands has been promoted as a means of contributing to regional ecosystem services. Characterized by forests, rolling heathlands and sand dunes, a European bison reintroduction to the Veluwe will contribute to regional nutrient cycling, increasing local biodiversity and seed dispersal. However, most ecosystem services are considered externalities and unaccounted for in traditional cost-benefit valuations and other decision-making analyses which largely excludes them from management decisions for large landscapes (Daily *et al*, 2009). Restoring European bison to the Veluwe may contribute to regional ecosystem services but if services are not recognized by recreational users, managers and local residents, decisions surrounding the project could be based on misinformation. Identifying ecosystem services of social, environmental, and economic significance helps focus resource and environmental management efforts to ensure long-term protection of these key services and their associated human benefits. Ensuring future continual use and benefits from these services for generations to

come is synonymous with protecting and restoring the ecosystem integrity of the characteristics which contribute to providing these vital functions and processes.

### **3.1.2 Ecosystem Service Contributions of European Bison**

Large herbivores are drivers behind a multitude of ecosystem services in their respective ecosystems; affecting the regimes and interconnectedness of the landscapes they inhabit (Ripple *et al*, 2015). Adopting roles smaller herbivores cannot, large herbivores ( $\geq 100\text{kg}$ ) impact inorganic and organic ecosystem processes such as fire regimes, primary production, soil quality, and various relationships with other animals through the food web (Ripple *et al*, 2015). Despite the numerous ecosystem services provided by large herbivores, the only services of importance to this study are those contributed to by the presence of European bison in the Veluwe. European bison are keystone species and act as ecosystem engineers. Through interactions with their habitat they become integral to certain functions and processes involved in contributing to ecosystem services (Ripple *et al*, 2015; Gates *et al*, 2010; Knapp *et al*, 1999). Although other large herbivores are already inhabiting the Veluwe region (e.g. multiple deer species; wild boar; cattle) the European bison, through their different foraging habits and social behaviours, play a wider and more significant role in regional ecosystems (Van de Vlasakker, 2014; Krasinska & Krasinski, 2013). This is particularly the case when juxtaposing the role of cattle against European bison in the ecosystem; cattle are domestic animals and as such are more strictly managed by humans in explicit areas (Van de Vlasakker, 2014). Documented ecosystem services provided by European bison include: nutrient cycling; increased local biodiversity (both flora and fauna); seed dispersal; and, contributing to local tourism (Ripple *et al*, 2015; Van de Vlasakker, 2014; Eycott *et al*, 2013; Krasinska & Krasinski, 2013; Gates *et al*, 2010; Melis *et al*, 2007; Knapp *et al*, 1999).

As has been noted with other large herbivores, European bison contribute greatly to the nutrient cycling of a region; specifically, nitrogen (Ripple *et al*, 2015; Eycott *et al*, 2013; Melis *et al*, 2007; Knapp *et al*, 1999). This occurs through deposition of urine and feces both of which have high concentrations of nitrogen, and through the decomposition of bison carcasses (Gates *et al*, 2010; Melis *et al*, 2007; Knapp *et al*, 1999). Vegetation growing in these nitrogen-rich urine patches has increased nutritional value for grazing bison and increased productivity (Gates *et al*, 2010; Knapp *et al*, 1999). Bison grazing has also been shown to play a role in limiting the export of nitrogen from plant communities as well (Knapp *et al*, 1999). Bison grazing also impacts nutrient cycling through the disturbance of plant litter and the quantity and quality of what is left to return to the soil (Gates *et al*, 2010; Knapp *et al*, 1999). A bison's final, and greatest, contribution towards the nutrient cycle is through their carcasses upon death (Knapp, 1999). Although initially killing vegetation surrounding and beneath the carcass, it will subsequently add large amounts of nitrogen and calcium to the underlying soil (Ripple *et al*, 2015; Gates *et al*, 2010; Melis *et al*, 2007; Knapp *et al*, 1999). This surge of nutrients to the immediate area will not only provide an abundant amount of resources which will benefit plant communities, but the disturbed area will regrow with increased heterogeneity (Gates *et al*, 2010; Melis *et al*, 2007; Knapp *et al*, 1999). The effects of the resulting nutrient pulses from bison carcasses lasts for years after the death of the animal (Melis *et al*, 2007; Knapp *et al*, 1999).

European bison can not only contribute to nutrient cycling in regional ecosystems, they also impact local flora and fauna biodiversity with certain grazing patterns and grooming habits (Van de Vlasakker, 2014; Gates *et al*, 2010; Knapp *et al*, 1999). Bison foraging preferences for both short and mixed vegetation create heterogeneous patches; as well as increase the diversity of flowering forbs in grazing patches (Ripple *et al*, 2015; Van de Vlasakker, 2014; Gates *et al*, 2010).

The manner bison browse for their preferred food also breaks through thick vegetation and opens scrubland; which fosters new competition and creates a more diverse plant community (Van de Vlasakker, 2014). They will also maintain plant species composition of meadow, grassland, and shrub communities from encroaching tree and other woody plant species along marginal borders through grazing practices as well as horning damage to trees along the margins (Ripple *et al*, 2015; Van de Vlasakker, 2014; Gates *et al*, 2010). This is particularly important to the Veluwe region, as creating and maintaining these heterogeneous grassland landscapes free of trees equates to keeping heather fields open and clear from woodland encroachment. Heather fields were an important utilitarian aspect to pre-modern life in western Europe as a source of fuel and pasture-land and became a significant part for regional human tradition (Rotherham, 2015). Due to its historical importance, it has become identified as part of the Dutch natural landscape; with multiple attempts to protect and maintain these areas (Janssen, 2009; Turnhout, 2009). In some European nature reserves, domestic livestock are used for this form of grazing management; however, bison browse more than cattle and sheep and would be more effective in this regard (Van de Vlasakker, 2014).

In addition to the effects of European bison's grazing patterns on regional biodiversity, their grooming habits play a large role in shaping their local environment as well. Part of bison grooming, and to a lesser extent, sexual behavior involves the act of wallowing. This involves rolling in loose, dry terrain (e.g. gravel, sand, etc...) while simultaneously disturbing the ground with their horns and hooves; creating compacted depressions in the ground stripped of most vegetation which can remain for years after (Van de Vlasakker, 2014; Gates *et al*, 2010; Knapp *et al*, 1999). Bison wallows – as a result of rain or spring time melt – will accumulate water and become ephemeral pools; providing a more diverse habitat to support small birds and reptiles

(Ripple *et al*, 2015; Gates *et al*, 2010; Knapp *et al*, 1999). Grazing practices in conjunction with wallowing can even enhance a landscape's capacity to support a diverse number of nesting bird species in the region (Gates *et al*, 2010). Not only do these temporary wallow-ponds provide fauna habitat, they also support wetland plant species which would otherwise not be present in a grassland ecosystem (Gates *et al*, 2010).

Another impact of European bison on the landscape is their involvement in seed dispersal throughout the ecosystem. Bison predominantly spread seeds through two mechanisms – defecation and through carrying seeds stuck to their hair (Eycott *et al*, 2013; Gates *et al*, 2010). Bison come in contact with seeds throughout their day – either by resting; wallowing; or, walking through thicker vegetation – which then become dispersed; increasing patch heterogeneity of the bison's resident landscape (Gates *et al*, 2010). European bison – as large herbivores – also have an extremely high defecation rate and consume larger seeds, contributing significantly to seed dispersal in the ecosystem with species smaller herbivores may not be able to consume and subsequently spread (Ripple *et al*, 2015; Eycott *et al*, 2013). European bison also consume a variety of forage, meaning their feces contain a high diversity of plants, and they spread a heterogeneous mix of vegetation to throughout their regional ecosystems (Eycott *et al*, 2013).

The European bison has become a flagship species for the rewilding movement across Europe; a symbol of success for restoring a marginalized species once ecologically extirpated (Van de Vlasskker, 2014). Large herbivores in general can be drivers for regional tourism and European bison are no exception to this (Ripple *et al*, 2015). European bison can generate positive economic benefits in areas surrounding their reintroduction sites through the pursuit of ecotourism endeavours, as seen in Germany and Poland (Van de Vlasskker, 2014; Krasinska & Krasinski, 2013). Poland even makes explicit mention of their populations of European bison residing in their

country on their tourism website to encourage interest and bring tourists to their country (Polish Ministry of Foreign Affairs, 2014). In other jurisdictions, such as Slovakia, ecotourism opportunities have yet to be fully explored from a lack of financial resources in areas; in order to compensate for this, NGOs – such as Rewilding Europe – have started investment funds for entrepreneurs to access (Van de Vlassker, 2014). Ensuring the continual provision of European bison’s contributions to ecosystem services is a long-term goal of the reintroduction project, which can be a complicated task when ecosystem services themselves are not typically considered in management or economic decisions.

### **3.1.3 Payment for Ecosystem Services**

A major issue with protecting ecosystem services is that they are not captured under current market systems, and are considered externalities (Costanza *et al*, 2014; MEA, 2005; Costanza *et al*, 1997). Because of their acknowledgement as externalities they are often not incorporated into management decisions or protected for the continued use of current and future generations (Costanza *et al*, 1997). This creates an urgent need to incorporate and protect these services; leading to development of payment for ecosystem services (PES) schemes to better reflect the beneficial services provided by the natural world. This is where a buyer (e.g.: an individual, organisation, or monopsony) creates a market for the services and “buys” them to ensure the continuation of the services for present and future use (Alcamo *et al*, 2003; de Groot *et al*, 2002; Costanza *et al*, 1997). Thus, PES should be not seen as arbitrary *payments* for services, but instead as *investments* in regional ecosystems and associated, reliant socio-economic systems. In the context of externalities provided by wildlife species, typical PES schemes have been designed around an individual’s or stakeholder’s, hypothetical or actual, Willingness-To-Pay (WTP) for conservation projects and efforts (Decker *et al*, 2012). Due to the application of contingent

valuation for wildlife conservation efforts, estimates of WTP are typically monetary. In the context of this study, however, the costs of ecosystem services manifest as potential social costs borne by the recreational users of the Veluwe. Specifically, the potential ecological and social costs include risk of disease transfer to local pre-existing wild and domestic animals; destruction of culturally significant heather fields; recreational users' wildlife acceptance capacity; and, increase in restricted areas for humans.

### **3.1.4 Wildlife Stakeholder Acceptance Capacity**

This research focuses on the social costs and trade-offs recreational users and local populations will be making if a European bison reintroduction were to take place. While a European bison reintroduction conducted in the Veluwe may very well include certain ecological risks/costs involved – such as interspecies competition, disease transfer, and increased browsing pressure (Van de Vlasakker, 2014; Gates *et al*, 2010) – an assessment of these costs was beyond the scope of the current study. In the field of resource management, the concepts of biological and social carrying capacity are well understood by managers (Carpenter *et al*, 2000; Decker & Purdy, 1988). An ecosystem's biological carrying capacity (BCC) is the sum of a variety of ecological factors which limit the growth of wildlife populations (e.g.: the quantity and quality of habitat, food resources, water, etc...); the concept is a foundation of modern wildlife management paradigms (Carpenter *et al*, 2000; Decker & Purdy, 1988). Conversely, the concept of social carrying capacity (SCC) refers to how visitation rates and visitor density in a specific area affect the experiences of other visitors; either through physical degradation or user perception of the site (Carpenter *et al*, 2000; Decker & Purdy, 1988). A third capacity concept has been touted to understand public – and stakeholder – tolerance thresholds towards various wildlife species in a specific area. This new concept – initially referred to as Wildlife Acceptance Capacity (WAC) –

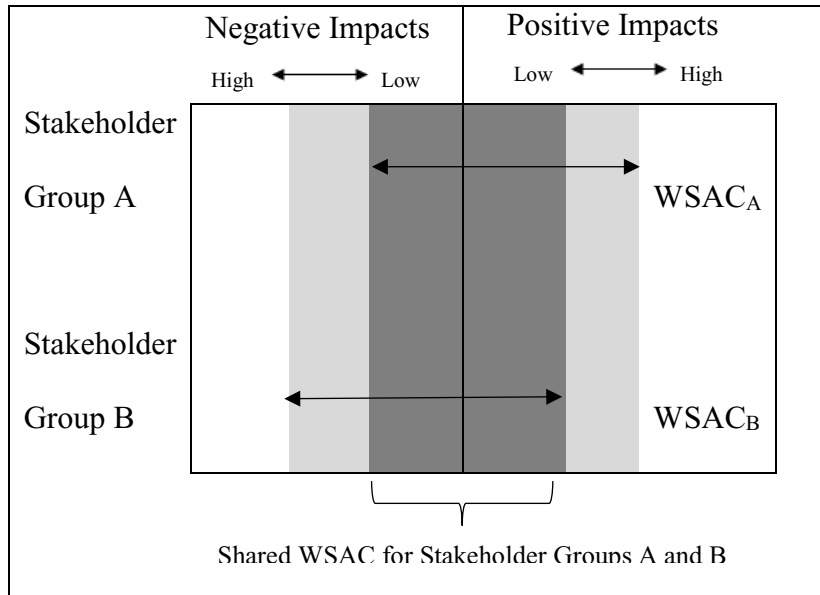


was later developed as Wildlife Stakeholder Acceptance Capacity (WSAC); fitting under the themes of human dimensions of wildlife management (Carpenter *et al*, 2000; Decker & Purdy, 1988). Despite a region's ecological capacity to support a certain population of a given species, local stakeholder capacity thresholds may very well be lower; effectively limiting a viable population in a certain region.

As Carpenter *et al* (2000) notes, at the start of the 20<sup>th</sup> century, the tolerance capacity of humans for wildlife species was a non-issue – aside from “pest” species and predators – due to the scarcity of many wildlife and less contact between wildlife and humans. Throughout this century, however, this began to change with the different incarnations of wildlife management paradigms attempting to incorporate human dimensions into their management styles. Multiple iterations of BCC definitions attempted to incorporate human dimensions; typically categorized as culturally based carrying capacities, all related to sustainable yields of wildlife species by humans (Carpenter *et al*, 2000). However, definitions of culturally based carrying capacities failed to reflect the complexity and pluralistic nature of actual wildlife management issues (Carpenter *et al*, 2000). During the 1980s two concepts, cultural carrying capacity and sociological carrying capacity, were touted as terminology to represent the human-tolerance factor for wildlife (Carpenter *et al*, 2000). However, cultural carrying capacity was historically used to refer to human growth limits in a region – essentially BCC applied to human populations – and sociological carrying capacity was too similar a label to the pre-existing term social carrying capacity (SCC) (Carpenter *et al*, 2000). Wildlife acceptance capacity as a term was developed upon in the 1990s to more properly reflect the diversity of stakeholder values involved in human-wildlife interactions and more “...descriptive of the conditions necessary for optimum stakeholder acceptance...” (Carpenter *et al*, 2000, p. 10). Wildlife Stakeholder Acceptance Capacity not only captures the tolerance

different stakeholders have for wildlife impacts and management but provides a separate method of evaluating wildlife aside from purely economic valuations (Carpenter *et al*, 2000, p. 10). What Carpenter *et al* (2000) proposed was WSAC is “...at the center of most contemporary wildlife management issues.” (p.10) as a combination of both tolerance, and desire for, the negative and positive impacts from wildlife.

Similar to various biological carrying capacities used by resource managers, calculating WSAC requires identifying the optimum equilibrium point between negative and positive impacts. Regarding applying WSAC, the equilibrium point is determined through surveying various stakeholder or other groups to categorize perceived negative and positive impacts on a continuum of high to low impact value – essentially determining what trade-offs stakeholders will face (Decker *et al*, 2012). Impacts on these groups are then placed alongside one another on a continuum to determine the regional acceptance capacity for a certain population of any one species (Decker *et al*, 2012). Managers then have a visualization of various stakeholder groups’ tolerance thresholds for various species which can be used to inform future management decisions or better target educational efforts.



**Figure 3.1 – Stakeholder group overlap in Wildlife Stakeholder Acceptance Capacity (WSAC) for two theoretical stakeholder groups (as adapted from Human Dimensions of Wildlife Management (Decker *et al*, 2012))**

stakeholder or other groups to categorize perceived negative and positive impacts on a continuum of high to low impact value – essentially determining what trade-offs stakeholders will face (Decker *et al*, 2012). Impacts on these groups are then placed alongside one another on a continuum to determine the regional acceptance capacity for a certain population of any one species (Decker *et al*, 2012). Managers then have a visualization of various stakeholder groups’ tolerance thresholds for various species which can be used to inform future management decisions or better target educational efforts.

The concept for WSAC continues to underline many current studies on human-wildlife conflict and coexistence (Inskip et al, 2016; Kimmig et al, 2020; Skupien et al., 2016). A deviation of the model is used now in reference to damage-causing wildlife, referred to as the Wildlife Tolerance Model (Kansky & Knight, 2016). This model will not be used in this report as it focuses on a dichotomous relationship with the wildlife at hand, whether it is tolerated or not (Brenner & Metcalfe, 2020). Human-wildlife relationships are more nuanced and the WSAC model allows for expression of more complex relationships for stakeholders and wildlife managers to visualise and explore (Brenner & Metcalfe, 2020).

### **3.1.5 Problem Statement**

Through a European bison reintroduction, the Staatsbosbeheer (SBB) – the Dutch State Forest Service – hopes to restore vital ecosystem services. However, the Netherlands is the most densely-populated country in western Europe. With a total population slightly under 17 million people and a population density of 489 people per square kilometer, the Netherlands is by all accounts a human dominated landscape (Statistics Netherlands, 2015). This particular reintroduction project was planned for the eastern province of Gelderland; specifically, in the Veluwe region, a 100,000ha area known for its landscapes of woodland, heath, moraines, and sand dunes (Van Wieren & Groot-Bruinderink, 2010). As well as having a unique landscape, the Veluwe region also supports many different wildlife species, including the largest population range for several different species of deer, wild boar, and mouflon in the country (Van Wieren & Groot-Bruinderink, 2010). Even in the human dominated landscape of the Netherlands, the Veluwe presents one of the most interconnected natural areas in the whole country. As a result of the Veluwe’s unique landscape and wealth of natural areas, it is a high-traffic tourist destination; seeing approximately two million visitors to the region’s many bungalow parks, hiking trails, and

heritage sites annually (Statistics Netherlands, 2012). As the Veluwe is such a highly utilized recreational area, an understanding of visitors' perceptions of both the potential ecosystem services of bison, as well as the potential trade-offs or costs that may be borne in exchange for such services, is essential to informed discussions about the management and future of the reintroduction project.

### **3.1.6 Purpose Statement**

The SBB initiated this project as a means to fulfill its departmental mandate regarding maintenance of ecosystem processes and services on lands under their management. To support this effort, managers can enlighten discussion surrounding the purpose of their reintroduction and develop a sense of ownership for the project by recognizing recreational users' knowledge gaps of ecosystem services provided by bison and develop educational efforts to mitigate these gaps. This study, by identifying knowledge gaps surrounding European Bison's contributions to ecosystem services will identify areas of future interpretative efforts to reduce misinformation and increase general knowledge levels. Also, this study will attempt to identify the social costs (payments) made by recreational users in exchange for ecosystem services provided through reintroducing bison to the region. However, unlike other instances of PES, costs incurred by recreational users as beneficiaries of the bison's ecosystem services would be social (e.g: altering traditional activities) and ecological (e.g: risk of disease transfer), instead of being economic. Recreational users' wildlife stakeholder acceptance capacity provides managers a means to assess various stakeholder groups' reception to a bison reintroduction and offers managers a baseline which can indicate social thresholds which should not be surpassed. A more holistic understanding of the social, ecological, and economic costs of this conservation project will better inform managers and recreational users alike as to the values at stake and what trade-offs may occur. This process is

synonymous with more transparent, accountable decision-making; making future management decisions more legitimate and “bottom-up” in approach.

### 3.2 Methods

Data for this study were collected using a convenience sample (n= 306) of recreational users utilizing the Veluwe area of Gelderland province in The Netherlands (Figure 3.2).

A convenience sample was used for this study as more-rigorous, probability sampling techniques could not effectively be employed due to contextual factors of the study area and due to study constraints. A convenience sample is a non-probability sampling technique which selects participants due to their accessibility to the researcher (Haan, 2013). Although, as Yin (2016) notes, convenience sampling is prone to information bias and insufficiencies, it is suitable for special circumstances when a more representative and thorough sampling is not possible. Considering both the time constraints faced by the researchers and the nature of the study area, it was decided as the best method for this research situation. In effort to account for the shortcomings of the convenience sampling technique, efforts were made to select participants during various times of the day, various days of the week, and at various geographical locations within the study area. Regardless, this study was not designed with the intent of being statistically representative of the visitors to the Veluwe area. Rather, this study was designed solely to garner an understanding of the perceptions, attitudes, and values of recreational users regarding management efforts associated with a proposed bison restoration and related

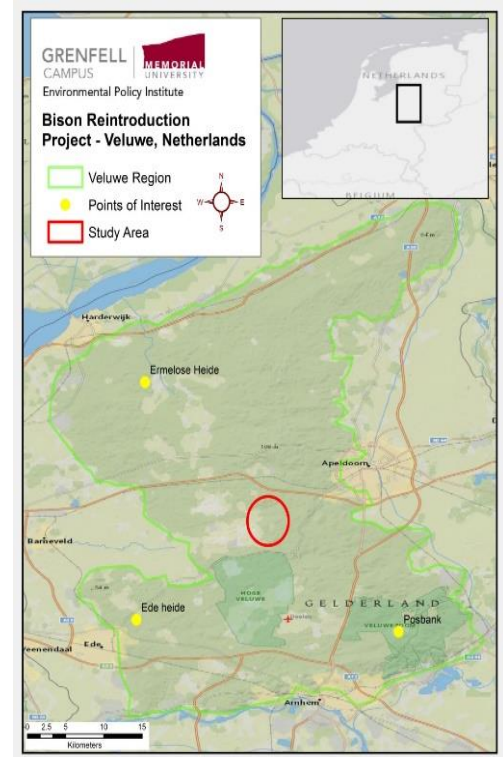


Figure 3.2 – Map of study area

ecosystem services. The research study design and questionnaire used for this study were reviewed and approved by Memorial University's Grenfell Campus Research Ethics Board on July 30<sup>th</sup>, 2014. The reference number 20150340 was assigned to the research.

### **3.2.1 Survey Structure and Administration**

Data were collected using a researcher-administered survey consisting of nineteen questions; twelve questions were used in a separate analysis focusing on perceptions, general knowledge levels, values and levels of support to a bison reintroduction to the Veluwe (see Edwards & Decker, 2016 – in preparation). The remaining seven questionnaire items were designed to address issues such as recreational users' knowledge levels of ecosystem services provided by European bison; and, what trade-offs and social costs will be incurred by recreational users regarding a European bison reintroduction to the Veluwe. The questionnaire was constructed with Dillman's (2007; 1978) Total Design Method (TDM) in mind. Following the TDM, similar survey questions were grouped together; simple questions (e.g.: True or false: "European bison play an important role in nature"; "Do you feel the Veluwe should develop more naturally?") were placed at the beginning of the survey and more contentious questions pertaining to the reintroduction were placed at the end (Dillman, 2007; Crosby *et al*, 1989; Dillman, 1978). The survey was conducted from October 5-8<sup>th</sup>, 2014; however, questionnaire items were pilot tested during an earlier study (which utilized the same study design as the current study) which gathered data from 77 visitors to the Veluwe area. Questionnaires were made available to recreational users in both English and Dutch in an attempt to mitigate language barriers involved in the study. Questions were developed using plain language for ease of translation. Research assistants were on-site to administer the questionnaire in both languages. Questions pertaining to recreational user knowledge base did not require technical or scientific background to respond. The questions

analysed in this paper focused on the open-ended sections of the questionnaire. These questions elicited limited qualitative data mostly surrounding knowledge levels of bison and what ecosystem services they may be able to provide the Veluwe.

### **3.2.2 Survey Analysis**

Compilation and analysis of the data was completed using IBM's Statistical Package for the Social Sciences (SPSS) program. Simple descriptive analyses were performed on the data sets and supplemented through anecdotal information garnered from a selection of open-ended survey questions. The use of a combined quantitative and qualitative approach to data analysis will make the findings of the study more defensible and thorough. As acknowledged by Yin (2016; 2006), mixed-method approaches are synergistic to research questions requiring qualitative and quantitative evidence.

### **3.3 Results**

Of these 229 study participants, 102 (44.5%) respondents lived within or on the border of the Veluwe region while the other 127 (55.5%) were from outside the Veluwe region (Figure 2.1). For the purpose of this study, those living within the region were considered "local" and those outside of the Veluwe borders were categorized as "non-local". Male and female distribution was almost even, with 48% (110) of respondents being female and 51.5% (118) identifying as male. There was one missing entry which contributed to a 0.4% discrepancy in the total findings. Lastly, age demographics were separated into three categories: 18-25; 26-40; 41-55; and, 56+ with the distribution being 5.2% (12); 16.6% (38); 34.1% (78); and, 44.1% (101) respectively. This suggests that the survey results were thus skewed for those in older demographics, such as the 41-55 and 56+ brackets.

### **3.3.1 Recreational User Awareness of European Bison Ecosystem Services**

To gain an understanding of whether recreational users recognize ecosystem services provided by European bison, responses to a set of five questions (out of the total of 19 questions) were assessed. These questions centered on assessing the participants' opinions regarding the importance of European bison in nature; if the Veluwe region should develop more naturally – with little human management intervention – and if the European bison had an added value for the Veluwe or if there would be any positive aspects of their reintroduction. Response options for these survey questions included both Yes and No as well as open-ended options.

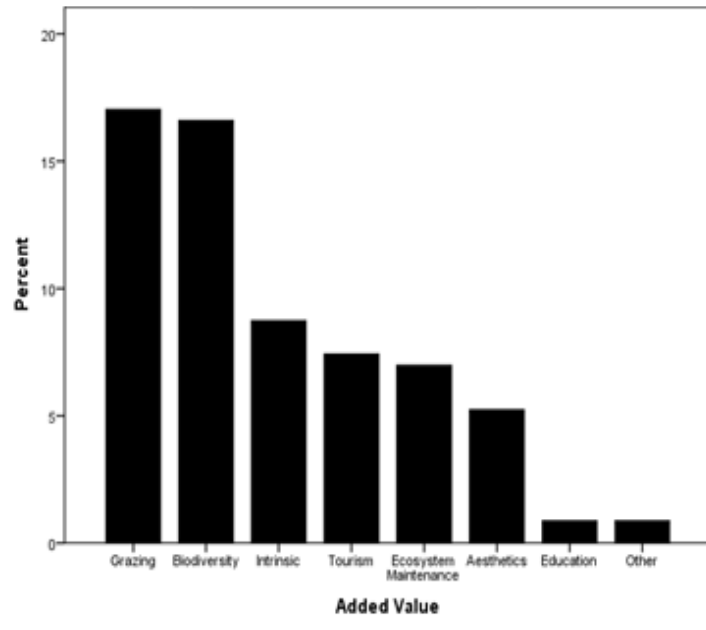
When recreational users were asked to what extent they agreed or disagreed with the statement “European bison play an important role in nature”, the majority (70.3%) of respondents felt they did. Participants who did not agree with the statement, however, were not entirely in disagreement with it. Close to one-fifth of recreational users (19.7%) were not sure whether the statement was true or not; while 7.4% answered that they did not believe the statement to be true. Survey participants were then asked if they felt the Veluwe should develop more naturally (e.g. with less direct management intervention by managers). Just over three quarters of recreational users seemed to generally (77.3%) be in favour of this, while 17.9% of participants were opposed. A small portion of recreational users surveyed, 4.4%, were unsure of whether the Veluwe should develop more naturally.

Regarding recreational users' perceptions of potential for European bison to provide an added value in the Veluwe region, just over two-thirds (68.1%) of participants thought they would; while 11.4% disagreed. Comparatively, almost one-fifth of respondents were unsure if the presence of European bison in the Veluwe had an added value. When asked to elaborate on the issue and specify what that added value would be; the majority of survey participants stated



European bison would either provide a grazing function (17%) or contribute to the region’s biodiversity (16.6%). Other responses recreational users gave as the added value of European bison were the intrinsic value (8.7%); tourism benefit (7.4%); performing ecosystem maintenance (7%); contributing to the region’s aesthetics (5.2%); and finally, as an environmental educational tool (0.9%). Together these percentages add up to 63.8%. The remaining balance of these responses, 36.2%, consisted of those who answered no

**Figure 3.3 - Perceived added values from bison reintroduction**



to the first portion of the question (i.e.: they did not feel European bison added any value to the Veluwe) or who were unsure if the bison added any value to the region.

The final survey question aimed to understand recreational users’ awareness of ecosystem services provided by European bison by asking “What positive aspects the bison brought to the Veluwe region?”. Nearly one-fifth of recreational users (19.7%) felt the most positive aspect European bison would bring to the Veluwe was an increase to region’s biodiversity. However, it is interesting to note that the second highest category, 15.7% of participants, were unsure if European bison added any positive aspects or not. Other responses were grazing functions (14.8%); aesthetic qualities (13.1%); maintaining ecosystem balance (9.6%); intrinsic worth (8.3%); tourism benefits (7.9%); and, environmental education (3.9%). It should be noted that 5.2% of recreational users surveyed felt the European bison had no positive aspects to offer the

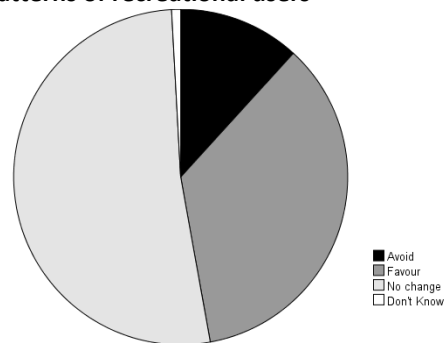
Veluwe region. While this seems similar to the proceeding question, it is interesting to note that biodiversity ranked higher as an answer for this question (19.7% compared to 16.6% from the previous question), as well as aesthetic values (13.1% compared to 5.2%). Another notable difference between these two questions is the number of respondents who were unsure of whether European bison would have positive benefits to the Veluwe region (20.5% of respondents in the previous question compared to 15.7%).

### 3.3.2 Perceived Costs of European Bison Ecosystem Services

Questions concerning attitudes towards European bison and what negative aspects a reintroduction could present were analyzed to examine perceived trade-offs recreational users would be making for a European bison reintroduction. Five questions were used to accomplish this. Two questions were open-ended, and three questions used a binary response option. Data from a sixth question were also used in another, separate aspect of the study. Here only those responses which were categorized as “negative reactions” upon encountering a wild European bison were assessed.

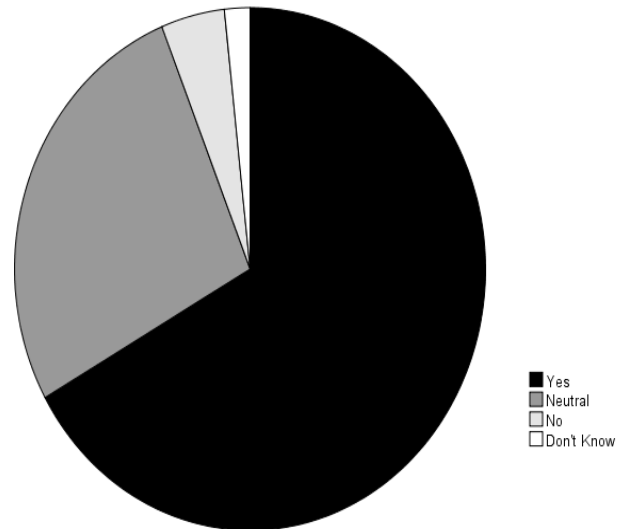
When asked if they would avoid or favour an area where European bison are present, a little more than half of the participants surveyed (52%) said it would not make a difference in their visitation patterns positively or negatively (Figure 3.4). Correspondingly, just over one-third (35.4%) of respondents stated they would increase their visitations to an area with European bison while 11.8% of recreational users said they would avoid such an area. When asked if recreational users

**Figure 3.4 - Hypothetical changes to visitation patterns of recreational users**



would like to see more wildlife in the Veluwe region, most participants (78.2%), stated they would like to see such a change. Comparatively, a little under one-fifth of people surveyed (19.2%) said they would not enjoy such a change while 2.6% of respondents could not say whether they would be in favour of such a change. Finally, survey participants were also asked if they would be a proponent of a European bison reintroduction project in the area (Figure 3.5). Two-thirds of respondents (66.8%) said they would support a reintroduction while only 4.4% stated they would be against it; 27.1% of the recreational users surveyed stated they would be neutral towards such a project.

**Figure 3.5- Support for a European bison reintroduction**



Recreational users were asked about what they thought the most negative aspect of reintroducing European bison to the Veluwe region was. One-quarter (25.3%) of participants suggested that instilling a sense of fear in visitors would be the biggest negative aspect. It is important to note the second-highest response were participants who could not specify what (if any) the most negative aspect of a proposed reintroduction would be (19.2%). This was followed by respondents who believed there would be no negative aspects whatsoever from a reintroduction (15.7%). Other participants expressed concerns regarding damage to natural and cultural landscapes (11.8%); future management uncertainties (9.6%); and a lack of adequate space for the reintroduction (8.7%) in almost equal distributions. Lastly, two equal categories of responses (3.9% for each category) identified apprehensions about the potential creation of new restricted areas to host the reintroduction and that a reintroduction could bring too many tourists to the

region. A small group of respondents (0.9%) expressed concerns which were not captured with the other categorical groupings.

A similar question that was used in the survey asked participants whether they thought a European bison reintroduction would bring an added value to the Veluwe region. Although most respondents felt European bison would result in positive outcomes, 3.1% of survey respondents thought there would not be adequate space; while 2.6% expressed concern over the future management implications. Positive responses to this question were explored in more depth in the separate human dimensions portion of the study (see Edwards and Decker, 2016). Also taken from that survey were recreational users' hypothetical responses to encountering a European bison in the wild. While the entirety of responses is elaborated on in the above paper, it is important for this paper to highlight the negative responses given by participants. These responses consisted of: caution (20.1%); fear (9.6%); and, surprise/shocked (6.6%).

### **3.4 Discussion**

This study aimed to accomplish two goals. Firstly, to highlight ecosystem services offered by European bison and determine if recreational users were aware of the services. Secondly, to illustrate the social payment – or cost – for the ecosystem services that recreational users would be making. This information will lead to a more holistic understanding of the trade-offs being made in order to host such a reintroduction project in the region, which will ultimately lead to greater discussion and clarity surrounding the decision-making process.

#### **3.4.1 Knowledge of ecosystem services**

Although survey respondents were not expected to have in-depth knowledge of the entirety of ecosystem services contributed by European bison, some knowledge of ecological interconnectedness was anticipated. The research findings from this study generally supported this

assertion with approximately 70% of participants acknowledging European bison either played an important role in nature or would provide the Veluwe region with an added value. This is important as raising awareness surrounding ecosystem services contributed by European bison may also raise awareness of the positive impacts which could be experienced in the region through a reintroduction project. Awareness of potential positive impacts offers recreational users a more informed understanding of positive versus negative trade-offs occurring with any reintroduction. Misinformation could very well affect recreational users' opinions regarding the bison reintroduction, and potentially be based on unfounded assumptions. However, the survey was not designed to probe the depth of knowledge recreational users had towards bison-contributed ecosystem services. Therefore, some users may not fully understand the impacts (positive or negative) bison have on the local ecosystem, which could be addressed through educational campaigns and outreach programs.

Educational outreach projects and campaigns regarding bison can assist recreational users by better informing them on the goals of the SBB, bison ecology, and knowing how to live and recreate in landscapes shared with bison. Having more information regarding the reintroduction program publicly available can mitigate misinformation and development of hearsay regarding the intent and goals of department. Considering public funds have and will be spent on the project, transparency is important throughout the project lifetime. Members of the public may not offer support to the project if the goals and objectives are not openly discussed with sound justification for the choices made by decision-makers. Considering the potential disruption to the day-to-day recreation of local inhabitants due to the reintroduction, educational campaigns regarding bison behaviour as well as safe and unsafe practices of those sharing spaces with them would be a responsible management decision from the SBB. It is not in the scope of this research, but one

could make an argument that since the SBB is responsible for the reintroduction, they should be equally as responsible for educating recreational users on ways to mitigate negative human-wildlife conflict with the bison. Through such educational campaigns and projects, the SBB can reduce the perceived social cost of having a bison reintroduction occur in such a well-visited natural area. Through the mitigation of negative human-wildlife interaction and through educating the public on ecosystem services provided by bison the SBB can potentially increase the overall tolerance and willingness-to-accept levels of the public towards the project.

### **3.4.2 Expanding payments for ecosystem services**

It is easy to discuss payments for ecosystem services when both the services and payments are easily quantifiable. When the ability to quantify either of these moves into the realm of subjectivity, the metrics used to evaluate and decide what the specific services and payments are become more ambiguous and harder to manage from a decision-maker position. This ambiguity impacts valuations of payments involving elements such as intrinsic value, aesthetics, and recreational enjoyment. If a proportion of respondents feel that their enjoyment or visitation of an area with reintroduced bison would decrease that should be valued and considered as a cost these recreational users are trading in lieu for the benefits provided. Whether it be a diminished sense of safety, a desire to not see wildlife, or some other intangible factor, these recreational users feel a diminished overall value to either the region or visit. This diminished value some users may feel should be incorporated as part of the total cost of the reintroduction by project managers. This can also be more objectively collected through surveys, or consultations to determine well-articulated results of willingness to accept or WSAC towards the project. Utilizing a more holistic understanding of costs as it comes to ecosystem services allows managers to better shape

discussions involving what members of the public are receiving in return in increase positive social license for resource management projects.

This more thorough valuation of payments through inclusion of WSAC or similar measurements offers managers more holistic data with to inform decisions, which is more in-line with the SDM approach for management. By eliciting this information from stakeholder groups, including WSAC and other similar measurements will also inherently increase public participation in the decision-making process. Increased public participation and interaction with resource managers can lead to enhanced public trust in management decisions and develops a greater lens of transparency surrounding the proposed project. Including more subjective or qualitative values into the SDM process creates rigorous decision(s) and allows managers to incorporate multiple value sets into their decision making and justification process. If this social information is kept in databases, managers can rely on this to inform future, similar projects or even contribute to adaptive management decisions through the creation of baseline public HDWM knowledge. Future studies can further inform managers of any major shift in societal values towards certain resource management projects or topics.

### **3.4.3 Research significance and future directions**

Given the importance of HDWM to wildlife conservation efforts, this study – and others similar – is essential when evaluating the success of delivering desired ecosystem services by way of wildlife conservation programs. Incorporating similar studies into resource management programs in the future is in line with best practices for wildlife governance (Decker *et al*, 2016) by producing sustainable benefits for recreational users and also a means of engaging citizens in the decision-making process. Increasing the presence of more intensive HD studies during the decision-making process puts pressures on managers to adapt their current management paradigm

from one which may be more ecological based to a more holistic social-ecological paradigm model (Decker *et al*, 2016). Publicly-funded wildlife management programs can have a high financial cost associated with them, understanding the public's perception, understanding and values towards the programs is a responsible management action for undertaking public-funded expenditures. Especially in the context of attempting to encapsulate a holistic view of payments, or trade-offs, these groups are making as a result of the reintroduction. Future studies involving reintroduction projects should always include HD components to ensure proper consideration of the social elements of local inhabitants or recreational users to the areas. Further research towards a HDWM approach will support the ongoing paradigm-shift in wildlife management to a social-ecological perspective.

Further wildlife management projects conducted by the SBB should continue to use a human dimensions method and attempt to increase the scope of future HD studies as it would yield more beneficial results for management. Increasing scope of these studies could include surveying and consultation work with actual local residents living nearby the reintroduction area, instead of recreational users who may be visiting from outside the region. It could also include studying the attitude, behavior, perception and values towards these reintroduction efforts between different groups of peoples (i.e.: urban v. rural; comparing different age demographic; local resident v. visitor to region, etc.). This could then be used to develop baseline HD profiles for different demographic cohorts for future reference towards similar projects. Lastly, more in-depth stakeholder consultation could be conducted to more accurately understand HD elements of different groups and to then better account for those learnings in management and action plans for the projects in question.



## **Chapter 4: General Conclusion**

The findings presented above demonstrate that most recreational users surveyed in the Veluwe over the course of this study in general support reintroduction of European bison on the landscape. Furthermore, it also indicates the majority of respondents believe the reintroduction would not impact their visitation patterns and that the project would result in an added value to the Veluwe region as a whole. It is also important for decision-makers, in this case the SBB, to note what recreational users saw as the largest negative aspect of the reintroduction: fear of the animal itself. Addressing this issue is crucial to support long-term coexistence between humans and bison on the landscape. Knowing this, the SBB can develop educational campaigns targeted towards recreational users of the area and how to recreate safely in landscapes with bison and what safe behaviours to engage in. Specifically addressing what user groups see as negative aspects of a management decision may assuage these opinions and further public trust towards the decision as a whole.

It is also important to note that many recreational users cannot identify any of the ecosystem services a bison reintroduction can provide to the local ecosystem. This is an important consideration for the SBB to note. If recreational users and other groups cannot identify other positive externalities outside of intrinsic value from having bison on the landscape, this may negatively impact their WSAC. Recreational users or other groups may struggle to identify elements on either side of a “trade-off” situation for reintroductions if they are not aware of the totality of the positives and negatives. This knowledge gap can be addressed with educational campaigns or surveyed again to note differences in knowledge from when this study was conducted to monitor for change.

However, there are limitations to this study and considerations for future research. A limitation to be considered is that this study solely surveyed recreational users and there is a need

to incorporate local residents and stakeholder groups to garner a more complete understanding on the actual public opinion on the reintroduction. Limiting the study to a small transect of the public limits the effectiveness of the human dimensions' information garnered by it in terms of the overall issue management. The views expressed in this study are only those identified as "recreational users" to the Veluwe. Different stakeholder groups or demographic cohorts may express different opinions and survey responses than those presented in this study. Another area of interest for future research is to study more in depth the knowledge gaps existing between recreational users and SBB towards the ecosystem services provided by bison and if this exists with different stakeholder groups or subsections of the public or even different species. As this study provides insight into knowledge levels and opinions in 2014, it can provide baseline data to the SBB to further inform future studies or monitor levels of change in those respects. If the SBB wishes to pursue their mandate of restoring ecosystem services, understanding a stakeholder's group knowledge level of them is important to consider when discussing management issues with that group.

Lastly, in respect of transparency and open access of research, this study and its findings will be made available through MUNS online archives.

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**Appendix A: Veluwe Recreational User Questionnaire**

*Recreational User Survey on European bison (Bison bonasus) in the Middle Veluwe*

**Researcher-Administered Questionnaire**

| Question  | Answer                      |
|---|-----------------------------|
| 1. Do you know what a European bison or wisent is?  | (yes/no)                    |
| 2. Have you ever seen European bison? If, yes where?  | (open)                      |
| 3. What kind of image do you have of a bison?   | (open)                      |
| 4. Did you know there are bison in a nature reserve in the Netherlands?                               | (yes/no)                    |
| 5. Would you avoid or favour an area where there are European bison? Or wouldn't it matter?           | (avoid/favour/no change)    |
| 6. How would you react if you saw a European bison in the wild?                                       | (open)                      |
| 7. E. Bison play an important role in nature  | (true/false)                |
| 8. Would you like to see more wildlife on the Veluwe?   | (yes/no)                    |
| 9. Do you feel the Veluwe should develop more naturally?  | (yes/no)                    |
| 10. Do you think the E. Bison has an added value for the Veluwe? describe what                        | (open)                      |
| 11. If the European Bison should be introduced in the area, would you be a proponent or not?          | (yes/no/neutral)            |
| 12. Where do you think this introduction could best take place?                                       | (open)                      |
| 13. What do you see as the positive points of E. Bison on the Veluwe and what as the negative points? | (open)                      |
| 14. Why do you visit the area now?  | (open)                      |
| 15. Why do you visit the area generally?  | (open)                      |
| 16. How often do you visit the area?  | (number of times per month) |

Demographic data:

1. Male/female
2. Age group:
  - 25 or younger
  - 26 – 40
  - 41 – 55
  - 56+
3. In which town do you live? \_\_\_\_\_