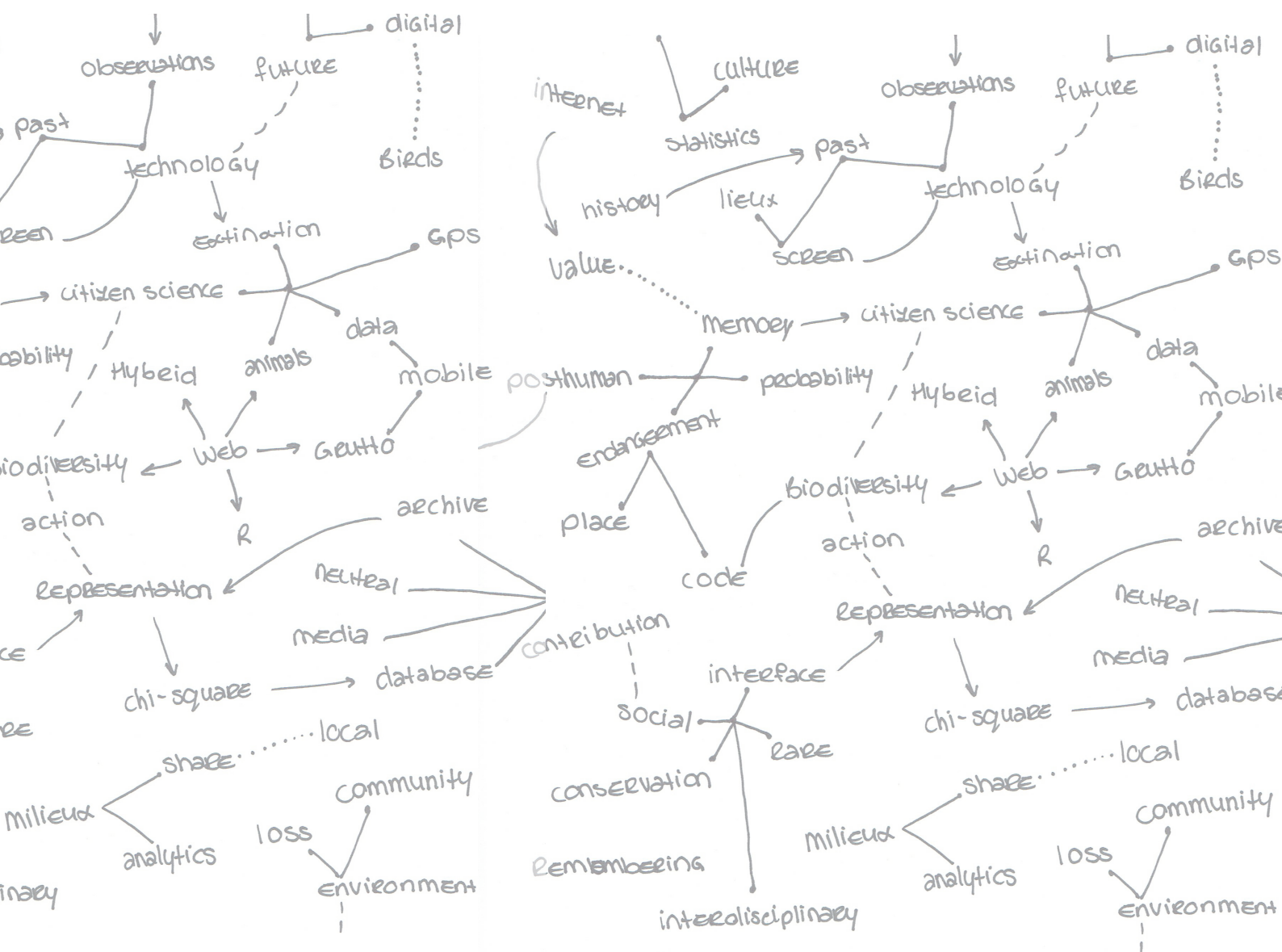


NATURE THROUGH THE SCREEN

how digital archives of biodiversity shape our understanding and experience of nature



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Thesis Research Master Historical, Literary and Cultural Studies

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CHAPTER 1:

INTRODUCTION

1.1 INTRODUCTION

The Black-tailed Godwit, *Limosa limosa*, or in Dutch: de Grutto. This popular shorebird was voted the National Bird of the Netherlands in 2015 and bird of the year in 2019 by the Dutch public (Vogelbescherming 2015; Vogelbescherming 2019). Its presence in our grasslands deemed unmissable. And the Godwit seems to enjoy our land just as much as we enjoy its presence, with almost 90% of the global population breeding in our small country (Vogelbescherming, n.d.). Or at least, they used to. The Black-tailed Godwit is just one example of many species that are disappearing as biodiversity declines. Not just in the Netherlands, but all over the world the impact of humans is threatening nature. We live in the era of the Anthropocene¹, a time in which humans are irreversibly impacting the world. This goes together with high extinction rates, the so-called ‘sixth extinction’, mainly caused by HIPPO activities; habitat destruction, invasive species, pollution, human population growth, and overharvesting (ten Bos 2017). Many of these activities are also causing the Black-tailed Godwit to disappear. In 2017 it entered the Dutch Red List for endangered breeding birds, its once unmissable presence now labelled as sensitive (van Kleunen, Foppen, and van Turnhout 2017).

So how can you still see this bird, which is on the edge of extinction? What places do you have to visit? Perhaps it is not surprising that the internet has the answer. Nature enthusiasts around the world are registering observations of nature digitally to keep lists, share knowledge with others and help science by providing valuable biodiversity information. In the case of bird biodiversity, there are an increasing number of websites and mobile applications that allow anyone to upload bird observations, such as e-bird, iNaturalist or the Dutch waarneming.nl. One search for the Black-tailed Godwit on these platforms will show you where this bird has been seen today. Additionally, these platforms allow you to share your own observations in real-time.

These digital platforms are essential to gather knowledge on biodiversity. They allow amateurs and nature enthusiasts to contribute data to science, so-called ‘citizen science’. The data they provide is used for ecological research, nature protection policy and conservation efforts (Dickenson and Bonney 2012). But these websites are not only means to a scientific end. They are first and foremost digital cultural productions that play a role in our understanding and experience of nature. As environmental humanities scholar Ursula Heise (2016) argues “biodiversity, endangered species, and extinction are primarily cultural issues, questions of what we value and

¹ Popularised by atmospheric scientist Paul Crutzen (2002), The Anthropocene denotes a geological epoch in which humans are having an irreversible and unprecedented impact on the earth’s geology and ecology. The concept has been both celebrated and criticised. For example, see Brondizio et al. (2016) for an introduction into different approaches to the term.

what stories we tell, and only secondarily issues of science” (5). This thesis will move away from the scientific perspective on digital platforms for nature observations and focus on their engagement with biodiversity, endangerment and extinction as cultural issues.

1.2 CASE STUDY

Waarneming.nl is the largest nature observation platform in the Netherlands. Through this platform, users can create an account and upload observations. This includes all types of nature observations, from plants to insects, mammals or birds. From the launch of the platform in 2002 until today², 72,695,609 observations were registered by 120,885 unique users. In 2019 alone 8,227,728 observations were uploaded (Waarneming.nl Statistics n.d.). Waarneming.nl describes it as their mission: “to share observational data about global biodiversity, past and present, as a source of knowledge for the future” (Waarneming.nl Mission n.d.). Observations can be uploaded either on their website or through their mobile applications (ObsMap for Android, and iObs for iOS). All observations include the name of the observed species, the time and date of the observation and the location where the observation was made. Optionally, users can add additional information such as their observation method or the activity and life stage of the observed species. Data from waarneming.nl is used in ecological research, policymaking and the creation of biodiversity trends.

In line with the mission of waarneming.nl and Ursula Heise’s (2016) notion that registering biodiversity is a cultural issue, this thesis will answer the question: *how does the digital archive waarneming.nl shape our understanding and experience of places in nature and the bird biodiversity present there?*

Although waarneming.nl does not specifically focus on bird observations, this thesis does. In the first place, this is motivated by the overrepresentation of bird observations on waarneming.nl. Roughly 66% of the observations on waarneming.nl are of bird species (Waarneming.nl Statistics n.d.). More importantly, this focus is based on the fact that birds are one of the most present animal species in our everyday lives. Whereas animals such as insects or fish are hard to see and even harder to identify, and as reptiles or mammals often spend their lives hidden away from our view, birds are all around us and relatively easy to identify with an average dose of common knowledge. Furthermore, there is a long history of human-bird interaction through bird-watching and bird-counting activities (Greenwood 2007). This popularity of birds also makes them a so-called ‘proxy’ species. Just like mammals, or some insects as butterflies, such species are ‘proxies’ as they are often used as a shorthand to talk about broader biodiversity issues (Heise 2016). This qualification does not mean that these proxy species are also more relevant for the ecosystem than other species, but rather that they are appreciated for their anthropomorphic qualities and aesthetic appeal.

Given that birds are such proxy species they are an effective example to use throughout this thesis to discuss issues around biodiversity. Nevertheless, it should be critically reflected upon that this focus on birds excludes many other species that might be more prone to extinction or endangerment, and who’s disappearance would have more negative consequences for the ecosystem, such as bees or fungi. This thesis is written with awareness of this biased focus on birds but aims to engage with the topic critically and hopes to create a tangible analysis by choosing to focus on such a proxy species. Throughout this thesis, the Black-tailed Godwit will often make its return to make the analyses and theoretical concepts easier to grasp.

1.3 THEORETICAL FRAMEWORK

To answer the research question, an interdisciplinary approach will be taken by combining theories from the environmental humanities, media studies and memory studies. Within the humanities, there is an increased interest in the role arts and culture play in environmental issues such as climate change and biodiversity loss (Heise, Christensen, and Niemann 2017). This has resulted in the development of the sub-field of the environmental humanities, where issues related to the environment take centre stage. This includes the analysis of literary works on climate change, the role of art in communicating environmental issues and other analyses of cultural artefacts. Ursula Heise (2016), who has been mentioned above, is one of the key environmental humanities scholars studying the role cultural artefacts play in the representation of biodiversity loss. Her work will be addressed throughout this thesis. Her emphasis on ‘value-judgements’ will return frequently. Heise addresses that the representation of biodiversity is highly dependent on what our culture values and what we do not. Some species are valued more than others, as already became clear in the discussion on ‘proxy species’. Starving Polar Bears tend to get a lot of media attention and have turned into symbols for biodiversity loss in many (popular) cultural productions, whereas the loss of many insects is given much less attention. Nevertheless, the loss of insect biodiversity has more dramatic consequences for the earth’s ecosystem compared to Polar Bears. The values humans attach to specific types of nature does not always match with what the ecosystem needs. This makes it specifically important to look critically at the nature we tend to represent and the nature we tend to ignore.

In *Imagining Extinction* (2016), Heise analyses biodiversity databases such as the (no longer existing) ARKive and the IUCN Red Lists. Together with a handful of other theorists (Youatt 2008; Bjærke 2019) she has produced one of the only theoretical explorations on biodiversity records similar to waarneming.nl. So far, biodiversity records have thus only received limited scholarly attention from a cultural perspective. This thesis is an addition to this unfortunately still scarce field.

Inherent to the environmental humanities is the interdisciplinary approach taken. This is often evident in the combination of cultural and environmental theory (Heise et al. 2017). This thesis takes full advantage of this interdisciplinary approach by combining environmental humanities with media studies and cultural memory studies. Furthermore, the methodology of this thesis adds to this interdisciplinarity by drawing on the field of cultural analytics, where computational tools are integrated into the analysis of global cultural issues (Cultural Analytics Lab n.d.). The theoretical exploration in this thesis is combined with quantitative data-driven analysis, by applying statistical tests to the content of waarneming.nl. As will be elucidated further in the following methodological chapter, this data will form the foundation for the theoretical analysis of waarneming.nl and will benefit the critical evaluation of the emerging statistical patterns.

1.3.1 MEDIA STUDIES

Findings from the field of media studies form another important part of in this thesis. Waarneming.nl is a digital archive that shares information in similar ways as many other new media technologies that we use today, such as Facebook or Wikipedia. Most importantly, within media studies much attention has been paid the collaborative abilities of digital platforms, where many contributors can add and share information. All content on waarneming.nl is produced by the collaborative effort of more than 120,000 users. This collaborative effort has both positive and negative consequences that will be further addressed in this thesis.

Furthermore, scholars in media studies have analysed the geo-tagging abilities of digital devices. Our mobile phones, tablets and computers utilise Wi-Fi and GPS technologies to determine our exact location and make it possible to share these with others. This thesis will most importantly draw on de Souza e Silva's (2006) conceptualisation of 'hybrid place'. She argues that our understanding and experience of place are shaped by the interaction between physical and digital spaces. We increasingly assign meaning to places digitally, by sharing locations with others. Our experience of a place has thus become a combination of how we experience it physically and the information we have gathered about it digitally.

However, analyses of geo-tagging are limited to urban places and have not been extended to nature. In times where our environment is under pressure, it is of great importance to extend such analyses to nature, as this will help to understand how digital media influences our understanding and experiences of places in nature as well. This thesis will fill this gap by proposing that the concept of hybrid places is not only applicable to the urban environment, but that *waarneming.nl* is an example of how our experience of nature is also becoming hybrid.

1.3.2 MEMORY STUDIES

Media studies has already joined its efforts with cultural memory studies. Media scholar Andrew Hoskins (2009) has noted that we do not merely remember individually or by sharing our experience with others offline, but increasingly by sharing them digitally. This thesis follows this digital approach to cultural memory studies. Cultural (or collective) memory studies is an umbrella term for the study of objects that are related to the memory of specific communities and their way of life, and specifically the interaction between the individual and the collective (Erl 2008). In this thesis it will be addressed how species and nature as a whole can be remembered through *waarneming.nl*. This is especially relevant in light of the expectation that much of this nature will be lost in the near future or is even lost already. In this sense *waarneming.nl* can be understood as a digital 'place' where people can remember lost nature, reminding of historian's Pierre Nora's (1989) concept of 'Les Lieux de Mémoire'. Nora argues that symbolic objects as archives function as places of memory where communities can go back to, to remember key moments from the past. Although Nora's concept is of great importance in the field of cultural memory studies, it has only modestly been applied to the digital context. Additionally, no theoretical evaluations of places of memory for biodiversity have been developed. Within this thesis, *waarneming.nl* will be conceptualised as a *lieu de mémoire* for lost biodiversity, arguing that this digital archive makes biodiversity loss visible. This allows remembering to take place, and possible actions to be taken in response to the environmental crisis.

1.3.3 POSTHUMANISM

Throughout this thesis, a posthuman approach will be taken to the analysis of *waarneming.nl*. A posthuman perspective aims to do away with the human/nature divide that has dominated humanist academic studies over the years (Peterson 2011; Sullivan and Malkmus 2016; Dooren, Kirksey, and Münster 2016). Although this thesis will not extensively engage with the large philosophical debate around posthumanism, it is necessary to touch on its definition and its role in this thesis. This thesis will follow an ecological posthumanism, which has its origin in animal studies (Sullivan and Malkmus 2016). It proposes a non-hierarchical approach, where the human species is decentered. In doing so, the human is understood to be enmeshed with the rest of the natural world (Heise et al. 2017). This allows humans to be seen as part of the ecological system, instead of an outside factor acting in

isolation. Especially in the area of the Anthropocene this perspective has been called for, as it allows to understand the many ways in which humans are irreversibly affecting this ecosystem, and have agency in their treatment of nature (Sullivan and Malkmus 2016; Ulmer 2017).

Within the posthuman debate, different concepts have been used to refer to the non-human (e.g. inhuman, non-human animals, non-human actors). Throughout this thesis, the term ‘non-human actors’ will be used. This term can refer to a variety of things, ranging from inanimate objects to animals. In the case of this study, ‘non-human actors’ only refer to living organisms, such as animals, plants or fungi.

Within the environmental humanities, this ecological posthumanism is already a popular vantage point (Heise et al. 2017). On the other hand, this posthuman view is less popular in media studies and memory studies, which are mostly concerned with human experiences. According to Craps and colleagues (Craps et al. 2018), the humanities and especially memory studies is going through a posthuman phase, where the human should not be central to analyses but equal focus should be given to non-human agents.

Although there has thus been a call for a more posthuman approach within the humanities, the theories introduced above - hybrid place and lieu de mémoire - focus on urban spaces and human experience and understanding. Even though the research question this thesis aims to answer also focuses on ‘our’ human understanding and experience, an emphasis will additionally be put on how ‘we’ affect non-human actors. ‘We’ are understood as part of the ecosystem rather than in isolation of it. Digital media might only be used by humans and we might only have access to human memories, but non-human actors do not remain unaffected by these memories and devices. Our phones and computers guide us through nature on our walks and our drives. But while our eyes are on our screens we might also stomp through grasslands, scare off bees or disturb breeding birds.

1.4 OUTLINE OF CHAPTERS

In the following chapters, the introduced theories will be further elucidated and analysed to answer the main research question. Four sub-questions have been formulated which each contribute to answering this research question:

- * Sub-question 1: How can waarneming.nl be understood as a digital archive of bird biodiversity?
- * Sub-question 2: What places and bird biodiversity does the archive contain and what biases might be at play in this?
- * Sub-question 3: How does waarneming.nl mediate the experience and understanding of (non-)human actors in nature?
- * Sub-question 4: How can waarneming.nl be understood as a digital lieu de mémoire?

Before answering these sub-questions, *Chapter 2* is concerned with introducing the methodological framework of this study, further introducing the realm of Cultural Analytics and how a data-driven approach benefits this study.

In *Chapter 3* an answer to the first sub-question will be formulated. In the main research question, waarneming.nl is referred to as a digital archive. From the perspective of the environmental humanities, scholars as René ten Bos (2017) and Ursula Heise (2016) have emphasised the tendency to archive nature in the age of the Anthropocene to make sure changes in nature are conserved and extinctions are not forgotten. However, the

idea of the archive has changed drastically in our digital times. Especially the relation between the archive and the database has been challenged by theorists as Lev Manovich (2002). This brings with it the need to further explore how waarneming.nl can be understood as a platform, archive and/or database of nature. In the answer to this first sub-question, it will be established why waarneming.nl can and should be conceptualised as a digital archive, which will allow to analyse waarneming.nl as such in the following chapters.

After establishing waarneming.nl as a digital archive, *Chapter 4* is concerned with the content of this archive. Archives are subject to human biases and are not neutral (Schwartz and Cook 2002). They are sites of negotiation, where values and ideologies are contested or confirmed. By taking a data-driven approach, this chapter will note what content is represented on waarneming.nl and what biases can be found within this content. Through a statistical analysis of a dataset of waarneming.nl observations, it will be illustrated that the understanding and experience of nature that waarneming.nl shapes are not all-encompassing or neutral. This will allow to formulate an answer to the second sub-question, which provides the basis for the analysis in the following chapters, where this data will be scrutinised in light of the introduced theories.

Chapter 5 discusses how the content of waarneming.nl analysed in Chapter 4, plays a role in the mediation of our experience and understanding of nature. In doing so, an answer to sub-question 3 is formulated. De Souza e Silva's (2006) idea of hybrid place is key here, arguing that waarneming.nl mediates our experience with nature by making our understanding and experience of nature hybrid. This mediation is dependent on the content of the archive. The posthuman perspective is of specific importance here, as this chapter emphasizes how this mediation has both negative and positive consequences for non-human actors.

Finally, *Chapter 6* extends the idea of waarneming.nl as a mediating factor. This chapter is concerned with how waarneming.nl mediates our remembrance of lost biodiversity by conceptualising waarneming.nl as a lieu de mémoire (Nora 1989). In doing so, an answer to sub-question 4 is formulated. With the drastic extinction of species, it is of specific importance to not only analyse how waarneming.nl shapes our understanding and experience of nature that surround us today, but also how we can understand and explore nature that has been, or and will be lost. It will be argued that waarneming.nl can be understood as an online container of memories; a place where nature can be remembered when it can no longer be experienced physically and where actions to protect nature can be triggered.

CHAPTER 2:

METHODOLOGY

2.1 MIXING METHODS

To answer the research questions proposed in the introduction chapter, this thesis will take a mixed-methods approach, combining theoretical exploration and quantitative analysis. In doing so, this research is situated within the field of cultural analytics, a sub-field of the much broader digital humanities. Although data analysis is often shelved as a technique for the natural sciences and put in opposition with the humanities, there is a long-lasting tradition of integrating data analysis in humanities research. Edward Vanhoutte (2013) elaborately analysed the historical movement towards the use of digital methods in humanities research, which especially gained prominence in the field of linguistics and literary studies around the 1950s. From then onwards data analysis and computation methods became part of the humanities as a whole and related disciplines such as history and the arts.

Lev Manovich first proposed the more specific term ‘cultural analytics’ to describe the integration of computational tools into the analysis of global culture (Cultural Analytics Lab n.d.). In the introduction to the ‘Journal of Cultural Analytics’, Andrew Piper (2016) discussed the relationship between computation and culture. Most importantly, computational methods can add new findings and evidence to the study of culture. In return, cultural scholars can reflect on these computation tools with a critical perspective and highlight the biases and situatedness of the knowledge that is produced through these methods.

The symbiotic relationship between data analysis and cultural analysis that Piper proposes here is exactly what is taken advantage of in this thesis and brings an innovative character to the analysis of biodiversity databases. Data analysis offers a variety of benefits in analysing waarneming.nl. First of all, computational methods are highly appropriate for the analysis of so-called big data, making it possible to derive patterns from large datasets as that of waarneming.nl. Furthermore, statistical analysis provides a calculation of the probability of certain patterns. It shows how likely it is that certain patterns and relationships are true. However, this is where data analysis in the natural or social sciences often ends. These possible truths are rarely questioned and scrutinised.

This is where cultural theory is of benefit, characterised by critical evaluations and the questioning of seemingly natural or taken for granted ideas. Although it would be possible to apply theories from the environmental humanities, media studies and memory studies to waarneming.nl directly, the knowledge on probability and relationships between variables provided by data analysis helps to form a stronger foundation on which to build theory.

As a result of the statistical analysis, knowledge is produced that can then be critically deciphered by theories from media studies and cultural memory studies. The statistical analysis will show certain probabilities

and likelihoods, but instead of stopping here and merely taking these for granted, this study will go a step further by scrutinizing what these probabilities and likelihoods mean. Statistical tests are based on statistical models that are simplified representations of the world (O'Neil 2016). In the case of this thesis, the results from the data analysis can be considered directions at where to point a critical eye. The statistical analysis is used as a basis for further theorisation, but more importantly theories around the mediation of digital devices and processes of remembering will help to problematise the biases and situatedness of the statistical results. In this way, the statistical analysis and theoretical approach complement each other to come to more wholesome and critical insights.

2.2 CASE STUDY

To analyse waarneming.nl, an anonymised dataset of all observations registered in 2019 will be taken as a case study. Throughout this thesis, this dataset will be used to reflect and build upon the theoretical framework. The choice for this specific dataset was pragmatic, as the most recent data set was seen as the best representation of the current content. Additionally, the choice to focus on a specific year was a methodological consideration, as it limited the observations to a workable number, while still leaving a large and representative dataset. The boundary of a year was specifically chosen as it included all seasons. This was necessary for the observations to be representative, since the number of observations differs per season, with more observations in spring and fall compared to other seasons. This can be explained by bird migrations and breeding seasons.

The 2019 dataset consists of a total of 7,371,637 observations, registered by 24,348 unique users. As clarified in the introduction chapter, this analysis will specifically focus on bird observations. The dataset includes 4,547,574 bird observations, by 16,998 unique users. The dataset only includes validated observations, as waarneming.nl works with a team of volunteer validators and a validation algorithm to check if each observation is likely to be true. On the website, not yet validated observations are also visible, but these are thus not present in the dataset.

All observations feature the *species name* of the observed animal (e.g. Black-tailed Godwit, Rabbit) and the *species class* to which it belongs (e.g. bird, mammal). All observations are linked to a unique anonymised *ID code* for each observer. Furthermore, the *time* and *date* of the observations are present as well as the GPS location of the observation, expressed in *longitude* and *latitude*. It is possible for users to hide the time of an observation in their privacy settings, so for some of the observations the time is not available.

Waarneming.nl uses a coding system to assign each observation a *level of rarity*. On the platform, these are expressed in four levels (common, relatively common, rare, very rare). These levels of rarity are also expressed in the dataset. It is not publically communicated how these levels are determined specifically.

For each observer, demographic information is available about *gender*, *province of residence*, *birth year* and *registration date*. As gender and birth year are not mandatory fields when registering, this data is not available for all users. The registration date is not specified for users who registered before 2008.

As this thesis is connected to questions around endangerment and extinction, additional data was added to the dataset on the endangerment levels of birds in the Netherlands. The Dutch Red List for Breeding Birds as published by Sovon, the Dutch Ornithology Foundation (van Kleunen, Foppen, and van Turnhout 2017). was used for this. This list includes breeding birds that have decreased in amount of individuals, populations or spread. The

most recent 2017 version of the Red List was matched with the species in the dataset provided by waarneming.nl.

2.3 ANALYSIS

The dataset was ‘cleaned’ to fit the structure needed to apply statistical testing. This was done using packages in the RStudio environment using the R programming language. Such data cleaning includes searching for unrealistic data (such as birth years previous to 1900 or random numbers as 89128) and determining what data to include and exclude in certain tests (for example a minimum of ten observations for determining user mobility). It should be acknowledged that determining such criteria for data cleaning is not without assumptions. For example, pragmatic assumptions are made about complex categories such as gender, place of residence or species groups (Bowker and Leigh Star 1999). Other pragmatic choices might be the exclusion of users with less than ten observations, as the statistical model was not able to draw a valid conclusion based on this little data.

In Chapter 4, several statistical tests are applied to the dataset, that focus on testing the distribution of variables or relationships between variables. These statistical tests were again conducted using packages in RStudio.

Apart from integrating the results of this data analysis into the further chapters, qualitative interviews with users of waarneming.nl will also be referenced. These interviews were conducted as part of a previous study on the experience of users with citizen science platforms. These interviews are analysed in a forthcoming publication (Verploegen, Ganzevoort and van den Born 2020). Throughout this thesis, quotes from these interviews will be used to contextualise some of the argumentation and give insight into the user experience of the platform. The use of these quotes also adds to the mixed methods approach taken in this analysis, adding a qualitative data element to this thesis.

CHAPTER 3:
ARCHIVING NATURE

3.1 ARCHIVAL TENDENCIES

In the introduction chapter of this thesis, waarneming.nl was introduced as a platform where users can upload observations of nature. This chapter will further contextualize waarneming.nl as an archive, by answering the first sub-question: *how can waarneming.nl be understood as an archive of bird biodiversity?* The answer to this question will form the foundation on which the following chapters of this thesis will be built.

To understand waarneming.nl as an archive, it is essential to consider the historical context in which the tendency to archive developed. Historically, the archive was introduced as a political tool that was most relevant for practicing law. It offered a systematic way of organising records that could be used for governance (Blom 2016). During the Enlightenment, the function of the archive to organise information became of greater importance as it was used to order and classify scientific knowledge (Bowker 2005). This idea of classification through archives is especially notable in biodiversity research. As environmental politics scholar Youatt (2008) has analysed, there is a tendency and desire to count all species on earth because of conservation needs. He links this to the “Western narrative of discovery and conquest of nature” (398). Heise (2016) acknowledges Youatt’s finding and notes this as the “encyclopedic, centripetal impulse that reaches back to the Enlightenment and seeks to inventory the entire known world” (65).

This tendency is specifically recognisable in the case of birds. Bird counting has a long history that is grounded in the enthusiasm of amateur bird watchers who initiated censuses and ringing sites¹ during the nineteenth century (Greenwood 2007). This was often motivated by the enjoyment of nature but also opened up major possibilities for bird research and conservation, which became more important as biodiversity was put under more pressure (Ganzevoort et al. 2017; Greenwood 2007). Thanks to the efforts of these ‘citizen scientists’, there are long existing archives of bird populations and migrations.

Although these archives were not initially started for conservation purposes, Rene ten Bos (2017) argues that during the Anthropocene, archiving of biodiversity becomes ever more important. He notes the recent tendency to collect nature and put it on display; on the one hand, to make sure the past is not forgotten and on the other hand to highlight the importance of protecting what is still around. As informatics scholar Bowker (2005) noted in his analysis of memory practices in science: “It is generally agreed that if we want to preserve a decent portion of animal and floral life from the current great extinction event, then policymakers need the best possible information about current species size and distribution” (116). Archiving is one of the main ways in which this information

1 Locations where birds are ringed; the attachment of a numbered metal band around the leg of a bird for individual identification.

is collected and shared. This shows that although the archival tendency was initially driven by law, governance and for the purpose of sharing knowledge, today, biodiversity archiving is more importantly driven by nature conservation and protection efforts.

This need to archive in light of conservation is something that waarneming.nl addresses in their mission statement, in which they call their platform “a powerful tool for nature conservation, research, policy, education and experience” (Waarneming.nl Mission n.d.). Users of the platform are thus made aware of the fact that they are contributing information for these specific purposes. To some users, this use of their observations is even a motivation to share data (Ganzevoort et al. 2017). This indicates that conservation needs have increased the tendency of archiving biodiversity in Anthropocentric times, as Ten Bos (2017) already suggested.

Thus, from the perspective of biodiversity conservation, archives are of great importance. Additionally, this thesis engages with memory studies, a field in which archives play a key role as well. Previously, theorists have highlighted the importance of archives within the realm of cultural memory studies. Memory studies scholar Assmann (2011) noted that cultural memory is a constant selection process of what to remember and what to forget. Remembering can be done in many different ways: it can be done actively, through dance, oral stories or even museum exhibitions. However, remembering can also be done more passively through archives. Assmann defines archives as “the basis for what can be said in the future about the present when it will have become the past” (Assmann 2011, 355). By adding pieces of information to archives, we are storing information, but not yet interpreting them. In doing so, this stored information can be remembered in the future. What is stored in an archive is given the “chance of a second life that considerably prolongs their existence” (355). As such, archives are a type of containers in which memories are stored to be opened up for interpretation and remembrance when needed. This fits the conceptualisation of archives as memory institutions. What is especially interesting, when considering waarneming.nl as an archive, is that it is not merely a container of what is no longer present (Haskins 2015). Much rather it contains that which is still present today but might be gone tomorrow. Following Bowker (2005), the users of waarneming.nl are thus determining the way in which nature will be remembered in the future by determining the content of the archive, arguing that “what we are doing now is setting the agenda for what the world will be based on” (127). Especially for this reason, Bowker argues it is essential to consider what we choose to forget and remember.

As Assmann (2011) already noted, cultural memory is the result of the selection process of what is deemed worthy to be remembered. Archiving is thus as much about forgetting as it is about remembering. It should therefore be emphasised that archives are not neutral but are socially constructed; influenced by social and political contexts, as well as power relations. Viewing archives as containers for information has historically led archives to be seen outside of power relations and politics. In postmodern times however, it has become widely acknowledged that archives are not comprehensive reflections of the past, but only represent specific events that are deemed worthy enough to be remembered by those in the power to create, order, preserve or access archives (Schwartz and Cook 2002). For example, one might think of overrepresentations of white males in many historical archives. Waarneming.nl is not unaffected by such biases and although it contains information about nature instead of society, it is just as much a social construction. One might think about biases in the type of users on waarneming.nl, but also about taxonomic biases, in which certain species are registered more often than other species that are deemed less valuable to us than others (Heise 2016). Furthermore, information in archives is

ordered in many different categories, meaning that information is often simplified, and context is needed to further understand what is presented (Bowker 2005). These biases in the content of waarneming.nl will be extensively explored in the next chapter using statistical methods.

3.2 FROM ARCHIVE TO DATABASE

Waarneming.nl is not an archive in the traditional sense, but rather a digital archive. In the digital age, the archive saw major changes. This gave yet another impulse to the already strong archival tendency in biodiversity recording described above. As Ursula Heise (2016) noted, the encyclopedic impulse that triggered the archiving of nature is now combined with a second impulse: the capacity of the internet. According to Heise, this “hyperlinked, centrifugal architecture of the internet” (65) allows for even more effective archiving of biodiversity.

Due to the development of digital devices and the internet, a shift was made from the archive to the database. Cultural analytics scholar Lev Manovich (2002) was one of the first to develop a theoretical framework around the database, describing it as “collections of items on which the user can perform various operations: view, navigate, search” (2). He noted that the database is a ‘cultural form’, and even goes as far as labelling it the genre of the twenty-first century. Manovich noted that historically, the narrative was the great cultural medium through which information and knowledge was communicated. He argued that today, the database has taken over this role. All types of digital media are structured as databases, or include databases. We access these in our everyday lives to gain information and knowledge. In doing so, the database has turned into the main cultural product that “presents a model of what the world is like” (2).

The database and the archive are two versions of the same information sharing medium. A database is best understood as an archive that presents itself through a computer interface. This interface is a design through which we can communicate with computers (van Dijck 2013). In the case of waarneming.nl, this interface takes the shape of a website as well as a mobile application. Such interfaces allow to search through information and manipulate the information by filtering choices or adding new information.

The structure of the archive also changes due to this digital presentation. Archives have always been structured by physical places, folders and categories. Digitally, these structures are represented by menus, tables, links or maps (Manoff 2010). These can be designed in many different ways. Such design choices affect how information is presented in an archive, and the experience of accessing or searching through this information. The design of the interface to a large extent guides how the database can be used and how knowledge is produced. As discussed above, the content of an archive is biased and non-neutral. The interface adds another dimension to this. In the case of biodiversity archives such as waarneming.nl, the influence of the interface can for example be recognised in the ease with which information can be accessed; not only in terms of speed but also in terms of space, with the possibility to access information from all over the world at your fingertips. For waarneming.nl, this means that users can easily search for specific users, areas or species in specified time frames. Users can choose how many observations are shown on a single page and can navigate easily from one page to another. These options would have taken much more time and it would likely be required to travel to many places over the world when these archives were only available on paper. Bowker (2005) takes this a step further by arguing that the possibilities that digital devices open up will allow ecological information to be shared more effectively, thereby increasing the chances of saving species from endangerment or extinction.

3.3 DIGITAL DEMOCRATISATION

One major change that the digitalisation of archives brought about was the possibility to share information on a much larger scale. As an archive becomes available digitally, and especially when connected to the internet, it becomes accessible to a larger group of people. In some cases, as with *waarneming.nl*, people can even contribute to the archive themselves. This is in line with the democratic potential that the internet was expected to have, being an open and transparent tool (van Dijck 2013). This democratisation potential did not leave the archive untouched. For some, this was a positive development, whereas others expressed critique. Notoriously, Derrida (1998) positioned himself negatively towards this digital development in his lecture and essay *Archive Fever*, questioning the consequences of the move from a privately governed space, to a public space for all to contribute to and for all to create. Similarly, Assmann (2011) raised the question if the endless storage capacities of digital devices would lead to archiving ‘everything’ without thorough selection processes, while human memory would remain limited. On the contrary, other scholars emphasize the potential of a more complete archive that includes more diverse contributions from a wider audience (Manzuch 2009).

This idea of democratisation and crowd involvement fits well with the conceptualisation of *waarneming.nl* as a citizen science platform. Although citizen science projects existed long before digital tools were available, the ease of use and accessibility of the internet has certainly made the field of citizen science boom (August et al. 2015; Dickenson and Bonney 2012). Especially in the case of biodiversity data, this power of the crowd is necessary; there is too much nature to be observed by paid professionals who are assigned specific tasks. The power of the crowd is needed to collect more of this endless data, and most importantly, share it to be used by others.

However, following theorists as Derrida, it is relevant to question if this democratisation of the archive can really live up to its positive or negative potential. As Muller (2017) noted: “one is not free to create digital archives from scratch but has to adapt their form to existing modules of hard- and software” (14). As will become evident in the following chapters, this is also the case for *waarneming.nl*. The role of the interface is key. The structure of the interface prevents certain usages of the archive and stimulates others (McGann 2007). The platform of *waarneming.nl* has a structure that users have to adapt to and does not make everything possible. Especially since *waarneming.nl* is a citizen science platform with certain usage in mind (conservation, policy, education etc.), the interface is designed in such a way that content is created to fit these goals. Categories are fixed, icons are assigned, and some information is even inaccessible. This involves icons that indicate the validation level of an observation, thereby noting whether the observation is correct. Observations can be changed, obscured or even removed by administrators when it is found that the observation has been registered wrongly. Additionally, icons indicate the rareness of observations. Other examples of how the structure of the interface influences usage are the fixed submission fields for registering an observation. Some information (time, data, location) is mandatory, whereas other information cannot be shared as no field is made available for it. A data curation process thus takes place, which can add or simplify information (Mauthner and Gárdos 2015). Users have to adhere to these processes and are not free to share anything they want, as the democratizing potential of the internet might suggest. The power to share information is not the only power that is relevant for archives, but also the power to label, name or order, which users of most co-created archives do not have (Schwartz & Cook 2002). This power remains in the hands of interface designers, coordinators or assigned users. Even though archives might now be

co-curated, they are still social constructs due to the limitations the interfaces provide and due to the biases of users, influenced by social and political contexts.

As this chapter has shown, an archive is a cultural production that is laden with biases and far from neutral. It influences the way knowledge is produced and waarneming.nl is no exception, as will be seen in the following chapters.

The archive and the database are closely related to each other. Waarneming.nl could be conceptualised as both an archive and a database. It is a place where information is stored and contained to be remembered in the future. However, it is presented through a computer interface instead of a traditional physical archive. Therefore, it is important to emphasize that the database is a *type* of archive. It is the form through which an archive is presented. It is the digital representation of an archive through an interface, that allows for searchability and manipulation. The archive is the content, the database the medium. This thesis will mostly focus on the content of waarneming.nl, and the medium is merely of secondary importance. Throughout this thesis, waarneming.nl will therefore be referred to as an archive rather than a database. In doing so, focus is put on the content of waarneming.nl. This does not disregard the fact that the medium influences the content. As will be addressed multiple times throughout the following analysis, the presentation of the archive through the interface certainly influences how the content is perceived and understood.

CHAPTER 4:
QUANTIFYING NATURE

4.1 INTRODUCTION

In the previous chapter it has been established that waarneming.nl can be understood as an archive. Specific attention was paid to the non-neutral state of the content of the archive, even though the democratic potential of the internet might suggest so. In this chapter, a cultural analytic approach is taken to answer the second sub-question of this thesis: *what places and bird biodiversity does the archive contain and what biases might be at play in this?* This chapter will cover three types of variables that were part of the dataset, as described in the second methodological chapter. Firstly, *demographic variables* of users of waarneming.nl were analysed as well as their *mobility* throughout the country using the GPS data of the observations. These variables were chosen as they provide the best picture of the users of waarneming.nl and their engagement with the archive. Thirdly, variables related to *rarity* and *endangerment* were analysed as these fit best with questions around the recurring theme of endangerment and extinction running through this thesis.

4.2 DEMOGRAPHIC VARIABLES

In Chapter 3, waarneming.nl was conceptualised as a digital archive that was contributed to by many users. This raises the question who the users are that register observations on waarneming.nl. To answer this question, the available demographic variables of users will be analysed below, considering the users' gender, age and province of residence.

Previous literature on the demographics of citizen scientists, and specifically users of platforms for bird observations, has shown that users tend to be male and between 50 and 70 years old (Ganzevoort et al. 2017; Wright et al. 2015). The following statistical tests will allow to determine if this is also the case among users of waarneming.nl.

4.2.1 GENDER

When registering as a user on waarneming.nl it is optional to register your gender. Of all users in the dataset, 59.36% did so. As this study merely focuses on bird observations, only users with at least one bird observation in 2019 were considered (16,998). Of this group, 54% registered their gender (9,179). 68.99% of these users registered as male, and 31.01% as female. Given the previous research described above, it was hypothesised that there would be more male users than female users. A chi-square goodness of fit test was applied to determine

whether the found distribution in the data is merely due to chance or not¹. A null hypothesis was formulated that the gender distribution would be 50:50².

The chi-square test revealed that the gender distribution found was not due to chance ($\chi^2(1) = 1,324.7, p < 0.001$). This allows to reject the null hypothesis and assume that there are significantly more male than female users of waarneming.nl³.

4.2.2 AGE

Users can also optionally register their age on waarneming.nl. The dataset featured some undefinable birth years, birth years before 1920, or birth years after 2015. These were changed to 'unknown', given the unlikeliness of these values. 44.26% of users with a registered birth year remained (10,776). For users with at least one bird observation this was 46.63% (7,927).

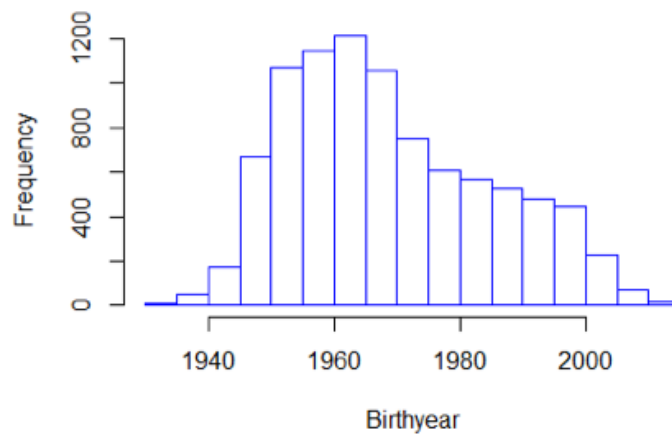


Figure 1. Histogram of birth years (for users with at least 1 bird observation)

Given previous research, it was hypothesised that middle-aged users (between 50 and 70 years old) would be overrepresented on waarneming.nl. The graph in Figure 1 shows the frequency in which each birth year occurs (a so-called histogram), for users of waarneming.nl with at least one bird observation. As is evident in the histogram, there are more users of waarneming.nl with birth years between 1950 and 1970⁴. To test if this distribution was due to chance, another chi-square goodness of fit test was applied, with a null hypothesis that each birth year was represented equally. The results ($\chi^2(9) = 7,180, p < 0.001$), indicated that this distribution was not due to

1 The Pearson's chi-square (χ^2) goodness of fit test is a statistical test which is used to calculate if a found distribution is due to chance or not, by comparing a found distribution (as in the dataset) with an expected distribution. The test is applied to categorical data, where data is divided into groups.

2 When doing a statistical test, two hypotheses are formulated. One alternative hypothesis that is based on theory (e.g. for gender: more male than female), and a second 'null hypothesis' that proposes what the test would show if there would be no differences between the tested groups (e.g. for gender: equal male and female). Based on the statistical test, the null hypothesis can be rejected or not. To do so, the p-value (probability value) functions as an indicator. A so-called 'significance level' of 0.05 is commonly used as a cut-off value. If the p-value found is equal or smaller than 0.05 this means that there is strong evidence that the null hypothesis can be rejected in favor of the alternative hypothesis.

3 Among the group that registered their gender and uploaded at least 1 bird observation in 2019.

4 The histogram is not normally distributed but skewed towards the right.

chance, allowing to reject the null hypothesis. We can thus assume that there are significantly more users between the age of 50 and 70 years old on waarneming.nl. However, we know that the distribution of birth years among the Dutch population is not equal. A second test was run with the null hypothesis that the distribution would be equal to that of the Netherlands⁵. This null hypothesis was also rejected ($\chi^2(9) = 3,012.9, p < 0.001$). This means that the age distribution of waarneming.nl is also significantly different from that of the Netherlands, with an overrepresentation of users between 50 and 70 years old.

4.2.3 PROVINCE OF RESIDENCE

All users of waarneming.nl have to register their province of residence. Figure 2 shows the distribution of users with at least one bird observation per province of residence and indicates that there is no equal distribution between provinces. To test if this is due to chance, the chi-square goodness of fit test was applied again. The null hypothesis was formulated that users were equally distributed among the provinces. This null hypothesis was rejected, meaning that the unequal distribution throughout the provinces is not due to chance ($\chi^2(11) = 5,469.6, p < 0.001$). However, similarly to age, the Dutch population is not equally distributed throughout the country. The null hypothesis that users are distributed similarly to the distribution of the Dutch population, was also rejected by the goodness of fit test ($\chi^2(11) = 1,633, p < 0.001$). It can thus be assumed that there is an overrepresentation of users from Gelderland, Noord-Brabant, Noord-Holland and Zuid-Holland.

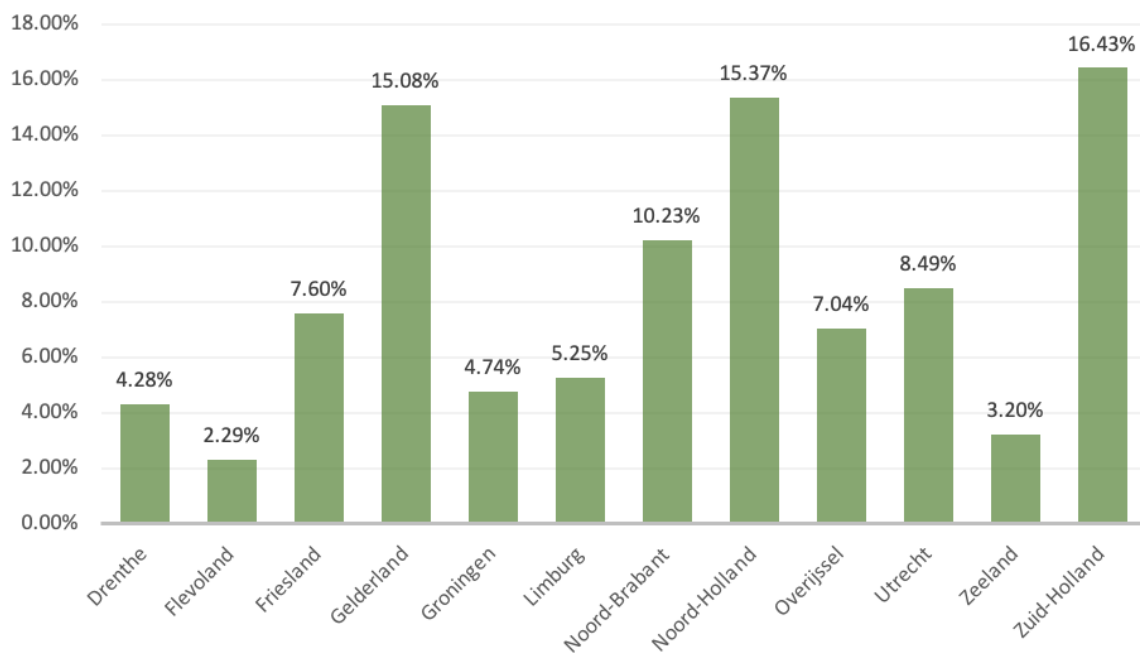


Figure 2. Percentage of users with at least one bird observation per province of residence

These statistics tests have thus shown that users of waarneming.nl who register bird observations are more often male and between 50 and 70 years old and are more likely to reside in Gelderland, Noord-Brabant, Noord-Holland or Zuid-Holland.

⁵ Based on data from the CBS (<https://opendata.cbs.nl/statline/#/CBS/nl/>)

4.3 RELATIONSHIP RARITY AND ENDANGERMENT

Observations collected and shared through waarneming.nl are used as indicators for biodiversity in the Netherlands. Furthermore, the observations presented on the platform give users an impression of the number of species present at what locations. As this thesis takes a posthuman approach, where non-human actors as birds are given specific attention, it is of importance to consider how these actors are represented on waarneming.nl.

As was already noted in Chapter 3, special attention is paid to the rarity of species on waarneming.nl. Rare species are divided into different levels and indicated by icons (Figure 3). Rare species are also presented prominently on the homepage (Figure 4). Arguably this is in line with the popularity of ‘twitching’, a subgroup of bird watchers who aim to see as many different species as possible (Wilkinson, Waite, and Gibbs 2014).

Rarity status






icon	description
	common
	relatively common
	rare
	very rare
	unknown

Figure 3. Rarity icons. (Waarneming.nl Icons n.d.).

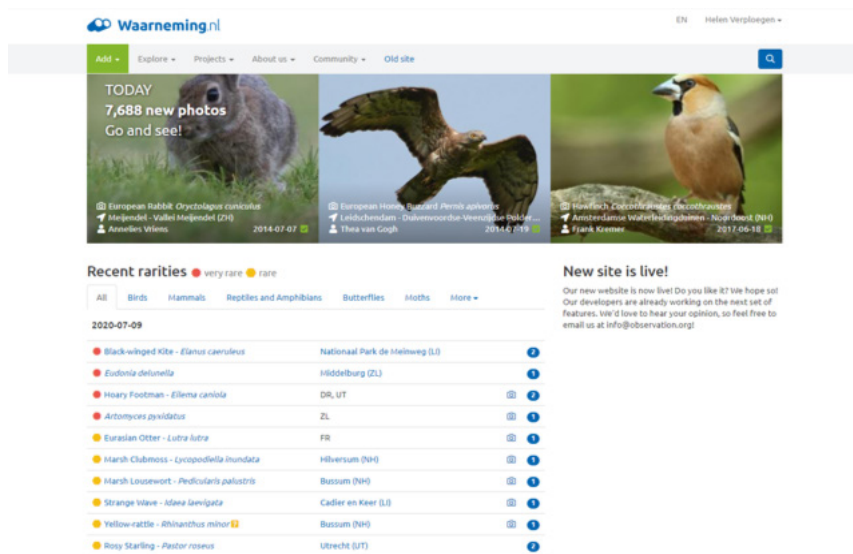


Figure 4. Homepage featuring recent rare observations. (Waarneming.nl Homepage n.d.).

4.3.1 STATISTICAL TEST

Waarneming.nl is less concerned with levels of endangerment of species. Although bird biodiversity is declining, endangerment is not indicated on the platform through levels or icons. However, the relationship between rarity and endangerment is an interesting one. One might expect that endangered species are also rarer. As the number of individuals goes down, they are arguably also less likely to be observed. To explore this relationship between rarity and endangerment, levels of endangerment were added to each species in the dataset on the basis of the Dutch Red List for breeding birds as published by the Dutch Centre for Field Ornithology (van Kleunen, Foppen, and van Turnhout 2017). Following this, it was hypothesised that there would be a relationship between rarity and

endangerment. A chi-square test of independence was conducted to test whether or not endangerment and rarity are (in)dependent of one another⁶. If there is no association between these two variables, the null hypothesis would be true. The test shows a significant association between rarity and endangerment ($\chi^2(24) = 265,956, p < 0.001$). This means that the null hypothesis can be rejected and that the rarity of an observed bird and the endangerment of an observed bird are not independent. As expected, rarity and endangerment are thus related to each other.

The presence of this association does not yet provide information about the direction of this association. However, looking at the distribution of the variables, some trends can be indicated (Table 1 and Figures 5 and 6). As can be expected, most observations are of common species which are not endangered (2,289,248). This would include species as the Blackbird or the Chaffinch. Most observations of endangered and very endangered species are labelled as less common or even rare on waarneming.nl. This would include species as the Corncrake or Ruff, of which populations have decreased dramatically over the last years. As can also be observed in Figures 5 and 6, rarity levels and endangerment levels follow the same pattern, which a decrease in observations as endangerment or rarity increases. Interestingly, species that have been labelled as disappeared on the Red List are relatively often labelled as common observations on waarneming.nl (11,407). This has to do with the fact that the Red List merely focusses on breeding birds. This concerns birds that breed on Dutch soil. These ‘disappeared’ birds thus no longer breed here, but individuals often still spend time on Dutch soil, for example when migrating. Individuals can thus still be observed, and can even be observed commonly. Furthermore, rare species on waarneming.nl are most often not breeding birds but rather migration birds, meaning they only visit the Netherlands throughout the season. These birds are not taken into consideration for the Dutch Red List.

Table 1. Contingency table indicating the number of observations for rarity x endangerment

	<i>Not endangered</i>	<i>Orange list</i>	<i>Sensitive</i>	<i>Vulnerable</i>	<i>Endangered</i>	<i>Very endangered</i>	<i>Disappeared</i>
Unknown (or escape)	2,708	9	0	0	0	0	0
Common	2,289,248	386,384	377,369	167,327	33,206	0	11,407
Relatively common	842,523	34,642	134,053	103,730	52,855	23,393	6,714
Rare	40,687	0	11,256	0	600	3,481	1,820
Very rare	22,212	0	681	0	0	751	518

⁶ The Pearson’s chi-square (χ^2) test of independence, is another version of the chi-square test. It measures whether two groups are independent of another or if they are related.

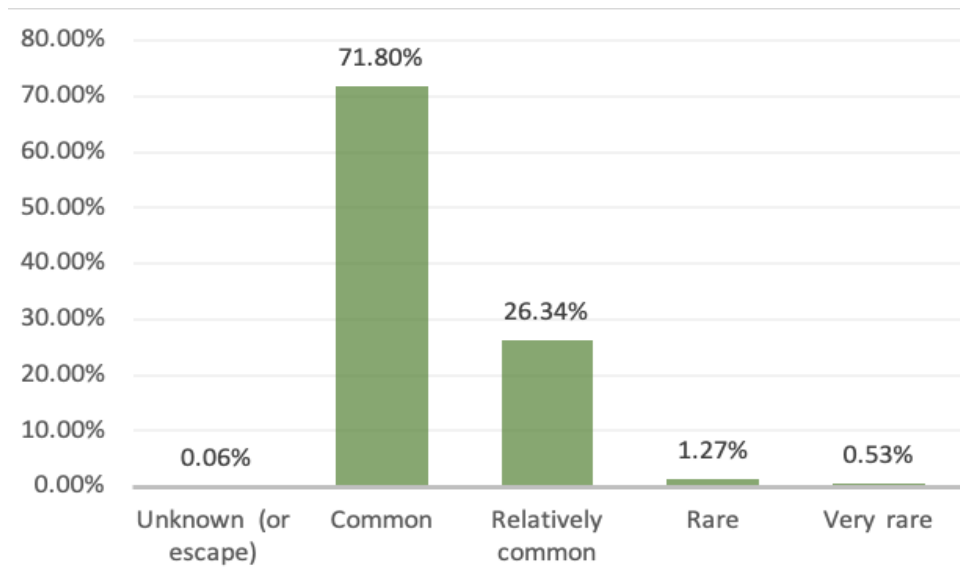


Figure 5. Distribution of observations per rarity level

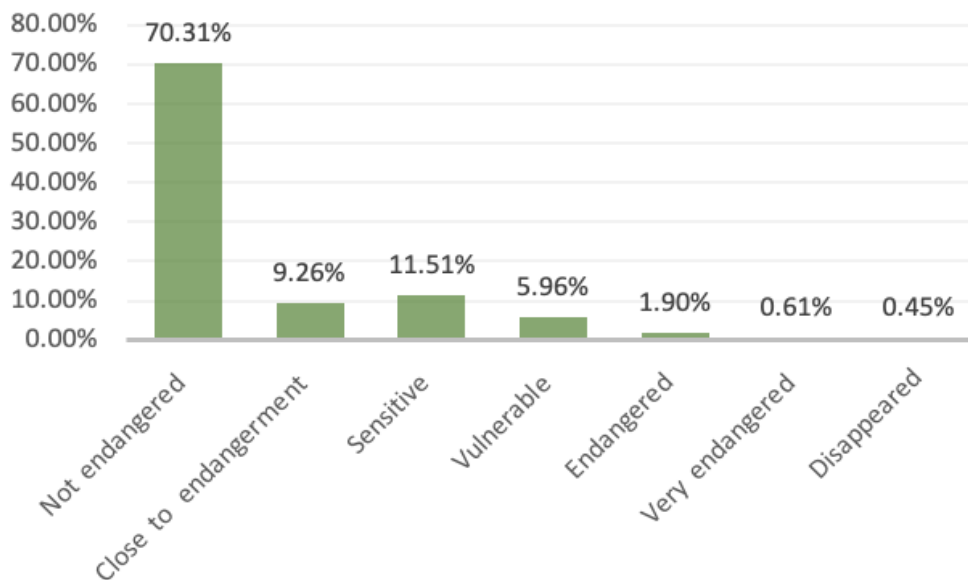


Figure 6. Distribution of observations per endangerment level

4.3.2 CONTEXT RARITY DATA

An important distinction should be made between the number of observations and the true number of individual birds present in the Netherlands. One individual bird might be observed by multiple observers and can thus be registered multiple times. When analysing collaborative data like this, one should thus take into account certain observation biases in the data as standardised methods of data collection are not present. One of the most interesting observation biases for waarneming.nl is the taxonomic bias, which notes that observers are more likely to register specific types of species over others (Dobson et al. 2020; Isaac and Pocock 2015). Especially rare or endangered species are often seen as more important and therefore registered more than common species. For example, a Little Curlew individual was observed in the Netherlands in 2019 as a vagrant, meaning that an individual bird has ventured away from its usual migration path and therefore appears in a geographical location it would not usually be seen. Between the 22nd of December 2019 and the 28th of December 2019, 1,003 observations of the Little Curlew were registered on waarneming.nl. In comparison, 1,670 Blackbird observations were registered

in this same period, even though this species is very common throughout the Netherlands. Of course this is an extreme example, but the observer bias is an important factor to keep in mind when interpreting this data, especially when considering the relationship between rarity and endangerment.

It is important to emphasize that waarneming.nl is most of all a reflection of human observations, not necessarily of the size of bird populations. This also becomes clear when going back to the example of the Black-tailed Godwit. On waarneming.nl this bird is classified as common and when looking at the statistics on the Godwit on waarneming.nl (Figure 7) it shows a rather steep increase in observations between 2005 and 2011 and a relatively stable number of observations since then. However, when considering the data from the Dutch Centre for Field Ornithology (Sovon), who publish the Dutch Red List for breeding birds, the Godwit is in decline, and therefore labeled as ‘sensitive’ on the Red List. This is firstly explained by the fact that Sovon is only focused on breeding birds. In their counts, they do not take Godwits into account that are not breeding, whereas users of waarneming.nl are not necessarily concerned with this. However, a lack of breeding birds would most likely also lead to a decline in individuals and can thus not purely explain this increase in Godwit observations in Figure 7. Rather, the observer bias is at play here again. The steep increase in Godwit observations between 2005 and 2011 is not due to an increase in individual Godwits but rather an increase of users of waarneming.nl. The decrease that Sovon is indicating is therefore also not deducible from waarneming.nl’s data.

This does not mean that the data of waarneming.nl is not relevant, but it does very much show something that Ursula Heise (2016) has described previously, namely that biodiversity databases are firstly cultural productions. They are laden with meaning and value judgements. As seen in Chapter 3, archives (and their databased versions) are not neutral. The data that is available on waarneming.nl is representative of the number of humans who have gone out into nature to register a Godwit, Little Curlew or Blackbird. This goes hand in hand with many value judgements. The fact that the Little Curlew is a vagrant makes it valuable to many users, whereas the always present Blackbird is evidently less valuable to report. Perhaps this might even lead to an increase in Godwit observations the rarer they become, after all, scarcity often makes valuable. The emphasis that is put on rare species on waarneming.nl will most likely play a crucial role in this. Although the data shows (Figure 5) that only 1.80% of all observations are of rare or very rare species, it is thus likely that this percentage is relatively high.

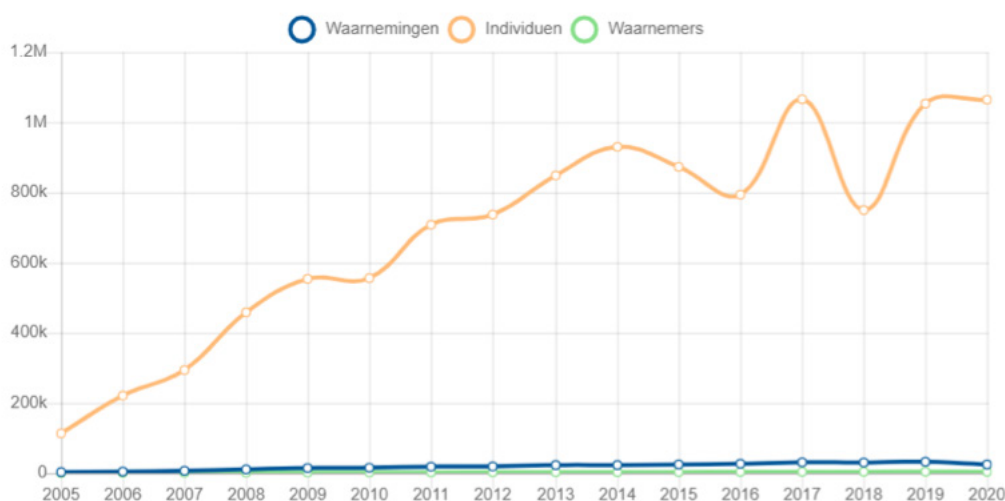


Figure 7. Number of Black-tailed Godwit individuals registered (Waarneming.nl Black-Tailed Godwit Statistics n.d.).

When it comes to endangerment, waarneming.nl does not communicate about levels of endangerment. Nevertheless, much interaction with endangerment takes place, for example through their option to obscure observations or put observations under embargo. In the first case, observations are published on the platform but without a precise location or time. In the latter situation, observations are not published on the platform until a given date, for example for the next 10 years. Users can choose these options themselves, whereas in certain cases endangered species are obscured automatically by waarneming.nl. On the platform it is noted that this is done “to prevent vulnerable species from abuse. This can be based on: combination species/area, but also the combination species/behaviour. This is to prevent disturbance during the breeding season and/or hibernation. Embargoes are usually requested by site managers and/or local working groups” (Waarneming.nl Getting Started n.d.).

The Eurasian Penduline Tit is a good example of this. This bird is on the Red List and according to the dataset of observations in 2019, no observations of the Penduline Tit were registered during this year. When searching for the bird on the platform itself it also gives zero hits. However, when taking a look at the occurrence map of the Penduline Tit in 2019, some observations *do* show up (Figure 8). It is noted on the page that observations of the Penduline Tit are obscured. This means that no public data is available on individual Penduline Tit observations. The level of endangerment of the Penduline Tit thus influences the data available about it.

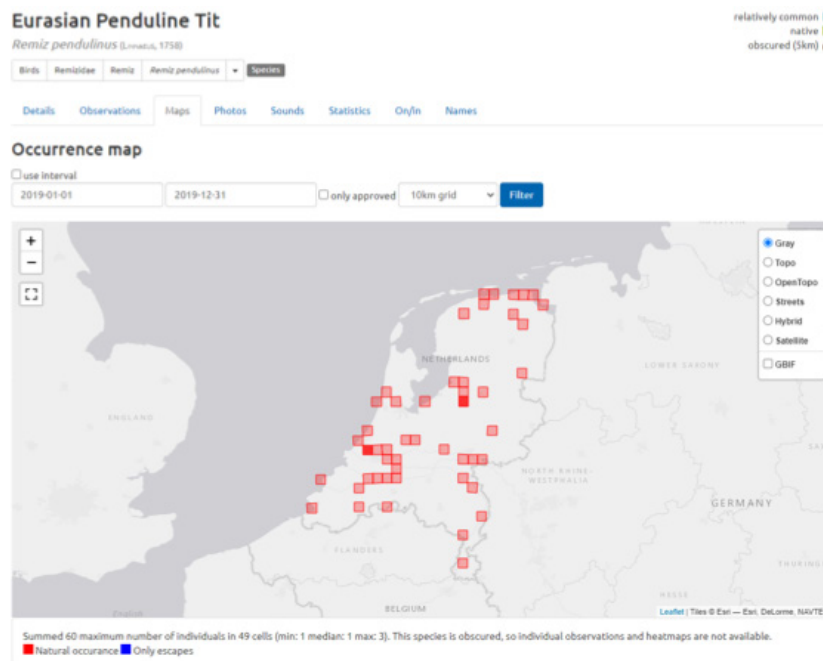


Figure 8. Occurrence map of the Eurasian Penduline Tit for 2019 (Waarneming.nl Eurasian Penduline Tit n.d.).

Although all observations of the Eurasian Penduline Tit are obscured or under embargo this does not have to be the case for an entire species. For example, some Black-tailed Godwit observations have been obscured or put under embargo as well. Often this is the case when they have been observed in vulnerable situations, for example when breeding.

The statistics test in this section has thus shown that observations labelled as rare on waarneming.nl are often also of endangered species on the Dutch Red List of breeding birds, although the complexity of this relationship is to be taken into consideration.

4.4 RELATIONSHIP RARITY AND NUMBER OF OBSERVATIONS

As explained above, rarities get specific attention on waarneming.nl. In the previous section this was related to users who specifically focus on rare species, but users generally differ greatly in the number of observations they register and how rare these are. When only considering users who have registered at least one bird observation in 2019, a majority of 55.99% registered only 1 to 10 bird observations in this year (Figure 9). In a previous study on users of waarneming.nl, such users have been considered ‘try-outs’ and merely create an account, register a few observations and quickly drop out (Jacobs et al. 2018).

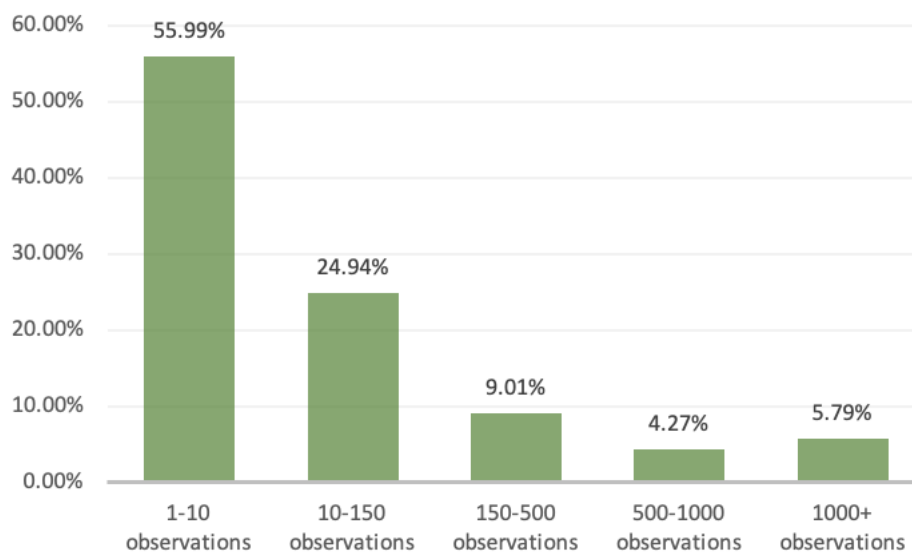


Figure 9. Distribution of users per number of observations

Table 2. Contingency table indicating the number of observations for levels of rarity x number of bird observations

	1-10 observations	10-150 observations	150-500 observations	500-1000 observations	10000+ observations
Unknown (or escape)	207	362	539	446	1,163
Common	11,483	129,443	285,050	339,144	2,499,821
Relatively common	11,531	75,521	145,929	172,099	792,830
Rare	1,683	6,085	10,203	10,048	29,825
Very rare	613	3,064	4,660	4,472	11,353

Given the profiles of bird watchers in this previous study (Jacobs et al. 2018.), it was hypothesised that users with more observations also register more rare observations. As can be seen in Table 2, this indeed seems to be the case. To test if there was indeed a relationship between the level of rarity of an observation and the number of observations a user has registered, another chi-square test of independence was conducted.

The test shows that there is a significant association between the number of observations and the rarity of observations ($\chi^2(16) = 84,893, p < 0.001$). This means that the null hypothesis that there is no association between rarity and number of observations can be rejected. The rarity of an observed bird and the number of bird observations a user has registered are not independent but are significantly associated and thus not due to chance. This test thus shows that users who have registered more observations in total are also more likely to register more rare observations.

4.5 MOBILITY

In line with previous profiling of different bird watchers and observation platforms, it was hypothesised that there would be great variety in the way users registered observations throughout the country (Jacobs et al. 2018; Seymour and Haklay 2017). Certain users register more observations close to home, for example in their garden, while other users register observations throughout the country, for example, ‘twitchers’.

To determine this geographical dispersion, the standard deviation (SD) of the longitude and latitude for all observations of each individual user was calculated⁷. These two standard deviations were then multiplied to result in a product of both coordinates. The lower the standard deviation, the lower the geographical dispersion of observations. Users with less than 10 observations were excluded from this analysis, as these were considered as merely trying out the website, and did not have enough observations to come to a reasonable conclusion about their mobility. Similarly to the analyses above, only users with at least one bird observation were included in the analysis.

4.5.1 MOBILITY DISTRIBUTION

To further run tests on the difference between users and their mobility, the standard deviations described above had to be grouped into categories. To determine what the cut off points of these categories should be, the GPS locations of a random number of users were plotted on a map of the Netherlands. By doing so it was determined what range of standard deviations reflected local mobility, regional mobility or national mobility. This resulted in four categories. SD’s between 0 and 0.05 most often reflected **local mobility** (see Figure 10 for an example of the mapped GPS locations of a random user in this category). SD’s between 0.05 and 0.1 reflected **regional mobilities with a local focus** (Figure 11). SD’s between 0.1 and 0.5 reflected **national mobility with a regional focus** (Figure 12) and SD’s between 0.5 and 1 reflected **national mobility** (Figure 13). The distribution of these groups is visible in Figure 14.

The study of Seymour and Haklay (2017) indicated that users mostly travel close to home. It was therefore hypothesised that the majority of users in this study would register observations locally. To test this, a chi-square goodness of fit test was applied, with the null hypothesis that users would be equally distributed among the groups. The results of the test were significant ($\chi^2(3) = 4,216.6, p < 0.001$). The null hypothesis can thus be rejected. The majority of users of waarneming.nl (51.33%) register observations locally (Figure 14).

This previous test tested the distribution of waarneming.nl users. However, a different distribution emerged when looking at the distribution of observations (Figure 15). Although most users upload observations locally (51.33% in Figure 14), the majority of observations were registered by users in the regional/national category

⁷ The standard deviation is a statistical measure that indicates how spread out given values are.



Figure 10. Example of local mobility

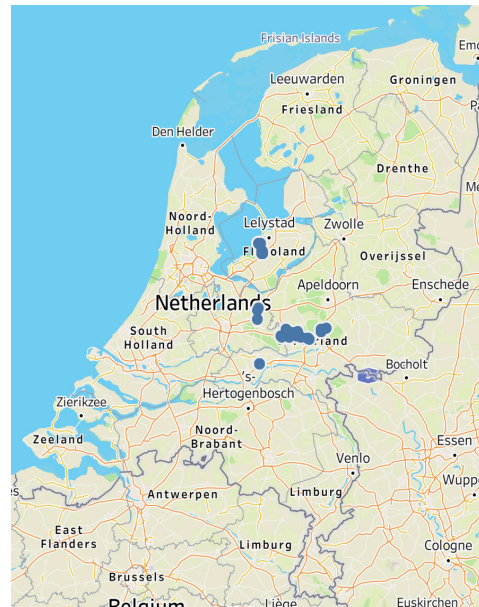


Figure 11. Example of local/regional mobility



Figure 12. Example of regional/national mobility

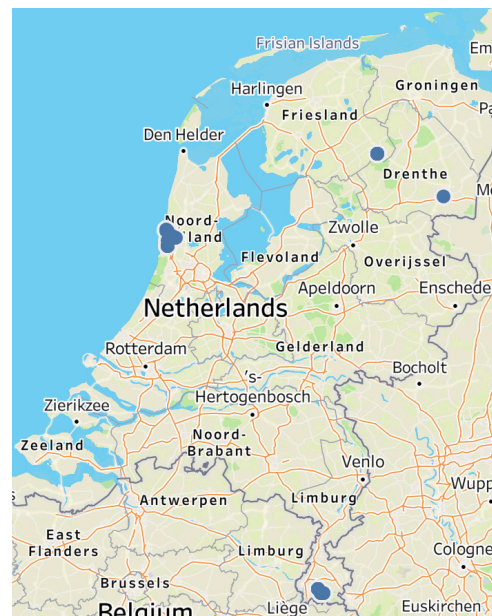


Figure 13. Example of national mobility

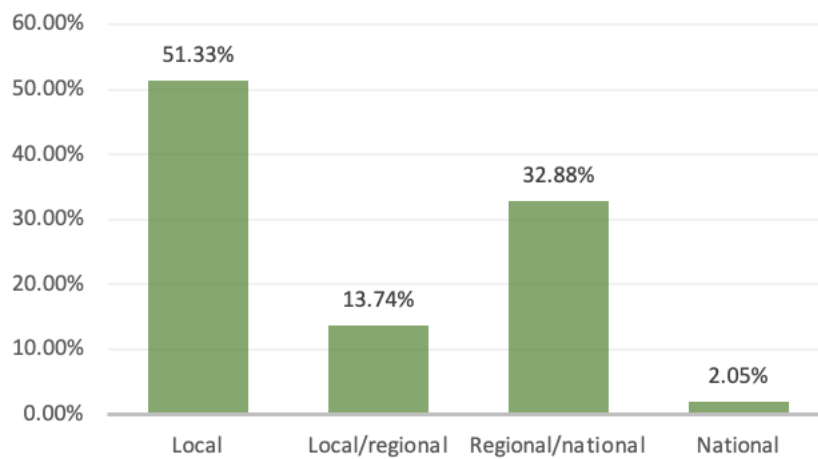


Figure 14. Distribution of users by mobility

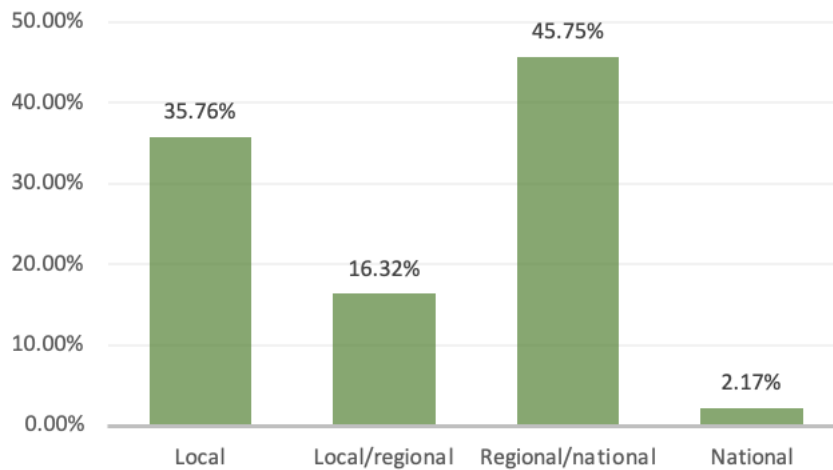


Figure 15. Distribution of observations by mobility

(45.75 % in Figure 15). A chi-square test for goodness of fit indicated that this distribution of observations was also not due to chance ($\chi^2(3) = 2,067,675, p < 0.001$). Although the majority of *users* thus register observations close to their homes, the majority of *observations* is registered by those users who rather register observations throughout the country, with a regional focus. Users who register observations nationally, with a regional focus, thus seem to upload more observations than users in the other mobility categories. Users who register observations nationally, with a regional focus, thus seem to upload more observations than users in the other mobility categories.

4.5.2 RELATIONSHIP MOBILITY AND NUMBER OF OBSERVATIONS

Given profiles of bird watchers in previous research (e.g. Jacobs et al. 2018), and the findings in Figures 14 and 15, it was hypothesised that there would be an association between mobility and the number of observations of a user. Table 3 indicates that users with 10-150 observations usually register observations locally. Users who register between 150-500 observations mostly register observations locally or regionally/nationally. For users who registered between more than 500 observations in 2019, most observations were registered regionally/nationally. To test if there was indeed a relationship between the number of observations and the mobility of a user, another chi-square test of independence was conducted.

The test shows that there is a significant association between the number of observations a user has registered and their mobility ($\chi^2(9) = 673.12, p < 0.001$). This is in line with the hypothesis. The null hypothesis that there is no association between the number of registered observations and the users mobility can thus be rejected. Users with fewer observations seem to register observations more locally, whereas users with more observations seem to register observations more regionally or nationally. This is especially the case for users with more than 500 observations.

Table 3. Contingency table indicating the number of users for mobility x number of bird observations

	10-150 observations	150-500 observations	500-1000 observations	10000+ observations
Local	2,699	617	223	301
Local/regional	504	252	108	164
Regional/national	976	610	376	498
National	61	52	18	22

4.5.3 RELATIONSHIP MOBILITY AND RARITY OF OBSERVATIONS

Based on the findings in the previous tests, it was also hypothesised that there would be an association between mobility and the number of rare observations of a user. Table 4 shows that users who move locally most often register common species. Rarer species are most often registered by users who move regionally/nationally. To test for this relationship between the rarity of an observation and the mobility of the user, another chi-square test of independence was conducted.

The test shows that there is a significant association between the number of rare observations and the mobility of the user ($\chi^2(12) = 22,209, p < 0.001$). The null hypothesis that there is no relationship between these variables can thus be rejected. This indicates that users who most often register observations locally are more likely to register common species, whereas users who register observations more nationally are more likely to register rarer species.

Table 4. Contingency table indicating the percentage of observations for mobility x rarity

	Unknown	Common	Relatively common	Rare	Very Rare
Local	0.05%	75.12%	23.74%	0.86%	0.23%
Local/regional	0.06%	72.92%	25.54%	1.14%	0.34%
Regional/national	0.04%	69.46%	28.23%	1.53%	0.74%
National	0.06%	65.39%	31.14%	2.22%	1.19%

4.5.4 Relationship mobility and endangerment

As a relationship was found between rarity and endangerment it can be expected that users who register observations locally also register less endangered species. In Table 5 it is indeed visible that more endangered species are usually registered by users who move more regionally or nationally. When applying the same chi-square test of independence to the endangerment levels of species, a significant association between the number of endangered observations and mobility was indeed found ($\chi^2(18) = 3,756.2, p < 0.001$). There seems to be slightly more emphasis on endangered species for users who register observations regionally or nationally. However, this does not seem to be as pronounced as for the rarity of species.

Table 5. Contingency table indicating the percentage of observations for mobility x endangerment

	<i>Not endangered</i>	<i>Orange list</i>	<i>Sensitive</i>	<i>Vulnerable</i>	<i>Endangered</i>	<i>Very endangered</i>	<i>Disappeared</i>
Local	71.26%	9.44%	10.96%	5.78%	1.69%	0.48%	0.40%
Local/regional	71.23%	8.92%	11.17%	5.81%	1.85%	0.61%	0.40%
Regional/national	69.40%	9.24%	11.99%	6.12%	2.08%	0.69%	0.48%
National	69.10%	9.45%	12.90%	4.98%	2.19%	0.81%	0.57%

These statistics tests have thus shown that users of waarneming.nl mostly register observations locally. Users who do so most often register common species, whereas users who register observations more regionally or nationally are more likely to also register rare species. Users who register observations regionally or nationally are also more likely to register more observations than those who only register observations locally.

4.6 CONCLUSION

This chapter has analysed a number of variables presented in the 2019 dataset of observations under analysis. This had led to the following findings:

Based on the available demographic data it can be assumed that users of waarneming.nl who upload bird observations are more often male and between 50 and 70 years old. They are more likely to reside in Gelderland, Noord-Brabant, Noord-Holland or Zuid-Holland than in other provinces. It should be taken into consideration that only about half of the users under analysis registered their gender and age. This can be explained by the fact that this data is not mandatory and that people might not register this information due to privacy concerns.

Following this, the complex relationship between endangerment and rarity was analysed. Based on the data it can be assumed that there is a relationship between these two factors. Observations labelled as rare on waarneming.nl are often also of rare species as labelled on the Dutch Red List of breeding birds. However, the context of this finding is of great importance to further interpretations of the data. It should be taken into consideration that the Red List only consists of breeding birds, whereas many rare birds on waarneming.nl only migrate through the Netherlands. Furthermore, factors as the observer bias and options to obscure observations should be taken into account. Additionally, it was found that users who upload more observations on waarneming.nl are also more likely to register rarer species.

Finally, the GPS data in the dataset was utilised to make analyse the mobility of users of waarneming.nl. Based on this data it can be assumed that most users register observations locally. However, most observations are registered by users who upload observations on a more regional or national level. This fits with the additional finding that users who upload more observations most often fit in the regional/national mobility category. Additionally, it was found that users who most often register observations locally are more likely to register common

species, whereas users who register observations more nationally are more likely to register rarer species. The same relationship was found for observations of endangered species, although this was less pronounced.

The findings from this chapter will be analysed further in the following chapters, focusing specifically on the relationship between rare and endangered species, as well as the finding that most users register observations locally.

CHAPTER 5:
MEDIATING NATURE

5.1 INTRODUCTION

Today, many websites and mobile applications allow to share locations in real time, for example through Facebook posts, Instagram images or Yelp reviews. Waarneming.nl is no exception. When uploading an observation, users have to tag the location where the observation was done. This location can either be chosen on a map or can automatically be generated by the GPS capabilities of the mobile device with which the observation is being registered (see Figures 1 and 2).

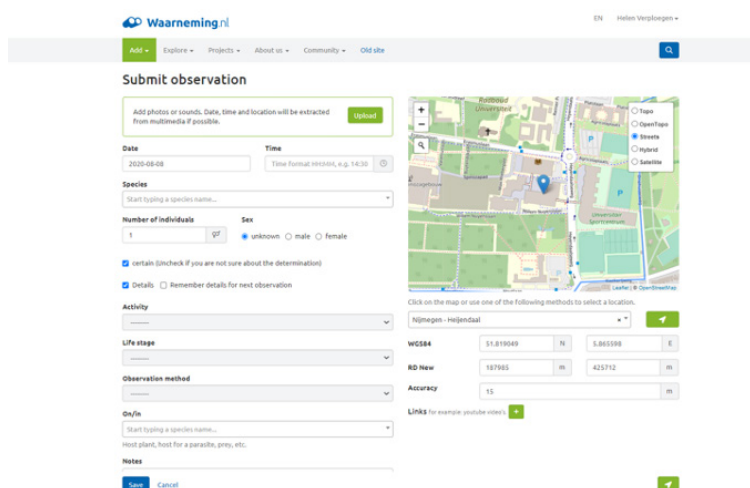


Figure 1. Pin location on map to submit observation. (Waarneming.nl Submit Observation n.d.).

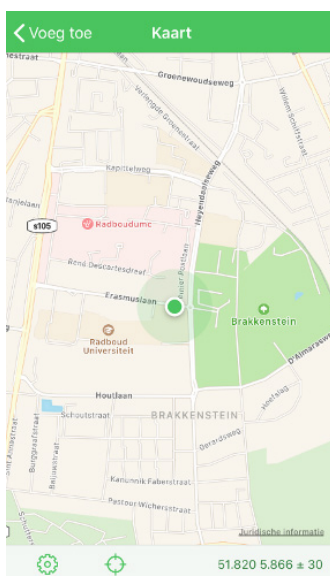


Figure 2. Automatically generated GPS location when submitting observation. (Zostera 2020).

The collection of observations with GPS locations forms the content of waarneming.nl. The previous chapter already discussed this content by running statistical tests on the dataset of all bird observations registered on waarneming.nl in 2019. This chapter will go a step further to answer the third sub-question of this thesis: *how does waarneming.nl mediate the experience and understanding of (non-)human actors in nature?* In the answer to this question both the content of the archive, as discussed in the previous chapter, as well as the manifestation of the archive as a digital platform will be taken into consideration¹. Theory from media studies, memory studies and animal studies will be combined with the data in the previous chapter to analyse how waarneming.nl acts as a mediator in our human understanding of the natural world. Non-human actors in the natural world do not remain unaffected by this mediation, as the posthuman perspective taken in this chapter will show. Waarneming.nl is not only a platform *about* nature; it actively shapes our understanding and experience of places in nature and what is present there.

Not all data presented in Chapter 4 will be addressed here. Rather, this chapter will build upon and refer to two specific findings, namely the relationship between rare and endangered species and the finding that most users register observations locally. These variables best fit with the discussions in the fields of media studies and the environmental humanities.

5.2 CONTEXTUALISING ‘PLACE’

The concept of ‘place’ is of specific importance within the environmental humanities. Discussions around biodiversity loss, extinction or endangerment are highly dependent on specific places. As environmental humanities theorist Thom van Dooren (2010) noted, extinction and endangerment are issues that only make sense in relation to a certain time and place. An example of this is the Dutch Red List for breeding birds presented in the previous chapter. Birds on this list are endangered, but only in the Netherlands. The Black-tailed Godwit might breed on Dutch soil less often, but on a global level this species is not yet endangered (BirdLife International 2017).

With place being such an vital concept when considering biodiversity loss, it is important to define what this concept entails and why place is different from similar concepts, such as ‘location’ or ‘space’. Most simplified, a place is “a meaningful location”: a location or place that has been given by humans (Cresswell 2004, 7). A location marked by coordinates, turns into a place when meaning has been given to this specific location, such as a description of what is present at this place and how this presence is valued.

Perhaps unsurprisingly, this important relationship with place is also evident on waarneming.nl. When registering an observation, all users have to upload the place of the observation, either automatically through the GPS abilities of mobile devices or manually by tagging the place on a map. This also highlights the changing interaction with place now that we are able to share our locations at all times through digital devices. Previously, meaning could only be attached to place orally or on paper. Today, users of waarneming.nl give meaning to locations by marking it on an online map and describing what species can be seen at this location. In doing so, the location is more than GPS coordinates: it becomes a meaningful place. One can now understand this location as the habitat of a certain species.

1 Here the interface as described in Chapter 3 will make modest return.

5.3 HYBRID PLACE

Media scholar de Souza e Silva has previously analysed the GPS abilities of digital devices and the effect these abilities have on our understanding and experience of place. She notes that ‘location-aware technologies’ allow users to both “read and write location” (2013, 119). These technologies are most evidently mobile phones with the ability to constantly track our location. Computers and tablets increasingly have such functions as well, or otherwise allow to tag locations manually. These technologies allow us to ‘read’ the location-based information that others have shared. By viewing location-tagged Instagram posts of friends or reading restaurant reviews from a stranger on TripAdvisor, we are ‘reading’ a specific location through the information provided to us about this location. In return, we have the ability to ‘write’ locations ourselves by sharing locative information in your own online posts.

According to de Souza e Silva, this ability to read and write locations digitally has consequences for our experience of place. She argues that digital devices are often considered to be a factor that distracts us from experiencing the physical world fully. They distract us from our work, when on the road or in social interactions. Furthermore, technological devices have been targeted as one of the main causes of a disconnect with nature (Louv 2010). However, de Souza e Silva (2013) proposed a more positive consequence:

In clear contrast with the common view of associating mobile devices with a removal from place...mobile devices could help strengthen people’s connection to surrounding space, rather than removing people from it. By using the mobile’s location-aware capacities, users could annotate locations, find other people in the vicinity, and access information connected to specific locations (117).

De Souza e Silva argues that digital media could strengthen our relation with our environment as we no longer experience place physically, but instead have a ‘hybrid’ experience of place. Before the rise of mobile technology, the digital and physical world could more easily be distinguished from each other. The one did not influence the other. However, now that mobile devices are embedded into our everyday lives, this distinction is no longer evident. We carry our mobile phones with us all the time, and access our computers multiple times a day. As described above, these technologies hold information about places. This emergence of locative technology into our everyday lives has thus caused physical space and digital space to merge together in, what she calls, hybrid place. Our experience of place is now partly physical, partly digital.

These hybrid places are inherently *mobile* and *social* (2006; 2013). Mobile, in two distinct ways. First, as information is shared through mobile interfaces, this information is dependent on how it is communicated to us through this constantly changing mobile interface. Additionally, hybrid places are mobile as they influence the mobility of people in physical places. By providing information on places these devices mediate the decisions people make on where to go. Secondly, de Souza e Silva notes that hybrid places are social places, as they are dependent on the communication from user to user. We can only have digital experiences of places because other people share their experiences with these places. To write and read locations, we need social interactions with others who do so too.

If someone were to visit a restaurant, one might visit websites of different restaurants, look them up on Google or read reviews on their Facebook pages. By ‘reading’ this locative information shared by others, a digital experience of the place is created. All this digital information gives these places meaning and provides us with the basis for choosing our mobility path; by looking at information of multiple restaurants, you choose what restaurant you want to visit. When you then visit the restaurant physically, the digital understanding of the place is combined with the physical experience; it becomes hybrid. While visiting the restaurant you might share a photo of your meal on Instagram, tagging the location in your post. The next day you might share a review of the restaurant on Google. By ‘writing’ the location as such, the mobility patterns of others might be changed in turn, as they ‘read’ this locative information and determine their mobility upon it.

The scenario described above is not much different from the locative reading and writing made possible through waarneming.nl. De Souza e Silva and other media scholars analysing locative media (e.g. Frith 2015) merely focus on *urban* places. I would like to argue that the concept of hybrid place is readily applicable to platforms such as waarneming.nl as well. The idea that our understanding and experience of place is both digital and physical, is not only relevant for urban environments, but also very much for places in nature. As environmental humanities scholar Jorgensen (2014) has expressed, “we seldom experience nature fully, directly and unfiltered, but instead mediated through, even enabled by different technologies” (97). Especially in Anthropocentric times, where nature is under pressure, it is of great importance to extend such theories to the context of nature and understand how humans come to understand and experience nature.

When someone does not want to visit a restaurant, but rather a nature reserve, the same steps are applicable. They might search for the island of Texel on waarneming.nl and see what observations have been done there in the past, by ‘reading’ the observations others have shared previously. They might see that a Black-tailed Godwit was seen at a certain spot, which shapes their understanding of this place as the habitat of this bird. This digital information shapes their mobility path; they will visit this specific spot when on Texel to see the Black-tailed Godwit. When visiting this place, their hybrid understanding of this place is formed, combining the physical and digital experience of it. While there, they might see a Black-tailed Godwit themselves and share this observation on waarneming.nl, ‘writing’ this place in turn.

The theory of de Souza e Silva makes clear that waarneming.nl allows users to read and write places in nature. They can change their mobile trajectory by viewing the observations of others. In turn, users can share places in nature and influence the mobile trajectories of others. In this sense, waarneming.nl *mediates* understanding and experience of nature. It is literally an intermediate to be consulted on where to go and to help understand what we will see there. However, in light of the previous chapter, this raises the question what information is provided. What information about nature is shared? What information is this intermediate providing us?

5.4 LOCAL PLACES

The analysis of GPS locations in Chapter 4 showed that the majority of users ‘write’ places locally. 51.33% of users with bird observations mostly register the observation around a single local place rather than regionally or nationally. Previous research also indicated that much nature volunteering and citizen science activities take place close to home, with a relatively small travel trajectory (Seymour and Haklay 2017). In other studies (Newman et al. 2017; Wilkinson, Waitt, and Gibbs 2014; Ryan, Kaplan, and Grese 2001) it has also been argued that citizen

science and nature volunteering activities often take place in the local environment close to home. This focus on the local is in line with the local attitude often conveyed in nature protection (Bjærke 2019). Approaching biodiversity decline as a local issue makes changes in nature visible close to people's homes, where they are often more emotionally invested. The 'local' is thus linked to someone's area of residence. The dataset did not provide sufficient information to conclude if the local areas in which users registered observations are also the areas where they actually live. It could alternatively be an area where they work, or which they regularly visit for other reasons, such as a place where they grew up or where their family resides. However, given the patterns found in the previously mentioned studies, it is reasonable to assume that many users who register observations in close proximity to each other do so around their homes.

Whether the majority of users also 'read' places locally cannot be determined on the basis of the dataset. However, when considering the interface of *waarneming.nl*, it becomes clear that this local focus has been integrated into the design of the platform. For example, sub-pages are available for local areas (e.g. *amsterdam.waarneming.nl* or *texel.waarneming.nl*), where observations are published within this specific region. During the interviews with users of *waarneming.nl*, this local focus was also emphasised (Verploegen et al. 2020). One user noted: "I mostly register observations here in the [local nature reserve]. It is sort of my own area. It's where I was raised and where I learned about nature." Another user noted she often searches for local observations and mostly registers observations locally as this allows her to "learn about my own surroundings". Thus, based on these findings, the presented theory and the interface of *waarneming.nl*, there seems to be a strong reason to assume that locative information on *waarneming.nl* is mainly read and written locally. The mediation that *waarneming.nl* provides is thus rather limited to the local environment. It has been widely discussed in environmental sciences, sociology and philosophy that this local focus has beneficial effects for the way humans treat the nature in their local surroundings (Folmer, Haartsen, & Huigen 2019; Haywood 2014; Sharma et al. 2019; Ryan et al. 2001). Places where we have significant experiences shape our identities and make us emotionally connected to these places. This emotional connection arguably leads to "a greater sensitivity to the places in which humans live and to the non-humans on which we depend" (Youatt 2008, 408). This leads to the assumption that we are more likely to care for and protect nature at places that we have emotional connections with, such as our local environment. People have more knowledge and attachment to our local environment than the rest of the world, and therefore put in more effort to keep such places safe (Goodbody 2011). As author and environmental activist Berry (1975) argued: "without a complex knowledge of one's place, and without the faithfulness to one's place on which such knowledge depends, it is inevitable that the place will be used carelessly, and eventually destroyed" (95).

However, this proposition of a strong connection with our local environment has also been challenged by those posing that our globalised culture has done away with this emotional attachment to local places. In her book *Sense of Place, Sense of Planet* (2008), Heise argues that people are no longer dependent on their local environments. They no longer have to source our food and tools from their local environment, but they can have them produced elsewhere and shipped to them. The close connection with the local environment is therefore decreasing. The assumption that a close connection with the local involvement leads to better care of the local environment should thus be viewed critically in our globalizing times. It might be more efficient to think of our relationship to places as plural, an eco-cosmopolitanism where one feels close connection with a multiplicity of

places. These might include places we have never even visited, but gained knowledge about through others, for example through digital media such as waarneming.nl (Heise 2008; Goodbody 2011).

5.5 NON-HUMAN PLACES

Apart from the focus on urban places, de Souza e Silva's conceptualisation of hybrid place merely focused on the human perspective. However, when extending her principle of hybrid place to nature and given the posthuman perspective taken in this thesis, it is essential to consider the role of non-human actors. By gaining digital information on places and determining mobility paths based on this, non-human actors are directly affected. The example of a trip to Texel does justice here again. When someone is looking for the Black-tailed Godwit at a specific spot they saw on waarneming.nl, they are likely to leave a path through the grasslands. With their movement or sound they might disturb the Black-tailed Godwit or other birds, insects or mammals present in the area. As theorised above, waarneming.nl turns nature into a hybrid place. However, this does not leave non-human actors out of the equation. As this example shows, this mediation has potential negative consequences for nature as well.

These described consequences for non-human actors are especially important considering that rare species have a prominent role on waarneming.nl, through icons and on the homepage, as described in previous chapters. Furthermore, the data analysis in Chapter 4 showed a relationship between observations of rare and endangered species; rare species are often endangered species. The chance of disturbing endangered species is thus relatively large because rare species play such a prominent role on waarneming.nl. When the exact location of endangered birds is digitally retrievable at all times, pressure on their existence could increase. People might go looking for these endangered birds and disturb them. Additionally, this information might be used for purposes that conflict with nature preservation, such as illegal hunting (Arts, van der Wal, and Adams 2015). Without the opportunity to gain digital information, one might also disturb these non-human actors, but as physical places turn into hybrid places this becomes more intentional. Previously, researchers (Verma, van der Wal, and Fischer 2016) analysed digital observation platforms such as waarneming.nl and called attention to the 'surveilling' of nature that is made possible by such technologies. It allows humans to go online and discover where certain animals can be seen. They argue that these platforms should therefore be understood as "anthropocentric techno-scientific projects" (84). This definition puts emphasis on the central role that humans play on platforms like waarneming.nl. In essence, the platform offers humans the opportunity to gain more knowledge about nature and experience nature in a hybrid way. However, the consequences of this for non-human actors seems only of secondary importance.

Rose and van Dooren (2011) noted that some species or sub-species avoid such surveillance because they are unpopular. The taxonomic bias described in the previous chapter is an example of this. In the case of waarneming.nl, this means that rare species (which are likely to be endangered) are very actively surveilled by being published on the homepage and by gaining notable icons. Although the data shows that common species are very actively registered (71.80% of all observations in 2019 were of common species), less emphasis is put on these species by the design of the interface. As a result, these common species are surveilled less intensely.

Heise (2016) also addressed this 'surveillance', but noted that some species have the privilege of being protected from this surveillance. This is also recognizable on waarneming.nl, as the platform provides options to actively protect specific species or sub-species from such surveillance. When registering an observation, waarneming.nl provides the option to register it as 'obscured' or 'under embargo'. In the first case, the observation

is not made visible on the portal, although it is visible for the observer who registered it. In the second case, the observation is also visible for the observer, but are also made visible to others after a specific timeframe. Not only can users select these options, but observations can also be obscured or put under embargo by administrators of the platform. In the case of some endangered species, observations are automatically obscured or put under embargo. Waarneming.nl describes that: “data from vulnerable species and locations can be obscured to prevent abuse. This can be based on: combination species/area, but also the combination species/behaviour. This is to prevent disturbance during the breeding season and/or hibernation.” (Waarneming.nl Getting Started n.d.). However, it is not specifically listed what these species/combination of circumstances are. During interviews with users of waarneming.nl, it became clear that they were aware of the possible negative consequences of providing the locations of observations (Verploegen et al. 2020). One user noted: “When I think they might be building a nest, I will always obscure [the observation]. Or when it is a species that a lot of people could come to see, which would lead to disturbance.” The option to obscure is used to protect from this disturbance. Another user noted: “If I see a Nightjar in the ground, and I know it is breeding I would not register it. If I would, someone would just march through it.” However, as the comments of users show, it is only specific species, or species in specific circumstances (such as the breeding season), that benefit from the privilege of avoiding digital surveillance.

Users are thus aware of the possible negative consequences of public sharing of biodiversity data. However, there are not only negative consequences to this public data sharing. Emphasis should also be put on the possible positive consequences for non-human actors. As was already addressed in Chapter 3, Bowker (2005) noted that the archiving of biodiversity information can lead to a wider spread of information on biodiversity, which can lead to more effective conservation efforts and policymaking. For example, it makes it easier to prove whether Black-tailed Godwits are breeding at a potential building sight. Policy can then be changed to stop such building efforts, to protect the Godwit. The aim of waarneming.nl to contribute to conservation, education and policy is more in line with this emphasis on positive consequences of providing data, and also fits the general idea of the purpose of citizen science. The consequences of such digital surveillance for non-human actors can thus both be seen from a positive and negative perspective.

5.6 FROM EXPERIENCE TO MEMORY

This analysis has shown that waarneming.nl acts as a mediator in the human experience of nature by offering a hybrid experience of nature. On waarneming.nl, a local experience is emphasised over a more national experience. Furthermore, non-human actors in nature, specifically endangered birds, can experience both positive and negative consequences of this mediation; this surveillance can either take the shape of protection or disturbance.

Media scholar Frith takes (2015) the theory of de Souza e Silva a step further by conceptualizing the locative information that is being shared as ‘place-based digital memories’ (Frith and Kalin 2015; Frith 2015). Memory studies theorist Hoskins (2009) has noted that our memories are increasingly experienced digitally. We do not merely remember individually or by sharing our experiences offline, but increasingly do so online. According to Frith, the locative abilities of our digital devices have made these digital memories *place-based*. He thus argues that hybrid place is a combination of our physical experience of the place and the place-based digital memories that have been read. In turn, we share or our own place-based digital memories for others to read.

When following Firth’s conceptualisation of place-based digital memory, all observations shared on waarneming.nl should be understood as memories. Through this conceptualisation, this study enters the field of cultural memory studies. The memories shared on waarneming.nl are moments of a users’ life in which they were present at a certain location, gave meaning to this location, and shared their experience of what they observed there. According to Frith (2015), location sharing apps “enable people to use location as a way to remember their lives” (82) and “opens up new opportunities for remembering the past through locations” (92). Again, a post-human perspective is of importance here. Although the platform enables people to remember *their* lives, it also allows them to remember the lives of the species they observed. Especially in times of biodiversity decline, this is of great importance. With the chances of seeing certain species declining and places of nature disappearing, platforms such as waarneming.nl allow species and places to be recalled when they are no longer physically present. This is a very likely scenario, as nature is under pressure in today’s Anthropocene. When the habitat of the Black-tailed Godwit is turned into a suburban area, or when the species disappears from the Netherlands completely, waarneming.nl offers a place where it can be remembered through past observations. The next chapter will dive further into the conceptualisation of waarneming.nl as a place for memories.

CHAPTER 6:
REMEMBERING NATURE

6.1 INTRODUCTION

In Chapter 3, it was described how waarneming.nl could be conceptualised as an archive. In Chapter 4 and 5 it became clear what content is present in this archive, what biases are present in this content, and how the content of the archive mediates the human experiences with nature and non-human actors. The theory on place-based digital memories by Frith (2015), presented in the previous chapter, already illustrated the central role of memory in waarneming.nl, where people share their place-based digital memories with others. In this chapter this idea of waarneming.nl as a memory container will be taken a step further to answer the final sub-question of this thesis: *how can waarneming.nl be understood as a digital lieu de mémoire?* By drawing on the theory of historian Pierre Nora (1989), and other scholars who have studied his theory in the digital context, the relevance of lieux de mémoire for remembering lost species will be explored.

After discussing Nora's theory more generally, his concept will be applied to waarneming.nl to illustrate how waarneming.nl can function as a place of memory; a place where we can learn about the past presence of species such as the Black-tailed Godwit. As biodiversity declines more drastically and more species disappear from our country or completely go extinct, it is of interest to consider how we can make sure these species are not forgotten. Furthermore, it will be questioned why these species should be remembered in the first place, analysing how this remembering can drive action to avoid further natural violence from taking place.

6.2 LIEUX DE MEMOIRE

Historian Pierre Nora is most notable for his concept 'Les Lieux de Mémoire'. In his text *Between Memory and History* (1989), he argues that in recent times, environments of memory (milieux de mémoire) have disappeared. In the past, safekeeping and remembrance was ritualised among families and communities. Through rituals such as storytelling, dance or traditions, memory used to be shared among communities. According to Nora, these rituals have disappeared in today's globalizing mass culture, with the consequence that milieux de mémoire no longer exist. Rather, memory is now contained in specific 'sites', so called 'lieux de mémoire'. Lieux de mémoire are the 'remains' of 'real memory':

Lieux de memoire originate with the sense that there is no spontaneous memory, that we must deliberately create archives, maintain anniversaries, organize celebrations, pronounce eulogies, and notarize bills because such activities no longer occur naturally (12).

These ‘places of memory’ are often literal places, such as Auschwitz or Ground Zero, but as Nora argues they can also be symbolic objects, such as archives or museum. For Nora, the concept was most useful in a nationalist context, as he specifically analysed how memorials and symbols such as the national flag were part of the French national identity.

As addressed by Winter (1997) in his review of Nora’s book *Realms of Memory* (1997), the contemporary application of Nora’s concept is much broader than this nationalistic focus. Especially Nora’s move away from traditional memorials such as geographical locations and his inclusion of symbolic objects, has allowed historians and cultural scholars to investigate ‘popular culture’ as sites of memory in both a national and global context. Especially for these reasons, digital platforms such as waarneming.nl can be effectively understood as lieux de mémoire.

Although this might suggest a type of ‘anything goes’ attitude, Nora set clear criteria for what can and cannot be considered a lieu de mémoire. Most importantly, there should be a will to remember the event the site of memory refers to. An object, day or site that is merely historical should not fall under the description of a lieu de mémoire. This links to a second criterion, namely that the site should be symbolic for a given community. The emphasis that Nora puts on the role of the community and their will to remember make Nora’s concept popular within cultural memory studies. As has been addressed in the introduction chapter of this thesis, cultural memory studies is concerned with how the past is remembered in the present through a socio-cultural lens. As Erl (2008) noted, cultural memory studies is not so much defined by its disciplinary boundaries or specific case studies, but rather by the concepts used to study these cases. Especially thanks to Nora’s emphasis on the community and the possibility for his theory to be applied to a wide variety of cases, lieux de mémoire has become one of the most important tools in the toolbox of cultural memory studies today.

Nora’s lieux de mémoire helps to gain insights into the role of waarneming.nl in the understanding and experience of nature. Waarneming.nl confers with Nora’s conceptualisation of a lieu de mémoire, and I argue that waarneming.nl can be understood as a place of memory for biodiversity loss. The platform is a digital structure that exists somewhere between the boundaries of a symbolic object and a literal place. On the one hand, waarneming.nl is a web-‘site’, a place that can be visited, although not physically but digitally. On the other hand, waarneming.nl can be understood as a symbolic object; it is an archive. Furthermore, waarneming.nl is relevant to a specific community with the will to remember biodiversity. This is highly evident in the mission waarneming.nl describes on the platform, which states that they wish to share data on biodiversity from the past and the present, as a source for the future (Waarneming.nl Mission n.d.). Through waarneming.nl users purposefully share their place-based digital memories with their future selves and with other users in the community (Frith 2015). During interviews with users of waarneming.nl, they explain their perception of waarneming.nl as a type of diary: a place they can go back to and be reminded of their past interactions with nature, and the interactions of others within the community (Verploegen et al. 2020). For Nora (1989), the community mainly consisted of family or the nation. In the case of waarneming.nl, users are not bonded by family ties or by a shared nationality. Rather, they are bonded by a shared interest. In this case, the interest for nature. Online communities often take this shape as communities of interest, where people find others with similar interests and connect with them without having to be at the same place at the same time (Preece 2016).

6.3 DIGITISING LIEUX DE MEMOIRE

Although much of our lives resides around digital media, and although many archives have turned digital, only little attention has been paid to the understanding of lieux de mémoire in this digital context. The analyses of theorists Haskins (2015) and Müller (2017) are two rare examples of studies that have contextualised digital archives as lieux de mémoire. Haskins (2015) analysed The September 11 Digital Archive by the American Social History Project which aims to collect, preserve and present the 9/11 attacks. The content of the archive is formed by submissions from anyone touched by the attacks all over the world. It is a collection of stories and images in which attitudes of history and historical facts coincide as the lay public and trained historians collaborate. Müller's (2017) analysis focused on the Indian Memory Project and the 1947 Partition Archive, both established by the lay public, independent of established institutions. Both archives invite people to submit photographs or audio-visual information on the partition of India and Pakistan.

Both theorists conclude that the strong distinction Nora poses between milieux de mémoire and his alternative lieux de mémoire is not as strict in their examples of digital archives. Nora described milieux de mémoire as “settings in which memory is a real part of everyday experience” (Nora 1997). By proposing the alternative lieux de mémoire, he argues that his everyday experience of memory no longer exists. Both Haskins (2015) and Müller (2017) argued that in a digital environment, the ritual becomes relevant again, as citizens can contribute information to these lieux de mémoire through ritualistic contributions. In line with Haskins and Muller, I argue that the community that contributes to waarneming.nl does so in a ritualistic manner. Using digital devices that have been integrated in our daily practices, users go outside, see an animal, identify it and register it online to share it with others. This ritualistic process is part of everyday life and reminds of the milieux de mémoire that Nora described.

This is not to say that waarneming.nl is a milieux rather than a lieux de mémoire. In line with Haskins and Muller, I rather argue that when addressing such digital archives, where the crowd can contribute, the boundaries between the two become blurred and are not as distinct as Nora proposed. Waarneming.nl is first and foremost a container of memory, a literal (web)-'site' where memories are registered. However, it puts biodiversity, and the loss thereof, in between the ritualistic remembrance in everyday life and the mere observation of an artefact. Although waarneming.nl has become part of everyday life, it is still a place that people return to, to set these processes of memory in motion.

One of the main reasons digital archives such as waarneming.nl do not entirely do away with milieux de mémoire is their collaborative effort. A prevalent idea is that as containers of memory can now be filled by anyone and everyone, the content will be more representative. There is room for discourse that goes beyond the hegemony. Nora (1989) predicted so himself, noting that “a strange role reversal has occurred between the professional, once reproached for an obsession with conservation, and the amateur producer of archives...the materialization of memory has been tremendously dilated, multiplied, decentralized, democratized” (14). As Blom (2016) notes, “digitalization seems, at least in theory, to promote a radical democratization of memory: everything may, potentially, belong to everyone” (13). This reminds of the democratic potential of the internet that was introduced and criticised in Chapter 3. There is no denying that the digital environment leads to more diverse content. As the analysis in Chapter 4 has shown, users have highly diverse ways in which they use waarneming.nl regarding the amount of observations they register, where they register observations and the rarity of

their observations. Additionally, more than 120,000 users have contributed to this data instead of a few institutionalised archivists, thereby eradicating the authorial agency of these institutions. However, the analysed dataset also illustrated that users come from limited demographic backgrounds; they are mostly male and middle-aged. As Blom rightly described, digitalisation only leads to democratisation ‘in theory’. In practice, the contributors of archives are not always as diverse as might be expected, and the content that they create often comes with biases, as was addressed multiple times throughout this thesis and will be contextualised again later in this chapter.

6.4 MAKING VISIBLE

One way in which waarneming.nl stands apart from Nora’s conceptualisation and the examples of digital archives addressed in the previous section, is the nature of the tragedy that is being remembered. *Lieux de mémoire* most often become places of memory *after* a tragic event has taken place. Archives of the 9/11 attack or the partition of India and Pakistan only became symbolic objects for cultural memory in hindsight, after the tragic events took place. In the case of biodiversity loss this is more complex, as contributions to waarneming.nl are made while the tragedy is still taking place. Professor in the humanities and the environment Nixon (2011) noted that many tragedies in the Anthropocene, such as biodiversity loss or climate change, are types of ‘slow violence’ that often go unnoticed in everyday life. Cultural productions are needed to make these types of violence visible.

In Chapter 5, it was analysed how waarneming.nl ‘surveils’ nature, and how the visibility of species and their locations mediates our understanding of, and experience with, nature surrounding us. However, waarneming.nl also mediates how we understand and experience nature that has been lost, when the physical experience of nature is no longer possible. For example, Black-tailed Godwits used to breed in the Blaricummermeent, a former polder area in the Dutch province of Utrecht. In 2019, zero Black-tailed Godwit observations were registered. In 2014 this area was repurposed as a residential area (see Figure 1 and 2 for before and after aerial photographs). Visiting the waarneming.nl page for the Blaricummermeent gives an uncanny feeling (Figure 3). Old observations of the Black-tailed Godwit are pinned on the map; observations that were done before the area was repurposed. The map no longer shows polder at the places of these pins, but instead the pins are visualised on top of the now present houses. Although we can no longer experience the Blaricummermeent physically as a habitat of the Black-tailed Godwit, waarneming.nl makes visible what used to be there and allows us to digitally experience the area as a prior habitat of the Black-tailed Godwit. The archive makes the past life of this species and their change of habitat visible.



Figure 1. Blaricummermeent 2012. (De Blaricummermeent n.d.).



Figure 2. Blaricummermeent 2014. (De Blaricummermeent n.d.).



Figure 3. Blaricummermeent Black-tailed Godwit Observations 2019 (Waarneming.nl Blaricummermeent n.d.).

Waarneming.nl thus provides a place where biodiversity loss can be made visible, as the example of the Blaricummermeent illustrates. Users are given the possibility to search for species or places and observe changes in the number or type of observations. It should be noted that this making visible of biodiversity loss and experiencing waarneming.nl as a place of memories do not necessarily have to be the aim of users. Furthermore, waarneming.nl does not explicitly create a discourse around biodiversity loss. There are no icons indicating the endangerment of species or pop-ups reminding to protect nature. However, as described above, users use waarneming.nl as a type of diary to flip through. Searching for old observations might often be motivated by personal interest, recalling a personal memory. Although this search is motivated by a personal memory that might have little to do with biodiversity loss, users will unintentionally be confronted with a decline in observed individuals of a species or observe a change in the examined location on the map. When searching for the Black-tailed Godwit in the Blaricummermeent in 2019, it becomes clear that this species is no longer observed in this area. Furthermore, this search will show a change of habitat on the map. The explicit and implicit ways in which waarneming.nl makes biodiversity loss visible is arguably not much different from any other lieux de mémoire. Walking past a WWII memorial in a city does not have to be intentional for it to initiate remembering processes. Whether intended or unintended, explicit or implicit, indirectly or directly, waarneming.nl makes biodiversity loss visible by presenting observations over time through lists, statistics, and maps.

Waarneming.nl can thus be understood as a place where biodiversity loss is made visible and where lost biodiversity can be remembered. However, the visibility provided by waarneming.nl is not all-encompassing. What the previous chapters have shown is that the content of waarneming.nl is biased towards local observations

and rarer species. In Chapter 5, the implications of this for our interaction with the nature around us have been analysed, but these biases also have an effect on what nature we remember. Waarneming.nl is not a place of memory for *all* nature, but only for the nature we deemed valuable enough to register. In the discussion in Chapter 3 around the role of archives in cultural memory, it was established that archiving is a process of forgetting and saving, providing the basis for what can be remembered in the future. As Assmann (2011) potently described, what is archived is given a ‘second life’. In an anticipatory manner, users of waarneming.nl are actively deciding what will have the potential to be remembered and what is already written out of history today. To use an example from Chapter 4, the dataset showed that many users want to remember the rare Little Curlew sighting, whereas it appears little users are interested in remembering sightings of the common Blackbird¹.

Of additional importance in analysing waarneming.nl as a lieu de mémoire is Nora’s acknowledgement that the meaning of memory places is not fixed, but changes over time (Nora 1989). This is of particular importance for biodiversity loss, as the meaning and value attached to specific species changes in relation to endangerment and extinction. Endangered species and rarer species often gain value as the ecosystem changes. When the number of Blackbirds would start to decline, or if it would completely disappear from the Netherlands, the species would be viewed differently compared to today, when it is still roaming freely in the Dutch landscape. Scarcity makes valuable.

6.5 CONSEQUENCES OF VISIBILITY

The value judgements made by users of waarneming.nl have consequences for what elements of biodiversity will be remembered. In Assmann’s (2011) words, that which is not archived, is not given a second life. As Professor of inhuman geography, Yusoff (2012) argues: “More often than not the absence has no mark, because that which existed and then ceased to exist did not make it into the ledges of classification and nomenclature” (579). This absence can have multiple consequences, both in terms of endangerment and extinction.

Firstly, a lack of visibility in archives can have consequences for the timely protection of an endangered species while it can still be saved. As Yusoff (2012) adds: “representation stands for the possibility of protection” (583). If the Black-tailed Godwit would not be made visible through archives, because we deemed it of too little value to register observations, no data would be available on the decline of this species. With little to no data available, it would be impossible to decide when protection efforts are needed. The species would not be labelled as endangered, it would not make the Red List, and conservation measures would not be taken. An extreme example might be that the Black-tailed Godwit declines ‘in secrecy’, with the consequence that no conservation efforts are taken to try and stop its extinction. In the case of the Black-tailed Godwit this is unlikely, given its status as the Dutch National Bird, and this fate is generally unlikely for bird species given their benefit as proxy species. Much attention is paid to birds due to their aesthetic appeal and anthropomorphic nature. However, even within this avian species group, there might be less popular species, like the Magpie or Feral Pigeon, that people pay less attention too. This is even more extreme for animals such as insects, which do not share the aesthetic or anthropometric character of birds or mammals. Although they are of incredible importance for our ecosystem their unpopularity among humans makes these species less popular to observe and register, leading to gaps in data (Lousley 2016). However, it is important to recognize that conservation efforts are not completely based on

1 See Chapter 4, section 4.3.2 for more elaboration on this example.

citizen science data such as that of waarneming.nl. Many professional ecologists put their efforts in the collection of data on species, regardless of their popularity. Nevertheless, citizen science data is of great interest as there is too much data on natural phenomena to be observed by the limited numbers of professionals alone (Dickenson and Bonney 2012). Additionally, biodiversity loss needs to be combatted by society as a whole; species cannot be saved by professionals alone.

The need to archive is not only relevant in the case of endangerment, but also after extinction. Firstly, archiving can avoid ‘double death’, in which both a literal extinction occurs, as well as an extinction in our minds (Jones, Rigby, and Williams 2020). These double deaths are already occurring today, when generations are experiencing ‘environmental amnesia’ as they are not aware of the lost nature which preceded them (Kahn 2002). This can lead to a lack of effort to protect nature and an acceptance of nature’s degradation (Soga and Gaston 2018). Kahn and colleagues, (2009) expressed scepticism towards the ability of technology to ‘replace’ experiences of nature. However, when elements of nature can no longer be experienced physically, perhaps the digital places of memory that technology such as waarneming.nl can offer are the next best thing to avoid nature from getting lost in amnesia, with the consequence of a reduced connection and urge to protect nature.

Secondly, as waarneming.nl makes biodiversity decline visible, it is able to drive action for nature protection. This is in line with the more positive consequence of nature surveillance suggested in the previous chapter. Here it is of interest to view remembering as a political and transformative act. Going back to the tragedy of 9/11, Butler (2004) noted that remembering this catastrophe leads to affective responses that have the potential to lead to action. Feelings of grief, mourning or guilt can transform the person who remembers and drive them to action, to avoid such catastrophes in the future. In the case of biodiversity loss, this is of particular interest since the tragedy of biodiversity loss has not come to its end yet. Much of this potential loss can still be prevented. In his analysis of climate change, literary theorist Craps (2017) posed the idea of anticipatory memory and argued that the ‘narratives’ we are writing today are the memories of the future. He also links this to the memory imperative presented by Levy and Sznajder (2010) in their work on the Holocaust. According to Craps (2017) “the idea is that the Holocaust memory has come to serve as a prompt to denounce and prosecute human rights violations in the present” (488). Craps applies this to the situation of environmental violence and argues that “just as the memory of the Holocaust can allegedly help prevent future genocide, so the proleptic memory of climate catastrophe can perhaps function as a spur to action that would prevent the anticipated catastrophe from actually coming to pass” (488). As Bowker (2005) also emphasizes: “What we choose to remember about the past and our ways of remembering shape our appreciation of and actions in the present” (127).

When understanding waarneming.nl as a lieu de mémoire for lost biodiversity, one can also anticipate that this memorialisation might spur action to stop biodiversity loss. Because users observe a decrease in observations of a given species as they scroll through their ‘diaries’ and search for observations from the past, this has the potential to make users aware of the biodiversity loss going on around them. This awareness is the first step towards action to stop this loss. This goes for individual users, as well as for conservation institutions and the governments. The data provided by waarneming.nl makes visible how species are doing, where they are declining or moving. This information from the past gives the opportunity to prevent the same fate in the present and future. This also fits the aim of waarneming.nl to contribute to conservation and nature protection. We need tangible examples of biodiversity decline and extinction to spur to action. As scholars such as Butler (2004) and

Craps (2017) argue: we need to remember the tragedies of these disappearances and extinctions to be reminded of what we can still save. Even though waarneming.nl does not put extinction and biodiversity loss at the centre of their archive, the content of this archive does make biodiversity visible and rememberable, and sets actions to protect nature in motion. Waarneming.nl might not directly present itself as a place to remember lost nature, but it would not be possible to remember nature without places such as waarneming.nl. Waarneming.nl is a place where users share their memories, and in doing so makes biodiversity loss visible, allowing for the possibility to spur action to protect endangered species, and avoid future extinctions.

CHAPTER 7:
CONCLUSION

7.1 MAIN FINDINGS

The Black-tailed Godwit, *Limosa limosa*, or in Dutch: de Grutto. One of the many species that have become endangered due to human impact on the planet. In the Anthropocentric era, humans are negatively impacting nature in a wide variety of ways, with drastic consequences for the climate and biodiversity. Although these might seem issues for the natural sciences, issues as biodiversity loss are cultural as well. This thesis has followed pioneering theorists such as Ursula Heise (2016) in acknowledging and analysing the role of cultural productions in contributing to environmental issues, both in positive or negative ways. Through both a theoretical and statistical analysis, this thesis examined how cultural productions shape our understanding and experiences of nature, and specifically bird biodiversity. Waarneming.nl, the largest platform for nature observations in the Netherlands, has functioned as a successful example of a cultural production that plays a role in shaping this understanding and experience of nature. Analysing this platform has resulted in a highly interdisciplinary endeavour that crossed both theoretical and methodological boundaries. Grounded in the environmental humanities, this analysis has drawn on multiple fields such as memory studies and media studies, as well as the environmental sciences. In doing so, theoretical frameworks from different fields were connected and extended to the context of biodiversity loss. Furthermore, this thesis has combined theoretical analysis with data analysis, to make sense of, and critically assess the 8,227,728 observations registered on the platform registered in 2019. The main argument resulting from this analysis is that waarneming.nl is an archive of biodiversity information that is shaped by value judgements about species and places. In doing so, this digital archive plays a role in both our current experience of nature, the nature that will be remembered, and what actions are taken to protect nature.

To answer the question how the digital archive waarneming.nl shapes our understanding and experience of nature, each chapter of this thesis answered one of the sub-questions. What follows are the summarised answers to each of these sub-questions:

Sub-question 1: How can waarneming.nl be understood as a digital archive of bird biodiversity?

In Chapter 3 it was analysed how waarneming.nl can be understood as a digital archive, concluding that waarneming.nl is a container of information on biodiversity that is deemed worthy enough to be recalled at a later stage. In today's digital world, the archive has undergone major changes, where many archives have been digitalised. As the example of waarneming.nl shows, this digitalisation has the potential of crowd contribution, as anyone

can contribute observations to waarneming.nl. This digitalisation also changed the presentation of the archive. As archives are digitised, they take the shape of databases that are presented to us through an interface and allow us to search, filter and view the content of the archive. As this thesis is primarily concerned with the content of the archive, and only secondarily with the way this content is presented to us, waarneming.nl is conceptualised as a digital archive rather than a database throughout this thesis.

Sub-question 2: What place and bird biodiversity does the archive contain and what biases might be at play in this?

Inspired by cultural analytics, the fourth chapter included the statistical analysis of a dataset containing all observations registered on waarneming.nl in 2019. This analysis firstly showed a bias in terms of user demographics. Users of waarneming.nl were mostly male and middle-aged. Furthermore, users were not distributed throughout the Netherlands equally, with more users residing in Gelderland, Noord-Brabant, Noord-Holland or Zuid-Holland. Secondly, it was found that most users register common species, but that rare species receive more attention on the platform itself. Based on the analysis of rare species in the dataset it can additionally be assumed that there is a relationship between species labelled as rare on waarneming.nl and species labelled as endangered on the Dutch Red List. This suggests that there is a relationship between rarity and endangerment. Additionally, it was found that users who register more observations also tend to register more rare species. Finally, the GPS data of all observations were utilised to conclude that most users register observations locally. These local observations are most often of common species. However, as the number of observations a user registers increases, more observations are registered regionally or even nationally. Users who register observations more nationally are more likely to register rarer species.

Sub-question 3: How does waarneming.nl mediate the experience and understanding of (non-)human actors in nature?

In her theorisation of hybrid place, de Souza e Silva (2006) noted that our experiences of urban places have become partly physical, partly digital. In Chapter 5 I have suggested that this is not merely the case for urban places, but also for places in nature. Waarneming.nl is an example of a platform that allows to gain digital information on nature, thereby allowing physical and digital experiences of nature to be combined. By providing this information, waarneming.nl mediates our understanding and experience of nature. However, this mediation is not all-encompassing as the content of waarneming.nl contains biases, as the answer to sub-question 2 shows. Especially important is the fact that rare species are overrepresented on waarneming.nl. These rare, and often endangered, species are given more attention on the platform, and thereby surveilled more intensively. This has both positive and negative consequences for non-human actors. On the one hand, it allows conservation efforts to take place as much information is available on these species. On the other hand, as we can access a constant stream of information on these species, we might disturb them more easily. Finally, following the answer to sub-question 2, it can also be assumed that the mediation waarneming.nl provides mostly plays out in local places, as this is where most people register observations and have stronger emotional ties.

Sub-question 4: How can waarneming.nl be understood as a digital lieu de mémoire?

Waarneming.nl does not only mediate our understanding and experience of the nature around us but also mediates how we remember nature that has been lost and can no longer be experienced physically. This is best understood by conceptualising waarneming.nl as a digital lieu de mémoire for lost biodiversity. Following Nora's (1989) theory on lieux de mémoire, I argue that waarneming.nl is a place of memory. It is a container where members of an online community of interest share their memories. These memories make biodiversity loss visible and form the basis of what can be remembered about biodiversity in the future. This has multiple consequences for endangered and extinct species. Firstly, this making visible is needed to initiate nature protection efforts in a timely matter. Secondly, these memories allow extinct animals to be remembered. This remembering can have a transformative effect, and in doing so set in motion action to make sure future extinctions are avoided.

When combining the answers to these sub-questions, this leads to the following threefold conclusion. Firstly, waarneming.nl acts as a mediating factor in our understanding and experience of nature. By providing digital information on species as the Black-tailed Godwit and its habitat, waarneming.nl turns nature into a hybrid place. Secondly, waarneming.nl does not only mediate our physical experience of nature but also plays a major role when this physical experience is no longer possible, as habitats are lost and species go extinct. As such, waarneming.nl is a digital lieu de mémoire where biodiversity loss is made visible. Thanks to the observations on waarneming.nl, we are made aware of the loss of birds such as Black-tailed Godwits and their habitat. In this way, waarneming.nl contributes to making sure these lost species are not forgotten. Additionally, the provided observations allow action to be taken to protect nature both by individuals and conservation agencies. Finally, thanks to the data-driven approach of this thesis it can be concluded that the mediation and remembering that waarneming.nl offers are not neutral, as the content of waarneming.nl is biased towards local observations and rarer species. Waarneming.nl thus makes biodiversity loss visible, but not for all of nature. Although we will most likely not forget the Black-tailed Godwit given its label as the Dutch national bird, many other more unpopular species do not have this privilege. Waarneming.nl is a powerful mediating factor and place for remembrance. Nevertheless, it should be recognized that waarneming.nl only shapes our understanding and experience of nature in a limited way.

Although these limitations and the negative consequences such as disturbances have been emphasised throughout this thesis, I wish to conclude on a positive note. Digital archives for biodiversity as waarneming.nl play an important role in nature conservation and protection. By experiencing nature as hybrid, people can explore more of nature, and see the Black-tailed Godwit while it is still around. By sharing these observations, the Black-tailed Godwit is made visible digitally, making it possible to follow its decline and step in when necessary. If we ever get to the unlucky position of losing our national bird, waarneming.nl allows to keep the memory of this bird alive and stimulate people to take action against the violence that nature is experiencing.

7.2 POSITIONING 'NATURE THROUGH THE SCREEN'

This thesis has contributed to the growing field of the environmental humanities, combining theories from a variety of corners of the humanities, to understand an environmental issue. In doing so, this analysis also contributed to a few fields specifically, for which different takeaways are relevant.

Firstly, this thesis has aimed to take a more posthuman perspective towards *media studies*. Especially analyses of digital media (e.g. Hoskins 2017; De Souza E Silva 2006; Frith 2015), have focussed on the way humans use, experience and are influenced by these digital devices. Furthermore, this is most often discussed in an urban context. However, in times of an environmental crisis, it is of importance to also address that digital media has an influence on more than the human experience. Through our computers and phones, we gain information about nature, experience nature differently, and both positively and negatively affect this nature. For example, this thesis has shown that users of *waarneming.nl* can access the observations of others to determine their mobility paths, determining what places in nature to visit.

Within *cultural memory studies*, this more posthuman perspective was already developing (Craps et al. 2018). This thesis has contributed to that move by illustrating how Nora's (1989) theory of *lieux de mémoire* is of great importance in understanding biodiversity loss. Furthermore, the cultural memory toolbox has more to offer for the analysis of digital memory. Nora's *lieux de mémoire* was only very modestly analysed from a digital perspective (Müller 2017; Haskins 2015). This analysis thus also offered an addition to this application of Nora's theory to a digital context.

This thesis also hopes to contribute to a not yet mentioned field; that of *ecology*. Within ecological research, there had been little attention for cultural productions and the role these play in the deterioration of nature or its protection. Comments on the environmental humanities from a natural science perspective are very rare. In one of the only texts written from this perspective, environmental history professor Sörlin (2012), notes that “our belief that science alone could deliver us from the planetary quagmire is long dead” (1), but that the solution was sought with economics and management. Only very recently eyes have been on the humanities. While the humanities are extending their focus on the non-human, natural scientists are called to do the exact opposite: focus on the human(ities). This thesis aims to be of interest to natural scientists and specifically ecologists to make clear how cultural productions make biodiversity loss visible and the implications this has for nature conservation and protection. The data analysed in this thesis is the same data that is used by natural scientists, but our conclusions are most likely very different. I hope that my conclusions will be of interest to them as well, as they provide insight into the value judgements made in our experience and remembrance of nature.

Finally, within the environmental humanities, work on the representation of biodiversity already started to modestly lift-off (e.g. Heise, 2016). This thesis has not only given more weight to the study of this representation but has also provided a new approach to studying this representation, namely by integrating a new data-driven approach. Statistical analysis and theoretical exploration have formed a symbiotic relationship throughout this thesis. The statistical analysis allowed to derive patterns from the big data content of *waarneming.nl*, that would not have been able to be derived qualitatively. For example, it would not have been possible to conclude the relationship between rare and endangered species, of between the number of observations and mobility through a visual or discursive analysis of the platform. More importantly, however, this data was critically evaluated and scrutinised throughout this thesis. The critical reflection that is central within the humanities is highly beneficial in combination with data. Instead of merely taking data for granted, the data was critically evaluated and put into perspective in the theoretical explorations. For example, even though only a small percentage of observations are of rare species, by scrutinising this data in detail and putting this into a broader perspective it could be analysed how such species were overrepresented and the consequence of this for their disturbance as well as protection.

7.3 FUTURE RESEARCH

Waarneming.nl is only one of many digital biodiversity archives out there. Many are collaborative efforts just like waarneming.nl. For example, e-bird, iNaturalist or NatureToday. Some are accessible to everyone who wants to contribute, others are connected to specific conservation organisations. Although this thesis focused specifically on waarneming.nl, the analysis and conclusions are in many ways applicable to these similar archives. All these digital productions play a role in creating hybrid places and digital places for remembering. However, they might do so in different ways. For example, these platforms differ in the emphasis they put on certain species (groups), how they deal with the obscuring of data, or the type of users that contribute to the platform. Future research would benefit from analysing more of these platforms from a humanities perspective and analyse their differences and similarities. This would give a broader perspective on how such digital archives represent biodiversity (loss). Additionally, future research would ideally focus on the role of the interface. Given the limited scope of this thesis, the interface of waarneming.nl was only addressed as a secondary issue, and not analysed in its own right. It would be of great interest to see how the interface specifically influences the content of the archive.

Furthermore, this thesis is limited in its focus on bird biodiversity. In the introduction chapter, the choice for this focus was explained. Here it was addressed that birds are ‘proxy species’ that are often used in discussions around biodiversity for their aesthetic and anthropomorphic appeal. Ideally, future research would apply such analysis to less prominent species as well, such as insects, fish or reptiles. Although the majority of conclusions can arguably be extended to these species, the biases at play in the content will most likely be different for such species.

Additionally, this thesis has only shortly addressed the discourse around posthumanism. It would be beneficial to reflect more elaborately on the posthumanism discussion and apply different perspectives to the representation of biodiversity loss. For example, this thesis has only focused on how humans affect nature, and not so much on how non-human actors take action themselves and might affect humans in return. When doing so, the posthuman perspective would move even further away from the centralisation of the human compared to the still rather large emphasis on the human perspective in this thesis.

Finally, the scope of this analysis has only allowed for the statistical testing of a few of the variables in the data set. In future research more of these variables could be compared, to find additional patterns. In doing so, more advanced statistical testing would be beneficial to come to more insights on the relationships between variables. Especially considering observations that have been obscured would be of interest to include. These obscured observations were not part of this dataset. Taking these into consideration would allow to draw more conclusions on how users protect species from digital surveillance.

Throughout this thesis, theories and methods from multiple disciplines have been uniquely combined. This has resulted in an unconventional and ambitious humanities analysis, that went beyond a traditional humanities approach. In doing so this thesis is not only a call for the integration of a more cultural perspective in the analysis of environmental issues, but also a call to not let disciplinary boundaries stand in the way of new insights. As a researcher, it is a challenging but highly fulfilling endeavour to search for new ideas and find connections in unconventional places. The environmental crisis screams for these links. Just as our planet can only be saved by the entire society, we can only save our environment as a collaborative academic community. In the end, this

thesis has only scratched the surface of what is possible with the combination of theories from different fields. There is much more work to do. Let this thesis be oil on the little fires that are already burning through the works of others who are analysing biodiversity loss from a cultural perspective.

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SUMMARY

In ‘Nature Through the Screen’ it is analysed how digital archives of bird biodiversity shape our understanding and experience of nature. This is done through a case study of waarneming.nl, a collaborative digital archive where anyone can upload observations of nature. The analysis is a combination of a theoretical exploration with statistical data analysis of the content of waarneming.nl.

Firstly, it is analysed how waarneming.nl can be understood as a digital archive. It is discussed how the concept of the archive has changed since digitalisation and the role of crowd contribution. Following this, a dataset of all observations registered through waarneming.nl in 2019 is statistically analysed to gain insight into the content of the archive and possible biases at play in this, for example concluding a focus on local observations are rarer species.

Subsequently, it is conceptualised that waarneming.nl mediates our understanding and experience of nature, as it turns nature into a hybrid place. By reading and writing digital information, our experience of place becomes a combination of the physical and digital. This hybrid experience of nature is not all-encompassing as it is limited by the biases present in the content of the archive.

Waarneming.nl does not only shape our understanding and experience of the nature around us but also makes biodiversity loss visible, allowing us to remember nature that has been lost. In this way, waarneming.nl can be understood as a digital *lieux de mémoire*. Recalling observations from the past can make us aware of biodiversity loss and trigger action to protect nature. However, just like the mediation of the nature around us, this remembering is also limited by the biases in the content of the archive. In this way, waarneming.nl only allows us to remember certain elements of nature that are deemed valuable enough.

In conclusion, waarneming.nl is an archive of biodiversity information that is shaped by value judgements about species and places. In doing so, this digital archive plays a role in both our current experience of nature, the nature that will be remembered, and what actions are taken to protect nature.