Radboud University

Nature conservation & restoration policies

Assessing the implementation of the Dutch National Ecological Network

Juan Santiago Gallego

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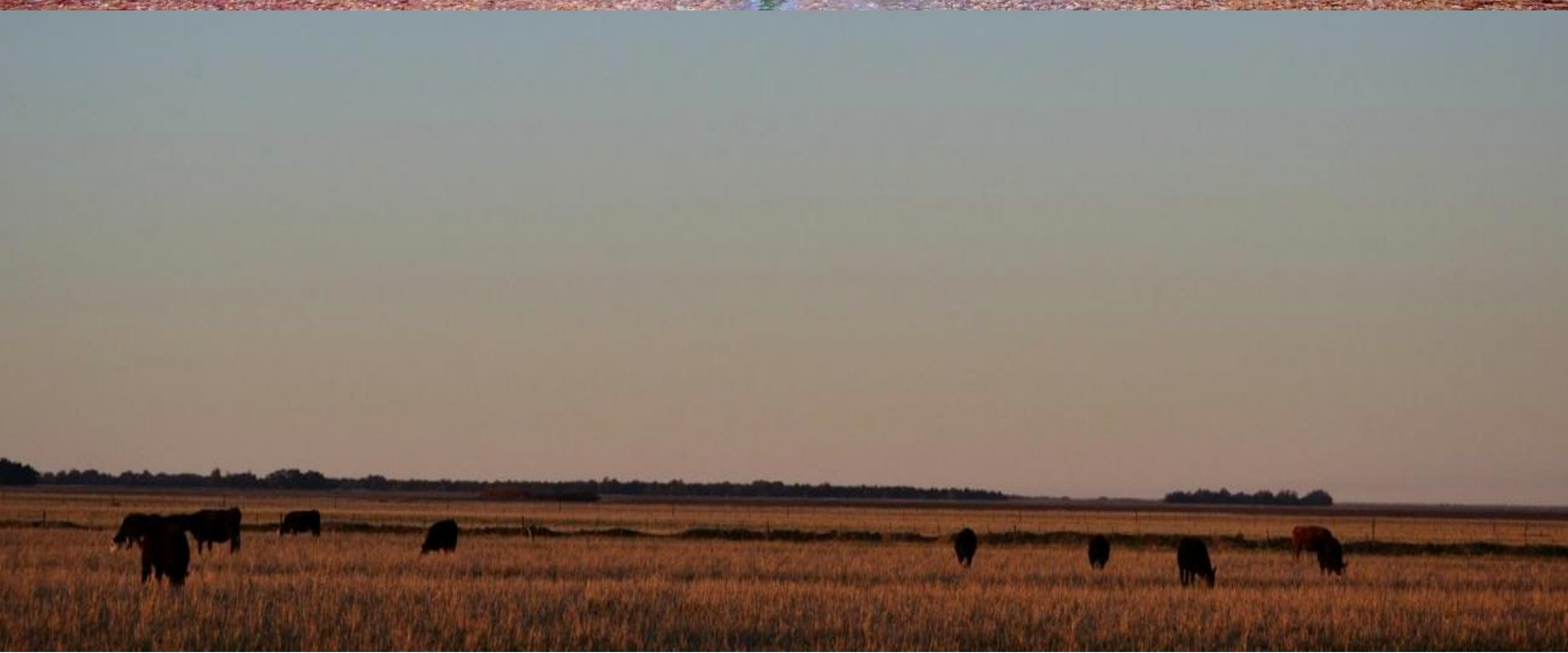

Nature policies for conservation & restoration

Assessing the implementation of the Dutch National Ecological Network

Master thesis

Author:

Juan Santiago Gallego (s1035065)

Juansantiago.gallego@ru.nl / jsantiagogallego@gmail.com

Supervisor & first reader:

Dr. Huub Ploegmakers

Radboud University , Nijmegen

huub.ploegmakers@ru.nl

Nijmegen School of Management - Radboud University

Preface

Dear reader,

I would like to offer you the results of two years of hard work, which have left me a great deal of knowledge and have seen me grow as a person and as a professional.

This is, at the same time, the result of a life experience which has brought me to be writing this preface. Having said that, the right thing to do is to thank my family for their support, examples of hard work and for giving me a marvellous childhood in close contact with nature. I believe that is the root of my passion for nature and the environment. Also, thank you Belle for accompanying through these years of work during my studies and for supporting when I needed it. In short, this works is not only mine, but also from those who have helped to arrive to this point.

This thesis took place during a pandemic, which reminds us that we are bringing the ecological boundaries of the earth to the limit. Therefore, I believe this work is rightly timed. Through it, I hope to contribute to the existing body of knowledge around nature conservations and biodiversity. Humanity is currently living a historical moment, Climate Change challenges us to come together and act jointly towards the betterment not only of the environment but also of society. In the end, my hope is for society to work together, and for the protection of nature to become a human value.

The process of writing this thesis was challenging. However, I can confidently say that I have learned a lot about my capabilities and the subject itself. Therefore, I would like to also thank my supervisor Huub Ploegmakers for challenging me, picking my brain and guide me in the process of writing my thesis.

With out any further ado, I leave you with my work and product of numerous hours of work and past experiences. I hope you can enjoy reading it as much as I enjoyed the process of writing it.

Santiago Gallego

ABSTRACT

The aim of this research is twofold, on the one hand, it aims to contribute to the current lack of knowledge regarding implementation of nature policies in the field of nature conservations and restoration. On the other hand, it aims to provide insight into the implementation of the Dutch National Ecological Network. Through the assessment of the implementation of the Dutch Ecological Network, this research explored how the content and context of the policy influence its implementation. The analysis was done through a survival model and a binary regression. More specifically, the elements analysed were the a) acquisition of lands necessary to expand the current ecological networks, and b) the implementation of ecological restoration activities on this areas. Being this, two required outputs of the Dutch nature policy to achieve its objective, the improvement of biodiversity. The results show a slow pace of the policy implementation, and a discrepancy between communicated plans by the implementing actors, and the real outputs obtained. Moreover, specific stakeholders' groups and specific areas result more challenging to be acquired and restored. Such as urbanized and agricultural areas. In views of this context, the policy's instruments could be improved to address these challenges. At the same time, it has been shown how congruent interest between the policy and other stakeholders lead to a better implementation of restoration activities. Finally, it is advisable for future research to gather a better insight into the interests behind the reluctancy of certain actors to support the implementation of the policy, and to assess to what extent has biodiversity improved as a result of the extension of the network and its ecological restoration.

List of abbreviations

BBL	Bureau beheer landbouwgronden
CBD	Convention for biodiversity
NEN	National Ecological Network
SNL	Nature and Landscape Subsidy system
UN	United nations

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1. Introduction to the research

World's nations have been addressing climate change for more than 50 years already, considering the 70'sthe beginning of environmental awareness. Since then, the sense of emergency and commitment has been slowly but steadily increasing. Along with it, different approaches to address climate change have arisen. Among all of them, nature conservation and ecosystem restoration have taken aprominent place. For example, the United Nations (UN) has defined 2020-2030 as the ecosystem restoration decade. The goal for the decade is to "*prevent, halt and reverse the degradation of ecosystems worldwide"* (United Nations, 2020).

To protect biodiversity, nature conservation and restoration are two strategies that are combined but still different from one another. While conservation is focused on avoiding the disappearance of specific populations, ecological structures and ecosystem services; restoration aims to re-build the ecological structure and services if they were destroyed (Urbanska, 2000). Moreover, protected areas have been the predetermined strategy to conservation, as they allow to avoid the most imminent threats to biodiversity. However, the sole creation of protected areas has shown to be insufficient due to low connectivity and poor environmental conditions generated by previous land uses. Consequentially, different species see their dispersal possibilities reduced, which threatens their survival capacities (Marcuzzo & Viera, 2015; Volis, 2019**;** Mensourian, 2017). To address this, ecological restoration can play a crucial role by improving ecological structures within an specific area; making restoration an important addition to conservation efforts (Marcuzzo & Viera, 2015 ; Volis, 2019). An additional practice is the implementation of ecological networks, which has been seen an increasing use as means to improve habitats connectivity to support biodiversity (Boitani et al., 2007). The reason for this, is the importance that barrier free corridors and habitats have on enhancement of biodiversity flows within an specific territory. Therefore, ecological corridors can be understood as a connected and coherent system of natural landscapes, whose ultimate function is to support ecological functions. Consequently, some of the benefits that they provide are strengthened ecological coherence, protection of critical areas through the creation of buffer zones , and possible restoring of ecological conditions(Simenova et al., 2009).

This research will assess the implementation on nature conservation policies in the Netherlands. More specifically, the creation of its ecological network and implementation of ecological restoration activities. The Dutch case is a good example to analyses the implementation of nature and biodiversity policies. The country has been attempting to support biodiversity conservation through the creationof a national ecological network (NEN) and restoration practices. In fact, the Dutch approach to the implementation of the ecological network is a reference at a global level, due to its role as one of the first countries to address such issue. The biggening of its approach to nature conservation can be tracked to the habitat fragmentation generated by transport infrastructure in the country. As a result of this, a diverse wildlife passages were developed, with the first one being built in 1974. Ultimately, this led to a current amount of 800 wildlife passages across its territory up to this date(van der Grift, 2004).

Besides the creation of wildlife passages, the implementation of the NEN, should be considered as a long term approach(van der Grift, 2004).Starting in 1990, and with several reforms through the years the Netherlands have projected the creation of their NEN, with the aim of increasing and enhancing biodiversity within their territory (van der Heijden, 2005; Bakker et al., 2015). Moreover, the several reforms were mostly initiated as a reaction to the improvements, or lack of them, regarding the status of biodiversity in the country. For example, in 1999, a re assessment of the network indicated that some areas were too small and the habitat connectivity was still insufficient. This resulted in the creation of "*robust corridors"* , which were considered as an "extra" room for nature devleopment(van der Grift, 2004). In 2013 took place the last reform of the nature plan. As part of it, a decentralization process took place, through which different actors were given a role to play in the creation of the NEN(Folkert & Boonstra, 2017; Kuindersma et al., 2020). As a matter of fact, this phenomenon allowed to include a bigger variety of actors and land uses in the efforts to improve the state of nature, which shall be deemed as a rather important characteristic. The reason for this being that changes in land use are considered as the primary reason behind habitat loss and consequent impact on biodiversity(Zwartkruis et al., 2020).

Besides the decentralized approach to nature conservation, the Dutch case is also relevant due to its attempts of improving nature. The Netherlands have carried out what Sandbrooks (2015) defines as an "active attitude" to nature conservation. This is done throughthe concept of "nature development", by which the Dutch government aims to carry out ecological restoration practices, assisting nature to reobtain its original ecological condition, the one it had before the degradation produced by man led land use (van der Heijden, 2005). Such practices are considered by some authors, such as Volis (2019), as necessary. In this regard, Volis(2019) deems the approach of passive conservation as not sufficient to halt biodiversity decline. Consequently, "the active attitude" to nature conservation, bynot only establishing protected areas ("*passive conservation")* is required. Adding up the long term expertise of the Netherlands, and their active approach towards nature conservation, it makes the Dutch case is a good opportunity to explore the implementation process of nature policies combining both, the creation of protected areas and carrying out the necessary ecological restoration measures.

1.1. Research problem

Besides the current weak results of conservation practices pointed out by several authors, such as Marcuzzo & Viera (2015), Volis (2019) and Mensourian (2017), conservation suffers of other bottlenecks, being these the problem of interest for this research.

To begin with, conservation policies and projects face an "implementation gap" (Keeley et al., 2018; Beunen et al., 2013). As such, *"implementation gap"* or "*implementation deficit"* can be understood as the discrepancy between objectives defined and outcome achieved through a specific program or policy (Hill & Hupe, 2005). To address it, the current knowledge is either scarce or deriving from natural sciences. For example, knowledge on nature conservation is mostly focused on management of species and their population dynamics, whereas the scientific literature related to land use and governance for ecosystem conservation and restoration is rather scarce (Runganap et al., 2020). At the same time, existing literature on management of conservation projects is originated by practitioners and is not likely to originate from scientific research practitioners (Mascia et al.,2014; Hulme, 2014). Lastly, specific knowledge on implementation of nature policies lacks an understanding of which factors influence the outcomes of policy implementation for nature conservation (Pezdevšek Malovrh et al.,2019).

When it comes to the Dutch nature policies, its implementation has yielded results that, so far, have proven to be insufficient to improve the current state of biodiversity (Folkert & Boonstra, 2017). Even though the country has shown leadership and political will to develop nature conservation policies, the implementation of the European Natura 2000 sites and Habitats and Birds directive has been below expectations (Wiering et al., 2018; Beunen & Hagens, 2009; Beunen et al., 2013.).

As a way to support the achievement of the european directives and international compromises regarding biodiversity, the Netherlands opted to implement its nature plan , being the NEN a core element of it(Sanders et al., 2019)However, the attempt to establish its NEN has been developed at a low pace, compromising the possibility to be fully implemented by 2027 (Folkert & Boonstra, 2017; Bakker et al., 2015). In this regard, the research carried out by Kuindersma et al. (2020) shows that the margin for completing the NEN in time and meeting the set targets has no margin, reason why the pace at which it is implemented must be maintained. On top of this, restoration measures have also witnessed a declined. In this regard, only 28% of the planned measures were actually implemented by 2020(Sanders et al., 2019).

1.2. Research aim and research questions

The following section will introduce the aim of this research and the question, which aim to be instrumental to reach its research aim.

Research aim

Considering the knowledge gap and the current international ambitions to halt the degradation of ecosystems and enhance their recovery, the aim of this research is to contribute to the body ofknowledge regarding the implementation of nature conservation and restoration policies. In this way, the research will contribute to the betterment of current and future nature conservation and restoration efforts. Additionally, by focusing on the Dutch NEN, the research will provide insight into what factors hinder the successful implementation of the NEN and restoration practices in the Netherlands

Research questions

To structure and guide this research, the following research question and sub questions will be answered:

To what extent have the restoration activities required for the creation of the Dutch national ecological network been implemented from 2007 to 2014, and how does the policy content and its context account for the results?

How has the implementation of the NEN and restoration activities progressed throughout the years?

How does policy content s influence the implementation of theNEN and nature restoration practices?

How does the policy context contribute to the successful implementation of the policy?

1.3. Scientific and societal relevance

The following section will introduce and elaborate on the scientific and societal relevance of this research, in that respective order.

Scientific relevance

The relevance of this derives from it contribution to the existent, but scarce, knowledge on conservation policy implementation. In this way, it will support the improvement of the current implementation deficit of biodiversity policies (Keeley et al., 2018; Beunen et al., 2013; Santa María & Mendez, 2011). Additionally, there is a current lack of insight in land use policies and governance of conservation and restoration practices, being the existent knowledge much oriented to biology and ecology (Runganap et al., 2020). Finally, the knowledge produced by means of this research will be of scientific nature. As such, it differs from the existent knowledge on management of conservation projects, which is mostly carried out by practitioners (Mascia et al.,2014; Hulme, 2014).By researching the Dutch implementation case, this work can address the current knowledge-gap regarding private led nature conservation, as pointed out by Godenn & Sas- Rolfes (2019). The reason for this is that agriculture and farmers are important elements in the implementation of the Dutch nature policy. Farmers and landowners have the possibility of carrying out a *"Self-realization"* of nature management on their own land to support biodiversity (Folkert & Boonstra, 2017; Kuindersma et al., 2020). By analysing the implementation of the Dutch NEN, it will be possible to identify the drivers behind the motivations and factors deterring farmers from transitioning to sustainable land uses.

Societal relevance

The theoretical knowledge that this research can provide regarding the implementation gap of conservation policies, adds to its societal relevance. As such, the societal value of this research builds upon the importance of nature and biodiversity conservation not only in the Netherlands, but for society as whole. Firstly, the Netherlands have assumed compromises with the EU, such as the implementation of Birds and habitats directive and Nature 2000 sites. However, such compromises are not yet fully met (Folkert & Boonstra, 2017; Beunen & Hagens, 2009; Beunent et al., 2013). To increase biodiversity rates within natura 2000 sites and meet the requirements of Birds and Habitats directives, the implementation of the NEN and restoration practices are of key importance (Folkert & Boonstra, 2017). Additionally, the Netherlands has witnessed increase levels of Nitrogen in different landscape, this has a direct effect on the biodiversity and has become a national priority and on its economy, since no new activities are allowed in certain areas without a reduction of current nnitrogen concentrations (Heer et al., 2017). Moreover, on a broader perspective, nature and conservation support several benefits that society can obtain from nature(Mitchell et al., 2021). Benefits range from economic development to genetic resources, protection from environmental impacts to even cultural services (Mulongoy & Gidda, 2008; Balmford A., 2002; Nelson et al., 2009; Hora.B, 2018; Mitchell et al., 2021). Furthermore, livelihoods of local communities are highly dependent on biodiversity and the state of nature(Convention on Biological Diversity, n.d.).

Secondly, and not less important, this research takes place within an extraordinary global context, as societies around the world are dealing with a pandemic. The relation between ecosystem degradation and biodiversity loss has been stressed repeatedly in the last year. Biodiversity and habitat loss increases the chances of zoonotic virus being able to infect humans. This occurs due to the spillover effect, referring to the pathogen moving from one host to another. While viruses evolve within their animal host, habitat loss and anthropogenic made changes on the environment increase the chances of new infectious disease affecting humans, through a higher contact rate between individuals and wildlife (Mitra et al., 2020). Therefore, policies for habitat and biodiversity conservation and restoration are necessary to reduce the spillover effect and probability of a new pandemic (IPBES, 2020).

Thirdly, improving biodiversity is at the core of world's efforts to address climate change, as the European Union understands and acts accordingly. Reason why, it is expected to promote a new nature restoration law, setting specific targets to be met by member countries(European Commission, 2021). The relationship between climate change and biodiversity is two ways. On the one hand, biodiversity can mitigate climate change by supporting the proliferation of green areas and plant species, which in return can act as carbon sink. On the other hand, climate change have proven negative effects on the adaptability of different animal and vegetable species(Convention on Biological Diversity, n.d.).

2. Literature review and theoretical framework

The following section will introduce the literature review. This, consists of two bodies of literature, the Dutch context in which the NEN will be implemented, and diverse theories in the field of policy implementation.

2.1. The Dutch nature policy

In the Netherlands nature policies are closely linked to other legislation from diverse fields and levels of government. Moreover, the country does not only count with specific national policy but also with European laws and directives. One good is example is the EU Birds and Habitats directive, which aims to decrease the halt of biodiversity within the EU territory. Next to it and being instrumental to the achievement of the directive's goal, the creation of Natura 2000 areas has been a key approach(Heer et al., 2017). In order to meet its international responsibilities, the Netherlands develops specific national legislation. For example, the Nitrogen Integrated Approach (PAS) which has a direct impact on the ecological condition in and outside Natura2000 areas, as it aims to lower nitrogen deposit levels to support biodiversity(Folkert & Boonstra, 2017).

Another important policy deriving from the European Union is the water framework directive, which has a clear influence on the ecological conditions of the areas in use for water management. Moreover, there framework established specific requirements when it comes to ecological conditions of surface and underground water bodies(Ligtvoet et al., 2008). Similarly, to the national nature policy of the Netherlands, responsibility for European Directives and legislation rely on the national governments as ultimate responsible agent. On top of this, the riverine areas are also subject to the national water management strategies. In this specific case, the country has been developing what is known as "room for the river" as its approach to water risk management. As part of its strategy, the country aims to make use of riverine areas as flood plains to be used in case of flooding. Interestingly, the connection with nature policies goes even further. In this specific case, the ecological restoration of riverine areas and flood plains is an actual practice with several benefits regarding water risk management(Ministry of Transport, Public Works and Water, 2005).

Naturally, this overlay of national and international legislation results in a diverse group of actors with interests and influence on one same area. This is further enhanced by a process of decentralization that has been taking place, distributing tasks and responsibilities to lower levels of governments and other actors. For example, when it comes to water management, the water framework directive requests to involve citizens and other actors , in a multi level governance approach. To cite an example, in the Netherlands this translates into subbasin areas being managed by provincial water bodies and working next to municipalities(Ministry of Transport, Public Works and Water, 2005).

The process of decentralisation does also apply to the Dutch nature policy and the implementation of the NEN. The reform of 2013 brought along important modifications to the process of establishing the NEN. To begin with, a new NEN was planned and equally important, nature policy witnessed a "decentralization process". From 2013 onward, provincial governments would become responsible for expanding the NEN within their territories. To do so, they could either offer a "voluntary buying" offer to landowners or they could well opt for "self-realization", meaning that agricultural practices would need to change in other to support biodiversity. Finally, the third option is the one of "expropriation", which has been seldomly used by provincial governments (Folker et al., 2020; Kundersma et al., 2020). Consequently, this sets three possible implementors for the land acquisition and restoration processes. It can be done by the provinces, nature organizations, or private individuals who change the land use of their property.

The inclusion of different actors implies that their interest will also be influenced and will play its part in the implementation of the policy. In this regard, besides the provincial government as ultimate responsible for the implementation of the NEN, landowners such as agricultural producers, recreation areas, nature organizations and water management agencies might also see their interests affected by the implementation of the NEN(Folkert & Boonstra, 2017). As a matter of fact, this has been the case since the beginnings of conservation policies. For example, in 1998 the Dutch Nature Conservation Act limited the expansion of economic activities close to Natura 2000 sites. As an expected consequence, different social groups have reacted negatively against these kind of nature policies. In particular, the active economic sectors such as agriculture and industries(Heer et al., 2017). At the same time, some actors find the implementation policy to be in favour of their interests. For example, and as it has been previously mentioned, water bodies are also interested in carrying out restoration activities on flood plains areas to meet responsibilities from other legislations(Ligtvoet et al., 2008).

Economic implications of the policy extend over to financing mechanisms, as they used to address constituent groups interests and make the implementation of the policy viable. In this regard, there are two different approaches that have been carried out by the provinces to finance the implementation of the policy. In the case that the province buys the land, the costs are covered fully by the provincial government and the land is later given to an organization for its management. Contrary to this, when the land is bought by an organization or a private individual, the provinces subsidise the purchase and the owner is required to pay at least 15% of the total value of the land while the rest is subsidised by the provincial government. Similarly, when land is not bought, but is added after a change on its land use or function, the landowner receives a compensation for the loss of economic productivity(Folkert & Boonstra, 2017). In this way. Provincial governments see their costs reduced, as they do not have to compensate for land depreciation and its acquisition. Nonetheless, actors such as recreation organizations and agricultural producers present a rather limited investment regarding the NEN(Folkert & Boonstra, 2017).

The restoration of land leads to restores land as second necessary output to achieve the policy objectives of an improved biodiversity and is also subject to specific financing mechanisms. After the decentralization of the nature policy, the implementors of restoration can be both nature organizations, private individuals or owners of agricultural land who have opted to change the land use of their plot. In the case of the latter, they must do it in a collective form, under an umbrella organization or "collective"(Kuindersma et al., 2020; Wouters & Beukema, 2007). The financing of the restoration and management activities is done in the form of subsidy by the provincial government through the Nature and Landscape Subsidy system (SNL). This can be in the form of funding for nature organizations, or by compensating the agricultural enterprises whose profit has diminished due to a change of land use. Nonetheless, some requirements must be met and not every land plot or nature manager is eligible for a SNL subsidy(Bij12, 2016, p. 12).

2.2. Implementation theory

Policy implementation can be traced back to 1950's, when the policy process approach raised as a theoretical lens within policy sciences. However, in its beginning it was merely conceived as a necessary step in the policy process (de Leon & de Leon, 2002; DeGroff & Cargo, 2009). Policy implementation has been defined as a specific stage in the life cycle of policies, more specifically, it is conceived as the process of transforming an idea or goal into an action, which aims to address an specific problem (O'Toole, 2000; DeGroff & Cargo, 2009). In other words, policy implementation can be defined by looking at the stage in which it takes place within the whole process of policy making. As the term states, implementation occurs at the later stages, differentiating itself from the subprocess of policy formation (the definition of the pressing problem and the solutions to it) (Hupe, 2010).

The kick-start of policy implementation as a science was triggered by the work of Pressman & Wildavsky (1978). They stressed the divergence between the aforementioned stages (defining a policy and the final results to be obtained). This conception would later be defined as the *"first wave"* of policy implementation theory (de Leon & de Leon, 2002*).* Their thesis was clear, implementation was highly dependent on the chain of causality, referring to the distance between top governmental levels, who define policies, and lower levels at which the policy is implemented. Therefore, the longer the chain, the higher the chances of not achieving the expected results. This is what Pressman & Wildavsky defines as "*implementation deficit",* referring to the implementation process as the source of mistakes, impeding the achievement of the pre-defined objectives (Hill & Hupe, 2005). This perception of policy implementation was later defined as a "*top- down approach".* Naturally, critics surged, and the second wave of policy theory emerged and was, not surprisingly, labelled as a "*bottom- up"* perspective. The focus was now placed on the lower level actors, who were determinant in the implementation process. As a result, to avoid unexpected drawbacks in later stages, implementation should be considered and planned during the policy formation phase (de Leon & de Leon , 2002) . Consequently, the processes of policy formation and implementation tend to blur. Additionally, the focus is placed on the strategies followed by actors responsible for the implementation, who will likely deviate the previously defined policy for their own ends (Sabatier, 1986). Finally, the third and, later the fourth wave of implementation theories were developed. While theories pertaining to the third wave focused on behavioral aspects of the actors responsible for implementation, the lately developed theories integrated actor-oriented perspective of previous theories with concepts.

surrounding the policy process and a focus on decision making stages (de Leon & de Leon , 2002; Howlet, 2018) . Some of the models of the fourth wave are a) *Phase model, b) Streams model and c) Rounds model*, in which policy making process is the main point of interest. Consequently, policy implementation is not addressed by them. These models provide explanation for the policy objectives and programs. Being them defined by the input of different actors and insights of different *"streams",* such as the problem and potential solutions (Howlet, 2018; Teismann, 2000). The approach of these models fits those interested in the policy formulation process as an element determining the outcome of the implementation. Therefore, they are not deemed relevant to the objective of this research.

Having reviewed and disregarded the latest models of policy implementation theory, the first wave models deserve a thorough analysis. One of them is the framework developed by Sabatier and Mazmanian (1980), which proposes an alternative lens to the one suggested by the fourth wave models such as the phase , streams and rounds model. For example, the framework does not analyze the policy formulation process. Secondly, they bring into consideration both internal and external variables influencing the implementation process. They posit that the potential for a policy to address a specific problem will be dependent on a) the diversity of the target group behavior, b) the percentage of the target group as part of the whole population, c) the exchange of behavioral change required.

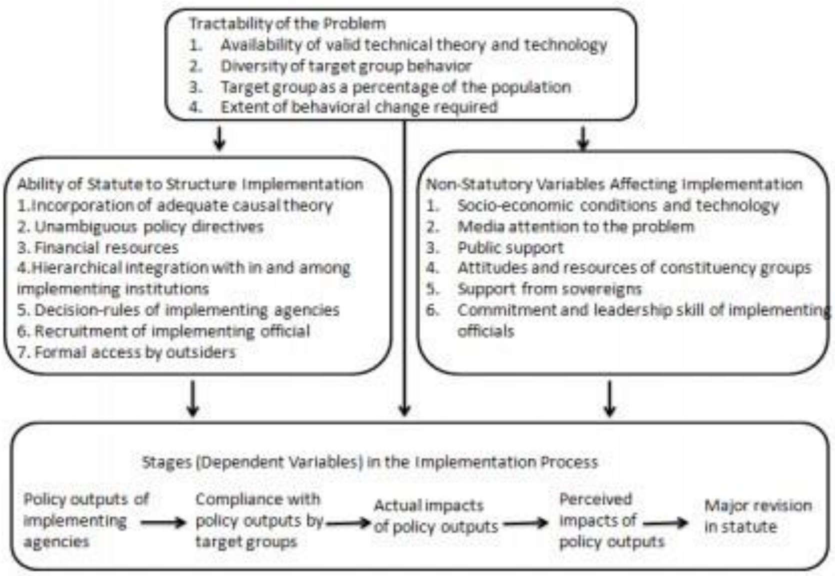

Figure 1Sabatier & Mazmanian framework. Source : Xu & Gao (2017).

Furthermore, the implementation process will be conditioned by two domains of independent variables. On the one hand those related to the policy itself and the relevant agencies, such as financial resources, clear objectives, and hierarchical integration of responsible agencies. On the other hand, external variables are also considered in the framework. For example, socio-economic conditions, public support, and attitudes of the constituency groups, among others (Hills & Hupe, 2002). A relevant characteristic of the framework is the multi-actor nature, achieved by introducing not only the governmental units in charge of implementation but also target groups. This is highlighted by several authors as an important characteristic of implementation theory, as it moves away from a single agency perspective and solely dependent on governmental authority (Xu & Gao , 2017; Conteh, 2011; O'Toole, 2000; Sabatier,1986).

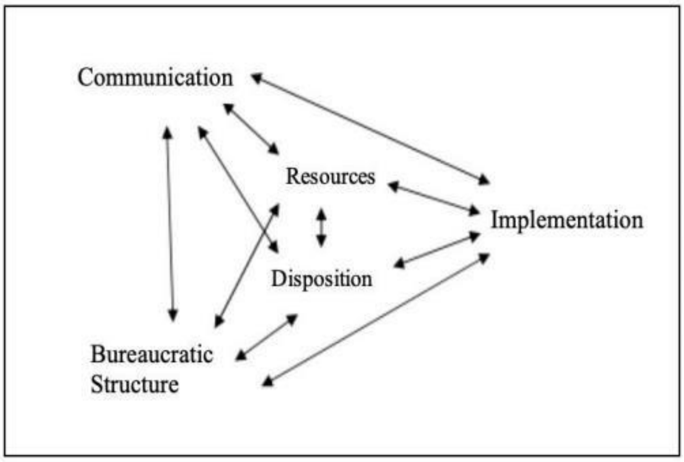

Figure 2Framework by Edward. Source: Mubarok et al. (2020)

A similar framework developed around the same time is the one by Edward (1980), who holds communication, bureaucratic structure, behaviors of implementers and resources as elements conditioning the implementation success. These elements become more relevant with higher levels of fragmentation in the bureaucratic structure. This is in line with the thesis of Pressman and Wildavsky, who stated that the bigger the chain of implementation, the higher the chances for an implementation gap to occur (Hupe, 2010). Therefore, the focus of this framework is on the process of the policy implementation.

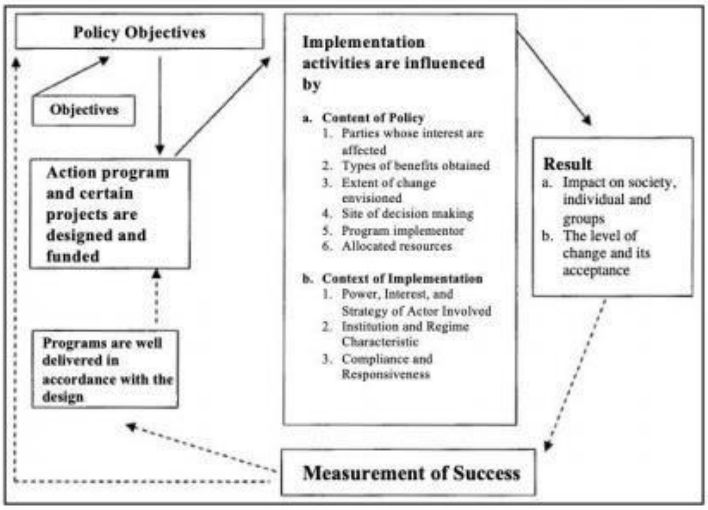

Figure 3, Model by Grindle. Source: Mubarok et al. (2020)

Another framework worth of consideration is the one developed by Grindle (1980), in which the content of the policy, more specifically the identified problems and subsequent objectives, take central role for the policy implementation assessment. Therefore, the implementation of the policy can be assessed against the previously defined objectives (Mubarok et al., 2020). While this is a distinctive element in the framework as compared to the one developed by Sabatier and Mazmanian (1980), both frameworks include variables pertaining to the policy itself and the context of implementation.

While the models of a) policy streams , b) rounds model and c) phase models are focused on the whole process of policy making, the frameworks by Sabatier and Mazmanian (1980), Edwards (1980) and Grindle (1980) omit the process of policy formation and depart from already defined objectives. Therefore, focusing solely on the implementation process. These three frameworks are operationalized by Mubarok et al., (2020) goes one step further and succeed in operationalizing the previously mentioned first wave frameworks. The authors are able to combine them following the policy triangle model. As such, it summarizes the key elements of any policy implementation model in content, process, actors and context. In this way, the most relevant aspect of the frameworks developed by Sabatier and Mazmanian (1980), Edwards (1980) and Grindle (1980) can be integrated.

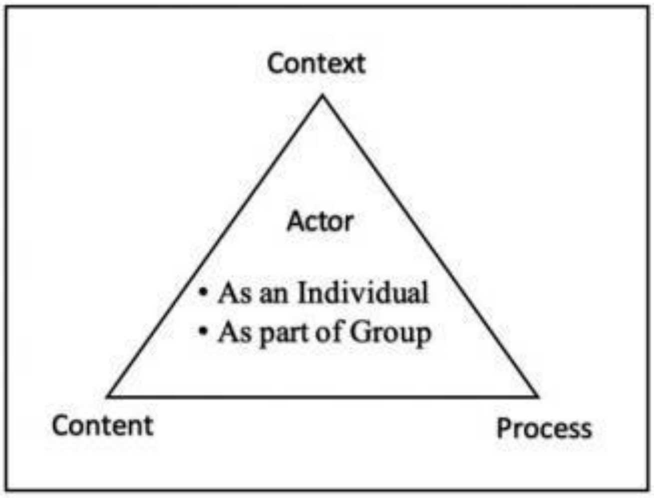

Figure 4,Triangle model Source: Mubarok et al. (2020)

3. Conceptual model

As the previous section showed, there is a variety of frameworks for policy implementation analysis. To operationalize a framework based on the different models within policy implementation theory, the fourth wave of implementation models, more precisely the rounds, policy streams and phase models, have not been taken into consideration. This has been decided on the basis that, the fourth wave models focus on the policy formulation process instead of the later stage of implementation. Meaning that the fourth wave of implementation models is focused on how a policy came to be, and not how it is implemented. In fact, other authors such as Knoepfel et al. (2011), identify this difference between implementation and policy formulation or “programming”. Therefore, the frameworks by Sabatier and Mazmanian (1980), Edwards (1980) and Grindle (1980) have been taken as the main reference, as they are specifically oriented to analyze the implementation process of a given policy.

The overarching structure is based on the models by Sabatier & Mazmanian framework (1980) and Gridle (1980).To begin with, the central policy objective acts as reference against which the assessment of the policy implementation is carried out. In this way, it is possible to a) identify the main outputs of the policy, and b) asses to what extent those have been met. Two groups of independent variables, namely the statutory (policy-content related) and non-statutory variables are distinguished. For this research, the statuory variables will be conceived as “the content of the policy”, while the non statutory variables will be considered as part of the “context of the policy”. Moreover, this same approach has been taken by by Mubarok et al. (2020) , as part of their triangle model.

Finally, the over-arching structure will be completed by the stage of assessment of the policy implementation. As it was previously stated, the assessment will be done on the basis of outcomes specified by the policy, being this objective that the implementation of it should achieve. Therefore, departing from the inclusion of the outputs in the conceptual model, conceiving it a central part of any policy. This is in line with the model by Grindle (1980) which measures the success of the implementation against the policy objectives.

In short and to summarize the general structure of the conceptual model, the output of the implementation process can be considered as the dependent variable, and to be the result of the several variables within the two categories of independent variables, specifically the content and context of the policy.

Going one step further, it is also plausible to specify the independent variables to be included into the subgroups of the content and context of the policy. Following the model by Grindle (1980) and Sabatier & Mazmanian (1980) , the content of the policy will be composed by a) *the financial resources*, *b) the implementor* , and c) *the extent of change* envisioned. Next to this, the context in which the policy is applied, contains *the attitude of the constituent groups* as its unique variable in conceptualized framework. Including this specific variables is not only important given the Dutch policy itself, but also in general terms. In this regard, other authors, such as Knoepfel et al. (2011) consider actors (both implementors and constituent groups), along with financial resources to be at the core of every policy implementation process.

The extent of change is at first glance, one of the most influential variables on the prospects of a successful implementation taking place. The hypothesis behind is that, the bigger the extent of change sought by the policy, the bigger the difficulties it will face. This applies to both quantitative terms as well as qualitative aspects, such as the diversity of elements or conditions to be changed (Mubarok et al., 2020).

The financial resources play an important role in policy implementation and refer strictly to the resources with which the policy is equipped. Therefore, meeting the policy objective is highly dependent on the existence of sufficient funding (Sabatier & Mazmanian, 1980). Moreover, resources are ought to be available at different stages of the policy implementation(Hill & Hupe, 2002).

The relevance of available resources can be traced all the way to constituent groups, being them the target group which the policy aims to reach. In this regard, the resources with which these actors count is also important, but their attitude toward the policy is equally relevant. Along this line of thought, some authors consider that the likelihood of a successful implementation increases if constituent groups are provided with sufficient resources and their interests are addressed (Sabatier, 1986).Furthermore, the response of those affected by the policy , as Hill & Hupe (2002) suggest, should be taken into account as a feedback loop for the implementation. At the same time, it is sometimes convenient to consider the constituent groups as co-implementors of the policy.

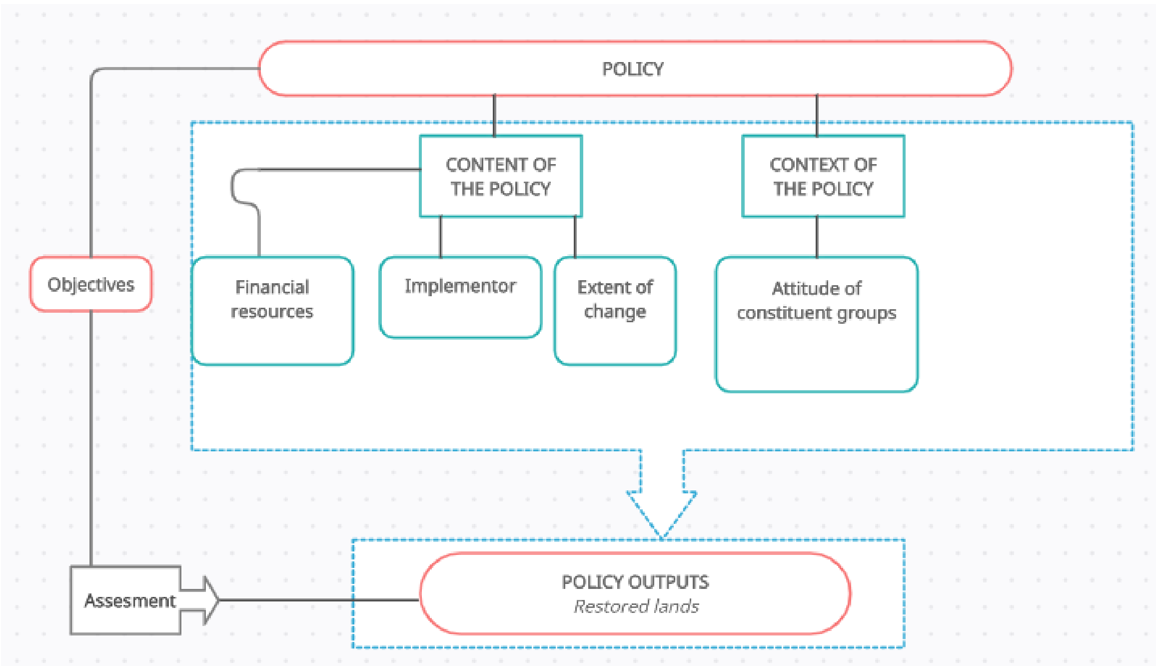

Figure 5, Conceptual model

3.1. Operationalization

The following section describes how the theoretical framework has been interpreted and applied to the specific case of the Dutch nature implementation policy. It is important to remark that this research will consist of a) An overview of the current status of the land acquisition and restoration processes, through a survival model, and b) A deeper analysis of both practices, through two different binary regression models. Therefore, while the dependent variables are specific for each activity, the independent variables will be used for both the binary regression models.

3.1.1. Policy objective: Theoutputs of Land acquisition & ecological restoration

Along the lines of the theoretical framework, the dependent variable will be defined by the objectives of the policy. Here, it is necessary to make a remark. Within the objectives of the policy, it is possible to differentiate between outcomes and outputs. In the case of this research, the focus will be explicitly and solely on the outputs of the implementation. In this regard, the outputs can be considered both the acquisition of land ,and their ecological restoration within the NEN. The reason for this being that, the outcome of the policy would be an increased and improvement of biodiversity, while the aforementioned outputs are a perquisite to achieve the outcome. As the Dutch nature policy establishes, acquisition of land can be done in different ways. Therefore, all those areas which are directly acquired or are owned either by nature organizations or agricultural producers who have transitioned to sustainable practices will be considered as acquired. When it comes to the ecological restoration of areas, the definition has been done in a straightforward manner, as only the fully restored lands have been considered to comply with the policy objective. Finally, those observations for which the total area restored or acquired equals the total surface, will be coded as 1.

3.1.2. Content of the policy

The content of the policy represents one of the main subgroups of the independent variables and is composed of 3 three different variables. Firstly, the extent of change, which can be interpreted as the area that needs to be acquired or restored. This will be done on the basis of the surface extent of each variable. Based on this, the extent of change will be estimated by the subtraction of the total surface , minus the sum of acquired or restored surface for each specific observation.

Secondly, the variable of implementor of the restoration practices can be applied to two different actors of the Dutch context. On the one hand, the provinces as implementors and ultimate responsible of the creation of the NEN within their territory. On the other hand, the specific ownership of the land has a roll to play, as it is those actors the one carrying out restoration activities. Therefore, implementing agents will be considered to be the provincial governments, while the specific owners will be taken as constituent groups and will be further explained as part of the context of the policy. Implementors will be defined based on the provincial jurisdiction on which areas to be acquired are restore fall. Therefore, the implementor will be one of the 12 provincial governments in the Dutch territory.

Finally, one more variable to be considered is the one of financing. In this regard, the variable of financial refers to the perception and origins of subsidies or budget for both the land acquisition process and the land restoration activities determines specific subsidies to be used by the owners and specifies which actors are not entitled to a specific financial instrument. At the same time, given the mix of actors and land uses involved, other source or financing outside the Dutch nature policy will also be considered, as in the case of areas related to water management projects.

Financing	**Goal for acquisition**
Nature network specific	*"new nature" or "NEN" –*
Other	*Riverine and water management areas - wetlands*
None	*Other*

Table 1, Operationalisation of the variable financing

The operationalization of the variables related to the content of the policy will be done in two ways. One the one hand, the goal for the acquisition was used to operationalize the variable of financing instruments. The different goals for acquisition of areas were used as a proxy. In this way, it is possible to infer a specific set of funding sources based on the future use of the respective areas and their related fundings. To be more precise, areas with an acquisition goal of new nature or new nature extra, will be assumed to have the specific funding by the nature policy. Contrary to this, areas with diverse goals for acquisition will be considered to have non specific funding, while those areas related to activities of water management, including wetlands areas, will be assumed to count with funding derived from water bodies. In this case, the funding will be defined as "other". The aforementioned categories are described on table 1.

Table 2 summarizes the operationalization of the variables belonging to the content of the policy as informed by the theory on policy implementation. Next to them, the different data sources are specified for each variable.

Theoretical framework	**Variable in the model**
Financing	*Acquisition goal*
Implementors	*Provinces*
Extent of change	*Observation's area*

Table 2 Operationalisation of the variables belonging to the policy content

3.1.3. Context of the policy

The context of the policy is the second subgroup of independent variables from the theoretical framework. In this case, the observable land use of the different land plots can provide insights into the ownership of each area. Departing from this, the attitude of the constituent groups are defined.

Theoretical framework	Variable in the model
Attitude constituent groups	*Landuse (2008)*

Table 3 Operatinalisation of the variables belonging to the context of the policy

The actors who own the land can be consider as constituent groups and denote either a supportive or not supportive attitude. More specifically, actors linked to those areas in which economic activities are carried out, such as agricultural lands or urbanized areas, will be hypothesized to have a negative attitude towards the creation of NEN and restoration activities. Contrary to this, the areas used as nature areas or water management will be considered to be under management of constituent groups with a positive attitude, as actor's interest are in line with improved ecological status of the land. In short, as table 4 indicates , urbanized , agricultural and recreation areas are assumed to have a non supportive attitude by their owners or managers, while nature and water management groups are supportive of the policy implementation.

Attitude constituent groups	
Urbanized landuse	*Not supportive*
Agricultural lands	*Not supportive*
Nature areas	*Supportive*
Water management areas	*Supportive*
Recreation areas	*Not supportive*

Table 4 , Operationalisation of the variable attitude of constituent groups

4. Data gathering and data analysis.

The following section will elaborate on the process of data gathering, including data selection , and an overview of the analysis methodology chosen in the section of data analysis.

4.1. Data Gathering

This work can be defined as a desk type of research, as it will make use of pre-existent data. More specifically, two different data sets have been used and combined, the Natuurmetig op kaart (Bij12,n.d) and the bestandbodemgebruik(CBS, n.d.). Departing from these data, one unique data set has been created through the use of ArcGIS and SPSS. This process, as represented in figure 6 , it was done in the following sequential steps: a) Selection of observations pertaining to the NEN by means of ArcGis, b) merging of land use data on the observations selected in step “a” through ArcGis, and finally, c) aggregation of data through SPSS.

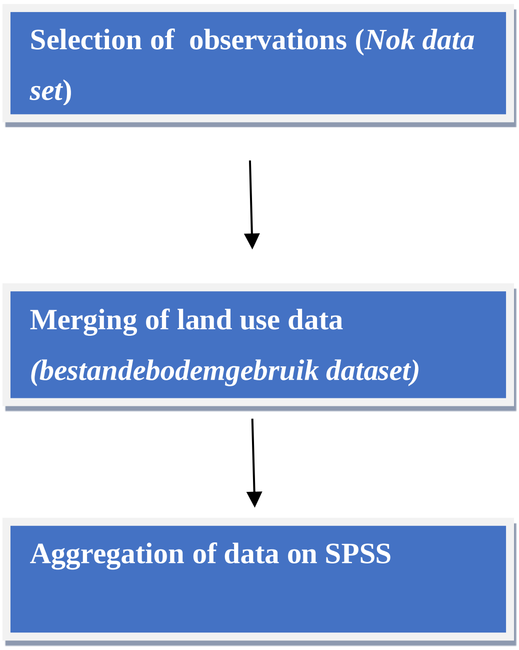

Figure 6 , Summary of the data gathering process

To carry out an analysis of the land acquisition and restoration activities 7 different data sets will be used. The creation of this data observations pertaining to a time span of over more than 5 years. More specifically, from 2007 to 2014. Therefore, the data sets differ from each other regarding the variables and categories they contain. The aim has been to reduce the variety of data sets used as much as possible, to achieve the higher degree of similarity in the process of data measurement through the years.

On the one hand, for the years 2007, 2010,2011,2012,2013 and 2014 the data sets used will be the ones of NOK (Natuurmetig op Kaart) developed by Bij12. The datasets pertaining to different years have been merged through ArcGis software. Additionally, the data set “*Bestaandebodem gebruik 2008”* by CBS has also been incorporated into the research and merged through ArcGis with the NOK datasets.

Through the use of both NOK and Bestaandebodemgebruik datasets, all the different variables as defined by the theoretical framework were operationalized. While the latter contains information solely regarding current land uses in the Netherlands, the NOK dataset counts with diverse information regarding the NEN. This data included information on the status of lands regarding their acquisition and need for ecological restoration, goals for its acquisition and management, among others.

The bestande bodemgebruik is a dataset developed by CBS (Central beureau for statistieks) and presents different categories as possible landuse. It is organized in 8 different caegories, within which different specific uses are included. The main categories in the data set are the ones of a) Traffic areas, b) Urbanized , c) semi urbanized ,d) Recreation areas ,e) Agricultural areas , f) Forest and open nature , g) Inland water areas and h) outer water areas referring to the dutch coast areas(Centraal Bureau voor de Statistiek, 2008).

Given the variety of information within the NoK data set, it is organized in differet GIS layer, or subdatasets with information on specific topics. This is illustrated through table 5, showing which subdata sets were present for each year.

NOK DATA SET LAYERS	2007	2010	2011	2012	2013	2014
BBL_BUITEN						
BEGRENZING						
EHS						
EHS_PLANOLOGISCH						
RODS						
VERWERVING INRICHTING						
Kopel						
BBLBEZIT_OASEOPDRACHTEN						
BEGRENZING_SIMPLE						
VERWERVING_INRICHTING SIMPEL						
EHS_PLANOLOGISCH SIMPEL						
BEGRENZING_ZONDER OVERLAP						
BEHEER_DR						
BEHEER_RODS						
BEHEER SIMPEL						
EHS PLANOLOGISCH DR						
EHS PLANOLOGISCH DR SIMPEL						

Table 5 , Totality of the NoK data sets for each year

Each data set contains within it different layers for each year. At the same time, these layers are made up of different attributes, or variables. Therefore, each variable, as presented in the operationalised model, were measured based on a specific attributes of the different layers.

Table 6 indicates the two main data sets , NoK "verwerving_inrichting" and Bestaandebosemgebruik, the different attributes within the layers of "*NOK"* data set -*"inriching verwerving"* layer- for each year, and how each of the data sets provided information for the different variables. This is also showed in table 6.

Land acquisition & Land restoration					
NOK data set: ***2007,'2010,2011,2012,2013,2014*** **"Verwerving_Inrichting"**	**Dependent variable**	**Independent variables**			
	Land acquired – Land restored	**Implementing Province**	**Financing** (*Based on land use)*	**Attitude constituent groups** (*based on landuse and consequent ownership)*	**Extent of change**
Doel verwerving					
Status Verwerving					
Status Inrichting					
Financiering Verwerving					
Financiering inrichting					
Eigenaar					
Beheerder					
Province					
Shape_area					
Bestaandebodemgebruik: 2008					

Table 6 , Sourcing of data per variable

Within the data set all the different natural areas of the Netherlands are measured. The population goes from green areas adjacent to the city to nature parks and agricultural lands that fall within and out of the NEN. Therefore, a purposive sampling was carried out. This means, that observations were selected as long as they could be considered part of the NEN.

The years 2007 to 2014 were filtered by making use of the layer "verwerving_inrichting" and selecting by attributes those observations for which the value to "doel verwerving" was not equal to Rods (*recreation op the stad)*. This means, that green recreational areas in the city- Rods, *Recreation op stad*, were left out. In this regard, the same differentiation has also been made by other research, such as Kuidersma et al (2020) to assess the implementation of the NEN. In short, Rods are areas outside the NEN ,and for which different financing mechanism and actors are involved.

Figure 7 , Demarcated National Ecological Network

After selecting the different observations from the data sets for each respective year, an overlay of the different data sets was done on ArcGIS to follow the observations through out the years. In order to identify each observation within the different year layers, a unique ID was given to each observation in each year. This was done on the basis of their original ArcGis ID , to which a prefix was added , "*year_ID".* By means of the *"Union"* tool of ArcGis, it was possible to define the sum of the different lands, and observations for in each year as the total sample of observations for this research. In this way, the final sample and observations were defined. Each observation was composed of the different landplots present in each yearly data set and that geographically overlayed. In this manner, some observations were composed by observations present in every year, while others were made of observations present in one year.

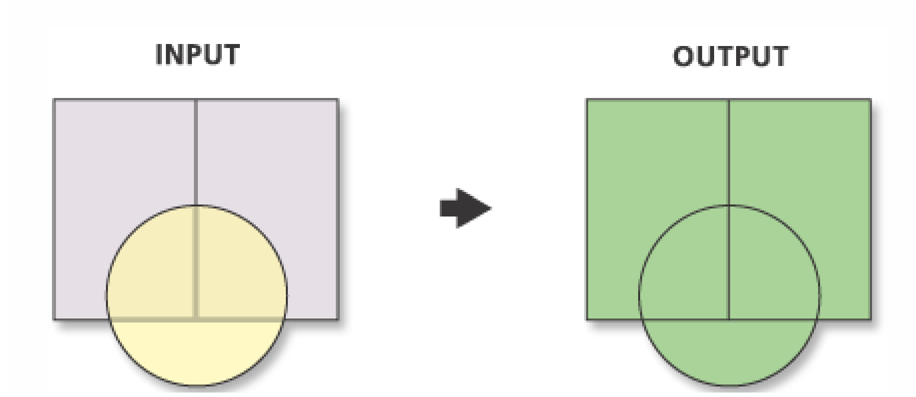

Figure 8 , Representation of the union process in ArcGis,(Source: ESRI 2016.)

As figure 8 representes, ArcGis enssambles one data set through the combination of several layers or data sets.

The selection of areas to be taken as observations for the analysis can be seen by comparing figure 7 and 8. On the one hand, figure 7 shows the whole of the NEN, including areas and natural reserves which were already integrated in the network. On the other hand, the area as indicated in figure 8 is a result of the union of observations of the NoK data set through ArcGis.

Figure 9 , Result of the selection of observations through the ArcGis union tool

After selecting the observations of relevance for the implementation of the NEN, the data from the bestandebodemgebruik data set were merged with the previously done selection. Once again, this was done through the use of ArcGis. However, in this case the process realized was an "*intersection"*. By means of it, it is possible to extract the data of a new data set that overlay with a pre existent dataset. Therefore, the selection of observations initially done with the Nok data set worked as reference, and the data from the bestandebodemgebruik data set was added for these specific selection of observations.

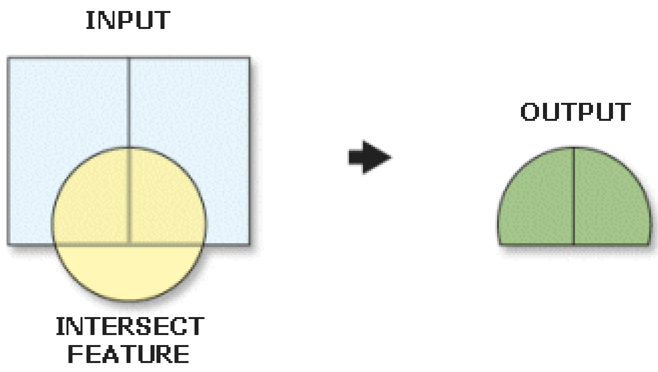

Figure 10 Representation of the intersect process in ArcGis (Source: ESRI, 2016).

Figure 11 shows the data set of bestandbodemgebruik in ArcGis. Each different colour represents a different land use and further details were given in section explained in section. This specificinformation was added to the observations of the NoK data sets.

Figure 11 Different landuse in the Netherlands (Source: CBS,2008)

4.2. Data analysis

This section introduces the data set structure is followed by an overview of the methodology for analysis .More specifically, the survival model and binary regression analysis. Finally, the section describes the process of construction of the variables used for the different analyses.

4.2.1. Dataset structure

As a result of the data processing in ArcGis, one data set containing all the observations was generated, from there onwards, observations were selected for the models of acquisition and restoration respectively. Initially, the data set contained all the observations that overlayed geographically and pertained to different years. As those observations overlayed, a unique ID was given to them. These became the unit of analysis in this research. However, it was necessary to aggregate the data and merge the observations of each different year into one same group of observations. Which, in the end, would constitute one same observation and the unit of analysis for this research. To do this, their corresponding unique ID and year were used as breaking variables of reference. Finally, as table 7… indicates, the data set was structured as follows: A- *New ID* representing each unit of analysis, B- *Year* in which that observations was present , C- *Number of original observations* composing the new observations generated on the basis of the overlay, and D- Dependent and *Independent variables.*

New_ID	Year	Number of original observations.

Table 7 Data set structure

Additionally, the different variables of interest for this research were aggregated and included in the data set. Among them they are : *a- Surface area , b- Land use categories c- acquisition goal , d- Provinces categories , e- extent of change , f- time variable* and *g- dependent variables : Status restoration and Status acquisition.*

4.3. Choice of method: Binary logistic regression & survival model

This research will be based mainly on a binary logistic regression model to obtain an in depth understanding of the different variables influencing the implementation of the nature policy, more specifically the processes of land acquisition and ecological restoration. At the same time, to generate an overview of the development and current process of the land acquisition and restoration , a survival model approach has been used to estimate the survival and hazard ratios , along with a survival table for both the acquisition and restoration tasks.

4.3.1. Survival model

The two building elements within the surivival model are *Time*, beginning at the start of the censoring, and finalizing at the occurrence of the event. In this research, the event are the one of land the acquisition and of land restoration. The beginning of the time should be set based on the occurrence of an event that provides every individual the possibility of experiencing the event.

Comparatively, other statistical techniques such as simple regression models and structural equation modelling are not able to deal with cases in which the observation focal to the analysis has not yet occurred(Willett & Singer, 2004). In this regard, the acquisition of lands to expand the Dutch NEN and its restoration activites can take place outside the censoring period proposed in this research. More specifically, censoring refers to the action of following observations through time. Therefore, observations can be labelled as left censored, when the event took place before observations started to be followed, or right censored if the event took place after the finalization of the period during which observations were tracked. Consequently, in this specific case, left censored observations are the ones that were acquired or restored before 2007 and, right censored observations in the case that the events took place after 2014 (Willett & Singer, 2004).Consequently, and taking into consideration the creation of the Dutch nature policy in which the NEN was envisioned. The year 1990 could be defined as the starting time for the events of acquisition and restoration. However, due to the lack of data previous to 2007, this research considers 2007 as the departing moment to measure time.

Equally central to the model is the risk set, referring to the group of individuals who are susceptible to perceiving the effect (Willett & Singer, 2004).In this case, the risk set will be composed by all the land parcels that have been designed to be part of the ecological network and require to be restored and / or acquired.

The next relevant element in the survival model is the hazard probability or rate, and it is the central dependent variable of the model. More precisely, it is, the probability of an individual experiencing the occurrence of an event. Based on the intervals defined for the variable *Time*, for each year (or interval) a hazard probability will be defined. This is done by averaging the initial number of observations that were at risk of experiencing the event against the total amount of individuals that experienced it at the end of the interval (Allison, 2014). Consequently, those observations who have suffered the occurrence of the event, will no longer be at risk of suffering. Therefore, those observations will not be included in the estimation of the hazard probability for the following interval. This characteristic is known as "conditionality", and has two implications. On the one hand, the risk set will be reduced as lands are acquired and restored. On the other hand, the hazard probability is prone to increasing as the risk set is reduced.

4.3.2. Binary logistic regression

Data analysis has been done based on a binary multi logistic regression model. As such, the model is distinctive for the binary outcome that the dependent variable can take. Simultaneously, logistic regression is a suitable technique for this research. This is because it allows to estimate the a) probability of an event occurring based on a series of explanatory variables, and b) estimate the relevance of the different explanatory variables regarding the outcome(Field, 2017). In the case of this research, one model was done to research the process of ecological restoration. The dependent variable will be binary, indicating whether the ecological restoration has taken place or not.

A key characteristic element of the binary logistic regression is the "*odds ratio".* In short, it is an indication of the relation among two variables, the dependent variable, and an explanatory variable. For example, starting with the relationship between financing characteristics and being the land restored or not. The ratio can also be estimated for the lands that do not count with finance and were restored. Once both ratios are obtained, it is possible to divide the ratio of financed land with that one of lands with no financing to obtain the odds ratio. However, as in the case of this research, it is necessary to bring into consideration the effect of other independent variables(Elliott & Woodward, 2007).

One last consideration needs to be made regarding the use of data in the model. Since the dependent variable is categorical in nature, and it is expressed in probabilities, it does not follow the assumptions that its relationship with the explanatory variables is linear. Therefore, to make such relationship linear, the model has been modified by means of a logarithmic transformation (Elliott & Woodward, 2007; Field, 2017):

$$\begin{aligned} logit(p) = a + \ & \beta_1 Implementing\ province + \beta_2\ landuse + \beta 3\ acquisition\ goal \\ & + \beta 4 extent\ of\ change + \beta 5\ time \end{aligned}$$

Where (p) indicates the probability of a land being restored. "*a"* is a constant of the model and *b1* represents the implementing province, *b2 landuse*, *b3 goal of the acquisition*, *b4 extent of change,* and *b5 time unit.*

The inclusion of the time variable is a necessary step in the estimation of hazard and survival risks for the observations as well as the creation of life tables. Observations are assigned a value for T (*time),* with the objective of keeping track of the different years through which an observation was at risk of being restored and / or acquired. In this way, independently of the year in which an observation was incorporated into the sample, each year in which the observations was at risk was counted equally.

The value for T is defined by the end of the censoring process. This could either be due to a land being acquired and / or restored, or due to the end of the censoring, at the year 2014. At the same time, this means that the time will be of discrete type as it will be measured in years. Therefore, each year will be taken as an interval. The range for the time variables goes from 1, starting in the year 2007, to 6 finishing in the year 2014.Unfortunately, the years 2008 and 2009 could not be included due to the lack of existent data.

In order to provide an equal starting time to follow all the observations, those areas that were considered restored and or acquired in 2007 were dropped. In this way, all observations included were at risk of suffering one or both events in 2007.

4.4. Variable construction

The following section will present the dependent and independent variables, with their respective categories and coding. At the same time, it will provide an insight into the samples used for the binary regression model land acquisition and restoration, in that respective order.

Prior to providing an in depth and detailed overview of the different models, it is necessary to recap the general structure of these thesis. In this regard, two methods of analysis were the ones chosen to explore the process of land acquisition and ecological restoration of areas pertaining to the Dutch NEN. These are the survival model and a binary logistic regression. At the same time, both methods make use of the same unit of observation. Being these the different areas that require to be acquired or restored. Moreover, and as the previous section of data gathering explained, the observations were defined on the basis of overlaying areas at risk by means of GIS software.

Going back to the methods of analysis, this research begins with the survival model for each process. By means of a survival analysis, it has been able to obtain an overview of the acquisition and restoration of areas between 2007 and 2014. In order to do so, the model makes use of two major variables. The dependent variable, being the status of acquisition or restoration, and a time variable. Basically, each observation gets a time variable defined based on the start of the period in which they became at risks of being acquired or restored, and the end of this period.

Building on top of this, the binary regression model adds different independent variables to explore the influence of these variables on the odds of areas to be acquired or restored. Naturally, this means that the dependent variables as well as the time variables are shared by both methods of analysis.

4.4.1. Dependent variables

The models have 1 specific dependent variable, the status of lands regarding their acquisition and restoration status. Moreover, this dependent variable is, as a matter of fact, specific outputs sought by the Dutch nature policy. Namely, acquiring and restoring the lands to support biodiversity.

The following section will indicate how the variables were coded. Starting with acquisition of lands and moving on to land restoration.

The final sample of observations to analyse the process of land acquisition counted with 94478 areas at risk of being acquired between 2007 and 2014, and were obtained from the Nok_verwerving_inrichting data set for each respective year. The dataset contained the variable "*status_verwerving"* and was used to code the dependent variable. For this research, those areas considered to be acquired were the ones labelled as acquired, those for which no acquisition was necessary as they belonged to the category "*niet van toepassing"* and finally, those labelled as exchange lands. In the case of the latter category, those lands were already in possession of the provincial governments and could be used as exchange areas to acquired land that feel within the NEN(Folkert & Boonstra, 2017). In the opposite category, the one of unacquired lands, fell the lands originally labelled as not acquired, agricultural lands(*"Landbouwkundige patch")* , areas under management of a third party ("*beheer door TBO")* and areas labelled as additional nature ("*bestaande natuur")* . While these observations were given a value of 0, those acquired were given a value of 1. In this latter case, lands were considered as acquired if the total surface acquired after the aggregation of the overlaying lands equalled the sum or total area of the newly defined observation. The different original categories for the status of acquisition, and their respective coding are shown on table 8.

Original category	Coded status
Beheer door TBO	*At risk of acquisition*
Bestaande natuur	*At risk of acquisition*
Ruilgrond	*Acquired*
Landbouwkundige pacht	*At risk of acquisition*
Niet verworven	*At risk of acquisition*
Verworven	Acquired
Niet van toepassing	*Acquired*

Table 8, Coding of the dependent variable "Status of acquisiton"

Status of land restoration is also binary. Lands that are not restored will take the value 0 and lands restored will be coded as 1. The data and values for the different observations are obtained from the "*Verwerving_Inrichting"* layer belonging to the NoK datasets for each respective year. When it comes to the ecologically restored areas, those are the ones that have received a subsidy for the restoration activities and those for which the restoration is indicated to be ongoin(Wouters & Beukema, 2007) Building up on that, the final value for the restoration status was coded as 1 in the case in which the total surface restored equals the total surface of each observation. The reason for this is that through the aggregation of data to compose the final observations, some lands were restored while others were not. The NoK data set counted with the variable of "*status Inrichting"* , which served as source for the coding of the dependent variable for the regression model. Within that category, the areas labelled as "*in need of full restoration", "ongoing restoration"* and "*not restored"* were coded with value 0. Opposingly, those areas within the category of "*ingericht"* or "*restored"* were coded with value 1.

Original category	Coded status
"Aanvullende Inrichtings Behoefte"	Not restored
"Ingericht"	Restored
"Niet ingericht"	Not restored
"Onderhanden"	Not restored

Table 9 Coding of the dependent variables "Status restoration"

4.4.2. Independent variables

The independent variables were sourced from both the NoK and the Bestaandebodemgebruik data sets. Firstly, the different landuse specified in the bodemgebruik data set are the basis from which the ownership and consequent attitude of the constituent groups can be inferred. Next to this, the variable of *implementing provinces*, *extent of change* and *financial resources were* coded based on the information provided by the variable "*Province*" ,"*area*" and "*goal of acquisition*" from the Nok data set. Finally, the *time* variable is included and estimated based on the "*status acquisition*" and *"status restoration"*, also retrieved from the NoK data set.

Landuse (*Bestandebodemgebruik)*	Ratio	*Bestand bodemgebruik*
Acquisition goal *(Nok)*	Categorical	*NoK*
Area	Ratio	*NoK*
Time	Continuous	*NoK*
Province	Categorical	*NoK*

Table 10 Description of the independent variables

Land-use

The different landuse can be used as a proxy to infer ownership by different actors. Departing from this, the attitude of the constituent groups can be estimated. In order to include in the model the different land use the data set "*bestand bodemgebruik"* was used. More specifically, the land use present in 2008.This variable was then incorporated into the model and translated into a ratio scale. This was done by dividing the area pertaining to each category o land use within one observation, with the total landuse area of it. Consequently, the values ranged from 0 to 1, and being 1 the sum of the different landuse's area within each observation.

Goal of acquisition

Similarly to the landuse, the goal of acquisition as specified in the data set Nok *Verwerving_Inrichting* provides insight into the future landuse for acquired lands. Departing from this, different financial instruments can be inferred to be applicable for the different observations. Therefore, being deemed as valuable, it has been included within the regression model. Differently from the coding of land use, the variable of acquisition goal is of categorical variable, and has been defined based on the maximum value within the different lands composing one same observation.

Implementing province

The implementor category depicts within which province does the restored and/or acquired land lays. Consequentially, and in line with the Dutch nature policy, the respective provincial governments are the ones responsible for the implementation of the Dutch nature policy within that jurisdiction(Folkert & Boonstra, 2017). When it comes to the different provinces, they have been coded in 3 different groups. The difference between them is the amount of communicated plans regarding the implementation of the NEN and restoration activities. Therefore, they were grouped in three groups based on their proactivity towards the implementation of the policy. The proactivity was measured based on the communicated plans for the implementation of the NEN within their territory(Kuindersma et al., 2020). The categorization of each province can be found on table 11.

Province	Proactivity level
Drenthe	Low
Flevoland	Low
Friesland	Low
Gelderland	High
Groningen	Medium
Limburg	Medium
Noord-Brabant	High
Noord-Holland	High
Overijssel	High
Utrecht	Medium
Zeeland	Low
Zuid-Holland	Medium

Table 11 Coding of implementing provices based on their proactivity level

Extent of change

The extent of change refers to the share of land within one observation that has not yet been restored. It was estimated by dividing the area of the land plots that were not restored by the total summed area of the observations that were aggregated into one same variable.

Time

The variable of time is an addition to the conceptual model as it is a necessary element for the survival model. More specifically, the time variable indicates the amount of time required for an observation to be subject to the event of interest, either acquisition or restoration. Consequently, it is estimated from the moment of the inclusion of the variable into the sample until it is either dropped , experiences the event or the censoring period ends. Moreover, The variable of time will be measure in years.

4.5. Reliability and validity

Reliability and validity are two different concepts that add to the confidence of arriving to representative findings. More specifically, reliability is defined by the level of accuracy of the findings. At the same time, a research is reliable when it can be repeated by an external individual. In this regard, the instruments used for measurement play an important role (van Thiel, 2014). Taking this into consideration, the process followed in this research aims to meet standards for reliability. For example, the selection of variables for the regression models has been informed by a substantial literature review. On top of this, it must be noted that this research makes use of data gathered by a third party. More specifically, by the central bureau for statistics, as it is the case for the dataset of bestandbodem gebruik. Consequently, the data used in this research is in line with norms that assure maximal quality(CBS, 2021).

Validity is the second but equally relevant consideration to reach trustworthy findings. As such, it is defined by the internal and external validity. To begin with, Internal validity refers to the consistency f the study, in terms of an accurate measurement of theoretical constructs and the existence of a relationship between the dependent and independent variable (van Thiel, 2014). In order to ensure these requirements have been met, the null hypothesis has been tested and statistical model assessed, ensuring the there is indeed a relationship between the dependent and independent variable. When it comes to the external validity, it relates to the extent to which a study can be generalized, or which the sampling phase is of crucial relevance (van Thiel, 2014). In this regard, it must be noted that the sampling process was done using geographical information systems and combining 6 different datasets. As a result, the sample reflects accurately the object of study, being these the area within the NEN.

Quantitative analysis of data adds complexity when it comes to research validity and reliability. Some of them are, the representativeness of the sample, the requirement to meet the statistical assumptions, and avoid the influence of outliers, among others (van Thiel, 2014).

When it comes to the representativeness of the sample, this research makes use of two dataset with numerous observations. Furthermore, the sampling method followed ensures that all observations taken into consideration are part of the NEN. At the same time, through processes of data management and aggregation of it, it was possible to avoid repetition of cases and outliers were dropped from the data set. Regarding the analysis of the data itself, the choice of methods are suitable and allow to obtain the required information to address the research questions.

5. Analysis and results

The following section will present the results for the statistical analysis for both the area acquisition and restoration activities. It will begin with the results for land acquisition's survival and regression models. Finally, the results for survival and binary regression models of area restoration are presented.

5.1. Land Acquisition

5.1.1. Survival model: Life table

For the survival model, the core variables are the dependent variable which indicates the occurrence of the event of interest ,*in this case an area being acquired,* and the time passed until that event takes place.

The life table is the product of the survival analysis and gives an overview of the observations at risk of suffering the event of acquisition, and the respective proportions of acquired areas for each year of censoring. The interval time represents each year of censoring. Consequently, the interval one is the year 2007 and, extends up to the interval 6 which represents the year 2014. It is important to remark that the years 2008 and 2009 were not included in the analysis due to lack of existent data. Therefore, the interval two, stands for the year 2010.

Life Table- Land acquisition

Interval Start Time	Number Entering Interval	Number Withdrawing during Interval	Number Exposed to Risk	Number of Terminal Events	Proportion Terminating	Proportion Surviving	Cumulative Proportion Surviving	Hazard Rate
1	31158	2156	30080.000	8159	0.27	0.73	0.73	0.31
2	20843	2236	19725.000	225	0.01	0.99	0.72	0.01
3	18382	2870	16947.000	334	0.02	0.98	0.71	0.02
4	15178	7952	11202.000	138	0.01	0.99	0.70	0.01
5	7088	4864	4656.000	395	0.08	0.92	0.64	0.09
6	1829	1784	937.000	45	0.05	0.95	0.61	0.00

a. The median survival time is 6.00

Table 12 , Survival model output, life table for land acquisition

The model beings with a sample of 31158 observations for the year one (2007). This number is smaller to the one of the binary regression analyses because of dropping those observations that suffered the event of acquisition.

The life table (*table 12)* is composed of different values. In this regard, is important to distinguish between the measurement of "withdrawn observations" and "terminal events". The values for the "terminal events" are the ones of greater relevance for this research, as they indicate the amount of areas being restored. Contrary to this, the number of withdrawn observations are those areas that were not included in following years despite of not being acquired. The reason for this is a change on the consideration of those areas regarding their need for acquisition. In this regard, it is important to remark the different changes that the design of the NEN suffered throughout the years (Folkert & Boonstra, 2017).

Another important element of the table is the section of "Number entering the interval", as it reflects the total amount of observations at risk at the beginning of each interval or year. Next to this, and contrary to the measurement of "terminal events", the "proportion surviving" indicates the proportion of observations that were not subject to acquisition during each interval. Finally, the hazard rate is an indication of the probabilities of observations being suffering the event of interest in each interval. As previously explained, the hazard rate is naturally influenced by the withdrawing of observations due to end of censoring or due to observations being acquired. As this results on a smaller sample of observations that are at risk, technically defined as "at risk set"(Allison, 2014).

The life table shows clearly that they year 2007, interval 1, is the year with the highest amount of areas being acquired and also the highest proportion of observations based on the total amount of areas at risk. The reason behind this outstanding proportion as compared to the rest of the years could be due to the inclusion within that interval those observations acquired during 2008 and 2009. However, the difference is still remarkably high with other intervals. Therefore, other reasons like the re design of the NEN due to policy changes should also be taken into account(Folkert & Boonstra, 2017). When it comes to the following years, the years between 2010 and 2012 rank similarly with the proportion of areas acquired, while being the lower values of the 6 intervals with a score of 0,01. Therefore, the increase on such proportion for the years 2013 and 2014 is remarkable, as they witnessed 0.08 and 0.05 % of the areas at risk being acquired. Nonetheless, it must be noted that the overall number of observations is remarkably low, with 395 and 45 areas respectively.

5.1.2. Descriptive statistics

Through the use of descriptive statistics is possible to get a sense and overview of the sample used in the model.

The model was composed by 8 variables, of which years and Proactivity of the implementing provinces were used through dummy variables. Next to them, the different land uses present within the NEN were computed as percentage of each observations area.

Taking a look at the first group of variables, the land use, ther is a clear trend for its observations. There are two clear leading categories, which are agriculture and nature areas, showing the biggest mean values. This means, that those landuse are mostly the dominant landuse for the different areas to be acquired. This can be seen specifically in the agricultural landuse, as in average, it represents 80% of the total surface of the areas. Additionally, it is possible to identify that most of the areas present a mix of different landuse, as there is no group with a high mean value, except for the already mentioned group o agricultural areas.Moreover, the mean value for the rest of the categories is below 0,10.

When it comes to the implementing provinces, those with a high proactivity are the ones with the most amount of observations (70% of the sample), followed by low proactive provinces with 20 % and medium proactive with 10% approximately. The next variable is time, expressed in years during which observations are censored. For this groups, the mean values are the higher for the year one and decrease progressively. This means, that most of the observations were restored in the first year of their censoring process. Finally, the group of acquisition goal represents the last variable of the model. The most remarkable characteristic is that the majority of the sample has the expansion of the NEN as its goal for acquisition. More specifically, this groups represents 95% of the sample in the model.

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
Builtup use percentage	94478	0.00	1.00	0.0213	0.12502
Recreation use percentage	94478	0.00	1.00	0.0060	0.07163
Nature use percentage	94478	0.00	1.00	0.1061	0.28747
water_use percentage	94478	0.00	1.00	0.0652	0.23178
Agriculture use percentage	94478	0.00	1.00	0.8014	0.37271
Highly Proactive Province (*Dummy)*	94478	0.00	1.00	0.7287	0.44466
Medium Proactive Province (*Dummy)*	94478	0.00	1.00	0.0801	0.27152
Low Proactive Province (*Dummy)*	94478	0.00	1.00	0.1922	0.39400
Extent of change	94478	0.00	1	0.13861	0.019
Year1 (Dummy)	94478	0.00	1.00	0.3298	0.47014
Year 2 (Dummy)	94478	0.00	1.00	0.2206	0.41466
Year 3 (Dummy)	94478	0.00	1.00	0.1946	0.39587
Year 4 (Dummy)	94478	0.00	1.00	0.1607	0.36721
Year 5 (Dummy)	94478	0.00	1.00	0.0750	0.26343
Year 6 (Dummy)	94478	0.00	1.00	0.0194	0.13778
Acquisition goal River	94478	0	1	.02	.133
Acquistion goal wetland	94478	0	1	.00	.018
Acquisition goal New Nature	94478	0	1	.95	.245
Acquisition goal “other”	94478	0	1	.01	.112
Acquisition goal New Nature extra	94478	0	1	.02	.141

Table 13 Descriptive statistics for land acquisition

5.1.3. *Binary regression:* Land acquisition binary logistic regression model

The following section provides the outputs and results of the binary regression for the process of land acquisition. By means of it, it is possible to assess the influence and relevance of the different variables. The section begins with an assessment of the model as a whole, followed by a specific analysis of the contribution of the explanatory variables.

It is necessary to highlight that different sampling were used for the survival and regression model. The reason being that the survival model required to drop observations from the sample once they were acquired or rested.

The regression model was composed by a total of 94478 observations, with not missing cases. Table 14 demonstrates the distribution of observations through the years. The year with the higher amount of areas or observations was 2012, closely followed by 2013 with 21195 and 21016 observations respectively. After them ,the years 2011 (18982 observations), 2014 (17810 observations) and 2010 (12409 observations) consist of a reduced amount of observations. Finally, the year 2007 stands out as the year with the lesser amount of areas by a big margin, as it has 3066 observations.

Year- *Frequencies*					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2007	3066	3.2	3.2	3.2
	2010	12409	13.1	13.1	16.4
	2011	18982	20.1	20.1	36.5
	2012	21195	22.4	22.4	58.9
	2013	21016	22.2	22.2	81.1
	2014	17810	18.9	18.9	100.0
	Total	94478	100.0	100.0	

Table 14 , Frequency of observations per year

This same distribution is graphically represented by Figure12, showing that the trend sees the number of lands increasing from 2007 to 2012, when it reached its peak.

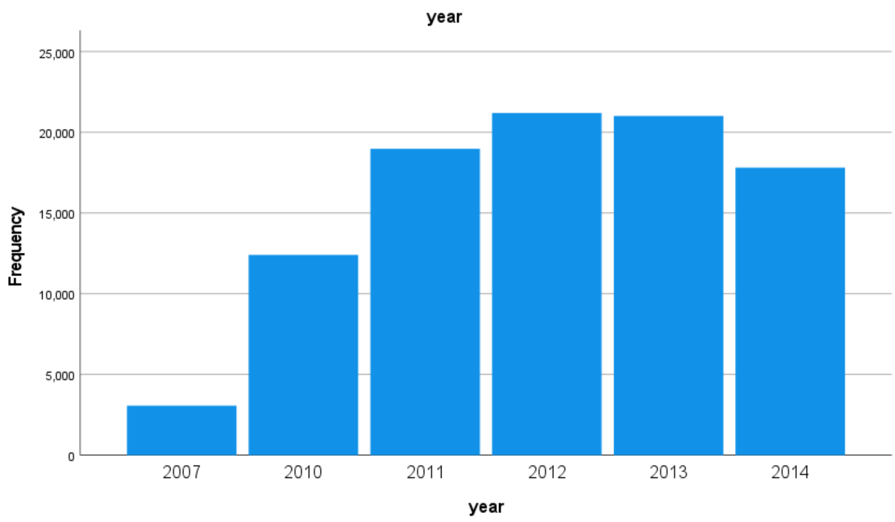

Figure 12 Observations distribution per year

Before analysing the effects of the independent variables is advisable to review the significance of the model as a whole. Therefore, the empty models needs to be assessed first. This, refers to a model with only dependent variables in it. By departing from it, is possible to compare it with the full model including the variables and asses the improvement of the model by including the independent variables. The empty model has shown to be significant, as it could predict observations with an accuracy of 89%. However, what should be highlighted is the improvement of the model after the inclusion of the predictor variables. This can be done based on a comparison of the -2 loglikelihood(Field, 2017). In this case, the value obtained was 677784.420 . Moreover, the empty model has shown to be significant, as it could predict observations with an accuracy of 89%.

To begin, the model has shown a significant Chi-square, meaning that the null hypothesis can be rejected and that there is a relationship of the independent variables with the explanatory variables(Elliott & Woodward, 2007; Field, 2017).

The odds ratio "*exp(b)*" indicates to what extent each variable contributes to the odds of an observation pertaining to a specific group, in this case restored lands. A value above 1.0 implies a positive effect, whereas a value below 0 the opposite(Elliott & Woodward, 2007; Field, 2017).

Variable		B	S.E.	Exp(B)
	Land use (Ref.Cat: "Other")			
	Built-up use	-0.009	0.186	0.991
	Agriculture use	0.163	0.165	1.177
	Water use	0.461	0.173	1.585**
	Nature use	0.781	0.168	2.183***
	Province stance (*Ref.Cat: "Low proactivity")*			
	Highly_Proactive_Province	-0.520	0.032	0.595***
	Medium proactive province	0.823	0.043	2.276***
	Extent of change			
	Extent_of_change	0.089	0.089	1.093
	Goal of acquisition (Ref.Cat: "Other")			
	goal river	-2.826	0.181	0.059***
	Goal wetland	-3.865	0.530	0.021***
	goal new nature	-4.508	0.168	0.011***
	goal new nature extra	-2.815	0.175	0.060***
	Time variable – Process duration (*Ref.Cat: Year one)*			
	Year 2	-3.347	0.069	0.035***
	Year 3	-2.759	0.057	0.063***
	Year 4	-3.487	0.087	0.031***
	Year 5	-1.746	0.055	0.175***
	Year 6	-2.519	0.156	0.081***
	Constant	3.214	0.252	24.870***
	-2 Log likelihood:	*42396.180*		
	Cox & Snell R Square	*0.210*		
	Chi-square	22287.562***		
	Significance values: *p ≤ 0.05; **p ≤ 0.01; ***p= 0			

Table 15 Binary regression output - Land acquisition

To assess the independent variables, it is important to consider their significance and their respective reference categories for the categorical variables. Regarding their significance, most variables included in the regression model have shown to be statistically significant, except for the ones of built up and agricultural areas, as their significance value is bigger than 0,05.

The first variable included in the model is the one of land use, for which the group "*other land use*" is the reference category. Based on that, it is possible to observe an increase in the odds of lands being acquired when the percentage of agriculture, water management or nature area types of land use within it is higher. Contrary to this, the areas with a higher percentage of built-up land uses have smaller odds of being acquired in comparison to the reference category. To be more precise, the odds increase by 1,2 with a 1% (0.01) increase in the share of agricultural areas. However, the effect is not statistically significant.

The odds of being acquired are 1,5 times higher odds for an 1% (0.01) increase in the share of water areas, and this effects doubles reaching an increase of two times for areas pertaining to nature reserves.

Another variable included is the one of the implementing provinces, divided into groups based on their proactivity. In this case, the reference category is the group of low proactive provinces and can be used for assessment of the medium and high proactivity groups. For this specific variable, the influence on the odds of areas being acquired is mixed. Firstly, high proactivity does not increase the odds of acquisition. In any case, it even leads to a reduction of 0.5 as compared to areas falling within provinces of low proactivity. Contrary to this, those areas within the jurisdiction of medium proactive provinces witness an increase of their odds of 2,2 times as compared to the reference category.

Additionally, the model includes the variable of goal of acquisition for the different lands. In this case, the reference category is the of "*other* " goal of their acquisition. Departing from this, it is possible to indicate that none of the different goals leads to an increase on the odds of lands being acquired, as compared to those areas with another or diverse goals for their use. In this regard, the odds are reduced by almost 0,5 time for the areas with goals of river management tasks. An even greater reduction in the odds of even 1 point applies for those areas for which the acquisition goal is the one of wetlands or new nature creation.

Finally, the last two groups of variables included in the model are the extent of change, and the time variable indicating the extent of time during which areas are at risk of being restored. Regarding the extent of change, an increase of 1 hectare in the size of the area leads to an slight increase on the odds of the area being being acquired, more specifically 1,1 times. Contrary to this, the effect of the time variable on the odds of acquisition is negative. In this case, the reference category is one year of duration until areas are restored. Based on the odds ratio for the following years, an increase of time reduces the odds of areas being restored, on average by 0.9 times as compared to areas at risk for only one year.

5.2. Land restoration

The following section presents the results for the survival and regression of the ecological restoration of lands. The structure is the same as the previous one,beginning with the life table of the survival model, and followed by the binary regression.

It is important to remark, once again that in the survival model, those observations that were restored, have been dropped for the following years, as they had already been subject to the event of interest, acquisition, and restoration respectively.

5.2.1. Survival model and life table

As previously explained, the life table for the survival model is structured around the intervals, each of them representing 1 year.

Life Table[a]

Interval Start Time	Number Entering Interval	Number Withdrawing during Interval	Number Exposed to Risk	Number of Terminal Events	Proportion Terminating	Proportion Surviving	Cumulative Proportion Surviving at End of Interval	Hazard Rate
1	29735	10723	24373.500	3931	0.16	0.84	0.84	0.18
2	15081	3568	13297.000	1122	0.08	0.92	0.77	0.09
3	10391	2107	9337.500	677	0.07	0.93	0.71	0.08
4	7607	1625	6794.500	568	0.08	0.92	0.65	0.09
5	5414	1788	4520.000	471	0.10	0.90	0.58	0.11
6	3155	2924	1693.000	231	0.14	0.86	0.50	0.00

a. The median survival time is 6.00

Table 16 Survival model output , Life table - Land restoration

As compared to the survival model of land acquisition, the regression model is composed by a smaller number of observations, more specifically by a total of 29735 at the year 2007. Similarly, this year shows the higher proportion of areas being restored, event of interest for this survival model. The proportion for 2007 was of 0.16 of the total observations. After this, the proportion remains steady and at a lower values for the years 2010,2011 and 2012 with 0,08 ; 0,07 and 0,08 respectively. From this point onward, the proportion of restored lands increase with a 10% and 14% for 2013 and 2014. Overall, the trend is similar for both the acquisition and restoration processes. This is, one of high proportion of acquired or restored lands at the beginning of the censoring period (2007), with lower values for the mid years and finalizing with an increase in the last two years. At the same time, the overall values tend to decrease in the final years. Moreover, both processes present a high amount of observations being withdrawn , this is likely to be product of the redesign of the NEN after the policy change.

5.2.2. Descriptive statistics

The land use variable group for the restoration model is similar to the one of land acquisition. Agriculture is the predominant use within the different areas, even shower a lightly bigger average on its extent. At the same time, areas containing natural reserves, lands for water management and recreation areas are slightly smaller on average. When it comes to the implementing provinces, the same trend as seen in the model for land acquisition occurs. The group with higher amount of observations is the on Highly proactive provinces, followed the low proactive group and finally the provinces showing a medium level of proactivity.

The distribution of the observations for this groups are 60 % , 26% and 13% respectively. The similarity between the models extends also to the rest of the variable groups. Firstly, for the variable of time, once again the majority of observations were censored for one year, with decreasing values thereafter. More specifically, 41% of the observations were at risk for one year. Secondl and finally, the goal of acquisition shows again a similar distribution. As the most observed goal is the one of new nature. However, in this case, areas with a water management goal are equally present as those areas with a goal of extra new nature creation.

Descriptive Statistics					
	N	**Minimum**	**Maximum**	**Mean**	**Std. Deviation**
Builtup Area	71383	0.00	1.00	0.0228	0.12839
Natur area	71383	0.00	1.00	0.0976	0.27196
Recreation area	71383	0.00	1.00	0.0050	0.06425
Water area	71383	0.00	1.00	0.0353	0.16722
Agriculture area	71383	0.00	1.00	0.8394	0.33613
Extent of change	71383	0	1	0.946	0.20324
Highly Proactive Province	71383	0.00	1.00	0.6027	0.48934
Medium Proactive Province	71383	0.00	1.00	0.1376	0.34448
Low Proactive Province	71383	0.00	1.00	0.2611	0.43924
Year 1	71383	0.00	1.00	0.4166	0.49299
Year 2	71383	0.00	1.00	0.2113	0.40821
Year 3	71383	0.00	1.00	0.1456	0.35267
Year 4	71383	0.00	1.00	0.1066	0.30856
Year 5	71383	0.00	1.00	0.0758	0.26475
Year 6	71383	0.00	1.00	0.0442	0.20554
Acquisition goal river	71383	0	1	0.04	0.186
Acquisition goal wetland	71383	0	1	0.00	0.050
Acquisition goal new nature	71383	0	1	0.93	0.259
Acquisition goal new nature extra	71383	0	1	0.04	0.185
Acquisition goal “other”	71383	0	1	0.01	0.110

Table 17 Descriptive statistics for the binary regression variables - Land restoration

5.2.3. Binary regression : Land restoration

The model for the ecological restoration contains 71383 observations, with no missing cases. It should be noted that the total number of observations is smaller than the one for the model of land acquisition.

Similarly to the sample for the model of land acquisition, the years of 2012 and 2013 were the ones with the highest amount of observations, being those 20564 and 13277 respectively. As a second group with the highest amount of observations the years 2010 and 2014 followed them with 12456 and 10088 observations. Finally, 2010 counted with 12456 observations while 2007, once again, presented the smallest amount of observations , more specifically 6460. The aforementioned distribution can be found on table 18.

Status restoration									
Count									
		Year						**Total**
		2007	**2010**	**2011**	**2012**	**2013**	**2014**	
Status_restoration	0	6460	8878	7878	19668	12279	9170	64333
	1	0	3578	660	896	998	918	7050
Total		6460	12456	8538	20564	13277	10088	71383

Table 18 Observations distribution per year - Land restoration

The distribution of the observations through the years follows an increasing trend from 2007 onwards, reaching a peak in 2012 and descending afterwards. This is graphically represented in figure 13.

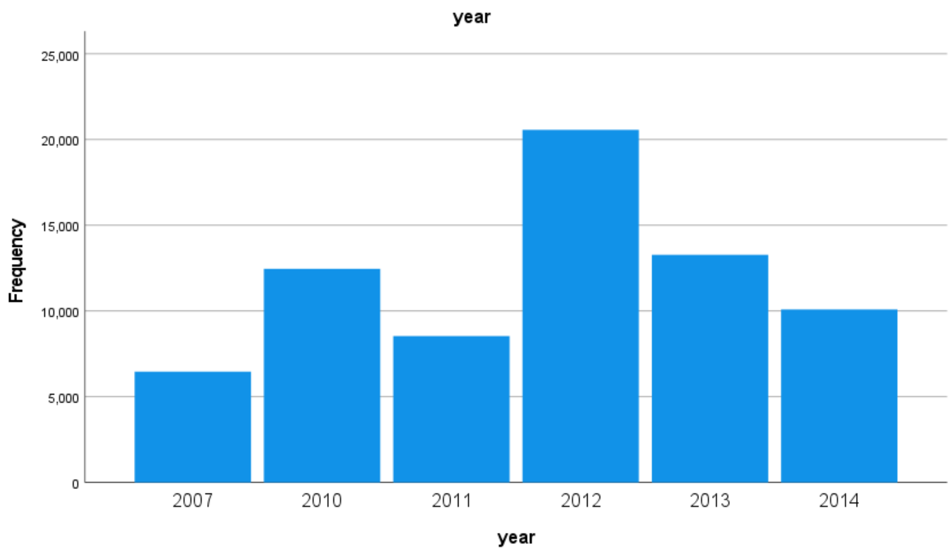

Figure 13 Distribution of observations per year - Land restoration

The empty model is also significant, as the one of acquisition of lands. However, in this case the empty model has shown to be slightly better in comparison, as it correctly predicted 90% of the dependent variable value without any explanatory variable.

As it has previously been done with the model for land acquisition, the assessment of this model will be done by comparing the empty model with the one including the explanatory variables. Similarly, the -2 *loglikelihood* will be the reference for the assessment of the full model. In this case, the value for the empty model was 48766.12. When compared to the value obtained for the full model, it is possible to conclude that the inclusion of the independent variables leads to an improvement in the model. However, the difference is not as big as the one seen for the model of land acquisition. In this case, the -2loglikelihood is slightly bigger for the full model, while the correctly predicted outcomes is equal to the one shown by the full model, almost 91%. Next to this, the full model is able to explain 3,8% of the variance.

To assess the predictor variables, it is necessary to refute the null hypothesis. In this case, the significant value (<5) for the Chi-square, allows to refute the null hypothesis, meaning that there is a relationship between the dependent and independent variable.

As a second step, it is important to consider the significance of the individual independent variables. In this regard, the majority of them have shown to be significant, except for the extent of change, and the acquisition goals of new nature and new nature extra.

VARIABLES	B	S.E.	Exp(B)
Land use (*ref. cat: "Other"*)			
Builtup_use_perc	0.583	0.253	1.791*
Agriculture_use_perc	0.480	0.235	1.616*
Water_use_perc	1.161	0.241	3.192***
Nature_use_perc	1.133	0.237	3.104***
Province stance *(ref cat: "Low proactivity")*			
Highly_Proactive_Province	-0.120	0.031	0.887***
Medium_proactive_province	0.209	0.043	1.233***
Goal of acquisition (*Ref.Cat: "Other")*			
(max) goal_river	-1.228	0.148	0.293***
(max) goal_wetland	-1.401	0.430	0.246**
(max) goal_newnature	0.170	0.109	1.185

	(max) goal_newnature_extra	0.005	0.118	1.005
	Time- Process duration *(Ref.Cat: "Year one")*			
	Year 2	-0.614	0.036	0.541***
	Year 3	-0.764	0.045	0.466***
	Year 4	-0.626	0.048	0.534***
	Year 5	-0.445	0.052	0.641***
	Year 6	-0.617	0.071	0.539***
	Extent of change			
	Extent of change	0.119	0.076	1.127
	Constant	-2.674	0.271	0.069***
	-2log.likelihood	44706.713[a]		
	Nagelkerke R Square	0.038		
	Chi-square	1314.835***		
	Significance values: *p ≤ 0.05; **p ≤ 0.01; ***p= 0.			

Table 19 Binary regression output - Land restoration

Table 19 shows the results obtained for the binary regression for land restoration. To begin with its interpretation, it must be remarked that the significance of the independent variables have shown to be below the 0,05 level of confidence, except for the variables of acquisition goal new nature and new nature extra. When it comes to the effect of the different land use, the reference category was the one of "*other"* land use, and against it is possible to assess the effect of the different groups within that variable. In this regard, all land use included present a positive influence on the odds of areas being restored as compared to other land uses. More precisely, an increase of 1 in agricultural or built-up land use, increased the odds by 1.6 as compared to other land uses. More remarkably, the effects on the odds of areas being restored doubles when it involves the uses of areas for water management tasks or nature conservation.

Moving on to the next variable, the stance of the provinces and their proactivity towards the implementation of the policy, the assessment takes a low proactivity as a reference category. In this case, the effect of high proactivity and low proactivity are contradictory. On the one hand, medium level of proactivity result on an increase on the odds of areas being restored as compared to areas falling within low proactive provinces. Surprisingly, areas within high proactive provinces have fewer odds of being restored as compared to those falling within low proactive provinces. More specifically, the increase in the odds for a medium level of proactivity is of 1.

The next category is the one of goal for acquisition, being it categorical , the reference group is the one "*Other goal".* Within this variable group, the effect is mixed in relation to the reference category.

On the one hand, those areas with a goal related to wetlands and water management present a lower odds ratio of being restored. More specifically, the odds decreases be 0,7 times on average for both variables. On the other hand , those areas acquired with the goals of new nature and extra new nature see their odds increase by one as compared to the reference category.However, as it was previously stated, the effect is not statistically significant.

The time variable, indicating the time spent before areas are restored has the initial year as the reference category. For this group of variables, the effect is clear. An increase in time during which areas are at risk of being restored does not increase the odds of the event taking place. Moreover, on average the diminished odds is around 0.5 for the different years. Finally, the extent of change is the last variable included in the model and refers to the extension of area at risk of being restored. For this variable, an increase of 1% in the extent of the area increased the odds of observations being restored by 1.

6. Conclusions & Discussion

This research has aimed to asses the implementation of the Dutch nature policy through the use of a survival and regression model. More specifically, the outputs of the policy , the acquisition and restoration of lands between 2007 and 2014, were the main reference to asses the implementation of the policy. This was done by following one central question : *"To what extent the restoration activities required for the creation of the Dutch national ecological network been implemented from 2007 to 2014, and how does the policy content and its context account for the results?"*

The acquisition of areas as well as the implementation of ecological restoration activities witnessed its biggest share of progress in the beginning of the policy during the year 2007. From there onwards, the trend has been one of diminishing overall amount of areas being acquired, while the restoration of areas diminishes to a lesser extent. Naturally, this is something to be expected. However, it is necessary to highlight that in views of the future progress, the pace is rather slow. The reason being the small proportion of areas that were acquired and restored every year.

Overall, it can be argued that the ecological restoration of lands has been done in a progressive manner as compared to the acquisition of land. As there is a slight increment on the ratio of restored lands towards the later years.

The progress witness can be explained by the content of the policy and the context in which it is applied. The underlaying question is how well does the policy work and how does it fit the context in which it is applied.

When it comes to the content of the policy, the implementing actors (more specifically the provinces) , the economic resources and the extent of change envisioned influence the implementation in different ways. To begin with, the implementing actors witness a rather surprising effect on the odds of areas being acquired and also restored. In this regard, it has been proven that strong proactivity does not lead to a higher odd of areas becoming acquired or restored. Contrary to this, a medium level of proactivity increases the odds of a more effective implementation of the policy. In this case, proactivity is defined based on the communicated plans by provinces to expand and restored the areas within the NEN (Kuidersma et al., 2020) Therefore, it can be concluded that a high proactivity by the implementing actors tends to become ineffective and should not be understood as an indication of the policy implementation.

Another element of the policy is the financial resources specified and designed to facilitate the implementation of the policy. In this regard, the effect of the financial resources as specified by the policy do not lead to an increasing odd of acquiring and incorporating areas into the NEN. This can be seen through the negative influence on the odds that the different goals for acquisition , as indicator of the financial resources, present. On top of this, other financial resources related to to other funding programs, such as the ones derived from water management tasks do not increase the likelihood of areas being acquired. However, the lack of positive effects of financial resources does not apply equally to the ecological restoration of areas. This becomes clear based on the increasing odds of areas being restored when the goal for their acquisition is either the inclusion of them within the NEN or water management tasks. Consequently, water bodies and nature conservation organizations along with their financial resources support the implementation of restoration activities. . Finally, one more element of the context of the policy is the extent of the area to be acquired and / or restored. In this regard, it can be concluded that smaller areas are likely to face more difficulties to be acquired and restored. Furthermore, a smaller area size can be inferred to derive from this specific land being isolated from other parts of the NEN, making them difficult to integrate and restore accordingly

Next to the content of the policy, the context in which it is applied is the second core group of independent variables. As such, it has shown a dissimilar effects. On the one hand, it favours the implementation of restoration activities to some extent, while it does not facilitate the acquisition of the areas to be included in the NEN. More specifically, the attitude of constituent groups have shown to favour the ecological restoration of lands. For example, water boards and nature conservation organizations can be inferred to have a supportive attitude, increasing the odds of areas being restored. At the same time, agricultural owners present a supportive attitude but to a lesser extent. This, is not surprising, as their land can be assumed to have economic value and be profitable. This same trend can be seen in the acquisition of lands. However, the support is somewhat lesser in this case. Moreover, the presence of urbanization or infrastructure leads to reduction in the odds of areas being acquired but does not negatively affect the odds of ecological restoration taking place. Comparing both processes, it should be remarked that both nature organizations and water bodies are supportive of the implementation of the policy, as ecological restoration of the areas are line with their interests. In this regard, literature has shown the benefits of ecological restoration when it comes to floodplains function., while the support of agricultural owners is smaller in comparison in both cases.

The findings of this research can be compared to the current literature on nature conservation and nature policy implementation. First of all, implementation of nature policies around the world, tend to witness the creation of “on paper natural reserves (Keeley et al., 2018; Beunen et al., 2013). What this refer to is to the intention of setting up protected areas and ecological networks by different governments but failing on its implementation. In this regard, the Dutch context can be considered to be another example of this phenomenon. A clear example of this is the rather inexistent positive influence of high proactivity by the implementing provinces on the likelihood of increasing the extent of the network. Moreover, those provinces with less communicated plans have shown to be more efficient and to increase the likelihood of areas being acquired. Finally, this research has found that the inclusion of different actors to implement the policy can provide benefits and be instrumental to achieving outcomes and objectives. In this regard, the support that water bodies provide in relation to ecological restoration of areas is a good example. Naturally, this derives from shared interest with this specific group.

6.1. Policy recommendations

Based on the findings of this research, a set of recommendations are specified with the aim of support the improvement of the Dutch nature policy implementation. The implementation of the Dutch nature policy has yielded insufficient results when it comes to both, the acquisition and restoration of areas. At the current pace and taking into account the number of areas acquired and restored, the likelihood of achieving the goal by 2027 is small. This conclusion can be based not only on the slow pace witnessed but also on the little effect that time has on the odds of areas being acquired and restored. Meaning that, passing of time is not likely to suffice for the implementation of the policy to reach its goal. On top of this, the effect of the policy itself and the context on which it is applied have different effects.

More specifically, further measures should be focused on the increasing the pace at which areas are acquired, should proactively address constituent groups related to agricultural areasand pay special attention to acquisition and restoration of small areas. On top of this, it is advisable to carry out a sound overseeing of the implementation process, to make sure that plans communicated by implementing provinces are followed through.

Another recommendation is increasing the pace of land acquisition is required. Given the current pace at which the lands for the NEN are being acquired, and more specifically, the decreasing pace towards the later years, it is highly advised to focus resources on the acquisition of areas to be integrated into the ecological network. The reason for the suggested focus of resources on land acquisition is the comparatively slower pace as compared to the implementation of ecological restoration practices. At the same time, increasing the connectivity of the network will yield positive effects to the biodiversity within it.

Secondly, an efficient overseeing of the implementation process is advisable in order to avoid a common bottleneck of nature policies. In short, communicated plans and intentions for implementation of the provinces is likely to not follow through and materialize. Therefore, a closer look on the actual process of acquiring the lands is recommended.

Thirdly, agricultural areas should be given priority when it comes to acquisition of land. The reason being that those current agricultural areas stand out for having a rather non-supportive attitude towards the implementation of the policy, and the financial resources available do not increase the likelihood of areas being acquired. Therefore, a stronger emphasis should be placed on nudging agricultural managers towards the transition to sustainable practices or self-realization of the ecological network. At the same time, waterboard and water management areas can be considered as a good example of beneficial partnership supporting the implementation of the policy. In this regard, financial resources and the support of this constituent groups can be linked to water areas increase the likelihood of restoration activities taking place.

Finally, acquisition and restoration of smaller areas should not be overlooked. This research has shown that the smaller the size of the area to be acquired or restored, the less likely it will end up being incorporated into the ecological network. The reasons for this could be various. At first glance, it could be assumed that these areas tend to be isolated, or that the acquisition and restoration are less viable economically due to their size. However, this could well be further researched in the future.

6.2. Limitations of this research

This research has been able to provide an overview of the general implementation process and the influence of the content and context of the policy in general terms. However, certain limitations have been encountered. These can be divided into data availability on the one hand, and on the other hand the level of in depth analysis of both the policy context and content.

To begin with, the availability of data was far from optimal for both Nok and Bestand bodemgebruik datasets. Regarding the NoK dataset, the years 2008 and 2009 were not present, nor in any other source. On top of this, the level of detailed for the used data set could have been improved. In this regard, the mechanisms through land were acquired were not specified. Unfortunately, this is of great relevance, as the Dutch nature policy provides different approaches that provinces can take to acquire lands. Consequently, this limited the depth of analysis that this research was able to carry out in regards to some of the elements of the content of the policy.

Additionally, the NoK data set did not count with sufficient information regarding ownership or management of areas by different groups. Despite information on land use having been used as a proxy to infer ownership was done, this research could have benefited greatly of a more detailed (original) ownership information. Naturally, this restrained the level of detail in which the context of the policy was analysed. As a result, the attitude of constituent groups can be further and better examined by means of data gathering.

6.3. Recommendations for future research

Departing from the findings, conclusion and policy recommendations, future research could be instrumental to address bottlenecks and improve the implementation of the Dutch nature policy. There are certain elements that stand out as worth exploring further. To begin with, a closer examination of possible pathways to guide relevant actors, such as agricultural firms, to support the implementation of the policy could yield great benefits. On top of this, this would be in line with the turn towards decentralization that the policy has witnessed in the latter years. To be more specific, identifying motivations behind the current attitude of reluctant constituent groups would result of great benefit. Adding to this, the efficacy of current financial instruments as specified by the policy should also be further analysed. Moreover, identifying possible improvements on these instruments as means to nudge constituent groups towards the support of the policy implementation could help to address the current bottlenecks. Finally, it is highly advisable to carry out specific research to assess the current status of biodiversity as a result of the expansion of the NEN and the implementation of ecological restoration activities.

Adding to the previous recommendations, to carry out future research, a different approach as compared to this work should also be considered and would allow to obtain the aforementioned information on specific actors and their support towards the nature policy. In this regard, future research could be based on a case study analysis, with focus on one or several specific areas, as this works has already provided a general overview of the implementation process throughout the Dutch territory. Moreover, approaching involved stakeholders in those areas and making use of surveys could yield valuable information. Additionally, by means of a case analysis, specific data could be gathered, allowing to obtain a better understanding of implementation on a ground level. Consequently, this could well allow to carry out the suggested research on the motivations of constituent groups and pathways to improve the current cooperation with them.

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8. Appendix

Table of content

1- NEN full size map
2- Observations selection – full size map
3- Bestandbodemgebruik full size map
4- Charachterization of variables

1- **NEN full size map**

2- Selection of observation – full size map

3- Bestand bodem gebruik full size map

4- **Characterization of variables** (Land restoration)

year

		Value
N	Valid	94478
Central Tendency and Dispersion	Missing	0
	Mean	2011.97
	Standard Deviation	1.585
	Percentile 25	2011.00
	Percentile 50	2012.00
N	Percentile 75	2013.00

goal_river

		Value	Count	Percent
	Measurement	Nominal		
	Role	Input		
Valid Values	0		92781	98.2%
	1		1697	1.8%

goal_wetland

		Value	Count	Percent
	Measurement	Nominal		
	Role	Input		
Valid Values	0		94447	100.0%
	1		31	0.0%

goal_newnature_extra

		Value	Count	Percent
	Measurement	Nominal		
	Role	Input		
Valid Values	0		92460	97.9%
	1		2018	2.1%

goal_other

		Value	Count	Percent
	Measurement	Nominal		
	Role	Input		
Valid Values	0		93272	98.7%
	1		1206	1.3%

Builtup_use_Perc

		Value
	Measurement	Scale
	Role	Input
N	Valid	94478
	Missing	0
Central Tendency and Dispersion	Mean	.0213
	Standard Deviation	.12502
	Percentile 25	.0000
	Percentile 50	.0000
	Percentile 75	.0000

Recreation_use_Perc

		Value
	Measurement	Scale
	Role	Input
N	Valid	94478
	Missing	0
Central Tendency and Dispersion	Mean	.0060
	Standard Deviation	.07163
	Percentile 25	.0000
	Percentile 50	.0000
	Percentile 75	.0000

Nature_use_Perc

		Value
	Measurement	Scale
	Role	Input
N	Valid	94478
	Missing	0
Central Tendency and Dispersion	Mean	.1061
	Standard Deviation	.28747
	Percentile 25	.0000
	Percentile 50	.0000
	Percentile 75	.0005

water_use_Perc

		Value
	Measurement	Scale
	Role	Input
N	Valid	94478
	Missing	0
Central Tendency and Dispersion	Mean	.0652
	Standard Deviation	.23178
	Percentile 25	.0000
	Percentile 50	.0000
	Percentile 75	.0006

Agriculture_use_perc

		Value
	Measurement	Scale
	Role	Input
N	Valid	94478
	Missing	0
Central Tendency and Dispersion	Mean	.8014
	Standard Deviation	.37271
	Percentile 25	.9081
	Percentile 50	.9989
	Percentile 75	1.0000

Highly_Proactive_Province

		Value	Count	Percent
	Measurement	Nominal		
	Role	Input		
Valid Values	.00		25636	27.1%
	1.00		68842	72.9%

Medium_Proactive_Province

		Value	Count	Percent
	Measurement	Nominal		
	Role	Input		
Valid Values	.00		86906	92.0%

	1.00		7572	8.0%

Low_Proactive_Province

		Value	Count	Percent
	Measurement	Nominal		
	Role	Input		
Valid Values	.00		76323	80.8%
	1.00		18155	19.2%

Extent_of_change

		Value
	Measurement	Scale
	Role	Input
N	Valid	94478
	Missing	0
Central Tendency and Dispersion	Mean	11147995.5955
	Standard Deviation	2495589722.01682
	Percentile 25	11.9310
	Percentile 50	275.4447
	Percentile 75	18704.8032

Time

		Value	Count	Percent
	Measurement	Nominal		
	Role	Input		
Valid Values	1		31158	33.0%
	2		20843	22.1%
	3		18382	19.5%
	4		15178	16.1%
	5		7088	7.5%
	6		1829	1.9%