

**POLICY  
ADVICE**

**THE  
BIODIVERSITY  
EMERGENCY**

PROPOSED BY  
**DEPARTMENT  
OF DYING  
ORGANISMS**

Andrea Sesana Camacho (443223)

Florence Li (457594)

Kudrat Kaur Paramjit (416536)

Martin Zimmermann (549088)

# EXECUTIVE SUMMARY

DATE PROPOSED

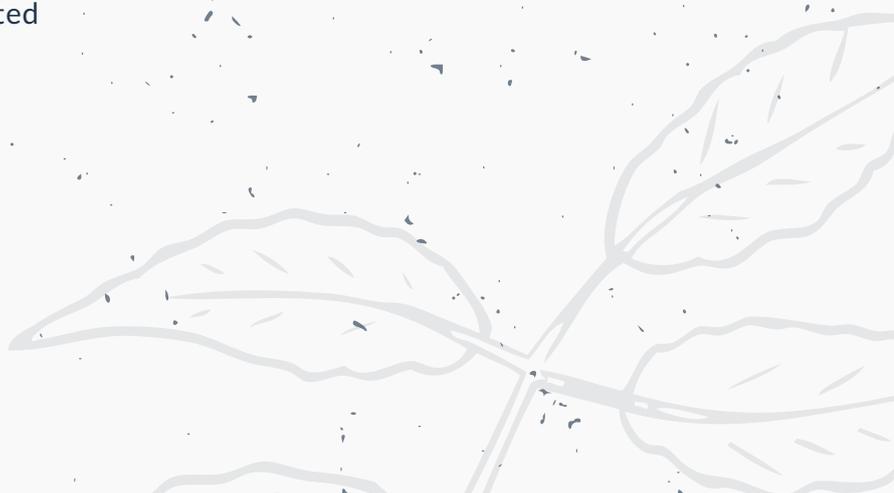
**12TH MARCH  
2020**

Ask yourself, can I afford to keep relegating biodiversity loss to the bottom of my priority list since I have so many other things that are urgent right now? I hope you said no, because any other answer is a gross underestimation of the severity of the situation we find ourselves in.

If that had not been your thought process regarding biodiversity loss, then allow us, the Department of Dying Organisms, or DODOs for short, to give you a brief overview of the problem you know you might have but are not actually addressing with the urgency it deserves. It is imperative that you act now because we are dealing with a biodiversity emergency. It is unequally distributed across the world and many areas are in a position to mitigate it before it becomes irreversible.

Recent violent natural and human disasters have shown that we can experience a devastating biodiversity loss any moment, either arising from the slow but steady degradation of our ecosystems or unexpected events that have immediate disastrous consequences.

Zeeland is one of the areas with the richest biodiversity in the Netherlands, but it is also one of the areas with the highest potential to become a hotspot zone for biodiversity loss. We propose a relief plan for an emergency that is already at your door, but you have not allowed in yet. We provide a holistic approach to improve resilience in ecosystems that Zeeland can become the frontrunner in. Our proposed plan provides four actionable steps that you can start taking as soon as after you finish reading our proposal. We also explain how technology, through the use of a Database, can help the Province of Zeeland be prepared for the emergency that we are globally headed towards.



**DODOs**

# INTRODUCTION

The Biodiversity Emergency is upon us as we are confronted with constant biodiversity loss and one disaster after the other. See for instance the heavy floods in India in 2016, which killed 200,000 hectares of crops and 200 animals including a rare type of rhinos (Dasgupta, 2016). But also more recently, cyclones in Southern have taken the lives of thousands of animals, and due to poaching in Kenya, there is now only one white giraffe left on the planet ("Cyclone Idai: We race to help up to 200,000 animals in Southern Africa", 2019; Sandford, 2020). Although these biodiversity disasters may sound far away, it can happen to any region in the world, at any time. Now imagine that there is a disease among seagulls in Zeeland which rapidly spreads, and suddenly all seagulls are falling from the sky. What would you do as the province of Zeeland? Who do you contact? Do you even have partners to reach out to? Do you have equipment and other resources to tackle the problem? Where do you even start?!

Biodiversity emergencies can happen unexpectedly, with major consequences. Yet, only some have declared it as such and are treating biodiversity loss for the emergency it is ("IFLA declares a climate and biodiversity emergency", 2019). There are numerous international meetings planned in the upcoming year for key stakeholders to come together and discuss plans of action ("2020: a crunch year for the biodiversity and climate emergencies", 2019).

Biodiversity in and of itself makes our planet function. The various species of plants, animals, micro-organisms and so forth are vital to food chains and ecosystems. Yet, certain species are reaching the point of extinction and disaster could strike at any moment (IPBES, 2019).

Species in danger of extinction are suffering the effects of continued misuse of said species, their habitats, and the obliteration of their food chains (Berke, 2018). This march towards extinction has been gradual, and almost invisible until the point the species is being put under surveillance due to their near-extinct status.

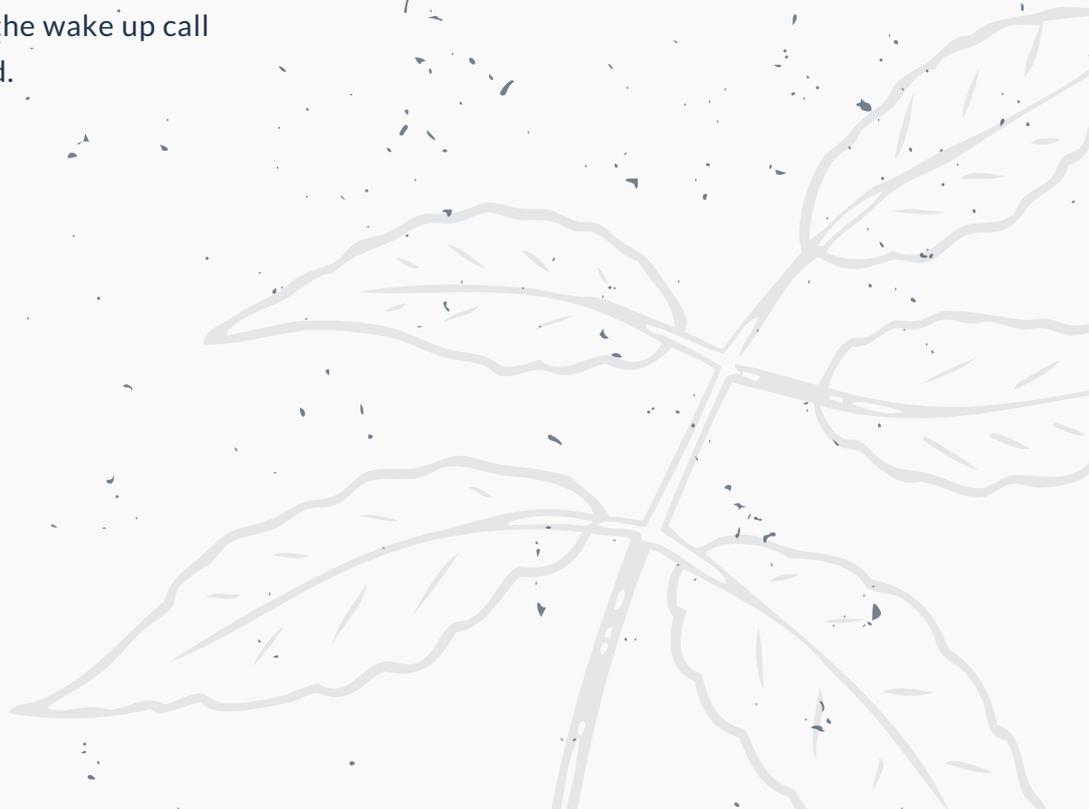
Then, there is the fear of disaster striking in the short-term and leading to devastating biodiversity loss. An example of huge biodiversity loss due to unprecedented events happened in Australia at the end of 2019 (Evans, 2020). The bushfires led to huge biodiversity loss in a country that has one of the largest endemic biodiversity populations in the world. The consequences of biodiversity loss at such a massive scale will be difficult to determine so close to the event, but rest assured there will be consequences not just for Australia but the world at large.

# INTRODUCTION

Understanding the gravity of the situation and the potentially fatal consequences it can have led our team, the DODOs, to come together and offer a plan that could help address this global issue. Think global, start local. We have decided to address this policy document specifically to the Province of Zeeland, but understand with slight alterations this plan is useful to parties other than the Province in question as well. Biodiversity loss needs multi-stakeholder engagement, and we hope with this document to make that realisation and how to address it clear.

This policy document offers an explanation of what is meant by the biodiversity emergency, and how it can be addressed in the short-term should a disaster strike tomorrow for example and the long-term. The action plan itself is subdivided into four parts: mitigation of the risk, response, preparedness, and response. We offer a database solution should disaster strike tomorrow in combination with a longer-term plan.

We hope this report is both the wake up call and call to action you needed.



# CONTEXTUAL- IZATION

## BIODIVERSITY

Biodiversity is a very abstract concept, as it encompasses many organisms and factors. The definition under which this paper operates is as follows: “the variability among living organisms from all sources and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems.” (Heywood & Baste, 1995, as cited in Bernau, 2006). This long and complex definition basically means that it is not only animals and plants that are affected, the entire ecosystem that they support is affected as well.

## PERSPECTIVE: SYSTEMS THINKING

System thinking, as the term suggests, is about viewing aspects as part of a system, which is interconnected and interdependent on other systems (Williams, Whiteman and Kennedy, 2019). Ecosystems are systems of biodiversity, with different species and interconnections between them. Systems thinking offers a holistic view of the world and stimulates actors to think about the connectedness of systems and hence, how their actions have consequences for other systems. Therefore, the loss of biodiversity could lead to unprecedented changes to how ecosystems function and life on our planet continues to evolve. The implications this presents are terrifying.

## COMPLEXITY

The interdependence that biodiversity has in our ecosystems shows how complex the problem truly is.

### Interdependencies: Business Risks

In an economic view, the World Economic Forum in 2010 (Dempsey, 2013) defined biodiversity business risks as risks that result directly from dependencies on biodiversity and also indirect risks arising from the relationship with both biodiversity and ecosystem services, showing it is a network and an inclusive term.

### Interdependencies: Sustainable Development Goals

Another way to dimension its interconnectedness is that biodiversity is linked to many Sustainable Development Goals (SDGs). Yet due to the absence of a clear direct visible relationship between nature and the grand challenges these SDGs represent, leads to an underestimation of its importance (IPBES, 2019). Thus, it is clear that biodiversity loss cannot be analyzed in isolation nor addressed as a separate issue. We operate in a system and so does nature itself. Any abrupt change in nature could lead to irreversible damage and start a domino effect affecting multiple populations of organisms.

## THE DANGER OF EXTINCTION

Over the past few decades there has been an increase in the number of species likely to face extinction. According to the doughnut economics model, biodiversity loss has far exceeded the limits of the planetary system, surpassing the ecological boundaries of the earth (Raworth, 2017). An example of this is the direct biodiversity loss caused by the fires raging through Australia (Evans, 2020).

## The Climate Emergency

Increasingly we are encountering climate disasters that lead to biodiversity loss. This highlights the close relationship between that of the biodiversity emergency and the climate emergency. This, in turn, affects our ability to deal with climate disasters in the future and degrades our adaptability going forward. At the expense of being able to meet the needs of future generations, nature is being exploited to meet the needs of the current generation (IPBES, 2019). Instead of calling it simply biodiversity loss, the reframing to biodiversity emergency is an attempt at getting us to treat it more seriously as the issue it is.

## HOTSPOT AREAS

When addressing biodiversity loss it is useful to consider hotspot areas. Hotspot areas are areas that have rich biodiversity (Bernau, 2006). These are zones in the world that have a high degree of endangered species. A number of experts find that focusing preservation efforts in these endangered species will be the most efficient and effective use of resources. If stakeholders are unable to address the multiple threats that biodiversity faces, then it will be unable to ever recover. However, stakeholders can manage the problem if they see it as an opportunity, leading to both profit and sustainable management practices in the future as firms are impacted in their own operations by continued biodiversity loss (IPBES, 2019).

## Biodiversity Loss: A Business Risk

The World Economic Forum recognized biodiversity loss as a risk that companies needed to consider for the first time in 2010 (Dempsey, 2013). They estimated a 15-20% likelihood of biodiversity loss to be a concern for the global economy. As becomes clear through this paper, this is underestimating the nature of the problem that is being reframed as an emergency. Biodiversity has reached a point where it has visibly become an economic concern. There are several NGOs working towards preserving biodiversity, which can be involved by providing direct aid, getting involved with international organizations, conventions and treaties (Bernau, 2006). However, they should be seen as legitimate entities by showing the good they do for society for the partnerships with NGOs to be successful (Mitchell, Agle and Wood, 1997).

## BIODIVERSITY LOSS: THE UNDERDOG EMERGENCY

It is vital to keep in mind that the biodiversity emergency is underestimated due to how it gradually accumulates making it less tangible and visible than other problems that have more of an immediate nature (Dempsey, 2013). This lack of immediate perception of the problem makes it harder to quantify, making it difficult for stakeholders to get a sense of emergency. And even if people are aware of the problem, the by-stander effect problem is also an issue as they are unwilling to act upon it (Jacques, 2012). Stakeholders in every sphere of society need to raise awareness for biodiversity loss. They need to take a proactive approach to it (van Tulder, 2018), as it needs to become a recognized emergency and actions should start now. It is vital that especially those sectors which regulate how we operate start treating it as the emergency it truly is.

# ZEELAND

## Hotspot Area

The Netherlands has areas of high biodiversity, which have been analyzed in order to determine if they face potential risks that could lead them to be hotspot areas for the biodiversity emergency. Zeeland has been identified as a potential hotspot area due to its rich biodiversity and its vulnerability to natural disasters. This triggers the need for preservation. More importantly, the urgency to take immediate action is strengthened by the area's vulnerability to disasters.

## VULNERABLE TO DISASTER

Geographically speaking, the country is situated below sea level, which already poses a risk for flooding (Klomp maker, 2009). In fact, the areas that are especially vulnerable to these natural disasters are the areas along the coast. An example of a major natural disaster within the Netherlands was in 1953, when a large part of the Netherlands was flooded due to the collapse of its dykes. It cost the lives of more than 1.800 people and uncountable number of flora and fauna ("Watersnoodramp 1953," n.d.). Zeeland was one of the areas where the flood hit first and most severely. This shows a sense of urgency to protect this area from natural disasters. Adding to this importance is the fact that Zeeland has the national park Oosterschelde, which contains a unique biodiverse landscape, making Zeeland one of the focus areas for the upcoming years in the Netherlands.

## OOSTERSCHELDE

The Oosterschelde is the largest national park of the Netherlands with an area of around 37.00 hectares. It is also the wettest national park because of the influence of the tides. In 1986, it was closed off from the sea through the flood barrier "de Oosterscheldekering", which from then on only allowed for tides to go through the barrier to some extent. As a result of the tidal currents, erosion and sedimentation processes take place which create varying patterns of mud flats, tidal flats, salt marshes, shallow water and deep tidal trenches ("Oosterschelde," n.d.). These patterns change over time, which creates an ever-changing landscape. Moreover, there are sandbanks in the area as well as many wet grasslands and open waters, which are surrounded by inland dykes.

Due to the diverse activities in the area, it is habitat for many flora and fauna. Varying species thrive in habitats of salt- and freshwater, shallow- and deep water, strong- and weak currents, mud flats, salt marshes and artificial rocky coasts. Each ecosystem has its own unique set of flora and fauna. Seals, porpoises, birds, salt plants, weeds and algae are only a few of the many species which call the area their home ("Natuur, " n.d.). Hence, there is a whole world of organisms living below sea as well as on land which all depend on this area, which makes the Oosterschelde such an important place to protect.

# ZEELAND

Besides this, the area is also important for the local people. Local communities in Zeeland are dependent on the fisheries of shellfish, such as mussels. It is the only national park which has local economic dependency, making the park not only an interesting focus in biodiversity, but also for local communities ("Economie," n.d.). Additionally, although the Oosterscheldekering protects the area from current floods, it may not offer enough protection for future floods. It will also not protect it from any biodiversity loss that would result from natural disasters, which reinforces the urgency to preserve this unique biodiversity rich area.



<http://images.freeimages.com/images/previews/76a/the-oosterschelde-storm-surge-barrier-1-1216382.jpg>

<https://www.eilandtholen.nl/wp-content/uploads/Untitled-3.jpg>



# PRACTICAL SOLUTIONS: RELIEF PLAN

## WHAT CAN YOU CONCRETELY DO TODAY AND TOMORROW ?

As explained above, biodiversity loss is an emergency that Provincie Zeeland, as any other region of the world, should consider. Zeeland will not be left unscathed by the disastrous consequences of a decline in species and ecosystems diversity, as it is even seen as a zone that can become a hotspot area. It is your responsibility then to do your utmost to protect Zeeland's biodiversity.

## EMERGENCY MANAGEMENT: BUILDING RESILIENCE

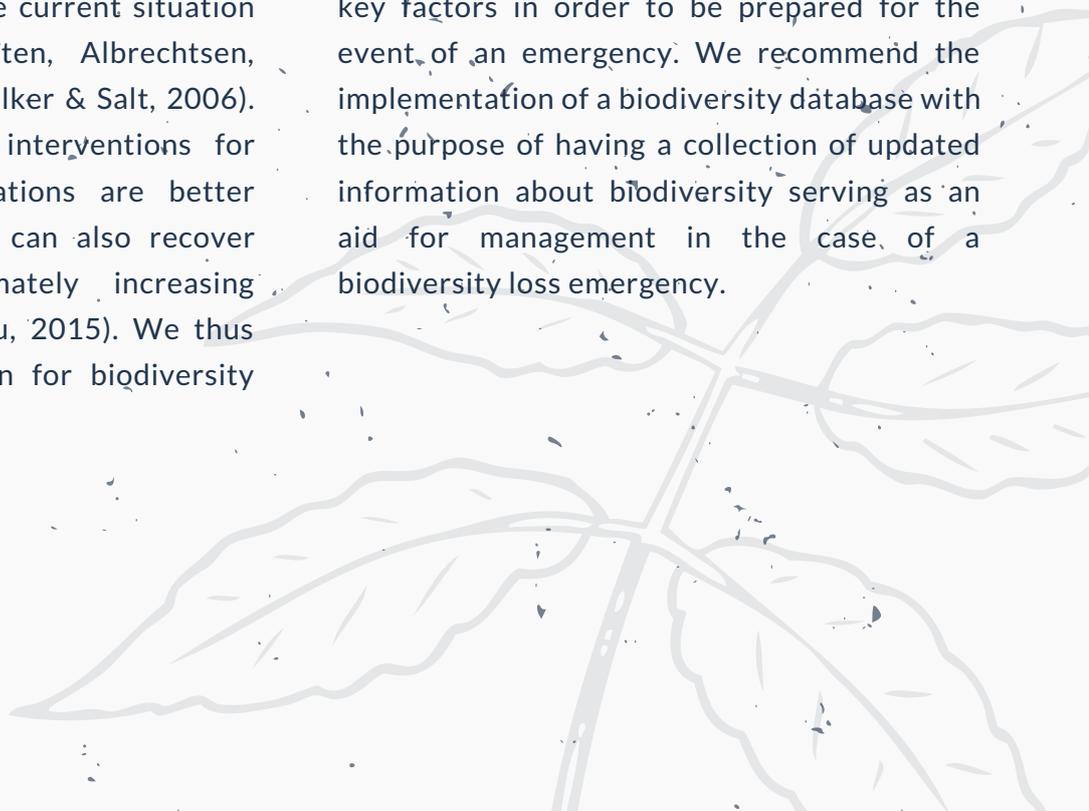
Resilience in the context of emergency management allows for hedging against the uncertainties and gaps from risk planning, allows for the reaction to unexpected situations, and allows for the adaptation of new practices either for the current situation or future practices (Tveiten, Albrechtsen, Wærø, and Wahl, 2012; Walker & Salt, 2006). Through the creation of interventions for natural disasters, organizations are better prepared for changes and can also recover faster from them, ultimately increasing resilience (Rivera & Kapucu, 2015). We thus recommend creating a plan for biodiversity loss emergency.

## A FOUR STEP APPROACH

As for any emergency, a professional systematic approach must be adopted. The National Earthquake Hazards Reduction Programme (NEHRP, n.d.) formally suggested the following four steps in implementing an emergency policy: mitigation, preparedness, response, and recovery. The aim of the proposed plan is to build resilience of the ecosystem in Zeeland.

## DATABASE

Previous studies about emergency management (Le Rutte, van Straten, and Overgaauwet, 2018; Tveiten et al., 2012) suggest the use of technology for the creation of a network platform to monitor and control key factors in order to be prepared for the event of an emergency. We recommend the implementation of a biodiversity database with the purpose of having a collection of updated information about biodiversity serving as an aid for management in the case of a biodiversity loss emergency.



# STEP 1: MITIGATION OF THE RISK

According to World Bank data tracking on biodiversity ("Terrestrial Biodiversity indicators | Data Catalog", 2020), Provincie Zeeland is fortunately not facing immediate massive danger for its biodiversity. One could argue that time is on your side, however, an unexpected biodiversity emergency can happen any time. Thus, there is a need to start now to reduce the negative impact on Zeeland's biodiversity due to slowly approaching and unpredictable events.

## IDENTIFY BIODIVERSITY

The first step is to track and trace biodiversity in Provincie Zeeland. To protect nature, you must know precisely the state of all species and their habitats. This is possible through a thorough mapping of different ecosystems in Zeeland, as well as of all the species and their interconnections within those ecosystems. In this work, priority must be given to the 16 natural reserves where biodiversity is particularly abundant and diverse, such as Oosterschelde, which is the habitat and breeding ground for many species (i.e. seals, porpoises, many species of birds among other). Concretely, this mapping is a massive scale-up of the Geoloket initiative in which the province is already involved ("GeoWeb 5.5", 2020).

## MINIMIZING THE PROBABILITY AND ADVERSE IMPACT OF BIODIVERSITY LOSS.

For less biodiversity-dense regions, this mapping can be done through the engagement of local communities. Associations, companies, and individuals can provide a vast array of information about the ecosystem they are surrounded by and interact with (Perry, 2007). There are quite a few organizations in Zeeland, and in particular NGOs, with a focus on nature and environment which you could collaborate with to get more insights of the local ecosystems. An overview of these NGOs can be found in Appendix 1.

## ENGAGING LOCAL COMMUNITIËS: PARTICIPATORY ECOSYSTEM MAPPING

Your role as Provincie Zeeland is first to raise awareness among local communities about the importance of biodiversity protection and the impact citizens can have by helping mapping the region's ecosystems. This is done with the aim of incentivizing people to collaborate in the project, and also aims at raising awareness within the local communities to create a sense of need for the emergency plan. Damastuti & de Groot (2019) analyze this involvement of the community in mapping of an ecosystem, calling it participatory ecosystem mapping. Using this

technique to involve the locals not only allows for an inclusion of cultural factors of interaction with the ecosystem, but also motivates them for participation as is a technique linked to social learning.

## ENGAGING LOCAL COMMUNITIES: MULTI-STAKEHOLDER INTERACTION

Additionally, social capital can be related to this interaction with local communities through bridging social capital (Norris, Stevens, Pfefferbaum, Wyche & Pfefferbaumet, 2007). By doing this, different groups across the community come together, allowing multi-stakeholder interaction. This, in turn, allows for a widespread of solutions, ideas, and awareness about the ecosystem to enhance resilience, facilitating overall the entire resilience-building process (Atkinson, 2014; Norris et al., 2007).

## ENSURING DATA QUALITY

Then, the next step is to offer training and procedures to ensure a reliable collection of information. In Big Data management, quantity does not mean quality, so ensuring the quality of the information collected should be one of the top priorities at this stage. One of the benefits of having big data on biodiversity is the ability of quantification of the data (Devictor & Bensaude-Vincent, 2016). However, it should be highlighted that already existing records of biodiversity data fall into the trap of being managed, failing to be updated.

Training of the citizens in methods of data collection on biodiversity can be managed in partnerships with organizations who already apply scientific and thorough methods in mapping biodiversity. In Zeeland, local representations of the Society for the Protection of Birds (Vogelbescherming), WWF Netherlands, or Coastal and Marine Union (EUCC) can be valued partners.

## KNOWLEDGE SHARING TOOL: THE DATABASE

Finally, you should provide an user friendly knowledge sharing platform to gather this information, which is the database proposed to aid the entire relief plan. The more you allow the information to be shared among stakeholders, the bigger and more complete the picture is that is obtained. The management of this platform and of all the data flowing in it must be managed by professionals. This service can easily be outsourced to companies used to manage massive loads of data if human resources and knowledge are not easily accessible for Provincie Zeeland.

## DATABASE IMPLEMENTATION IN THIS STAGE

### DATA GATHERING

All this gathered data should flow in a central database easily exploitable by Zeeland's and Netherland's central authority or any other person or institution able to take action in biodiversity protection. This is the stage where your role is to partner and invest in the

creation of the database. With the collaboration of the local communities and partnerships with experts in ecosystem biodiversity, a collection of the species present in a zone can be obtained. One limitation to this is that it has been seen that the tools for biodiversity science are underdeveloped and in a starting phase, making this collection almost unachievable at the moment (Soltis & Soltis, 2016). However, Soltis and Soltis (2016) also argue that a combination of bioinformatics, phylogeny reconstruction, digitized specimen data, and post-tree analyses can aid to provide a better outlook for obtaining the information needed in the database.

## SOFTWARE INVESTMENT

The previous data collection will allow for the database to contain the species and habitats composing the ecosystem of Zeeland. One of the biggest investments that needs to be done is in the software system of the database. Ideally, the database should be able to map the information into the ecosystem's network. An investment in software and software engineers to develop this system is necessary. This feature allows for the database to not only contain information, but also allow interaction with it. What is meant by interaction is the possibility to map the data in order to get the food chain in the ecosystem desired, allowing for a visual map of the situation.

## UPDATING AND WARNINGS

O'Brien, O'Keefe, Rose and Wisner (2006) highlight the connection between climate

change and biodiversity loss, by stating that any change or emergency caused by climate change has subsequent repercussions that can lead to biodiversity loss. It is then of utmost importance in this stage, that the investments and partnerships for the creation of the database are done periodically for having up to date control of climate disasters. Through already-established platforms, such as NL Alert ("NL-Alert | Crisis.nl", n.d.), an additional sentence can be added with a warning about the repercussions of such a crisis in biodiversity. This warning is based on the probability of the species to suffer a loss from the climate disasters alerted, which is determined by the ecosystem experts aforementioned. In addition, Appendix 2 shows the list of endangered species in the Netherlands by 2018, which gives an indication of vulnerable species that are prone to be included in the warning signs.



## STEP 2: PREPAREDNESS

Mitigating risk will not completely prevent adverse events from happening. You should be prepared to face problems that could be small or turn into complete catastrophes at any moment. Preparation allows for a smooth procedure in the case the emergency occurs.

### IDENTIFICATION AND BUILDING RESILIENCE

Being prepared means that you must be able to identify and qualify the nature of a risk on biodiversity whenever it happens. The biggest risks (i.e. floodings, nuclear) are already nationally monitored (e.g. the National High Water and Flooding Emergency Response Plan or National Plan for Nuclear and Radiological Emergencies) but more local ones must also quickly be reported (Etkin, Medalye & Higuchi, 2011).

Here again, engaging local communities is critical, however, it falls short as a sole stakeholder (Perry, 2007). Partnerships with institutionalized organizations such as NGOs, local associations and municipalities allow for a holistic approach to the emergency. This is as all the stakeholders that can aid in with their actions are embedded in the planning and are aware of their role if the plan needs to be executed, which in turn increases the resilience of the ecosystem.

The constant monitoring and forecasting of any factor that is potentially making the sys-

### ENSURING AVAILABILITY OF ALL REQUIRED RESOURCES TO DEAL WITH BIODIVERSITY LOSS AT ANY TIME.

tem more vulnerable, is immediately identified in the early warning signs analysis (Tveiten et al., 2012). It also allows for you to take action quickly, as people are prepared already with the warning signs that there is a high possibility of the emergency, thus actions are ready to be executed (Perry, 2007). To really minimize the impact of the event of biodiversity loss, however, civil services and citizens should be ready to act together with you because in isolation, the plan is not successful (Tveiten et al., 2012).

### PARTNERSHIPS WITH LOCALS AND INSTITUTIONS

The biodiversity loss emergency is also a result of natural disasters and hazards, as the entire ecosystem is affected by it. For hazards that require the intervention of civil services or professionals (i.e. firefighters), the preparedness stage is where you should make sure that the action plans for these disasters also cover protection of endangered biodiversity and that financial and material means are dedicated to that. In the case of smaller or more local hazards, citizens should be directly involved in biodiversity protection, as aforementioned, they are the ones that have the greatest knowledge about the ecosystem they interact with. As seen above in risk identification, you can work with NGOs, local associations and municipalities to train citizens

to take action as to how they can help in these cases. Appendix 1 includes several NGOs that could be fruitful partners for biodiversity preservation in Zeeland. As a starting point, it is recommended to form a partnership with SLZ (Stichting Landschapsbeheer Zeeland), which is involved in the management and development of the landscape of Zeeland, and they are part of a national network of landscape organizations, Landschappen NL otherwise known as LNL ("Over ons," n.d.).

## *DATABASE IMPLEMENTATION*

As this stage includes awareness and warning signs, the role of The Database is to be the information provider in order to make the establishment of an action plan and training regime feasible. This means that your actions regarding The Database at this stage revolve around data analytics and IT.

## *DATABASE COMPOSITION*

We believe that the minimum information as key categories needed for starting the database with a focus in Zeeland would be the following:

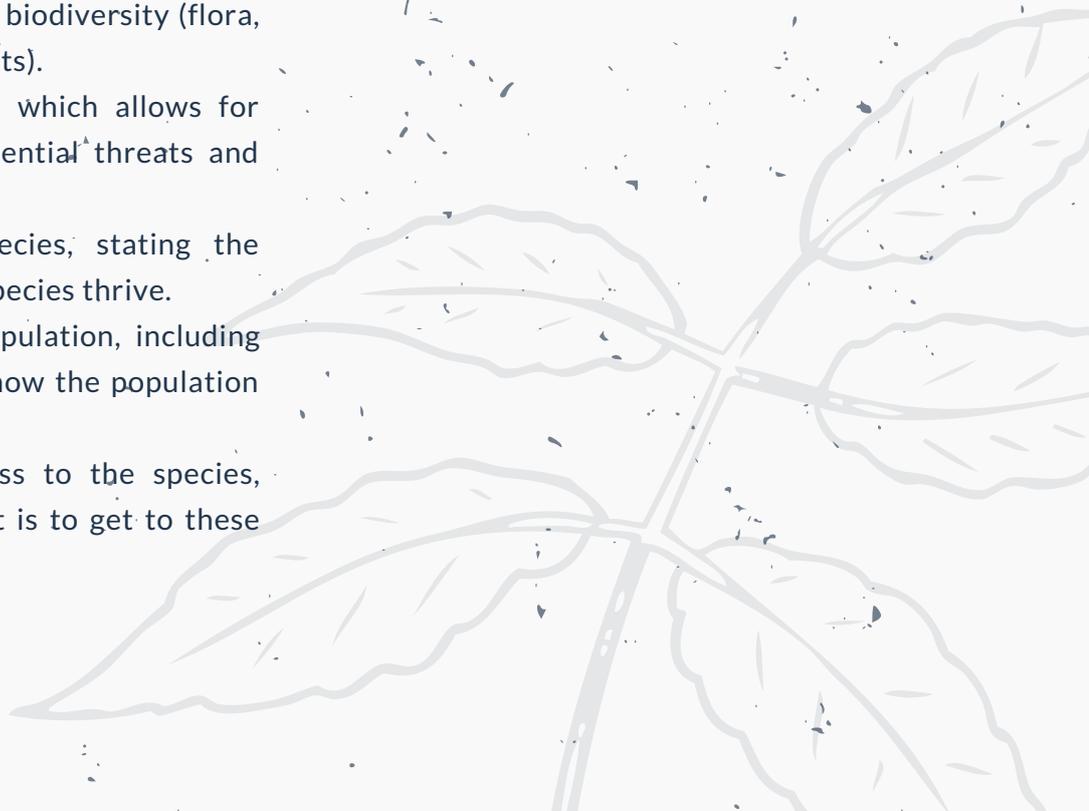
- A list of the species in the zone, to provide the knowledge of what is there in the ecosystem in terms of all biodiversity (flora, fauna, and abiotic elements).
- Their DNA composition, which allows for the identification of potential threats and potential substitutes.
- The habitat of the species, stating the conditions in which the species thrive.
- An estimation of the population, including the possibility to graph how the population is varying over time.
- The feasibility of access to the species, which means how easy it is to get to these species or mobilize it.

- The vulnerability of the species, which is connected to warning range aforementioned in the mitigation stage

In gathering the above mentioned information, the database is off to a great start.

## *DATA FILTERING*

Since there is a lot of information stored in the same Database, the idea is to allow filters within the categories (for a visual example of it refer to Appendix 3). An IT team can allow for this to happen, and data analysts have the expertise on how to manage the vast amount of data according to the needs of each situation. The filters allow for easy access to the information needed for the specific case, allow the focus in a certain zone, and most importantly, make the database easy to use for anyone involved in the project.



## STEP 3: RESPONSE

### IMMEDIATE ACTIONS WHEN AN ADVERSE EVENT HAPPENS.

All preceding steps allow for being aware of what actions should be undertaken in the case of any occurring biodiversity loss event. A biodiversity loss event could be climate-related (i.e. bushfires in Australia) or be due to loss of habitat. It is simply anything that has led or will lead to the loss of biodiversity. Taking immediate actions are meant for both unexpected biodiversity losses and biodiversity loss coming as an effect of a natural disaster. This stage consists in the actual deploying of professionals and citizens to carry out the action to protect biodiversity, as defined in the previous step. For instance when there is a need for animal rescue, partners such as the animal ambulance "Dierenambulance Zeeland" and the animal rehabilitation centre "De Mikke vögel- en zoogdieropvang" could be contacted to take immediate action (see Appendix 4). Along with this core response, the following point needs to be kept in mind.

#### REAL-TIME RISK TRACING

In the event of biodiversity loss, it is of utmost importance to have a team focused on real-time tracing of the risks that are arising, and forecast any possible future risks to act before it happens

#### RISKS

The risks referred to are any potential side-effects further damaging the ecosystem, risks

arising from natural disasters that are potentialized as zones become more vulnerable, or invasion of species in the zone as a reengineering of the food chain response to the loss. Previous events of diseases have shown that one of the most important things to take into account is the monitoring of the spread and the establishment of guidelines to follow that adapt to the conditions as they are changing (Le Rutte et al., 2018). An example of the need for this is the spread of the coronavirus, as it is currently closely being monitored and guidelines are being established to prevent its further spread (Bernard & Tilford, 2020). Your role as Provincie Zeeland is, therefore, to establish this response team, that includes experts from different fields to allow for multi-stakeholder perspective of the changing risks and accurate information.

#### THOROUGH MONITORING AND EVALUATION

Tracking and tracing also means thorough monitoring and evaluation (M&E) of the progress of the response in real time. Emergency response often requires quick adaptation to fastly changing conditions. For this, immediately available and reliable information is necessary to make good decisions. We extend here emergency guidelines suggested by NGOs operating in the emergency context to build strong monitoring and evaluation procedures.

To apply these in biodiversity emergency management, Provincie Zeeland should follow those four steps Adapted from IFRC M&E Guide (2011):

#### 1 - ESTABLISH M&E INDICATORS

- Identify objectively measurable outputs in the response programme design.
- Specify indicators in terms of quality, quantity and time.

#### 2 - ASSESS OF M&E CAPACITY

- Identify financial and human resources available for M&E activities.
- Ensure capacity-building of M&E staff.

#### 3 - PLAN TO COLLECT DATA AND ANALYSE IT

- Determine available source of data and their reliability.
- Determine and rank by order of priority information that needs to be collected.
- Agreeing on roles and responsibility for data collection within M&E staff.

#### 4 - REPORT, FEEDBACK AND USE THE RESULTS

- Dedicate resource of the M&E staff to design and run a reporting system.
- Incorporate results of programme evaluation in procedures update.

### STRUCTURAL INTEGRITY

O'Brien et al. (2006) highlight that one pitfall in disaster management is increasing resilience at the expense of vulnerability of the system. What this means is that the plans implemented in the response stage should keep into consideration the species that are still in the ecosystem. Oftentimes, in order to

counterbalance one of the losses, actions are taken without the analysis of their impact in the long term. However, as biodiversity should be managed in a holistic approach, no action can be taken if it reduces the vulnerability of another, as this has a repercussion within the system (Food and agriculture organization of the United Nations, 2017). Examples of these cases are seen with alien invasive species or introduction of species to an ecosystem. For instance, the cane toad from North and Central America is still causing great harm in Australia where it was introduced in 1935. Originally brought to tackle the invasion of two types of insects, the cane toad rapidly started to eat other prey and even intoxicated its predators, making its proliferation a daunting challenge to stop (Department of Agriculture, Water and the Environment, 2020).

### DATABASE IMPLEMENTATION

For the response stage to flow smoothly, it is important for the database to have the capability of real-time updating and continuous network reconfiguration. What this means is a constant tracing of the changing dynamics of the ecosystem as they are being observed, with its accompanying change in the ecosystem's network. It is also the stage where the information of the database is going to be mostly used to enable food chain reengineering and support of the ecosystem suffering the biodiversity loss.

### NETWORK RECONFIGURATION

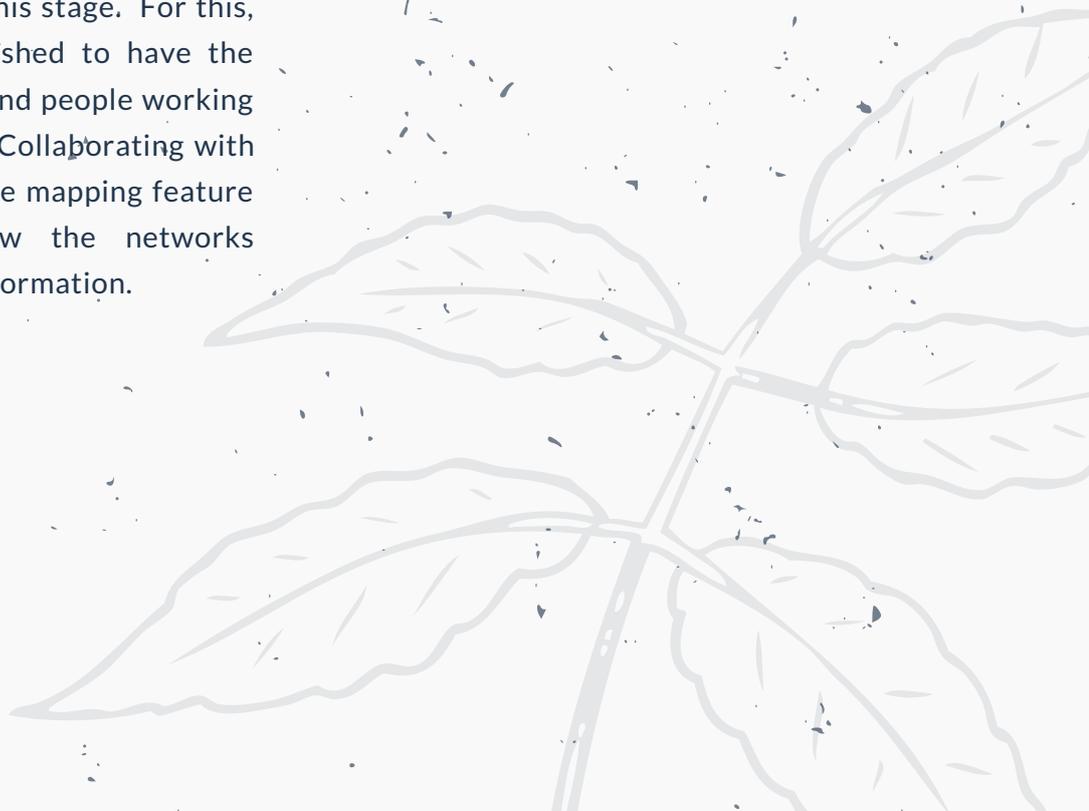
Starting with the latter, the database allows for the identification of species that can be introduced to counterbalance the loss experienced, identification of the species that should be taken away or treated in case of any

infection or potential carriers of diseases. For this, the ecosystem experts involved in the production of the database are key actors in the database as they have the knowledge and capacity to identify and monitor these cases.

It is also important to partner with disaster management institutions (i.e. the Red Cross), in order to acquire their information of any spread and development of the risks as the plan is executed. A collaboration between the IT group and the ecosystem expert teams is needed for the identification of the new balance of the food chain after the loss. The IT team allows for the information provided to be introduced into the database, providing the new balances in the food chain and ecosystem. This is all feasible with the categories provided per species and also with the network mapping of the ecosystem.

#### *REAL-TIME UPDATING*

In terms of real-time updating and network reconfiguration, the database allows for the zone experiencing the loss to have the most accurate information about the ecosystem's information, including any changes in the species or warning signs in terms of further biodiversity loss or any climate disaster alert that are forecasted during this stage. For this, a budget should be established to have the adequate monitoring tools and people working at all times on the updates. Collaborating with the IT team will allow for the mapping feature of the database to show the networks according to this updated information.



## STEP 4: RECOVERY

The previous stages are focused on the required procedures implemented before and during the event of a biodiversity loss emergency. The recovery stage differs from them as it is focused on the aftermath of the event, and the ensurance of long-term sustainability of the habitat with the changes undergone in the event. The aim at this stage is to allow the ecosystem to build back resilience with the new composition, avoid adding any vulnerable positions to the species as they recover, and integrate the stakeholders for learning and improvement of the emergency plan regarding the implementation, as another emergency can occur at any moment.

### LONG-TERM SUSTAINABILITY OF THE ECOSYSTEM

After the response stage, it is important to have a plan for the recovery of the system. This is because the solutions arrived at in the response stage need to be sustainable in the long term for the ecosystem, and need to be able to sustain themselves without the intervention of humans. It is suggested for you to denominate zones for those species that are dependent on humans to survive, in order for them to be monitored and to develop new plans to slowly decrease their dependency on human intervention. For species that can move freely, your role is to identify their new habitat and work to protect it. For this to be achieved, partnerships with local governments of these zones, such as municipalities or other

## LONG-TERM POST-EMERGENCY ACTIONS AIMING AT RECONSTITUTE OR BALANCE LOST BIODIVERSITY.

provinces' administration, and close collaboration with both ecosystem experts and veterinarians is required in order to achieve the optimal conditions for the species.

In the case the ecosystem has a sustained reengineered food chain after the response stage, your role is to ensure the protection of the area in order to allow for the vulnerability of the entire system to be reduced.

### RECOVERY RESOURCES

Throughout the entire plan, resources are mainly targeted to expert collaboration and inclusion of communities. However, at this stage, a budget is needed for resources for those affected. The exact nature of the budget needed for the recovery process will depend on the extent to which resources and the population were affected. This can differ greatly depending on each situation.

### DATABASE IMPLEMENTATION

As aforementioned, the database has updated versions of the ecosystems and their network maps. This ensures stability in this stage, as the tracking of the changes executed in the response stage can always be accessed. It is also important for the database to have a section for reflection and learning, which is achieved by employing an agile system. Partnerships with disaster analysts and ecosystem analysts will be ideal for this stage as they can provide better insights of the

development of the situation. This is because it allows for the use of these reflections to learn from the experiences, and provides recommendations for any other biodiversity loss emergency, regardless whether it would happen in the same ecosystem or in a different one.

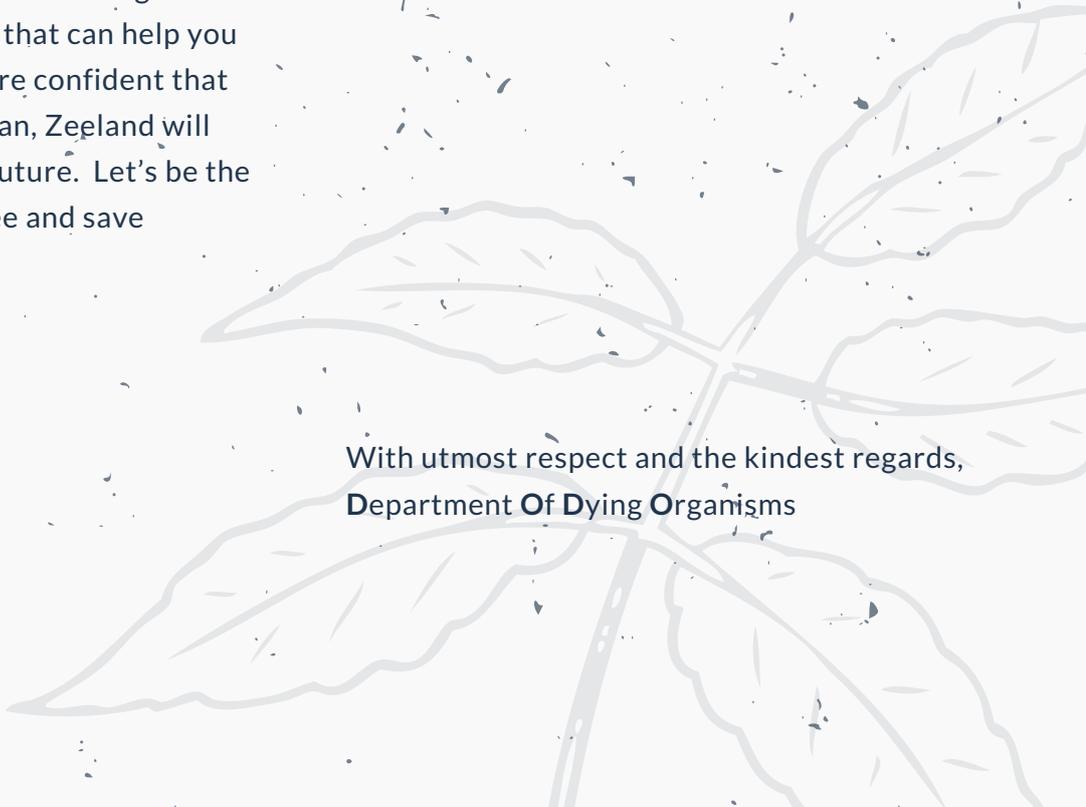
Part of the recovery stage is also to start thinking about the next potential occurrence of a biodiversity emergency. The emergency management framework we presented here is a cycle, which means that future risk mitigation and preparedness starts in this recovery stage. In particular, all lessons learned from good practice or mistakes captured in the response monitoring and evaluation should be thoroughly analyzed to adapt emergency response procedures.



# CONCLUSION

In this document we have outlined a plan of action for you, representatives of the Province of Zeeland. There are concrete steps you can take immediately after having gone through this report for the future of your Province and for when (not if) disaster strikes. Be the frontrunner your Province needs you to be and please stop relegating biodiversity loss to the bottom of your priority list. It has reached a point where addressing biodiversity loss, or the risk thereof, is no longer negotiable or a matter that can be put off any further. The ecosystems currently present in Zeeland will be altered in unprecedented ways should you be unprepared. We urge you to heed this for the warning it is, but also see it for the opportunity it is. It is not too late for Zeeland and you could be one of the early adopters that have a plan of action when it comes to addressing the Biodiversity Emergency. The difference being that instead of starting from scratch, you now have a plan that can help you hit the ground running. We are confident that through implementing our plan, Zeeland will be headed towards a bright future. Let's be the change the world needs to see and save biodiversity!

With utmost respect and the kindest regards,  
Department Of Dying Organisms



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# APPENDIX I

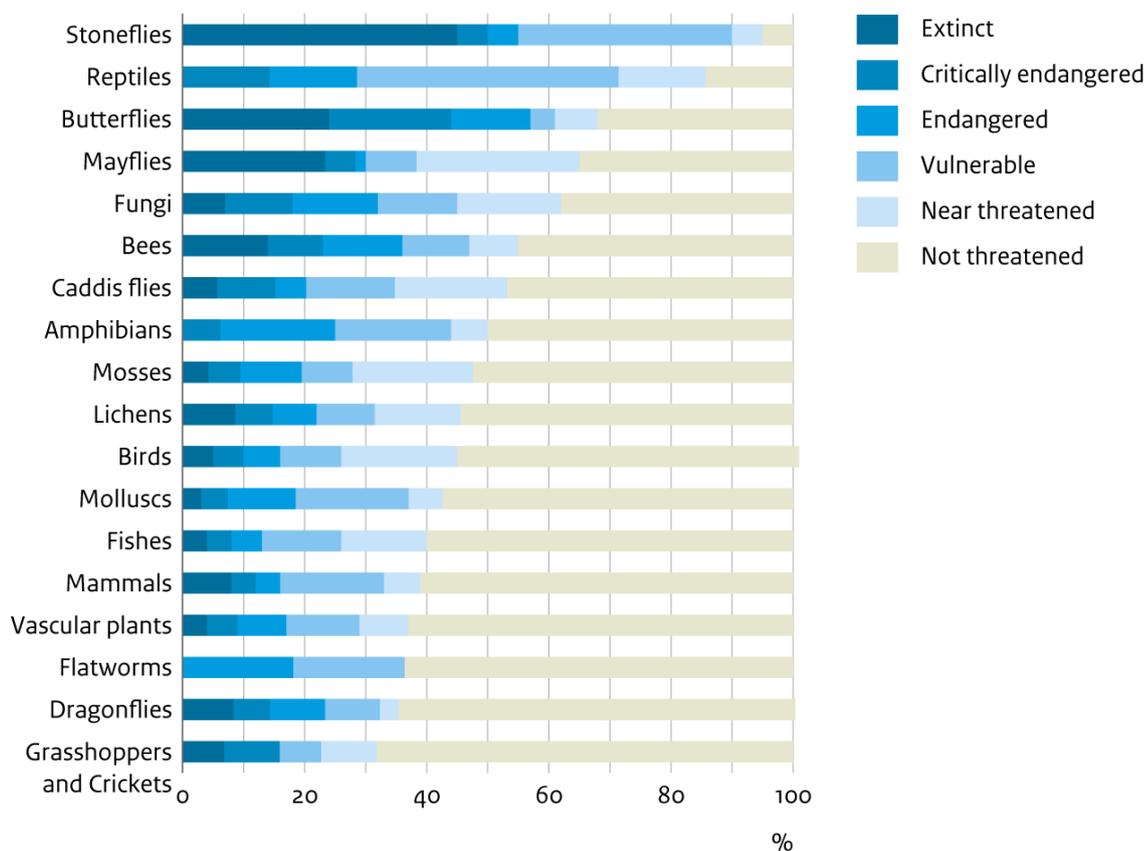
## NGOS IN ZEELAND

NGOs in Zeeland	Goal/mission	Source
Stichting Landschapsbeheer Zeeland (SLZ)	Professional organisation that is focused on the management and development of the 'Zeeuwse' cultural landscape	<a href="https://landschapsbeheerzeeland.nl/">https://landschapsbeheerzeeland.nl/</a>
Het Zeeuwse Landschap (HZL)	HZL is involved in the preservation, management and development of the nature and landscape in Zeeland. This can be defined in the broadest sense of the word, including the protection of cultural-historical heritage as well as the communication regarding nature and landscape.	<a href="https://www.hetzeeuwselandschap.nl/over-hzl">https://www.hetzeeuwselandschap.nl/over-hzl</a>
ZMF (Vereniging Zeeuwse Milieufederatie)	Protects the nature and environment in Zeeland and surroundings.	<a href="https://zmf.nl/over-zmf/over-zmf/">https://zmf.nl/over-zmf/over-zmf/</a>
ANNW (Agrarische Natuurvereniging Natuurlijk Walcheren)	Aims to maintain and improve the qualities of the typical landscape of Walcheren.	<a href="http://natuurlijkwalcheren.nl/">http://natuurlijkwalcheren.nl/</a>
MEC De Bevelanden	Encourages people to treat nature and environment more eco-consciously.	<a href="https://www.mecdebevelanden.nl/over-ons">https://www.mecdebevelanden.nl/over-ons</a>
Stichting Renesse	Invests its proceeds from commercial activities & investments, in charities and other good causes which support the area of Schouwen – Duiveland.	<a href="https://www.stichtingrenesse.nl/">https://www.stichtingrenesse.nl/</a>
Stichting Nutfonds Zierikzee	Supports initiatives in Schouwen – Duiveland, ranging from multiple fields such as art, culture, sports, recreation, education, nature and environment.	<a href="https://www.nutsfondszierikzee.nl/">https://www.nutsfondszierikzee.nl/</a>
Boerderijenstichting Zeeland (BSZ)	Manages the future of the farms in Zeeland and their characteristic buildings.	<a href="https://www.boerderijenstichtingzeeland.nl/over-de-stichting/">https://www.boerderijenstichtingzeeland.nl/over-de-stichting/</a>
ZSL	An independent foundation that aims to connect different parties (NGOs, companies, the municipality, individuals) to serve societal and/or	<a href="https://www.stichtingzsl.nl/">https://www.stichtingzsl.nl/</a>
	commercial goals from their stakeholders.	
Service organisation Rotary	Brings people together from all walks of life and enables them to provide humanitarian services.	<a href="https://www.rotary.nl/over/missie/">https://www.rotary.nl/over/missie/</a>
Dierenambulance Zeeland	To rescue animals in need.	<a href="https://www.dierenbescherming.nl/dierenambulance/dierenambulance-zeeland/over-ons/standplaats">https://www.dierenbescherming.nl/dierenambulance/dierenambulance-zeeland/over-ons/standplaats</a>
De Mikke vogel- en zoogdieropvang	The bird shelter takes care of injured and sick birds and other mammals and rehabilitates them.	<a href="https://www.demikke.nl/">https://www.demikke.nl/</a>

# APPENDIX II

## LIST OF ENDANGERED SPECIES IN THE NETHERLANDS BY 2018

Percentage of threatened species per species group in The Netherlands



Bron: PGO's, WUR

CBS/may18  
www.clo.nl/en105215

("Number of threatened species in the Netherlands, by 2018," n.d.)

# APPENDIX III

## DATABASE VISUALISATION

Filters								
<b>Geographical Filters</b>			<b>Habitat filters</b>			<b>Access filters</b>		
By continent			Terrestrial			Easy access		
By country				Forest		Accessible only by plane		
By province				Jungle		Accessible only by boat		
By city				Wetland		Accessible only by feet		
				Desert		Difficult access		
			Aquatic					
<b>DNA Filters</b>				Ocean		<b>Vulnerability filters</b>		
				Sea				Less vulnerable
<b>Population filters</b>				Lake				
			Aerial					
								More vulnerable

# APPENDIX IV

## STAKEHOLDER ANALYSIS: NGOS IN ZEELAND

