Advisory Report

CLIMATE CHANGE ADAPTATION: DATA-NEEDS IN THE AGRICULTURAL SECTOR

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ACKNOWLEDGEMENTS

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At last, I would like to thank the participants of the focus group discussions, online survey, and semi-structured interviews. Without their expertise, I would not be able to draw conclusions on the subject, and give advice to Statistics Netherlands. Their effort was a key success factor for my research.

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EXECUTIVE SUMMARY

This advisory report describes the recommendations concerning climate change adaptation in the agricultural sector and the data needs that are connected to it. The research uses the National Adaptation Strategy (2016) and the Regional Adaptation Plan (2017) as a framework. These reports describe a total of 33 climate change effects, which is narrowed down to a top 5, using focus group discussions and an online survey. The top 5 most urgent effects are as follows:

1. Decrease of freshwater availability
2. Increase of infectious diseases and plagues
3. Lower crop yields
4. Change in ecosystem/shift in species
5. Decrease of water quality

Through interviewing experts on the field, I determined components and data-needs that are connected to these urgent climate change effects:

1. Decrease of freshwater availability - The weather extremes are increasing, which means that long periods of drought could cause a lot of damage to crops and livestock. Monitoring ground and surface water levels, and long-term weather forecasting are perceived as important data-needs.
2. Increase of infectious diseases and plagues - This effect is perceived as important, and is strongly linked to the fourth effect. Current plagues and diseases should be monitored closely. The agricultural sector in the Netherlands can learn from other countries with a warmer climate.
3. Lower crop yields - Not everyone perceives this effect, which is seen as a result of a lot of the other climate change effects, as most urgent. It is recommended to monitor different parcels, and to register this data.
4. Change in ecosystem/shift in species - As changing ecosystems could mean that farmers have to swap to other crop varieties or other species, this effect is perceived as important. Monitoring current crops, and conducting effect studies on new varieties and species is key.
5. Decrease of water quality - This effect is considered less urgent than the others. Constant monitoring of water quality is key. Moreover, it is important to monitor the salt levels in the water, as salinisation becomes more problematic.

Other important findings that were not included in the top 5 most urgent effect are:

- As weather extremes are increasing, the role of insurance companies can change.
- It is important to determine whether the described effects are actually climate-related.
- Too much water can also be a problem in the Netherlands.
- Effects described in the National Adaptation Strategy (2016) and Regional Adaptation Plan (2017) should be quantified.

CONCLUSION

Firstly, monitoring is considered key in data-needs concerning climate change adaptation in the agricultural sector. This is the case for all covered effects in this research. One of the main findings of this research is that data-generating authorities should collaborate more effectively and efficiently. Moreover, microdata can become more important. Lastly, it is important to determine whether climate change is the cause of all effects that are described by the National Adaptation Strategy and the Regional Adaptation Plan.

Introduction and Background

Figure 1. Drought damage on crops.

The climate in the Netherlands is currently changing. The average temperature is increasing, and the sea level is rising. This has numerous consequences for all kinds of sectors. In order to prevent damage and big disasters from happening, it is important to adapt to these changing circumstances. Before implementing all kinds of climate change adaptations, proper research should be conducted (Howden, 2007; Nelson et al., 2009). In order to know what kind of research we should conduct, a set of data-needs should be determined. As these climate change effects and data-needs could be region-specific, we chose, together with Statistics Netherlands (CBS) and the municipality of Zwolle, to conduct this research on the regional scale, namely the region of Zwolle.

As time for this research was limited, we chose to use the National Adaptation Strategy (2016) and the Regional Adaptation Plan (2017) as a baseline. These two reports divide climate change adaptation in nine sectors in the Netherlands. In order to make the scope of this research achievable within the set timeframe, I chose to limit myself to one sector, namely the agricultural sector. The National Adaptation Strategy (2017) describes 33 climate change effects that are linked to this sector, of which some are combined. As this is still quite broad, I chose to narrow these effects down to the five effects that the experts on the field perceive as most 'urgent'. This process of narrowing down the effects was done through focus group discussions and an online survey. The five effects that are perceived as most 'urgent', were used as a baseline for eleven semi-structured interviews. I used the outcomes of these interviews to give advice to Statistics Netherlands. As these determined data-gaps can also be filled by other data-generating authorities, they are benefitting from this inventory of data-needs as well.

This advisory report contains a brief summary of the research design and process. After that, the key findings of the research are presented, along with determined data needs and other recommendations. This report serves as a guideline on what data is still required concerning climate change and climate change adaptation in the agricultural sector. Per determined urgent effect, I will give a brief summary of findings. This advisory report is based on the findings that are described thoroughly in the research report on the same topic, which is available on request.

Research Design and Sampling

RESEARCH DESIGN

As described in the introduction, I used the National Adaptation Strategy (2016) and Regional Adaptation Plan (2017) as a baseline for this research. These reports describe 33 climate change effects that are linked to the agricultural sector. A schematic overview of these effects is included in Appendix IV. In order to narrow these down to the five most urgent climate change effects, I conducted focus group discussions and an online survey. One focus group discussion took place in Zwolle, with a working group concerning climate change adaptation in the region of Zwolle. The other two focus group discussions were conducted with experts from Statistics Netherlands. Moreover, we distributed an online survey to selected experts. By combining the results of the discussions and the survey, a top 5 most urgent climate change effects for the agricultural sector was determined. I used these five most urgent climate change effects as a basis for eleven semi-structured interviews.

SAMPLING

For all the different parts within the research, I used a selective sampling method, which means that the participants were specifically chosen beforehand. I used this method in order to make sure beforehand that the participants of the research had sufficient knowledge of the topic. Participants from different disciplines were included in the research, in order to gather data from multiple perspectives. In order to find participants for first the focus group discussions, and then the online survey and interviews, the network of both Statistics Netherlands and the municipality of Zwolle was used. The focus group discussions and online survey had a total of 25 participants. The amount of participants of the semi-structured interviews was eleven.

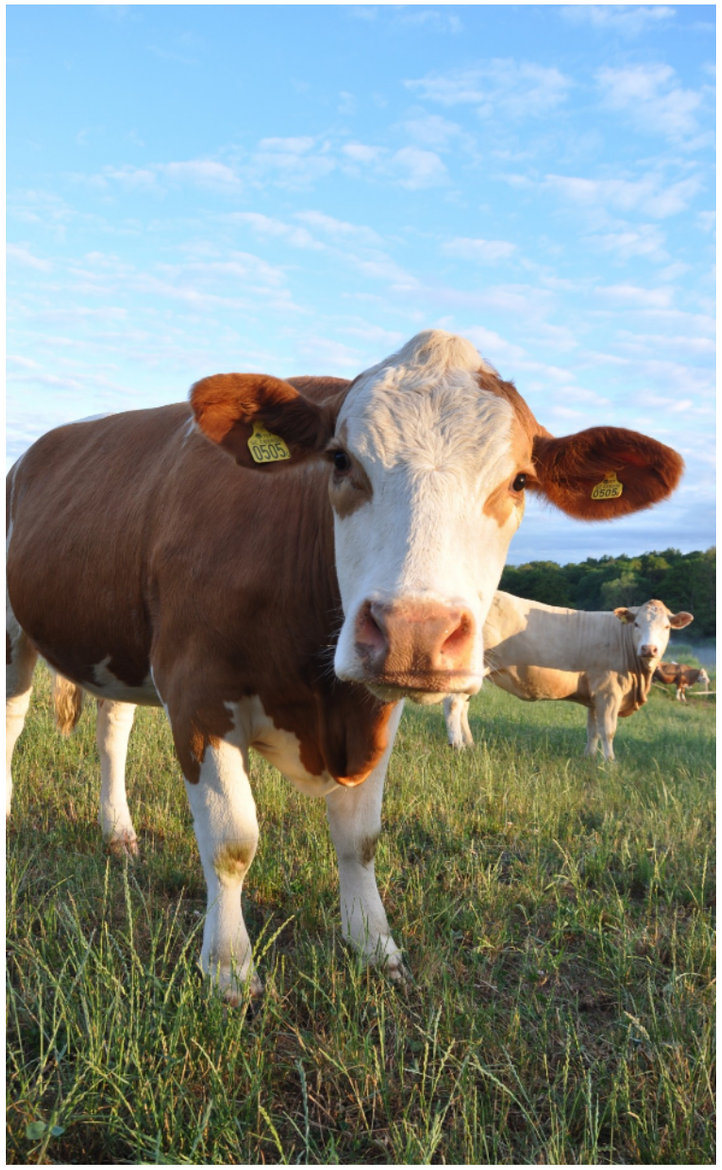

Figure 2. Cow.

Research Findings

FOCUS GROUP DISCUSSIONS, SURVEY, AND SEMI-STRUCTURED INTERVIEWS

Figure 3. Crop irrigation.

RESEARCH FINDINGS: FOCUS GROUP DISCUSSIONS AND SURVEY

The results of the survey were analysed thoroughly, and a top five of most urgent climate change effects on the agricultural sector was determined. The survey had a total of 25 respondents (focus group discussions and online self-completion questionnaire combined). As participants in the focus group discussions already pointed out, some of the effects are exactly the same or are very similar. Therefore, I clustered some of the effects in the results. The outcomes of the survey, and thus the top five of the most urgent climate change effects on the agricultural sector are as follows (in order):

1. Decrease of freshwater availability
2. Increase of infectious diseases and plagues
3. Lower crop yields
4. Change in ecosystem/shift in species
5. Decrease of water quality

The top 3 most urgent climate change effects were determined clearly. Number four and five were closer to some others, but after analysing the outcomes of the survey and the explanations for this, I was able to determine four and five as well. Taking into account recommendations from participants, the fifth effect, decrease of water quality, is a combination of three similar effects.

RESEARCH FINDINGS: SEMI-STRUCTURED INTERVIEWS

The findings of the focus group discussions and online survey that were mentioned in the previous segment were used as a baseline for the semi-structured interviews. I asked a total of eleven participants to answer a number of questions that are linked to the top 5 effects that are perceived as most urgent. The key findings of these interviews are shortly discussed in the next segment of this report. Moreover, I will give recommendations.

KEY FINDINGS: EFFECT 1. DECREASING AVAILABILITY OF FRESHWATER

The first effect that was discussed during the semi-structured interviews is the decreasing availability of freshwater. Almost all of the participants of the interviews perceive this as an important effect, because of the following reasons:

- The weather extremes are increasing, meaning there will be more long periods of drought, in which freshwater demand by the agricultural sector increases while freshwater supply decreases.
- Salinisation, which is roughly a consequence of the decreasing availability of freshwater, is becoming more problematic for the Dutch agricultural sector.
- If the availability of freshwater is too low, it could affect crop yields and livestock, as they require a lot of freshwater.
- There are currently not enough freshwater buffers to supply everyone in case of disaster. Moreover, some regions are not suitable for storing large amounts of freshwater, as they cannot hold it efficiently. Regions with sandy soils are examples of this.

Table 1. Recommendations effect 1.

Recommendations and data-needs:
• Constant water-monitoring.
• More water-use measurements.
• More weather data on short and long term.
• Experiments with drought-resistant crops.
• More data concerning water buffers.

During the focus group discussions, the online survey, and the semi-structured interviews, data-needs that are connected to the most urgent effect, the decreasing availability of freshwater, could be determined. These are as follows:

- It is important to know how much freshwater is available in the Netherlands (or in the region of Zwolle specifically) at any time. This is something that we should monitor closely. In this way, downward trends can be determined in an early stage, which gives more time to intervene. It is important to monitor this on multiple scale.
- There should be more measurements on how much water the agricultural sector uses. This should not only be monitored for the sector specifically, but also for the individual components within the sector, like crop farming, livestock breeding, gardening, and fisheries.
- There is a need of weather data, both on the short term and on the long term. In this way, farmers know whether a warm or cold, or a wet or dry year is coming. By knowing this beforehand, they can adapt themselves to the circumstances.
- As the risk of a decreasing availability of freshwater is present, more research should be conducted on more drought-resistant crops.
- There should be more data concerning water buffers, and its effectiveness. Relevant data includes volumes of water buffers, the effects on its environment, and how the water can be distributed to and from the water buffers.
- As there is a global phenomenon of increasing urbanisation (Tacoli, et al., 2015), there should be more research on the effects of using cities as freshwater buffers, as the participants of the interviews see this as an opportunity to solve water shortages.

KEY FINDINGS: EFFECT 2. INCREASE OF INFECTIOUS DISEASES AND PLAGUES

The second effect that was discussed during the semi-structured interviews is the increase of infectious diseases and plagues. Almost all of the participants of the interviews perceive this as an important effect, because of the following reasons:

- The increasing temperature and wetter conditions cause some bacteria and fungi to reproduce faster, which can damage crops.
- These expanding bacteria and fungi species can disrupt local ecosystems. These disrupted ecosystems can lead to the disappearance of crucial species for ecosystems and the agricultural sector.
- As ecosystems are changing (see fourth covered effect), the Dutch climate could become more appealing for species that are currently native to southern Europe. These species could bring all kinds of viruses and plagues with them, which we are not familiar with, which could disrupt crops and livestock as well.
- An increase of diseases and plagues ask for an intervention in the form of using more pesticides for example. As pesticides affect soil and water quality, using more is not desired.

During the focus group discussions, the online survey, and the semi-structured interviews, data-needs that are connected to the second most urgent effect, the increase of infectious diseases and plagues, could be determined. These are as follows:

- Current plagues and diseases in the Netherlands or specific regions should be monitored constantly. We are then able to identify big fluctuations. It is important to monitor this on parcel-level, meaning that all parcels should be individually monitored on plagues and diseases. This is also applicable to livestock, where an example of relevant level of scale could be the herd-level, as circumstances could differ per herd.
- It is important to know the effects that plagues and diseases have. This should be done on parcel-level as well. The more we know about the effects, the easier it is to make causal links.
- It is important to determine perfect growing conditions for fungi, plagues, and diseases. If we identify these perfect conditions, it is easier to get to the root of certain problems.
- If ecosystems are disrupted due to excessive presence of plagues or diseases, it is important to know how to get them to a desired state without these plagues or diseases again.
- As the climate is shifting north, it is good to look at current practices in the southern Europe. The climate that they currently have, could be the climate here in a couple of decades. We can observe things that they are struggling with, and what things they use to combat vermin, plagues, and diseases.
- As using more pesticides is not desirable, there is a data-need concerning the effects of (natural) alternatives for pesticides.

Table 2. Recommendations effect 2.

Recommendations and data-needs:
• Constant monitoring of current plagues and diseases.
• More data regarding effects of plagues and diseases.
• More data on parcel-level.
• Determine perfect growing conditions.
• Look at southern countries.
• Effect studies on alternatives for pesticides.

KEY FINDINGS: EFFECT 3. LOWER CROP YIELDS

The third effect that was discussed during the semi-structured interviews is lower crop yields. Most of the participants of the interviews see this as a result of the other mentioned effects important effect, and perceive it as important, because of the following reasons:

- As weather extremes are increasing, more long periods of drought will occur. This can, without proper adaptation, lead to drought damage to the crops, which leads to lower yield. This is also linked to the decreasing availability of freshwater.
- Longer wet periods can cause serious problems as well, as water damage can also lead to lower crop yields.
- Higher average temperature can cause some (crop) species to disappear, which could affect crop yields.
- As the export of agricultural products is a key form of income for the Netherlands (Statistics Netherlands, 2018), good yield should be conserved.

Table 3. Recommendations effect 3.

Recommendations and data-needs:
• More monitoring on parcel level.
• Take domestic good practices into account.
• More scenario planning concerning climate change.
• Look at current practices abroad.
• Determine whether the cause is climate change.

During the focus group discussions, the online survey, and the semi-structured interviews, data-needs that are connected to the third most urgent effect, lower crop yields, could be determined. These are as follows:

- In context of data-needs, monitoring per parcel is key. The monitoring should be differentiated per crop, soil-type, and climate, in order to identify trends. If a particular parcel has a bad year, it is possible to identify the reason for this. With good monitoring, it is easier to implement proper climate change adaptations.
- Good practices should be taken into account. If a year's yield is relatively good, it is important to know what set of factors made it a good year. Farmers can use this knowledge in order to increase yield in the future.
- It is important to gather data on which crop can and which crop cannot grow in the Netherlands in the future. Scenario planning is a good way of doing this, as it is yet unknown how much the climate is going to change. Scenarios for different climate outcomes should hereby be determined and analysed.
- In this case, it is also good to look at current practices abroad (like Portugal, Spain, and France), as they are coping with things that we could be coping with in a couple of decennia.
- Not all factors that could affect the yield are climate change-related. Therefore it is important to know what the most important causes of bad yield are. If they are climate related, climate change adaptation could be implemented, but if it is not climate related, implementing climate change adaptation would be a loss of resources.

KEY FINDINGS: EFFECT 4. CHANGE IN ECOSYSTEM/SHIFT IN SPECIES

The fourth effect that was discussed during the semi-structured interviews is change in ecosystem/shift in species. Most of the participants of the interviews perceive this as an important effect, because of the following reasons:

- If something happens in nature, it will affect the agricultural sector, and vice versa.
- The rising global temperatures will affect regional ecosystems.
- If new species from the south are introduced here, it could have a big impact on the ecosystems here.
- This climate change effect also could have positive influences on the agricultural sector, as with a higher temperature, the Dutch climate could be sufficient to grow different crops. Products that now have to be imported, might be able to grow here in the future.

During the focus group discussions, the online survey, and the semi-structured interviews, data-needs that are connected to the fourth most urgent effect, change in ecosystem/shift in species, could be determined. These are as follows:

- Here again, it is key to monitor the regional ecosystems closely. This consists of knowing what species live where, and in what numbers they live there. This should be monitored over numerous years, which makes it possible to identify potential trends.
- Monitoring should be done per ecosystem, as ecosystems are region-bound and could differ greatly.
- Some interviewees recommended to form a basic framework of actors in ecosystems. The basic needs for an ecosystem to function properly should be identified for this to happen. This makes monitoring (and identifying potential flaws) in ecosystems more effective.
- Components and effects of newly introduced crops or animal species should be clear beforehand, in order to prevent ecological disasters from happening. One way of doing this, as mentioned previously, is to look at ecosystems in other countries with a warmer climate, countries where those species now live. As they have dealt with these species, knowledge can easily be transferred.
    - In order to make these observations valid, observations in all countries should be done in the same way. Otherwise it can be difficult to compare multiple observations.
- Forecasting studies are increasingly important in this phenomenon. These scenarios contain:
    - What does it mean for agriculture if species disappear, or ecosystems change?
    - What does it mean for soil fertility or for other species if species disappear, or ecosystems change?

Table 4. Recommendations effect 4.

Recommendations and data-needs:
• Monitoring per ecosystem is key.
• Create a basic framework of actors in ecosystems.
• Effects of newly introduced species should be known.
• Conduct forecasting studies on ecosystems.

KEY FINDINGS: EFFECT 5. DECREASE OF WATER QUALITY

The fifth effect that was discussed during the semi-structured interviews is decrease of water quality. Not all participants of the interviews perceive this effect as particularly important, but it still made the top 5 because of the following reasons:

- A lot of the pesticides that are used for crops end up in surrounding waters, which affects the water quality greatly. As pesticides are potentially more necessary in the future, due to the increase of infectious diseases and plagues, this could affect the water quality more.
- The Netherlands still does not comply with the water quality norms that we agreed with from Brussels, which makes this an urgent matter.
- Salinisation is a serious problem, especially in coastal areas, which is bad for the water quality.
- If the groundwater and surface water levels are lower, it is important that the water quality is sufficient. Low level waters are more vulnerable to the impact of high temperature, and pesticides that end up in the water.

During the focus group discussions, the online survey, and the semi-structured interviews, data-needs that are connected to the fifth most urgent effect, decrease of water quality, could be determined. These are as follows:

- Here again, monitoring the water quality is key. Currently, reports concerning water quality should be delivered every three or four years. This is too long according to some of the participants; reports should be published more frequently, as water quality levels fluctuates.
- It is important to know who the main polluters are. It is clear that the agricultural sector plays a big role in this (Holden, et al., 2015), but all actors that pollute should be known.
- Moreover, it is important to know what the salt variations in the water are, especially close to the coast. If it is identified where rivers get saltier, it is easier to implement effective adaptations.
- By using sensors, it is easier to determine potential fluctuations in the water quality. If these fluctuations are determined in an early stage, a potential intervention can be implemented sooner, to prevent worsening of water quality from happening.

Table 5. Recommendations effect 5.

Recommendations and data-needs:
• Monitor water quality more closely.
• Find out who the polluters are.
• Monitor salt variations.
• Make more use of sensors.

KEY FINDINGS: OTHER EFFECTS AND FACTORS

During the interviews, I asked the participants whether there were factors that they perceive as important that were not yet included in the top 5 most urgent climate change effects. In the following list, there are some factors included that the participants of the interviews perceive as urgent, but were not included in the top 5:

- As damages could increase in the future due to the extreme weather, the role of insurance companies in the agricultural sector can change greatly.
- Currently, in case of a lot of effects it is unknown whether climate change is the main cause. Therefore, according to some of the participants, it should first be clear what the causes are, before actually implementing all sorts of adaptations.
- An effect that has been mentioned frequently is the risk of water nuisance and floods. Not only drought damage is a problem, but water damage is also seen as a serious risk.
- According to a lot of the participants, there is not enough collaboration between different data-generating authorities. This means that a lot of the data-generating authorities are too unaware of what the others are doing. This is certainly something that can be improved in the future. The different organisations should use their own strengths in order to tackle the problem that affects us all; climate change.
- The current National Adaptation Strategy (2016) and Regional Adaptation Plan (2017) should be elaborated. At the moment, a number of climate change effects are described in these reports, but it is not yet fully known which of these effects are particularly urgent. A suggestion that has been made is to quantify these effects. The norm that can be used to quantify these effects is for example potential costs. If these effects are quantified, a clear list can be created, and effects can be prioritised. This helps making climate change adaptations more cost-effective.

Figure 4. Water damage on crops.

Recommendations

Based on the gathered data during the focus group discussions, online survey, and semi-structured interviews, a number of recommendations can be made. These recommendations are included in the next section.

The first thing that is recommended is to find out whether the described effects in the National Adaptation Strategy (2016) and the Regional Adaptation Plan (2017) are climate change-related. If they are climate change-related, it is possible to implement climate change adaptation. As not all of these effects are caused by climate change, implementing climate change adaptations could be a loss of resources in some cases. Therefore, findings this out is recommended as a follow-up research. Moreover, it is suggested to elaborate and quantify the climate change effects that are described in these two reports. At the moment, a number of climate change effects are described in these reports, but it is not yet fully known which of these effects are particularly urgent. The norm that can be used to quantify these effects is for example potential costs. If these effects are quantified, we are able to create a clear list with prioritised effects, which can help with implementing effective climate change adaptation.

The second thing that is recommended is connected with the increasing importance of microdata in the future. Data of individual farmers and individual parcels is seen as increasingly valuable, as these microdata can be combined with other farmers and/or parcels. This combined data can help gathering knowledge about the effects of climate change on the agricultural sector. Moreover, using sensors for this gathering of data is also increasingly important. An example of a recommendation that interviewees gave is that every farmer in the Netherlands should have a small weather station. In this way, weather data on the small scale can easily be gathered. As precipitation, for example, can fluctuate greatly on the local scale, it is important that a lot of locations gather this data. A way of making it appealing for farmers to purchase a small weather station is to subsidise it.

One of the key recommendations of this research is that there should be monitoring of climate change and its effects on the agricultural sector. This is recommended for all of the five covered climate change effects. Even though monitoring already happens on a large scale, more close monitoring should happen. If this close monitoring happens at all times, we would be able to identify trends, which makes it easier to implement any sort of effective (climate change) adaptation. According to some of the participants, insurances can play a big role in this, as they gather a lot of data to base their (weather) insurance prices on.

Finally, the most important recommendation that is a result of this research is linked with collaboration between different data-generating authorities in the Netherlands. According to almost all participants, there is not enough collaboration between the different data-generating authorities, as they are operating in a more decentralised way. This means that a lot of these organisations are unaware of what their 'colleagues' are doing and researching. The different data-generating authorities should use their own strengths, in order to contribute to the bigger collective; gathering important data concerning climate change and climate change adaptation. This will benefit these organisations, as they will know what others are doing, so there will be no unnecessary work, and operations will be more effective. It will also benefit the people that are affected by these climate change effects, the normal civilians, as a better framework of data can lead to better climate change adaptations.

Particular data-needs are visualised in a mind-map (figure 5) on the next page.

RECOMMENDATIONS: MIND-MAP

Figure 5. Mind-map of particular data-needs

Discussion

My research confirms that there are data-gaps concerning climate change adaptation in the agricultural sector. The data that has been gathered is of great importance and relevance for Statistics Netherlands, and other data-generating authorities, as it gives more clarity on where these data-gaps are.

Apart from the data-gaps that have been identified, there are some other recommendations that the participants of the research have mentioned. The most important recommendation of these is that data-generating authorities should collaborate more often, in order to gather a set of data that is as complete as possible. Currently, there are a lot of organisations that are generating data, but the collaboration between these is not optimal. By using the strengths of these organisations, I believe a more efficient and effective network of data-gathering authorities can be created. Collectively, by conducting proper research, it is possible to gather more data concerning climate change, and its effects on the agricultural sector.

Since this is the first time that comparable research is conducted in collaboration with Statistics Netherlands, reflection on the research is important. First of all, using the network of both Statistics Netherlands and the municipality of Zwolle, a lot of data has been gathered. Even though the response rate of the online survey was low, I could determine a top 5 of most urgent climate change effects, due to the success of the focus group discussions. As only two sectors are (partly) covered by me and Pascal, I highly recommend Statistics Netherlands to conduct comparable research concerning the other sectors that are described in the National Adaptation Strategy (2016) with students in the future. If Statistics Netherlands desires to also identify the data-needs of effects within the agricultural that are not covered in this research, comparable research on those is optional. Moreover, I would recommend to conduct this research with two students as well, covering one sector each. It was a nice experience that we were able to help and peer-review each other.

Even though the amount of data that has been gathered in this research is satisfactory, there are some limitations connected to this research. These limitations contain:

- It only focuses on one out of nine sectors described by the National Adaptation Strategy (2016). Moreover, not all effects that were linked to this sector were covered in this research.
- The response on the online survey was low. By conducting focus group discussions, I could still identify a top 5 of most urgent climate change
- The focus of this research was initially on the regional level. Because it was sometimes hard to put something into regional perspective, not all recommendations are fully regionally based.
- As the regional and national scale could in this context differ greatly with the international or global scale, it could be difficult to relate some of the outcomes to other countries or regions.
- We desired to involve a policy-maker in this research, in order to determine potential next steps for Statistics Netherlands, but due to time restrictions, this was not realistic.

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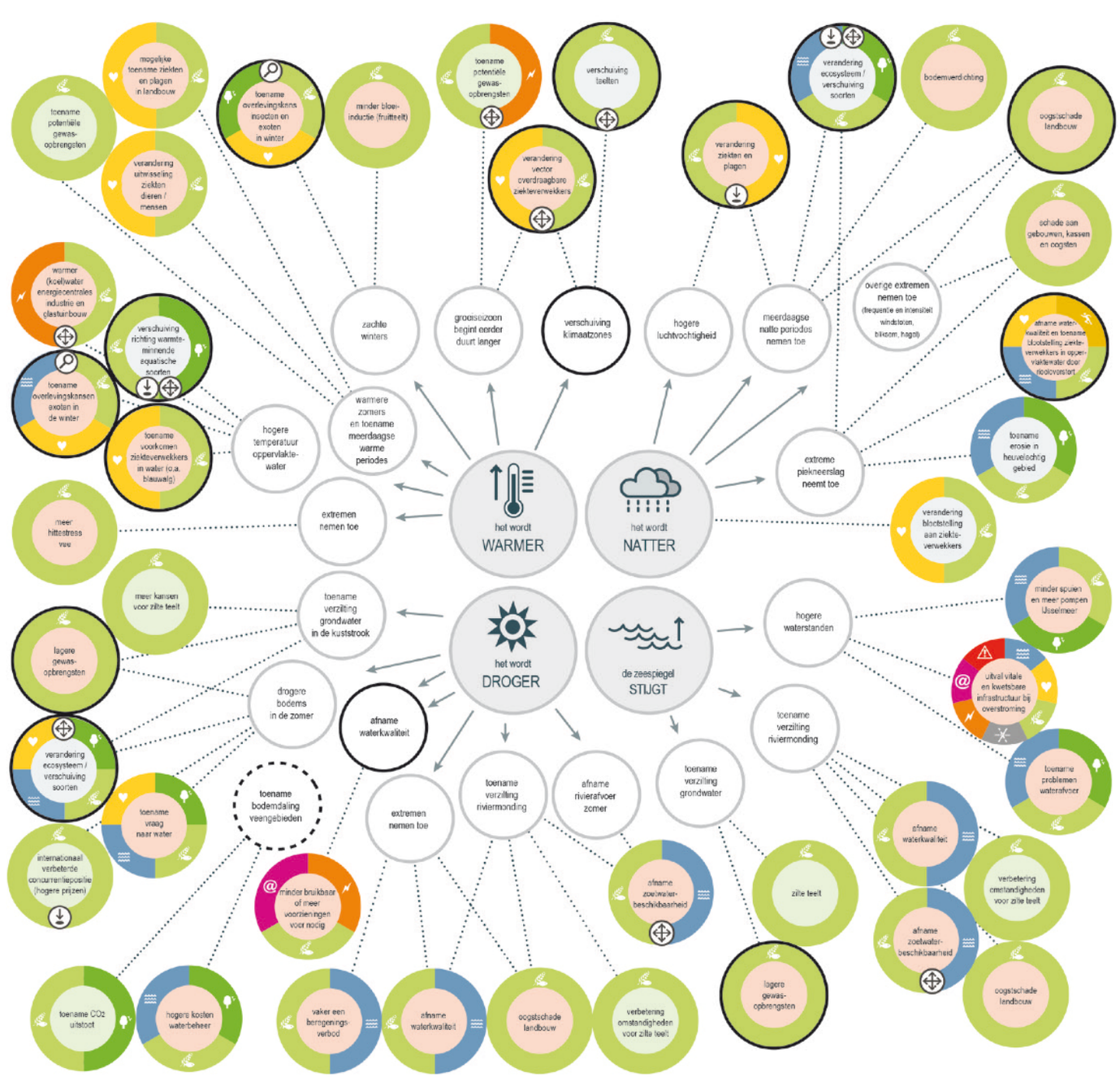
Appendix I

NATIONAL ADAPTATION STRATEGY: EFFECTS ON THE AGRICULTURAL SECTOR



Bollenschema_Landbouw_V7_A3, 13 december 2016

Nationale Adaptatie Strategie

Klimaattrends in beeld

Landbouw, tuinbouw en visserij

Impact, kansen en bedreigingen

- Generieke klimaateffecten
- Middelgroot tot groot effect - dit decennium
- Groot effect - deze eeuw
- Effect is kans
- Effect is bedreiging
- Onduidelijk of effect kans of bedreiging is

Gevolgen voor sectoren

- Water en ruimte
- Natuur
- Landbouw, tuinbouw en visserij
- Gezondheid
- Recreatie en toerisme
- Infrastructuur (luchtvaart, weg, spoor, water)
- Energie
- ICT en telecom
- Veiligheid

Bestaande maatregelen (incompleet)

- Onderzoek
- Procesaanpak
- Maatregel specifiek op effect
- Algemeen actieplan of maatregel

bron:
- PBL, Aanpassen met beleid, 2013
- PBL, Aanpassen aan klimaatverandering, 2015
- NAS werkateliers 07-06-2016, 01-09-2016, 12-10-2016

Disclaimer: Dit schema is een vereenvoudigde, onvolledige weergave van de werkelijkheid waarin omwille van de leesbaarheid en overzichtelijkheid niet alle stappen in causale verbanden in beeld zijn gebracht.