BASE BOTTOM-UP CLIMATE ADAPTATION STRATEGIES TOWARDS A SUSTAINABLE EUROPE

SEVENTH FRAMEWORK PROGRAMME

Subgroup: Agriculture

Case-study: Climate adaptation in two Danish rural municipalities

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Photo front cover:

Farm in Jutland, Denmark (photo: Anders Branth Pedersen 2014)

Purpose of this document:

"The Case Studies Living Document (CSLD) will be the document that each case study leader will use to share the information that (i) characterize and give context to its case study, (ii) the goals within BASE, (iii) the methods used and mainly (iv) a synthesis of the results that that case study is providing to BASE project. This will allow the CS leader to understand how its own case is going (having a good overview), but also (v) will allow the sub-group to which the case study belong to know what is happening and what can be done (mainly on synergies and so on) as well as to (vi) WP4 & 5 coordinators to use that information to report (including each WP task leaders). These living document will also (vii) allow WP6 & 7 partner to know the information."

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1. General Case Study Description

The case study is focused on agricultural climate adaptation in two Danish predominantly rural municipalities: Holstebro and Lolland, which are situated in different regions of Denmark. Both municipalities have in 2014-15 developed local climate adaptation plans as a response to an agreement between Local Government Denmark and the Danish Government.

In Lolland Municipality farmers have experienced severe flooding problems in recent years due to extreme precipitation events – in Holstebro, some farmers might not experience as many problems, but are (potentially) more a climate adaptation measure themselves as they can reduce flooding problems in the nearby city (Holstebro) by letting their fields flood (if they get an economic compensation) from time to time or permanently. Meanwhile, it is a potential chance for some farmers to earn an income from some fields which might be exposed to floodings anyway (Interview Knowledge Centre for Agriculture 2015). Consequently, the measure might be categorised as both an urban and an agricultural climate adaptation measure. In depth economic analyses (cost-effectiveness analysis and a simple CBA, see chapter 5) of the measure (farmer as water manager) are part of the Holstebro case study. In the Lolland case study there is no economic analysis, as the farmer-as-water-manager-measure has not been debated at Lolland.

At Lolland, no specific adaptation measures have been proposed involving agriculture during the initiation phase of the municipality's climate adaptation plan.

Additionally, both case studies analyse autonomous climate adaptation (crop change) among local farmers through farmer surveys; furthermore, a survey among Danish farmers in general has been performed (>1000 responses) in cooperation with the NORDSTAR project (http://www.nord-star.info/). The three surveys also address farmer perception on climate change and climate adaptation, as risk perception is an important trigger for autonomous climate adaptation (see chapter 8). In addition, stakeholder participation in the political processes is assessed (see chapter 3) and there is an implementation analysis of climate adaptation measures and the connected implementation barriers (see chapter 6).

The case study is primarily retrospective and ongoing, but there are also clear prospective elements, as the proposed adaptation measure – farmer as water manager – hasn't been approved yet in Holstebro Municipality and therefore neither implemented.

A. Location

The municipality of Holstebro is situated at Jutland peninsula with Holstebro city at N56.36/E8.62. Elevation of the city is 18 m (maps-streetview.com). The size of the municipality is 802 km2 and the population 57.500 (2014) (www.holstebro.dk). Denmarks second longest watercourse – Storåen – runs through the city of Holstebro (Gyldendal 2014b).

Figure 1.1. Holstebro Municipality (da.wikipedia.org).

The municipality of Lolland is situated at the island of Lolland south of Sealand. The coastline is flat and a substantial part of the area is land reclamated (Gyldendal 2014a; Hansen 2014). The municipality's administration is situated in Maribo at N54.78/E11.5. Elevation of the city is 15 m (maps-streetview.com). The size of the municipality is 885 km2 and the population is 43.528 (2014). The size of the population has been in decline in recent years – during the period 2004-2014 the population at Lolland declined 13 pct. (www.lolland.dk; www.da.wikipedia.org).

Figure 1.2. Lolland Municipality (da.wikipedia.org).

B. Case Study Summary

(Máx 500 words)

Short general summary

The case study on Danish agriculture focuses on climate adaptation responses in two rural municipalities. The study analyses the climate adaptation activities of two Danish municipalities (Lolland and Holstebro) and farmer responses to these. The case study initially revolved around two main research questions. 1) The first question concerns policy coherence - that is the interaction between local climate adaptation responses and strategies at local, national and EU level as well as conflicts and synergies between climate adaptation responses and agricultural policies. 2) The other original main question concerns the use of knowledge in the design of, and decision making strategies regarding, climate adaptation responses among key actors at the local level. However, during the initial phases of the BASE project attention was directed more towards the common research questions developed in BASE.

Consequently, the case study is primarily focused on the questions in BASE Deliverable 4.1 and the research questions developed by the BASE agricultural subgroup. The agricultural subgroup of BASE has developed the following common research questions:

How do farmers perceive climate adaptation and the need for climate adaptation actions? What is their risk perception? How are farmers motivated?

What climate adaptation actions have farmers already taken (if any)? And what are the costs? Are there any experienced benefits? (this information is needed for WP3 and WP6)?

How is climate adaptation knowledge disseminated from the top (municipality, government etc.) to the bottom (farmers)? (for WP2)

How is climate adaptation knowledge fed into the top (municipality, government etc.) from the bottom (farmers)? (for WP2)

Do farmers experience any conflict between climate adaptation policies and other policies (e.g. in the CAP)? (for WP2)

Agriculture is a key sector for the study of climate adaptation because agricultural production is widely affected by both biophysical impacts of climate change as well as the resulting socio-economic impacts (FAO 2007). Local adaptation strategies may help agriculture adapt to climate change, but farmer responses, such as changes in land use, also condition the effectiveness of municipal adaptation strategies. At the same time, adaptation strategies may interfere with the effectiveness of other policies directed at agriculture, including agro-environmental regulation. Thus, the case offers insights on horisontal policy coherence. But as local strategies are also likely to vary between rural and urban areas, a case study revolving around agriculture will also offer insights into the coherence between strategies across administrative levels.

The research strategy of the case study is in-depth as it focuses on two strategically chosen Danish municipalities. However, it also includes online surveys on farmers' perceptions on, and adaptation to, climate change including farmers in the two municipalities as well as a representative sample of farmers at the national scale in order to

potentially facilitate up-scaling of results. Furthermore, the study employs a bottom-up approach, analysing policy coherence from the level of the farm and upwards e.g. through qualitative interviews with stakeholders.

Short summary Holstebro

In Holstebro Municipality, expectations are that farmers in Holstebro Municipality and the nearby municipalities Herning and Ikast-Brande, as water managers, can help solve flooding problems in Holstebro City (due to extreme precipitation events). The watercourse Storåen runs through a narrow passage in the city of Holstebro (see photo 1.1 below) what causes floodings under extreme precipitation events, and by allowing farmlands to be flooded permanently or for periods, farmers as 'water managers' can as a climate adaptation measure be part of a solution by retaining water on their fields upstream Holstebro city (Holstebro Municipality 2014a). Furthermore, the measure is a potential chance for some farmers to earn an income from some fields which might be exposed to floodings anyway (Interview Knowledge Centre for Agriculture 2015). Last significant flooding in Holstebro City was 2011.

Photo 1.1. Storåen running through Holstebro City. (Photo: Jakob Stoktoft Oddershede 2014)

A network – named the Farmer as Water Manager - between some local municipalities in Jutland, agricultural consultancies and experts from e.g. universities and consultancies is aimed at developing farmer-as-water-manager-measures. The idea of potentially using farmers as water managers was an element in the Aquarius research project (2009-2011) which used the slogan 'the farmers as water managers'. The project was partly funded by the EU North Sea Region Programme Interreg IVB (www.aquarius.nsr.eu) - after this project finished the idea was continued in a Danish climate change context by the Danish Knowledge Centre for Agriculture (today named SEGES) - which define itself as a consultancy building bridge between science and agriculture in practice - in collaboration with other stakeholders (see above), SEGES established the network (Interview Knowledge Centre for Agriculture 2015). The farmer as water manager network is co-funded by the Danish Ministry of Food, Agriculture and Fisheries (Knowledge Centre for Agriculture 2014). In 2014, the Ministry of Environment adopted the idea of the farmer as water manager

and is now analysing the potential for farmers as water managers more broadly across Denmark. Besides the farmer-as-water-manager-measure, the Holstebro farmers' autonomous climate adaptation is analysed too throgh an online survey.

Short summary Lolland

In the part of the case study focusing on Lolland Municipality focus is on those flooding problems due to extreme precipitation Lolland farmers have experienced in recent years e.g. among sugar beet producers. Lolland was severely struck by floodings in August 2011 harming the crop. Lolland Municipality primarily see the municipalities role as providing information for the municipalities' citizens, companies etc. to make citizens and companies able autonomously to adapt to a changing climate, as there is no funding in the municipality or from central authorities for making public investments in climate adaptation measures. Additionally, Lolland is a relatively poor muncipality (Interview Lolland Municipality 2014). Lolland Municipality's climate adaptation work is analysed in the Lolland section below. Lolland farmers' autonomous climate adaptation is analysed through an online survey.

Photo 1.2. Lolland farmland with windmills. Lolland is very flat, a substantial part of the area is land reclamated (photo: Anders Branth Pedersen 2015)

C. Context

(Máx 500 words) *If relevant to the understanding of the Case Study , please provide any contextual information of the region, history, etc of the case study*

Table 1.1. Agricultural structure, Holstebro and Lolland, 2010, selected numbers

	Size of municipality (ha)	Number of farms	Cultivated area (ha)	Pct. cultivated area with grain crops (%)	Pct. cultivated area with grass and green fodder (%)	Pct. cultivated area with sugar beets (%)	Number of livestock (total)	Number of pigs (total)
Holstebro Municipality	80.155	792	46.551	53	31	0	40.851	181.423
Lolland Municipality	88.540	537	69.055	59	2	23	3.392	154.355

Source: Statistics Denmark 2014a

See also section 1E.

D. Brief General Information on Climate CHANGE and related issues

(Máx 2000 words) *Please state which is the European climate zone of the case study and insert any information regarding the current available information regarding the case-study, namely expected impacts, scenarios.*

The main focus of the Danish case study is flooding. Directive 2007/60/EC requires Member States to assess if water courses and coast lines are at risk from flooding, and to map the flood extent and assets and humans at risk in these areas. And to to take adequate and coordinated measures to reduce this flood risk.

Holstebro Municipality and Lolland Municipality both include areas which are among those ten Danish areas which in 2011 was appointed by the Danish Government, based on historical data and the criteria in Directive 2007/60/EC, as areas which might experience extreme climate events in the future (Ministry of Environment and Ministry of Transport 2011).

Denmark experiences a temperate climate. According to weatheronline.co.uk (15.11.2013): “Denmark is situated in the zone between three european climatic zones (Borea influence in the north, Atlantic influence in the west and Continental influence in the east); the climate throughout Denmark is a mixture of these influences. Generally the western parts of the country has atlantic climate and the eastern parts a more continental influenced climate”.

In 2014, based on IPCC projections, Denmark expected in the most optimistic scenario (RCP2.6) sea water rise of between 0,1-0,6 metres for the period from the reference period (1986-2005) to the period 2081-2100. In the highest scenario (RCP8.5) IPCC estimates the rise to be in the interval 0,3-0,9 metres. In RCP4.5 0,2-0,7 metres

are expected. In the BACC2 (BALTEX Assessment of Climate Change for the Baltic Basin 2009-2014), the sea water rise is estimated in a middle-high scenario (A1B) to be between 0,3-1,1 metres). The Danish Meteorological Institute assess the expected upper limit for sea water rise to be 1,2 metres (Danish Meteorological Institute & Ministry of Climate, Energy and Building 2014).

Expected temperature development in Denmark from the reference period (1986-2005) to 2081-2100 is in the optimistic scenario (RCP2.6) a 1,2˚C increase (both Summer and Winter). In the high scenario (RCP8.5) temperature increases are 4˚C (Summer) and 3,7˚C (Winter) (Danish Meteorological Institute & Ministry of Climate, Energy and Building 2014).

Furthermore, Denmark expects more extreme precipitation and more precipitation in general (see table 1.2). However, during Summer precipitation is expected to decrease. In the optimistic scenario (RCP2.6) average precipitation increases will be 1,6 pct. from the reference period (1986-2005) to 2081-2100. In the high scenario (RCP8.5) average increases will be 6,9 pct. (Danish Meteorological Institute & Ministry of Climate, Energy and Building 2014).

Table 1.2. Expected precipitation changes for Denmark 2100 for RCP2.6 and RCP8.5 scenarios

Precipitation change, %	**RCP2.6**	**RCP8.5**
Yearly	+1,6 (+/-4,6)	+6,9 (+/-6,1)
Winter	+3,1 (+/-7,9)	+18,0 (+/-12,0)
Spring	+3,7 (+/-11,1)	+10,7 (+/-12,6)
Summer	-0,5 (+/-9,6)	-16,6 (+/-21,0)
Autumn	+0,8 (+/-7,2)	+10,2 (+/-10,9)

Note: Changes are measured as % changes compared to a baseline period 1986-2005. The projection to 2100 covers the average of the period 2081-2100. Numbers in brackets indicate statistical uncertainties (+/- standard deviation) for average values for all 23 simulations.

Source: Danish Meteorological Institute & Ministry of Climate, Energy and Building 2014: 14.

Based on different climate models average wind speed is expected to have a small increase. Furthermore, the strength of storms and hurricanes will increase. Wind direction will probably be more from West, what will increase the risk for storm surge height – in particular in the Wadden Sea (Southwestern part of Jutland) (Danish Meteorological Institute & Ministry of Climate, Energy and Building 2014)

In general, higher temperatures and an extended season is expected to increase the agricultural production in Denmark. New crops as winter-wheat, winter-oats, winter-broadbeens, sunflowers, soya beans, feed maize and grapes for wine production will probably be possible to grow in the future. The potential for growing feed crops will increase. On the other hand, areas with spring-barley, spring-wheat and maybe potatoes will probably shrink and there will be an increase in weed, insects and fungis, what might increase pesticide consumption. There is a risk for new types of livestock diseases in Denmark. Increased precipitation will lead to more floodings and problems with more wet fields. Leaching of nitrogen to watercourses, lakes and the sea might increase. If increased precipitation lead to an increase in wetlands there might be environmental benefits of this. Wetlands can e.g. increase recreational benefits and lower climate gas emissions (klimatilpasning.dk, april 2014).

E. Existing Information on Case Study's adaptation history

(Máx 2000 words) *Please insert a Short resume of the Case study existing information related to Climate Change Adaptation (major goals, plans, measures and timelines already defined or implemented), important Milestones in its "Adaptation Journey" as well as relevant state-of the art regarding the implementation of Adaptation Strategies and Specific Measure*

E1) Holstebro

It is well documented that the city of Holstebro experiences damaging flooding problems from time to time. A time serie for the water level in the watercourse Storåen, running through Holstebro city, goes back to 1918. At a minimum of nine occasions Storåen has overflowed its banks in Holstebro city. Holstebro has experienced significant floodings in the following years: 1924, 1939, 1940, 1941, 1965, 1970, 2007 and 2011.

The 1970 flooding is considered by some as a 1000 year event (Aarhus University 2014:17) and some as a 100 year event (www.holstebro.dk). In January 2011, Holstebro experienced the most severe flooding problems since 1970. Following relatively heavy snowfall in December and January, Holstebro suddenly experienced 30-40 mm 'warm rain' in the course of three days. Meanwhile, temperatures rose, what melted the snow, but the ground was still frozen, and consequently all rain and meltwater ran to the watercourse causing flooding problems (Holstebro Municipality 2011; Holstebro Municipality 2014a). Statistically, Holstebro is experiencing extensive run-off events app. every 9th year (Aarhus University 2014). The 2011 event can be characterised as a 25-year-event under the present climate conditions (Holstebro Municipality 2014a:10). The limit for maximum flow of water through Holstebro without causing flooding problems is app. 50 m3/second equaling a height notation at 9,2 meter. Normal height notation is 7,5 meter. The 2011 incident reached 10,10 meters (ibid: 6).

Expected climate changes will increase the frequency and severity of floodings (Holstebro Municipality 2014a; see also climate change scenarios for Denmark above).

All Danish municipalities are committed by the Danish Government to present local climate adaptation plans (Ministry of Environment 2013). Holstebro municipality presented a Climate Adaptation Plan for Holstebro Municipality in January 2014 (Holstebro Municipality 2014a) with two overall aims:

- Overview and systematised climate adaptation actions through mapping and prioritisation of actions.
- Holistic climate adaptation actions coordinated with neighbour municipalities, utility companies and rescue.

The Climate Adaptation Plan is a strategic plan which is supposed to be integrated in the administration and planning of the municipality and has an interface with other policy areas in the municipality – e.g. waste water, climate and water plans. This first plan for Holstebro is solely centered on problems derived from more precipitation and higher groundwater level. The plan has been through an 8 week public hearing phase. Furthermore, following Directive 2007/60/EC a risk management plan was developed for Holstebro city ultimo 2014 – there is a public hearing phase regarding this plan until July 2015.

One of the suggested climate adaptation measures is to use the farmers along the watercourse Storåen as water managers solving the problems for the city of Holstebro (Holstebro Municipality 2014a) by letting their fields flood permanently or for periods. A description of this measure is available from Holstebro Municipality (2014a:23). The

case study on Holstebro is centered around 'the farmers as water managers'. Besides solving flooding problems in Holstebro City, the measure is a potential chance for some farmers to earn an income from fields which might be exposed to floodings anyway (Interview Knowledge Centre for Agriculture 2015).

Holstebro Municipality is part of a 'collaboration forum for climate adaptation' builded between the three municipalities which the watercourse Storåen runs through. The purpose being to coordinate the three local climate adaptation plans through coordinating initiatives and potential common development of ideas. Representatives from the municipalities and supply companies take part in the forum. Furthermore, the aim of the forum is to develop a common overall climate adaptation plan for Storåen, which can support the local climate adaptation plans (Holstebro Municipality 2014a).

Estimations from Holstebro Municipality demonstrate that there is a need to hold back 3 million m^3 of water in Storåen - based on max water level at a 100-year-event (Holstebro Municipality 2014b).

E2) Lolland

Lolland was among those Danish areas hit by a severe storm surge back in 1872 which led to comprehensive destruction and loss of human life. The likelihood and possible effect of another 1872 event has been analysed in several projects (Ministry of Environment and Ministry of Transport 2011). The 1872 incident can be considered a trauma on the two neighbouring islands of Lolland and Falster, which were the hardest struck areas in Denmark – 52 people were killed by the storm on Falster and 28 on Lolland (Lokalhistoriske Arkiver i Sydøstdanmark 2014). The 1872 storm is in 2014 still in the minds of people living at the island and part of the culture at Lolland (Interview Lolland Municipality 2014). The 1872 incident led to a strengthening of the dikes at Lollands south coast and to a draining of large areas behind the dike to Nakskov Fjord (ibid; Hansen 2014) (see photo 1.3).

Lolland has experienced severe flooding problems due to extreme precipitation too. The last severe incident was in August 2011 where heavy rainfall lead to a loss of a substantial part of the crop. 1/6 of the area of the municipality is dependable on pump stations and dikes to make it suitable for growing crops. 2/3 of the precipitation is pumped away from drains and pump stations to the sea (Lolland Municipality, undated). Pump stations and dikes are run by farmers throug pump guilds and dike guilds (Interview Lolland Municipality 2014).

In particular, sugar beet production is important at Lolland since this crop is very important in this region of Denmark. Only three Danish municipalities have a significant sugar beet production: Lolland (16.054 ha) and nearby Guldborgsund (13.515 ha) and Vordingborg (4.223 ha) (Statistics Denmark 2014a, 2010 figures). Sugar beets constitute 23 pct. of the cultivated area at Lolland (Statistics Denmark 2014a, 2010 figures). The only two remaining Danish sugar factories are located at Lolland and the neighbouring island of Falster. In total, the two factories produce app. 950.000 tonnes of sugar/year and employs 360 people (nordicsugar.dk). In contrast, there is no sugar beet production in Holstebro Municipality.

Photo 1.3. Dike at the southcoast of Lolland (photo: Anders Branth Pedersen 2015)

Following the August 2011 floodings, Lolland Municipality started in August 2012 a climate adaptation project for the Rødby Fjord catchment area involving several stakeholders – an area which to a high degree is land reclamated and protected from sea water flooding by a tall dike. The project was focused on developing a hydraulic model, which can assess flooding risk from extreme precipitation and can be considered a decision tool supporting the development of the local climate adaptation plan. The project ended in February 2014.

Lolland Municipality was delayed in developing the local climate adaptation plan, but February 27 2014, Lolland Municipality published a 2-page discussion note called 'Debate on Climate Adaptation in Lolland Municipality' and invited the public to issue ideas and proposals regarding areas with comprehensive challenges regarding rain and/or sea water, and proposals regarding the future work with climate adaptation in the municipality (Lolland Municipality 2014a). The discussion note was in a 4 week hearing process. In January 2015, Lolland Municipality sended a Risk Management Plan regarding flooding of the city of Nakskov in public hearing (Lolland Municipality 2015a). A Climate Adaptation Plan was being prepared in 2014-2015 (Interview Lolland Municipality 2014), but has not been send in public hearing yet (as of June 2015). As of June 2015, only three of the 98 Danish municipalities had not published climate adaptation plans (Lolland, Læsø and Struer municipalities) (according to klimatilpasning.dk).

Some possible actions to solve the problems at the farmland in Lolland Municipality could be to improve the dike (against seawater) or improve the pump stations (against extreme rain). However, the initiative is primarily the farmers (autonomous adaptation), as there is no public funding for this type of climate adaptation measures. Furthermore, according to Lolland Municipality, the Danish Act on Coast Protection and the Act on Watercourses

leaves no room for the municipality to protect single farmers by implementing public adaptation measures (Interview Lolland Municipality 2014).

Employment in the two municipalities

Table 1.3. Employment in the two municipalities

	Unemployed* (pct.) (2014)	Pct. of employed that are employed in agriculture, forestry or fishery (pct.) (2013)**
Lolland Muni.	8,0	6,3
Holstebro Muni.	3,6	5,1
Denmark	5,4	2,6

*Corrected for seasonal fluctuations. January 2014 figures (Statistics Denmark 2014b)

** Statistics Denmark (2014c)

F. Connection with other research projects:

(Please list and shortly describe previous or ongoing research projects directly related with the Case Study) Please write the name and summary of the project, relevant partner institutions, year of beginning and end of project)

There is established a connection to the stakeholder network project (mentioned above) involving e.g. Holstebro Municipality and farmer organisations regarding 'the Farmer as Water Manager' (Landmanden som vandforvalter) which is focusing on climate adaptation measures for Holstebro Municipality too. Aarhus University has participated in several meetings in this stakeholder forum and presented the BASE project and some initial results. Furthermore, there is a connection to the Aarhus University-led NORD-STAR project (Nordic Strategic Adaptation Research). AU performed a nation-wide questionnaire on climate adaptation among Danish farmers in collaboration between BASE and NORD-STAR. BASE and NORDSTAR researchers have been writing conference papers and articles together.

G. Case ID, Typologies and Dimensions

Having in mind the following BASE Objectives; Categories of Case Studies, please fill in the following table.

BASE OBJECTIVES
1. Compile and analyze data and information on adaptation measures, their effectiveness. (…)
2. Improve current, develop new and integrate methods and tools to assess climate impacts, vulnerability, risks and adaptation policies (…).
3. Identify conflicts and synergies of adaptation policies at different levels of policy making with other policies (including climate mitigation) within and between sectors. (…)
4. Assess the effectiveness and full costs and benefits of adaptation strategies to be undertaken at local, regional, and national scales using innovative approaches (mainly by integrating bottom-up knowledge/assessment and top-down dynamics/processes) with particular attention on sectors of high social and economic importance.
5. Bridge the gap between specific assessments of adaptation measures and top-down implementation of comprehensive and

integrated strategies.

6. Use and develop novel participatory and deliberative tools to enhance the effective use of local contextualized knowledge in adaptation strategies to assess perceptions of adaptation pathways and their co-design by citizens and stakeholders.

7. Disseminate findings by sharing the results of the project with policy-makers, practitioners and other stakeholders. (…)

CASE STUDIES CATEGORIES	
A.	Public administration (municipality, regional, national, european)
B.	Research and education Centres (universities, research centres, projects and groups, schools)
C.	Public companies
D.	Companies (farms, SMEs, big businesses)
E.	Social enterprises (cooperatives, non profit companies, woofing farms, etc)
F.	Consortiums (partnerships, campaigns),
G.	NGOs (environmental NGO, local development NGO, charities, etc)
H.	Transition Initiative
I.	Ecovillage
J.	Informal groups, Movements

Case ID			Typologies and characterization				
Country & Name of CS	BASE Objectives to be answered by the CS	Category of case study	Territorial zones	Scale	Process Direction	Temporal Definition	Timescale[1]
Denmark, Climate adaptation in two Danish rural municipalities	[x] Objective 1 [x] Objective 2 [x] Objective 3 [x] Objective 4 [x] Objective 5 [ ] Objective 6 [x] Objective 7	Example: [D] Companies (Farms)	[x] Rural [x] Urban [ ] Coastal [x] River Basin	[x] Local [x] Regional [x] National [ ] Transnational [x] European /Global	[x] Bottom-Up [x] Top-Down	[x] Retrospective [x] Prospective	App. 2011 - 2015

H. Impacts, Sectors and Implementation

Please tick the relevant boxes for impacts and implementation and insert the number 1 for primary sector and the number 2 for secondary sector.

Impacts	Sectors	Implementation

[1] Please insert year of start and year of end of case study.

Primary CC Impacts (Climate-Adapt)	Primary CC Impacts (BASE)	Primary and Secondary Sector (Climate Adapt)	Primary and secondary Sector (BASE)	Implemented[2]	Phase of Implementation[2]
☐ Extreme Temperatures ☐ Water Scarcity ☒ Flooding ☐ Sea level Rise ☐ Droughts ☐ Storms ☐ Ice and Snow	☐ Extreme temperatures ☐ Water scarcity ☒ Flooding ☐ Coastal Erosion ☐ Droughts ☐ Soil Erosion ☐ Vector Borne Diseases ☐ Damages from extreme weather related events (storms, ice and snow)	☒ 1 Agriculture and forest ☐ Biodiversity ☐ Coastal Areas ☐ Disaster risk reduction ☐ Financial ☐ Health ☐ Infrastructure ☐ Marine and Fisheries ☐ Water Management ☒ 2 Urban	☒ Agriculture ☐ Biodiversity & Ecosystems ☐ Coastal and Marine systems ☐ Energy ☐ Health and Social Policies ☐ Transport ☒ 2 Production Systems and Physical Infrastructures ☐ Water resources ☐ Tourism	☐ Yes ☒ Ongoing ☒ No	☒ Assessment ☒ Planning ☒ Implementation ☐ Monitoring ☐ Evaluation

I. Importance and Relevance of Adaptation

Please tick the relevant box for the case study.

[We haven't ticked this box as the meaning is unclear. If 'case' means 'measure', we would tick the first box]

☐ Case developed and implemented as a climate change adaptation measure

☐ Case developed and implemented and partially funded as a climate change adaptation measure

☐ Case mainly developed and implemented because of other policy objectives, but with significant consideration on climate change adaptation aspects

[2] When the case study consists of a public administration with a top down approach, implementation can be an approved legislation or regulation. When the case study is about practical adaptation measures like a sand dune, for example, implementation should be considered finished when the dune is built in situ.

2. Case study research Methodology

a) Research Goals

(Máx 500 words) *Please insert which are the General Goals for the case study as well as how will the case study contribute for BASE projects and BASE key research questions.*

The case study analyses the climate adaptation activities of two Danish municipalities (Lolland and Holstebro) and farmer responses to these and revolved initially around two main research questions. 1) The first question concerns policy coherence, that is the interaction between local climate adaptation responses and strategies at local, national and EU level as well as conflicts and synergies between climate adaptation responses and agricultural policies. Consequently, the case study focused on multiple levels: Farm level, local level (municipalities), regional level, national level and EU level. 2) The other main question concerned the use of knowledge in the design of, and decision making strategies regarding, climate adaptation responses among key actors at the local level.

However, as part of the streamlining of case studies, attention was directed towards the common questions developed in BASE's initial phases (deliverable 4.1) and the questions developed by the BASE agricultural subgroup. The agricultural subgroup of BASE's common research questions:

1. How do farmers perceive climate adaptation and the need for climate adaptation actions? What is their risk perception? How are farmers motivated?
2. What climate adaptation actions have farmers already taken (if any)? And what are the costs? Are there any experienced benefits? (this information is needed for WP3 and WP6)?
3. How is climate adaptation knowledge disseminated from the top (municipality, government etc.) to the bottom (farmers)? (for WP2)
4. How is climate adaptation knowledge fed into the top (municipality, government etc.) from the bottom (farmers)? (for WP2)
5. Do farmers experience any conflict between climate adaptation policies and other policies (e.g. in the CAP)? (for WP2)

b) Stakeholders involved

(Máx 2000 words) *Please insert any information about the stakeholders involved in the adaptation process with which you will relate to, namely their nature, involvement in the process, etc. If possible highlight the decision-making process as well as the leadership process for Climate Adaptation Strategies. Do Mention if there exists any kind of public engagement and participation within the Adaptation process.*

The primary stakeholders analysed are the farmers, the farmers organisations, the municipalities, and the involved national authorities. The Danish local climate adaptation plans have been going through a public hearing phase.

For further analysis of stakeholder involvement, see chapter 3.

Aarhus University has participated in several stakeholder meetings under the theme 'The farmer as water manager' which is one of the central possible climate adaptation measures in Holstebro Municipality. Aarhus University has also presented the BASE project in this forum.

c) Methodology

(Máx 2000 words) *Please insert what will be your research approach regarding this case study, how did you define it (did it include participatory sessions or not) and how you will implement it during the BASE Project period.*

- Qualitative semi-structured interviews with stakeholders
- Three quantitative questionnaires i) nationally (>1000 responses) ii) Lolland Municipality (app. 40 responses) iii) Holstebro (including a choice experiment in Holstebro) (app. 70 responses)
- Document analysis
- No participatory session – but participation is analysed through the questionnaires.
- Cost-effectiveness analysis of farmer as water manager measure (plus simple CBA)
- Implementation barrier analysis

The agricultural subgroup of BASE is having some Common Research Questions of the Agriculture and Forests BASE Subgroup, including:

1. How do farmers perceive climate adaptation and the need for climate adaptation actions? What is their risk perception? How are farmers motivated?
2. What climate adaptation actions have farmers already taken (if any)? And what are the costs? Are there any experienced benefits? (this information is needed for WP3 and WP6)?
3. How is climate adaptation knowledge disseminated from the top (municipality, government etc.) to the bottom (farmers)? (for WP2)
4. How is climate adaptation knowledge fed into the top (municipality, government etc.) from the bottom (farmers)? (for WP2)
5. Do farmers experience any conflict between climate adaptation policies and other policies (e.g. in the CAP)? (for WP2)

Some of these questions are addressed by having identical questions in those surveys which have been running in the four involved partner countries (the Czech Republic, Spain, Portugal and Denmark).

- Note: Partners/Case Studies using PRIMATE tool will be using CBA (to prioritize) and/or MCA (with stochastic PROMETHE II) and the Monte Carlo Uncertainty Analysis, so please check these boxes.

METHODS to be used in Case Studies[3]	YES // NO
A) Methods for prioritizing adaptation options	
Cost-Benefit Analysis (CBA)	YES[4]
Cost-Effectiveness Analysis (CEA)	YES
Multi-criteria Analysis (MCA)	NO
Analytic Hierarchy Process (AHP)	NO
B) Quantification of impacts and relationships between factors affecting adaptation	

[3] For descriptions and references of the Methods please refer to Milestone 8. For data requests from specific Work Packages please refer to Deliverable 4.1
[4] Simple CBA

Causal Diagrams	NO
Influence Diagrams	NO
Process-based Modelling	NO
Welfare variation analysis under restrictions	NO
C) Uncertainty and sensitivity analysis	
Probabilistic multi model Ensemble	NO
Monte Carlo simulations (PRIMATE uses this method)	NO
Real option analysis	NO
Climate risk management process	NO
D) Participatory Methods	
Scenario Workshop	NO
Participatory Cost Benefit Analysis (PCBA)	NO
Participatory add-ons to CBA	NO
Participatory add-ons to Multi Criteria Decision Analysis	NO
Participatory add-ons to Adaptation Pathways	NO
Other (add extra lines if necessary):	
Statistical analysis	YES
Qualitative semi-structured interviews	YES
Document analysis	YES
Online questionnaires	YES

(Máx 500 words) *Please highlight if you have any special need or focus regarding any of these methods and their use on your case study.*

d) Case study Timeline

(Please insert and image/graph of the Timeline of your Research Approach, highlighting important milestones and deliverables.)

	2013				2014				2015			
Continuous facilitation of dialogue between BASE partners holding agricultural case studies			x	x	x	x	x	x	x	x	x	x
Document analysis			x	x	x	x	x	x				
Initial contact stakeholders			x	x	x							
Development of common agricultural subgroup research questions and survey questions				x	x	x						
Devlopment and completion of three online surveys to farmers				x	x	x						
Cost effectiveness analysis of 'farmer as water manager'						x	x	x				
Stakeholder interviews							x	x	x			
Analysis of online surveys							x	x	x	x		
Analysis of stakeholder participation								x	x			
Implementation analysis										x		
Input on storylines for WP6											x	
Scientific manuscripts for conferences/journals		x	x	x	x	x	x	x	x	x	x	x
BASE reporting WP5:												
D5.1 Climate change, impact and adaptation scenarios for case studies						x						
D5.2 Impacts, costs and benefits of adaptation measures								x				
D5.3 Case specific adaptation strategies and measures									x			
D5.4 Methodologies and tools for adaptation planning and implementing adaptation in cases										x		

e) Collaboration with other Partners and Case studies

We have collaborated with all BASE partners. Deepest collaboration with the partners mentioned below, as they have also agricultural case studies/rural case studies.

Collaboration with BASE case studies (see list in EMDESK):

Case: CVGZ. Person: Blanka, Eliska, Zuzana

Case: FFCUL. Person: André, Gil, Ines

Case: UPM. Person: Ana, Pedro

Case: University of Exeter. Person: Roos

Case: SYKE. Person: Milla

Collaboration within BASE partners/researchers (EX: for a specific competence):

Don't know how the category should be understood, but probably not.

f) Research Outputs

a. Scientific Publications

- Conference abstract presentation 2013: How will the EU climate adaptation strategy affect EU agricultural policies?. / Nielsen, Helle Ørsted; Karali , Eleni; Castellari, Sergio; Pedersen, Anders Branth. Abstract from Science for the Environment, Aarhus, Danmark.
- Conference poster presentation 2013: Policy Instruments for Climate Change Adaptation - in Denmark, Finland and Germany. / Pedersen, Anders Branth; Troeltzsch, Jenny; Mäkinen, Kirsi; Boteler, Benjamin; Nielsen, Helle Ørsted; Jensen, Anne. Poster session presented at Science for the Environment, Aarhus, Danmark.
- Conference paper presentation 2013: Coherent Policy Instruments for Climate Change Adaptation?. / Pedersen, Anders Branth; Nielsen, Helle Ørsted; Troeltzsch, Jenny; Boteler, Benjamin; Mäkinen, Kirsi; Jensen, Anne. Paper presented at Nordic Environmental Social Science Conference (NESS) 2013, København, Danmark.
- Conference abstract presentation 2013: A Base Project Analysis of EU Member State Climate Change Adaptation Strategies: Comparing Approaches and Drawing Lessons. / Russel, Duncan; Pedersen, Anders Branth; Nielsen, Helle Ørsted; Jensen, Anne; Beck, Silke; Weiland, Sabone; Mäkinen, Kirsi; Castellari, Sergio; Karali, Eleni; McGlade, Katriona; Troeltzsch, Jenny. Abstract from Science for the Environment, Aarhus, Danmark.
- Conference abstract presentation 2014: Identifying and assessing policy coherence in climate adaptation in Denmark, Finland and Germany. / Pedersen, Anders Branth; Nielsen, Helle Ørsted; Mäkinen, Kirsi; Troeltzsch, Jenny; Boteler, Benjamin; Jensen, Anne. Abstract from Third Nordic International Conference on Climate Change Adaptation, Copenhagen 2014, Copenhagen, Danmark.
- Poster presentation for the Farmer as Water Manager Network 2014: Landmændenes oplevelse af klimaforandringer i Storåområdet og på Lolland - nogle første foreløbige resultater. / Pedersen, Anders Branth; Nielsen, Helle Ørsted; Woods, Bryndis; Nainggolan, Doan; Termansen, Mette; Zandersen, Marianne; Martinsen, Louise; Jensen, Jeppe Baden.
- Conference abstract presentation 2015: Barriers and opportunities in European agricultural climate adaptation - four case studies on farmer climate adaptation to droughts and flooding. / Pedersen, Anders Branth; Vizinho, André; Iglesias, Ana; Lorencová, Eliska Krkoska; Nielsen, Helle Ørsted; Penha-Lopes, Gil. ECCA 2015 - European Climate Change Adaptation Conference, Copenhagen, Danmark.
- Conference abstract presentation 2015: Farmer Perceptions of Climate Change and Likely Responses in Danish Agriculture. / Woods, Bryndis; Nielsen, Helle Ørsted; Pedersen, Anders Branth; Kristofersson, Dadi Mar. Abstract from ECCA 2015 - European Climate Change Adaptation Conference, Copenhagen, Danmark.
- Conference abstract presentation 2015: Payment for ecosystem services: paying farmers for using farmland for flood control, Zandersen, M., Oddershede, J., Pedersen, A. B., Nielsen, H. Ø. & Termansen, M. Abstract from ECCA 2015 - European Climate Change Adaptation Conference, Copenhagen, Danmark.
- Conference paper presentation 2015: Farmer Perceptions of Climate Change and Responses in Danish Agriculture. / Woods, Bryndis; Nielsen, Helle Ørsted; Pedersen, Anders Branth; Kristofersson, Dadi Mar. Paper presented at Seventh International Conference on Climate Change: Impacts and Responses, Vancouver, Canada.
- Conference paper presentation 2015: Farmer Perceptions of Climate Change and Climate Adaptation. / Pedersen, Anders Branth; Nielsen, Helle Ørsted; Lorencová, Eliska Krkoska; Iglesias, Ana; Louckova, Blanka; Vackar, David. Paper presented at Nordic Environmental Social Science Conference (NESS) 2015, Trondheim, Norge.

- Conference poster presentation 2015: Farmers Perceptions of Climate Change and Likely Responses in Danish Agriculture. / Woods, Bryndis; Nielsen, Helle Ørsted; Pedersen, Anders Branth; Kristofersson, Dadi Mar. Poster session presented at Annual Conference of the European Association of Environmental and Resource Economists (EAERE), Helsinki, Finland.
- The case study has contributed to all relevant scientific deliverables in BASE.

b. Other Publications

European Adaptation Newsletter 2014: Climate change: Perceptions and adaptation among Danish farmers. / Pedersen, Anders Branth; Nielsen, Helle Ørsted. 24 november 2014.

Newspaper articles

- Holstebro Dagblad [Danish newspaper], 02.02.2015, "Landmænd vil tjene på det, hvis marker skal oversvømmes"
- Ingeniøren [Danish newspaper], 11.05.2015, "Oversvømmede marker kan afvande byer" http://ing.dk/artikel/oversvoemmede-marker-kan-afvande-byer-175969
- Landbrugsavisen [weekly newspaper for Danish farmers], 13.05.2015, " 3335 kr. pr. hektar for at lade marken oversvømme?" http://landbrugsavisen.dk/mark/3335-kr-pr-hektar-lade-marken-oversv%C3%B8mme

Radio

- DR P4 Midt & Vest Nyheder [regional radio channel], 12.05.2015, "Landmænd stempler ind i klimaløsninger"

TV

- DR1 TV-Avisen, 12.05.2015 (at 17.50) [national tv broadcast], "Landmænd parat til at lade deres marker oversvømme"

News websites

- Dr.dk, 12.05.2015, "To ud af tre landmænd vil lade markerne oversvømme" http://www.dr.dk/Nyheder/Regionale/MidtVest/2015/05/12/071459.htm
- DCS, 29.04.2015, 'Landmænd kan hjælpe byboere mod oversvømmelser' http://dca.au.dk/aktuelt/nyheder/vis/artikel/landmaend-kan-hjaelpe-byboere-mod-oversvoemmelser/

c. Other

- **Scientific conferences: # ___**

(see 'scientific publications above')

- **Invited seminars, presentations at local events, etc…**

(see scientific publications above)

3. Participation in Climate Change Adaptation

The chapter is organised the following way: In section a-d we report the results for Lolland. In section e-h we report the results for Holstebro.

It is analysed through quantitative questionnaires whether the farmers are aware of the municipalities' development of local climate adaptation plans, whether they have been involved in the process, and (if yes) how they have been involved, whether they feel that the municipality is interested in their viewpoints etc. The same questions are addressed through qualitative stakeholder interviews too.

In general, the Danish public's access to environmental information, participation in environmental decision-making and access to justice follows the 1998 socalled Aarhus Convention (UNECE 1998).

Lolland

a) Process overview

(Please describe the use of Participatory Methodologies within your case study, namely its integration in the overall Research Methodology explained earlier in the CSLD, the rational behind it and key expected outcomes – Máx 1000 words)

Lolland experienced extensive flooding problems in 2011 due to extreme precipitation. The perception of the causes for the extensive flooding problems were divided (lack of maintenance of the water courses, too little pumping of the rainwater to the sea, too much run-off from the cities etc.) between different stakeholders (Lolland Municipality 2014b; Interview Lolland Municipality 2014). In general, the farmers were at the time unsatisfied with the municipality, which they felt were inactive in solving the flooding problems (Interview Lolland Municipality 2014). Lolland is also exhibited to floodings from the sea, but in the most exposed areas, the farmland is protected by existing, relatively tall, dikes (see photo 3.1).

Due to the disagreements about the causes of the 2011 flooding, Lolland Municipality started in August 2012 a climate adaptation project for Rødby Fjord catchment area (20.000 ha), which was one of the hardest struck areas in the 2011 floodings, involving several stakeholders and partly funded by the Ministry of Environment. The project was aimed at developing a hydraulic model, which can assess flooding risk and can be considered a decision tool supporting the development of the local climate adaptation plan. The project involved farmer representatives, holiday home owner representatives, the land reclamation guild (running Northern Europes largest pumping station in the area), representatives from the water supply, the municipality and two external consultants (one involved in the modelling and one involved in facilitating the cooperation process through a stakeholder analysis) (Lolland Municipality 2014b). Environmental NGO's were not represented in the project group; this was a decision made by the municipality based on the expectation that it would impossible to have a productive debate if all stakeholders were involved in the group and therefore only included stakeholders with a personal, commercial or economic interest in the area were invited (Interview Lolland Municipality 2014). According to the municipality, the environmental NGO's were very discontent with this decision – however, the municipality chose to debate climate adaptation with the environmental NGO's in another fora – the local Green Council – with positive outcome according to the municipality (Interview Lolland Municipality 2014).

Photo 3.1. Dike at the southcoast of Lolland (photo: Anders Branth Pedersen 2015)

The project ended in February 2014 with the desired end product – a hydraulic model which has given the project participants a common knowledge which they can use in assessing whether different climate adaptation measures are appropriate to solve the flooding problems (Lolland Municipality 2014b). Representatives from the municipality and the farmers are very happy with the end result – the hydraulic model - and the whole process developing it. It is emphasised by several stakeholders that there is now agreement – a common ground - on how the precipitation behaves on the ground during extreme events (Interview Agricultural consultancy Lolland area 2015; Interview farmer Lolland 2015; Interview Land Reclamation Guild 2015; Interview Lolland Municipality 2014). As a representative from the municipality stated: "If you can't agree on the causes of the flooding problems, you can't agree on the adaptation measures" (Interview Lolland Municipality 2014). It is also emphasised that the project had openminded discussions and all participants got a new knowledge and a realisation that prejudiced opinions were not necessarily correct (Interview Agricultural consultancy Lolland area 2015) – in this work it was very good to have an external consultant (a sociologist) involved in the project and e.g. mapping the expectations of different stakeholders (Interview Lolland farmer 2015; Interview Land Reclamation Guild 2015; Interview Lolland Municipality 2014). For instance, she could ask some questions which the project participants couldn't (Interview Lolland Municipality 2014). The project has had the additional benefit for the municipality that the long dialogue with the farmers has lowered other conflicts between the municipality and the farmers (Interview Lolland Municipality 2014). In the process, the municipality has realised that the process of simply understanding each other takes time – for instance, it is a challenge to make people understand how the term 'a 100-year-event' should be interpreted (Interview Lolland Municipality 2014).

In total, maybe 20 meetings were held (Interview Lolland Municipality). Furthermore, it was very good involving a hydraulic expert in the work (Interview Agricultural consultancy Lolland area 2015; Interview Lolland farmer 2015).

Finally, it was very lucky that when the extensive flooding happened in 2011, a local farmer with flight certificate, on his own initiative, decided to document the event by taking a number of photos of the flooding from his plane – this material was very valuable in developing the hydraulic model (Interview Lolland farmer 2015; Interview Land Reclamation Guild 2015; Interview Lolland Municipality 2014). According to some stakeholders, it is impossible to avoid flooding during incidents like the severe 2011 incident, but maybe it is possible to shorten the period where the areas are flooded (Interview Agricultural consultancy Lolland area 2015). For instance, the model showed that better municipal maintenance of the water courses would not have solved the flooding problem; and it also showed that the run-off from the nearby city disappears within 2-3 hours (Interview Lolland Municipality 2014).

When the Rødby Fjord project ended, the results were presented at a public meeting which were attended by approximately 75 persons – including representatives from environmental NGO's (Interview Lolland Municipality 2014). There has been no meetings involving all Lolland farmers in climate adaptation discussions (Interview Lolland farmer 2015).

Due to e.g. the work on the hydraulic model, Lolland Municipality was delayed in developing the local climate adaptation plan, but February 27 2014, Lolland Municipality published a 2-page discussion note called 'Debate on Climate Adaptation in Lolland Municipality' and invited the public to issue ideas and proposals regarding areas with comprehensive challenges regarding rain and/or sea water, and proposals regarding the future work with climate adaptation in the municipality (Lolland Municipality 2014a). The discussion note was in a 4 week hearing process and resulted in 6-7 proposals from the public. In January 2015, Lolland Municipality sended a Risk Management Plan regarding flooding of the city of Nakskov in public hearing (Lolland Municipality 2015a). A Climate Adaptation Plan is being prepared (Interview Lolland Municipality 2014), but has not been send in hearing yet (as of primo October 2015). According to Lolland Municipality, the ministries were very late in developing climate adaptation guidelines and when the guideline came, it was very focused on technical aspects (Interview Lolland Municipality 2014).

From a stakeholders viewpoint, the stakeholder involvement in the local Climate Adaptation Plan has been disappointing. From early on, it has been clear to the farmers that the Climate Adaptation Plan is very much focused on securing values in the cities (Interview Agricultural consultancy Lolland area 2015; Interview Lolland farmer 2015; Interview Land Reclamation Guild 2015; Interview Lolland Municipality 2014) – they were invited to some meetings, but lost interest when there was no focus on farmland, which e.g. was apparent from the agenda. One stakeholder characterises the Climate Adaptation Plan process as 'waste of time' (Interview Land Reclamation Guild 2015). According to the Danish Society for Nature Conservation, an environmental NGO, this organisation haven't been involved in developing the plan, because Lolland Municipality asked for peace to work (Interview the Danish Society for Nature Conservation Lolland 2015). Consequently, they will not be involved before the hearing process starts.

In general, the municipalities are obliged to develop climate adaptation plans which consist of a risk assessment based on a mapping of flooding risks and an assessment of the values (Local Government Denmark undated; Ministry of Environment 2013) and the problem from a farmer viewpoint is that city areas will always contain more values than farmland and therefore this type of assessment is focused on cities. Denmark is only in the early phases of discussing climate adaptation in rural areas (Interview Agricultural consultancy Lolland area 2015).

Some possible actions to solve the problems at the farmland in Lolland Municipality could be to improve the existing dike (against seawater) or improve the pump stations. However, the initiative is primarily up to the farmers (autonomous adaptation), as there is no public funding for this type of climate adaptation measures (Interview

Lolland Municipality 2014). A representative from the local agricultural consultancy has additionally proposed to consider farmer as water manager measures, as in Holstebro, for instance in the Rødby Fjord project, but didn't succeed (Interview Agricultural consultancy Lolland area 2014).

Below, the results from the local farmer survey from Lolland is reported. When interpretating the results it is important to be aware that the survey was running during Spring 2014 at a moment where the work on the Climate Adaptation Plan was only briefly started, because Lolland was delayed in developing the plan. February 27 2014, Lolland Municipality published a 2-page discussion note called 'Debate on Climate Adaptation in Lolland Municipality' and invited the public to issue ideas and proposals (see above). Before that there were some other climate adaptation related initiatives too, e.g. the work on the hydraulic model for Rødby Fjord (see above). However, the Climate Adaptation Plan itself was not send in hearing when the survey ran. Consequently, more farmers would probably know about the plan (table 3.1) if it had been send in hearing.

Table 3.1. Are you familiar with/do you know about your municipality's work to develop a Climate Adaptation Plan for Lolland Municipality 2014?

	Pct.	N
Yes	44	14
No	56	18
Total	100	32

Table 3.2. To what degree do you expect that the upcoming Climate Adaptation Plan for Lolland Municipality will address the potential climate-related problems that agriculture in your area may encounter?

Scale from 1 (not at all) to 5 (to a very high degree).

	1	2	3	4	5	Total
Pct.	7	7	57	21	7	99
N	1	1	8	3	1	14

Note: 22 missing answers

Table 3.3. Did you have any of the following opportunities to participate in discussions with the municipality regarding the development of the Climate Action Plan for Lolland Municipality 2014?

	Pct.	n
By telephone	6	2
Written contact	3	1
Participation in meetings or work shops	19	7
Other*	3	1
Don't know	0	0

* Meeting at own property; several answers possible; 36 respondents were asked

Table 3.4. Did you utilize the opportunity you had to discuss the development of the climate adaptation plan with the municipality?

	Yes	No	N
By telephone	1	1	2
Written contact	-	1	1
Participation in meetings or work shops	6	1	7
Other	1	-	1

Table 3.5. Do you experience an interest on the part of the local government in your viewpoints regarding climate adaptation? Scale from1 (not at all) to 5 (to very high degree)

	1	2	3	4	5	Don't know	Total
Pct.	19	16	13	26	-	26	100
n	6	5	4	8	0	8	31

In conclusion, 44 pct. of the farmer respondents knew about the work on the plan, when asked during Spring 2014. Expectations regarding whether the plan would solve problems the farmers encounter were in the middle range (table 3.2) for many farmers. Some farmers have had the possibility to participate in discussions on climate

adaptation with the municipality (table 3.3 and 3.4) – primarily through workshops (19 pct.) and many have utilized this opportunity too. Finally, the farmer experience of the local governments interest in farmer viewpoints on climate adaptation is divided (table 3.5).

b) Participation in the Process Phases

(Please uncover the role of all participants in the process of implementing adaptation measures. The adaptation implementation has been divided into four phases for purposes of ease: 1) Initiative/decision to act, 2) Development of potential adaptation options, 3) Decision-making, and 4) Implementation. The process phases are to be filled out with information corresponding to each participant. I.e. if experts were not consulted in the 'decision-making' phase, then describe why they were not included. It is also important that a wide array of participants is described, including those that were excluded from parts of the process.)

Make a bullet point for each of the five participant categories below (and distinguish between for example different stakeholder or expert groups) and be as descriptive as possible how, why/why not were they involved.

For a detailed description of this – see section 3a.

Process phases:

1. *Initiative/decision to act*

Farmer representatives were unsatisfied with the municipalities asserted inactiveness after the 2011 flooding of farmland at Lolland. As a consequence of this, Lolland Municipality took the initiative to start the Rødby Fjord project (development of hydraulic model). The EU Flood Directive and (later) the Danish Governments demand for national climate adaptation plans are important initiatives in this context too. Lolland Municipality took the initiative to develop the local Climate Adaptation Plan. (see section 3a).

Citizens. None according to our information.

Experts. None according to our information.

Politicians. Information not available. However, since there were costs connected to the Rødby Fjord project, there has probably been some type of political approval of starting the project in Lollands municipal council and the subsequent Risk Management Plan and Climate Adaptation Plan.

Officials/legislators[5]. The municipality was taking the initiative to start the Rødby Fjord project after the 2011 floodings. The municipality took initiative to an idea phase on climate adaptation in February 2014. In 2014/2015 the municipality developed a Risk Management Plan and a Climate Adaptation Plan on demand from Danish Government.

2. *Development of potential adaptation options*

Stakeholders. Farmer representatives have been deeply involved in developing the hydraulic model for Rødby Fjord, which can be considered an information tool. The Rødby Fjord project has also involved holiday home owner

[5] We found these categories unclear. Normally, a legislator does not differ from a politician.

representatives, the land reclamation guild (running Northern Europes largest pumping station in the area), representatives from the water supply, the municipality and two external consultants (one involved in the modelling and one involved in facilitating the cooperation process through a stakeholder analysis). In the subsequent development of the Risk Management Plan and Climate Adaptation Plan there hasn't been much invovement of stakeholders from outside the cities. Farmer representatives feel that the Climate Adaptation Plan process is very much focused on the cities and not rural areas. Environmental NGO's were excluded from the work on the hydraulic model and were instead included in climate adaptation discussions through the socalled Green Councils (see also section 3a).

Citizens. Farmers, and other citizens, have had the chance to send ideas in the idea phase regarding the local Climate Adaptation Plan – at least one farmer sended an idea in this phase. The municipality received a total of app. 6-7 ideas (Interview Lolland Municipality 2014). Some farmers feel that the municipality is not interested in their viewpoints on climate adaptation. Some farmers have been involved in the processes on developing a climate adaptation plan (primarily through meetings/workshop). Some farmers haven't heard about the local climate adaptation plan needless to say, those not having heard about the plan, haven't had the opportunity to participate neither.

Experts. Both a hydraulic expert and a sociologist were included in the work in the Rødby Fjord project (see section 3a).

Politicians. Are supposed to approve the Climate Adaptation Plan and Risk Management Plan in the beginning of 2015.

Officials/legislators. Public employees have been heavily involved (see section 3a) in both the Rødby Fjord project and in developing the Risk Management Plan and the Climate Adaptation Plan.

3. *Decision-making*

Lolland has not reached this phase yet. No decisions made.

4. *Implementation*

Lolland has not reached this phase yet. No implementation yet.

c) Participation Experience

(Please report with regards to your case study and the implementation of Participatory Methodologies using a traditional SWOT analysis – Strengths; Weaknesses; Opportunities and Threats)

Rødby Fjord project

Strenghts	**Weaknesses**
Common understanding between different stakeholders through development of the hydraulic model was reached. Gives the stakeholders a common ground/knowledge on how rainwater behaves in the area what facilitates the later discussions of adaptation options. Inclusion of a sociological expert and a hydraulic expert in the Rødby Fjord project seems to have been a very good idea as this initiative was welcomed by the stakeholders.	Environmental NGO's were not part of the project, what they were very dissatisfied with. However, inclusion of a broader group of stakeholders might have hampered the proces of developing the model due to more disagreements. From a democratic viewpoint, some might argue that they should have been involved. They got the chance to be involved through the Green Council instead – needless to say, this is not the same as being involved in the main fora though.
Opportunities	**Threats**
The hydraulic model gives a very important input to the local Climate Adaptation Plan and other climate adaptation processes in the municipality.	The legitimacy might be questioned by stakeholders who haven't been included in the process. However, we don't have any evidence of stakeholders questioning the model.

d) Learning through Participation

In order to capture how participation could improve the climate change adaptation process, please report with regards to your case study:

Your view whether and how participation influenced the strategies and measures decided in your case?

According to the stakeholders the hydraulic model is a very important input to development of future climate adaptation measures at Lolland. The model was constructed in a process involving several different stakeholders and it is very important in making a common knowledge among the stakeholders on how floodings behave locally.

How you think the participatory process in your case could be/have been improved?

No specific available information on this. There are pros and cons for a broader public involvement. Pro: a) Broader involvement (potentially) make more stakeholders agree or more ideas appear etc. – and b) some will argue that a broader involvement is more democratic. Con: a) Broader involvement may make it impossible to reach a common understanding (if that is the aim); and b) Broad involvement of stakeholders does not necessarily lead to better decisions (and might lead to worse decisions) from a societal viewpoint; c) but is good from a democratic viewpoint.

Any novel (use of) participatory methods observed in the case studies

The specific use of a sociologist to facilitate discussions and understandings of different viewpoints in the Rødby Fjord project is, as far as we know, a new initiative in a Danish farmer context and seems to have been working well.

Holstebro

e) Process overview

Introduction

The Climate Adaptation Plan of Holstebro Municipality (2014) does not address climate adaptation in the agricultural sector per se; rather, the plan includes agriculture as a solution to urban flooding problems in the municipality. One of 11 projects considered in the plan, 'The Farmer as Water Manager', would involve farmers in Holstebro Municipality as well as in two upstream municipalities as water managers. Another potential project, building a dam, across the water course upstream from the town of Holstebro, would also affect farmers along the Storå water course. However, both projects might solve climate adaptation problems for some farmers too – the measures are a potential chance for some farmers to earn an income from some fields which might be exposed to floodings anyway (Interview Knowledge Centre for Agriculture 2015).

Briefly about the projects

The municipal climate adaptation plan was developed partly in response to the EU flooding directive (Directive 2007/60/EC), as the municipality was identified as one of the flood risk prone areas according to the directive, partly in response to the national requirement that municipalities develop climate adaptation plans. Moreover, the municipality has experienced several significant flooding events in which the center of Holstebro town was flooded. Hence, the Holstebro plan focuses primarily on water management, particularly how to prevent and deal with flooding.

As described in Holstebro's Climate Adaptation Plan (2014a: 23), the 'Farmer as Water Manager project' is a cooperation project which aims to explore the role of agriculture in retaining water in the Storå catchment in order to limit water runoff from land to the water course in times with extreme precipitation. Ideas developed in the network may then be introduced as proposals to political decision makers in the three municipalities along the Storå water course. Generally, the project explores ideas that couple technological measures such as physical barriers or controlled drainage with land use measures such as crop changes, deepening of existing hollows in the terrain for usage as retention basins, or temporary water storage on agricultural lands (Holstebro Municipality 2014a). The studies involve potential benefits as well as other consequences, e.g. effects on nature or agriculture from temporary floodings, and costs. However, several of these measures have not yet been sufficiently studied and therefore have not yet made it onto the municipal climate adaptation plans as specific adaptation measures (Aarhus University 2014:21). Agricultural organizations request more specific data on the effectiveness of each of the measures and by implication how much agricultural land would be affected.

Another proposal in the climate adaptation plan is to build a dam across the Storå upstream from the town of Holstebro. Three different locations have been considered, all within the municipality of Holstebro. The three

solutions differ with regards to the land areas that would be affected, among others. The range in area affected is from 1.04 km^2 to 2 km^2 depending on the location and the height of the facility. A dam will probably be dependable on flooding farmland too.

Basically, the farmer as water manager network has been working with two different soulutions for flooded farmland: i) a compensation model where farmers are paid to be enrolled in a farmer as water manager programme and, additionally, compensated when it is needed to flood their fields. In chapter 5, it is analysed how much compensation farmers would need on average. A second type of meaure called a 'supply model' would demand that the authorities appointed areas of farmland which could be relevant for managing floods. Next, it would be up to the farmers in the area to pick from a list of adaptation measures and offer the authorities to supply these adaptation measures for a compensation, and based on that the authorities would offer the farmers to sign a contract with a certain compensation (Aarhus University 2014). This second measure is not analysed here, since it needs more development.

Overview of processes

The Climate Adaptation Plan (Holstebro Municipality 2014) was adopted by the Holstebro City Council in June of 2014 as an addendum to the Municipal Plan which lays out the general direction and guidelines for physical and land use development for a 12 year period. Adoption followed a 3-months public hearing as required by the Danish Planning Act. Only six organizations responded to the hearing, including a neighboring municipality, the multi-purpose utility in the area, and some nature and recreation organizations. However, no agricultural organizations commented on the Climate Adaptation Plan. The nature and recreation organizations addressed the dam proposal, raising concern about potential effects on protected natural fauna and flora species and requesting a dialogue with interest organizations. The national Fisheries Control Unit, based on an expert assessment, also raised questions about consequences for fish stock in the water course. The Climate Adaptation Plan was adopted, but its introduction was amended to emphasize that interest organizations would be consulted with as each of the proposed projects are further examined in order to ensure a dialogue before any final decisions are made on specific proposals.

As of January 2015, the most significant initiative towards the decision phase has been to hire a consultancy to examine more concretely the different proposals for a dam. This report was presented to the Municipal Council in January and subsequently made public. However, some stakeholders including a farmer and neighboring municipalities complained that they had not been given a warning (interview Holstebro farmer 2015; interview Holstebro Municipality 2015). E.g. the neighboring municipalities were dissatisfied that they did not have the opportunity to read and discuss the report before it was made public.

'The farmer as water manager' project came about as network cooperation between the Knowledge Centre for Agriculture (now SEGES) - which define itself as a consultancy building bridge between science and agriculture in practice - municipalities in selected areas of Jutland, knowledge institutions, another consultancy and agricultural consultancies. Additionally, meetings have been held with farmers from the relevant areas. Holstebro Municipality is a participant in this network, but so far SEGES has played the key role in developing the concept of the 'Farmer as Water Manager' as well as organizing network activities and participation. The idea and the network grew out of an EU-interreg-funded project, Acquarius, and the network received partial funding (app. 1 million DKK) from a government program, The Green Development and Demonstration Program. The network has organized a number

of meetings and workshops, with participation from municipalities, among these the three municipalities located in the Storå catchment, agricultural organizations and other stakeholders and has also involved experts from universities and consultancies. The aim has been to develop ideas, exchange knowledge and experience and to provide a forum for dialogue, but not to decide on or implement any specific projects. Hence, while the project is mentioned in the Holstebro Climate Adaptation plan and while it has explored project ideas for the Storå catchment no specific proposals have been developed yet. As for the process, the many meetings and workshops indicate a rather participatory approach, particularly as regards agricultural organizations, knowledge organisations and municipalities. But also nature and recreational organizations and farmers have been invited to presentations of the project ideas. But the attention is only now beginning to turn to individual farmers with land in the Storå catchment, who may actually be affected by the project.

The survey results reported here also indicate that while farmers have heard about the ideas of farmers as water managers they have not yet participated in discussions or in any other way been involved.

About half of the farmers in the survey indicated that they know about the ideas, if missing respondents are included. Among those who answered the question, 44 pct. did not know about the plans while 56 pct. did know. Of these only four farmers own land in the relevant areas.

Table 3.6. Do you know about the ideas about contracting with farmers to allow retention/storage of water on their land in the Storå catchment when there is a risk of flooding in the town of Holstebro?

	Pct.	n
Yes	56	38
No	44	30
Total	100	68

12 missing

Fewer, only 11 pct. have knowledge about the general climate adaptation plan of Holstebro Municipality, while as many as 89 pct. of the farmers do not know about the plan.

Table 3.7. Do you know about your municipality's work to develop a Climate Adaptation Plan for Holstebro Municipality 2014?

	Pct.	N
Yes	11	7
No	89	57
Total	100	64

Even fewer, only two farmers, indicated that they had been given the opportunity to participate in discussions about the climate plan, confirming that the overall plan and the hearing had not gained much attention in agricultural circles.

Table 3.8. Did you have any of the following opportunities to participate in discussions with the municipality the development of the Climate Adaptation Plan for Holstebro Municipality 2014? Pct.

	Pct.	n
By telephone	0	0
Written contact	0	0
Participation in meetings or work shops	3	2
Other	0	0
Don't know	3	3

Moreover, among the two who had been given an opportunity to participate in a work shop (presumably one of the meetings in the Farmer as Water Manager network), only one farmer had elected to or been able to participate.

Table 3.9. Did you utilize the opportunity you had to discuss the development of the climate adaptation plan with the municipality?

	Yes	No	n
By telephone	-	-	-
Written contact	-	-	-
Participation in meetings or work shops	1	1	2
Other	-	-	-

At the same time 34 pct. of the farmers indicated that they did not at all experience an interest from the local government in their viewpoints on climate adaptation while 13 pct. scored on the positive end of the scale.

Table 3.10. Do you experience an interest on the part of the local government in your viewpoints regarding climate adaptation? Scale from1 (not at all) to 5 (to very high degree)

	1	2	3	4	5	Don't know	Total
Pct.	34	5	11	8	5	38	101
N	22	3	7	5	3	24	64

Table 3.11. To what degree do you expect the upcoming Climate Adaptation Plan for Holstebro Kommune to address the potential climate-related problems that agriculture in your area may encounter? Scale from 1 (not at all) to 5 (to a very high degree).

	1	2	3	4	5	Don't know	Total
Pct.	14	14	29	14	14	14	99
n	**1**	**1**	**2**	**1**	**1**	**1**	**7**

Note: 73 missing answers

f) Participation in the Process Phases

(Please uncover the role of all participants in the process of implementing adaptation measures. The adaptation implementation has been divided into four phases for purposes of ease: 1) Initiative/decision to act, 2) Development of potential adaptation options, 3) Decision-making, and 4) Implementation. The process phases are to be filled out with information corresponding to each participant. I.e. if experts were not consulted in the 'decision-making' phase, then describe why they were not included. It is also important that a wide array of participants is described, including those that were excluded from parts of the process.)

Make a bullet point for each of the five participant categories below (and distinguish between for example different stakeholder or expert groups) and be as descriptive as possible how, why/why not were they involved.

As the agriculture related projects have not yet been decided upon and therefore also not implemented, it is not yet relevant to include these phases in the analysis of the projects. The Holstebro Climate Adaptation plan has been decided upon, but its implementation rests upon decisions related, a.o., to the 'farmer as water manager' ideas, including also here the dam project. The analysis of participation therefore is limited to the 'Farmer as Water Manager Project' with mentioning of the Climate Adaptation Plan where relevant.

Process phases:

1. *Initiative/decision to act*

Stakeholders

'Farmer as water manager network' - took initiative to develop farmer as water manager measure.
The EU Flood Directive and (later) the Danish Governments demand for national climate adaptation plans are important initiatives in this context too. Holstebro Municipality took the initiative to the local Climate Adaptation Plan.

Citizens:

Not involved, presumably because not considered relevant.

Experts:

The Knowledge Center for Agriculture/SEGES were together with Aarhus University experts instrumental in initiating the farmer as water manager measure through the establishment of the 'farmer as water manager' network

Politicians

Municipal council of Holstebro took initiative to local climate adaptation plan. Danish Government took initiative to National Adaptation Plan. EU took initiative to Flood Directive.

Officials/legislators[6]:

Holstebro Municipality (public employees) involved in the development of the farmer as water manager measure in the 'Farmer as water manager network' .

2. *Development of potential adaptation options*

Stakeholders

- The Knowledge Centre for Agriculture/SEGES has been central in developing the measure.
- Agricultural consultancies have been invited to and participated in public meetings and workshops regarding 'the Farmer as Water Manager', including also discussions about the dam project.
- Individual farmers with land adjacent to the water course: have not yet been involved directly. This is also reflected in the survey results as farmers were relatively negative about municipal interest in their viewpoints. However, the farmers have been presented for the ideas at a meeting (Aarhus University 2014).
- [Municipalities and their representatives may be considered stakeholders, but see below].
- Local chapter of Danish Nature Conservancy: were invited to participate in meetings about the project along with other stakeholders, see below. They also had a representative from the municipality present the project ideas at a chapter annual meeting. The association also responded to the hearing regarding the climate adaptation plan
- Other interest organisations (fishermen's association etc). were invited to meetings in the network. They also responded to the hearing on the climate adaptation plan

Citizens

[6] We don't understand the categories. How does a legislator differ from a politician?

- Citizens not invited to participate in development of farmer as water manager measure. Involved through hearing phase of the local climate adaptation plan.

Experts

- Researchers (e.g. from universities, consultancies etc) in the network have contributed with knowledge and analyses and have presented these at meetings with stakeholders
- Holstebro Municipality as well as the network have contracted with engineering consultancies to develop proposals and assess consequences of different options

Politicians

- The Municipality of Holstebro - but to some extent also the upstream municipalities of Herning and Ikast-Brande - have been involved in developing the project by participating in meetings and workshops and by including the idea in the Holstebro Climate Adaptation Plan.
- The politicians of Holstebro, Herning and Ikast-Brande city councils participated in a joint tour of the area and sites for specific projects under consideration. While no decisions have come out of this yet, it was considered very fruitful (interview Holstebro Municipality 2015)

Officials/legislators

Municipal administrators: the Climate Adaptation project coordinator of Holstebro is involved in developing project ideas and a planning employee also involved in developing proposals, including contracting with consultancies.

The Municipality of Holstebro - but to some extent also the upstream municipalities of Herning and Ikast-Brande - have been involved in developing the project by participating in meetings and workshops and by including the idea in the Holstebro Climate Adaptation Plan.

3. *Decision-making*

The municipal Climate Adaptation Plan has been brought to a decision and adopted, but no specific measures have yet been decided upon.

4. Implementation

Not relevant yet.

g) Participation Experience

(Please report with regards to your case study and the implementation of Participatory Methodologies using a traditional SWOT analysis – Strengths; Weaknesses; Opportunities and Threats)

Strenghts	**Weaknesses**
The network has brought together many relevant partners and has been able to bring out better understanding of opportunities but also barriers.	The workshop and meeting format does not necessarily link to actual decision making structures.
Opportunities	**Threats**
There exist Water Councils and Green councils with representatives from various interest organisations, including agriculture and nature and fishermen. These have a tradition of working together and finding solutions; this structure could be integrated more deliberately and extensively. Some farmers might see the measure as an opportunity to earn an income from land which might be threatened by more floodings in the future.	A lack of attention among farmers. A lack of interest in giving up land among farmers. Some of the solutions require commitment among many farmers, hence they are rather fragile.

h) Learning through Participation

In order to capture how participation could improve the climate change adaptation process, please report with regards to your case study:

a) *Your view whether and how participation influenced the strategies and measures decided in your case?*

The Farmer as Water Manager network/project has helped set an agenda about using farmland as buffers for urban problems, but also to address potential flooding problems in farming areas; moreover, it has helped bring together diverse players around this agenda. This has brought out much knowledge about both opportunities and barriers. The end result, however, may be a conclusion that the barriers seem greater than the opportunities, at least as far as the more decentralized measures. Hence, at this point it appears that the more traditional, centralized solution of building a dam is the more likely measure to be adopted.

Cooperation among the three municipalities appears to have brought out an open consideration of comprehensive and cost- effective solutions.

b) *How you think the participatory process in your case could be/have been improved?*

One challenge is how to make municipal decisionmaking processes and the network structure of the project development link up.

c) Any novel (use of) participatory methods observed in the case studies

The bringing together of stakeholders and experts is not necessarily a novel form of participation, but the extent to which this has occurred in this instance may be novel.

Comparison of some data on participation Holstebro vs. Lolland

Table 3.12. Do you know about the municipalitys draft climate adaptation plan? Comparison

	Yes (pct)	No (pct)	N=
Holstebro	11	89	65
Lolland	56	44	32

Table 3.13. Question (to those respondents knowing about the plan): Were you given the opportunity to give the local administration your viewpoints on the work on the climate adaptation plan through (possible to mark several answers). Comparison

	Phone Pct.	Written Pct.	Meeting/workshop Pct.	Other Pct.	None Pct.	Don't know Pct.	N=
Holstebro	0	0	29	0	43	29	7
Lolland	14	7	50	7	29	0	

Tale 3.14. Do you experience that the municipality is interested in your possible viewpoints regarding climate adaptation? Comparison

	Pct. scoring 4 or 5 very (high degree)
Holstebro	13
Lolland	26

Note: Likert scale from 1 (not at all) to 5 (to a very high degree) + don't know.

Table 3.15. In your opinion who should be responsible for initiating activities to protect your farm from potential negative impacts caused by climate change (e.g. flooding, drought, storm)? Scale 1-5 1 'not at all' to 5 'to a very high degree' + don't know. Comparison

	Government (Pct. answering 4 or 5)	You (Pct. answering 4 or 5)	Other (Pct. answering 4 or 5)
Holstebro	37	39	32
Lolland	78	60	25

4. Climate Change Adaptation Measures and Strategies

a) Adaptation Measures under analysis in your case study

(Please identify your Adaptation Measures considered in this case-study and provide a short description of each)

Adaptation Measure(s):

The farmer as water manager to attenuate/prevent inundations in nearby towns. A choice experiment among Holstebro farmers has been performed regarding their willingness to be 'water managers' (see below).

Farmer autonomous strategies as response to climate changes (crop rotation, crop change etc etc).

Other measures considered in the two municipalities are mentioned but not analysed in detail.

Short description for each Adaptation Measure (Máx 50 words):

By letting his fields flood (permanently or for periods) the farmer can, if subsidised, help solving flooding problems in Holstebro City. Additionally, for some farmers, the measure is a chance to earn an income from fields which are more exposed to floodings than other fields.

Farmers might have different strategies to autonomously adapt to climate changes and they might differ between the two municipalities, because they experience different problems.

Holstebro is considering other measures besides the 'farmer as water manager'. Lolland Municipality does not consider investing in agricultural climate adaptation measures as the municipality does not have the finances to make investments; and dikes and pump stations are privately run by the local farmers. Lolland Municipality more see its role as being an information provider, which provide citizens, companies etc. with the necessary information which make them able to autonomously adapt to a changing climate (Interview Lolland Municipality 2014).

b) Adaptation Measures selection and data availability prior to BASE

(Please describe how and why where these specific measures selected for further research and analysis under BASE and what is the baseline data already available for each specific adaptation measure. Máx 500 words)

The Holstebro case was selected because the local stakeholders were demonstrating an interest in the farmer as water manager measure, which was being analysed through a stakeholder network called 'the Farmer as Water Manager'. Furthermore, Holstebro city has recently (2011) experienced severe flooding problems. Recently, the Danish Government has found interest in the project and started analysing whether a 'farmer-as-water-manager-measure' could be more widely used in Denmark. Besides focusing on the farmer-as-water-manager-measure, the Holstebro case study is additionally focusing on farmer autonomous climate adaptation.

The Lolland case was selected because Lolland experienced severe flooding problems and economic losses in 2011. Lolland is almost flat as a pancake. Consequently, an obvious case to chose as the flooding problems are very present in the minds of the farmers and therefore a good case to illustrate problems in a future where more climate related events are expected. As mentioned above, the Lolland case is primarily focused on farmer autonomous adaptation.

No specific public adaptation measures directed towards farmers have been initiated in Lolland Municipality besides the development of a hydraulic model.

c) Full description of Adaptation Measures

(Please provide a full description on each of the Adaptation Measures regarding this 21 leading questions under. If more than one Adaptation Measure please copy paste the structure provided.)

Farmer-as-water-manager in Holstebro

After the 2011 floodings in the city of Holstebro, the municipality started developing measures to cope with the problems. Calculations show that Holstebro need to withhold 3 million m^3 – based on max water level at a 100-year-event (Holstebro Municipality 2014b). There are two main types of solutions: i) improve the watercourse Storåens flow through the city, ii) improve upstream water retention (ibid). Holstebros climate adaptation plan lists 11 climate adaptation measures (see table 4.1). As mentioned above, only the farmer as water manager measure (#7) is analysed in detail below.

Basically, the farmer as water manager network has been working with two different soulutions for flooded farmland: i) a compensation model where farmers are paid to be enrolled in a farmer as water manager programme and, additionally, compensated when it is needed to flood their fields. In section 5, it is analysed how much compensation farmers would need on average. A second type of meaure called a 'supply model' would demand that the authorities appointed areas of farmland which could be relevant for managing floods. Next, it would be up to the farmers in the area to pick from a list of adaptation measures and offer the authorities to supply these adaptation measures for a compensation, and based on that the authorities would offer the farmers to sign a contract with a certain compensation (Aarhus University 2014). This second measure is not analysed in the following, since it is only very roughly described by the network/authorities so far.

Table 4.1. Proposed climate adaptation measures in Holstebros Climate Adaptation Plan 2014

#	Measure	Purpose	Idea owner	Price	Expected effect
1	Widening of Storå at Storebro + increasing depth of Storå at the stretch below Storebro	Local lowering of water level in Storåen by improving the flow of water in Storåen	Holstebro Municipality	DKK 8.8 million	Minimum 4 cm lowering of water level upstream Storebro
2	Establishing bridge at overflow ramp	Local lowering of water level in Storåen by improving the flow of water in Storåen. The project was implemented 2013	Holstebro Municipality	DKK 0.5 million	Unknown (unclear description in Holstebro Municipality 2014a, p.18).
3	Increasing depth of Storå at the stretch upstream Østrbrogade to the allotments	Local lowering of water level in Storåen by improving the flow of water in Storåen	Holstebro Municipality	DKK 3-5 million (including transportation of digged up material and protection of river	Local lowering (only at the specific stretch of Storå) of water level for 600.000 DKK pr. cm

				banks)	
4	High water level protection at Vigen	Local high water level protection of residential area (app. 50 households) in Holstebro city. Through establishing plug wall and bank of earth. The proposed project is a matter of principle because the municipality establishes protection of private properties, if the project is implemented.	Holstebro Municipality	DKK 1.3 million excl. VAT. (costs for purchasing land or giving compensation to plot owners are not included. Neither are costs establishment of 'kontraklapper' and running the pumps)	Unknown
5	High water level protection of the Music Theatre	Protection of the municipalities own building – the Music Theatre – and infra structures towards intrusion of water from Storå. Project has been approved	Holstebro Municipality	DKK 0.6 million	Better protection of Music Theatre
6	Extended watercourse routing in Lægård Bæk and Frøjk Bæk	Lowering the hydraulic load from surface water ending up in Storå through two smaller streams. Project included in Waste Water Plan 2011-16	Vestforsyning/Holstebro Municipality	Unknown	Retention of surface water before it reaches Storå
7	The farmer as water manager	Project collaboration to uncover agricultures role in retaining water in Storåens catchment area	Knowledge Centre for Agriculture	Unknown	Unknown
8	Local dam to retain water east of Vandkraftsøen	Avoid flooding in Holstebro city. Demands EIA and in depth analysis of consequences	Holstebro Municipality	DKK 15-25 million	Basin expected to retain up to 5 million m3 of water
9	Retaining water through decentral dam solutions	Avoid flooding in Holstebro city through retention and river valleys in the municipalities of Holstebro and Herning	Vestforsyning/Holstebro Municipality	Unknown	Apparently retention of 11.28 million m3 (unclear descrption)
10	SMS flooding warnings to citizens	Information service to citizens with warnings for risk for flooding	Holstebro Municipality	Unknown	Citizens wth low-lying properties will have some hours to protect their property
11	Citizen report portal	Systematic registration of citizens' flooding experiences	Holstebro Municipality	Unknown	Unknown

Source: Holstebro Municipality (2014a). Note: Each measure is described in more detail in Holstebro Municipality (2014a). Note 1: Regarding measure #7 a number of sub-measures have been developed within the Farmer as Water Manager Network. Note 2: Holstebro Municipality has estimated that there is a need to withhold app. 3 million m3 of water (Holstebro Municipality 2014b).

Process

I. *Would, or at which part would, institutions and private stakeholders implement the measure autonomously to adapt to climate change (Adaptive capacity)?*

No, they would not. The farmers demand subsidies if their fields are flooded intentionally.

II. *Does the measure initiate further activities for adaptation to climate change? (Y/N)*
    a. *If Yes, please name which*

Yes, the farmer-as-water-manager-measure is now considered more broadly by central ministries.

III. *Does adaptation aim for flexibility and reflexivity (i.e. the ability to change as CC and other factors develop)? (Y/N)*

The measure is flexible if it is voluntary. There is every indication that the measure will be voluntary. There might be possibilities to extend the measure (the area of fields) as climate change develops. Hypothetically, a succefully implemented farmer-as-water-manager-measure could easen implementation of similar measures on other farmland areas.

IV. *Is the measure effective under different climate scenarios and different socio-economic scenarios? (Y/N)*

Yes, the measure will work under different climate scenarios.However, needless to say, it is more effective in the milder scenarios, and would e.g. probably demand more fields under more severe scenarios. Different socio-economic scenarios haven't been analysed.

V. *Is the adaptation measure iterative? (Y/N)*

Yes, the measure can be copied to other contexts (if that is what is meant by the question)

VI. *Does the measure contribute to overall sustainable development, alleviate already existing problems and bring benefits for other social, environmental or economic objectives than adaptation (no regret measures)? (Y/N)*

Haven't been analysed scientifically. Potentially, new permanent wetlands could contribute to more N-retention and thereby a cleaner water environment.

VII. *Can adjustments be made later if conditions change again or if changes are different from those expected today? (Y/N)*

Yes, but it depends on the contract length and contract content with the farmers.

<u>Outcome</u>

Relevance and effectiveness of adaptation measures

VIII. *How important is the climate change threat addressed by the measure? What economic values, ecosystem functions and socio-cultural values are at stake, and to what extent are they affected by*

climate change impacts? Is there an indication of overriding public interest, e.g. critical infrastructures, public health ?

The farmer as water manager can contribute to solving potentially severe flooding problems in Holstebro City threatening infrastructure, buildings etc. (see Holstebro Municipality 2014b). Holstebro Municipality is identified as one of the flood risk prone areas in Denmark according to the EU Flooding Directive. Additionally, the measure might be a chance for some farmers to earn an income from fields which might be more exposed to floodings in the future. Ecosystem functions haven't been analysed. As mentioned above, the measure might contribute to N-retention through the establishment of wetlands, thereby improving the water environment.

IX. *What portion of the targeted potential damages can be avoided by implementing the measure? (0-100%)*

Currently, impossible to assess. Depends on the magnitude of the measure (how many farmers will voluntarily be part of it).

Efficiency

X. *How high are the benefits of the measure relative to the costs? Are the costs justified by the benefits*
(Please refer to results of economic evaluation in chapter 5)

This is too complex to explain briefly, see chapter 5 for the answers.

XI. *What are the costs of the administrative implementation of the measure? Are there potential funding under the umbrella of other European policies(eg. CAP/Cohesion policy ?*

Costs of the administrative implementation are unknown.

Funding of the farmer subsidies through the EU Rural Development Programme might be a possibility. However, according to a central stakeholder. It will probably be difficult to get the necessary subsidies funded through the EU Rural Development Programme. Consequently, it would be the Danish public water supply companies who should provide the financial resources – here it might be a challenge that water supply companies in less populated municipalities do not have as many financial resources as water supply companies in more densely populated municipalities (Interview Knowledge Centre for Agriculture 2015).

XII. *Does the measure give an incentive for innovation to different actors (e.g. SMEs) / can it deliver a competitive advantage for the local economy? (Y/N)*

Not analysed.

XIII. *Does the measure have effects on employment? (Y/N)*

Not analysed.

XIV. How long is the time-lag between implementation of the adaptation measure and the effect of the measure?

Currently not possible to assess.

XV. What is the timeframe during which the measure will have an effect?

The effect will be lasting as long as the areas are used for water retention.

XVI. Does the measure create synergies with mitigation (i.e. reduce GHG emissions or enhance GHG sequestration)? (Y/N)

Wetlands might create synergies with climate mitigation policies as they might reduce CO2 emissions (see e.g. Nature Agency 2011).

XVII. Does the measure alleviate or exacerbate other environmental pressures? (Explain briefly)

The measure might contribute to N-retention through the establishment of wetlands, thereby improving the water environment.

Equity

XVIII. What are the impacts on different social or economic groups, are there expected impacts on particularly vulnerable groups? (distributional impact)

If the measure is voluntary, it improves the flexibility for farmers as they can chose to let their fields flood or not.

XIX. Does the measure enhance well-being and quality of life (e.g. in the urban environment)? (Y/N)

Yes, if it reduces the flooding risk in Holstebro City. Additionally, for farmers which have fields that are exposed to floodings it might be a chance to earn an income on those fields.

5. Impacts, Costs and Benefits of Adaptation measures

(This section of the CSLD follows the Economic Assessment Steps put forward by UFZ and thoroughly described in D4.1, chapter 4. Please check D4.1 for any doubts or questions. In case of duplication of information with previous sections of the CSLD feel free to copy paste.) For more detailed guidance (incl. two examples) please see the above mentioned chapter 4 of D4.1. Please do not hesitate to contact volker.meyer@ufz.de, oliver.gebhardt@ufz or Filipe Alves if you have questions about how to fill out this section.

It is only the Holstebro case which contains an economic assessment.

Holstebro case

Basically, the farmer as water manager network has been working with two different soulutions: i) a compensation model where farmers are paid to be enrolled in a farmer as water manager programme and, additionally, compensated when it is needed to flood their fields. Below, it is analysed how much compensation farmers would need. A second type of meaure called a 'supply model' would demand that the authorities appointed areas of farmland which could be relevant for managing floods. Next, it would be up to the farmers in the area to pick from a list of adaptation measures and offer the authorities to supply these adaptation measures for a compensation, and based on that the authorities would offer the farmers to sign a contract with a certain compensation (Aarhus University 2014). This second measure is not analysed here, since it needs more development by the authorities.

Choice Experiment Valuation Study Description

The economic focus in the Holstebro case 'Farmers as water managers' is on cost-effectiveness of using ecosystem services on agricultural land to avoid or at least reduce impacts of inundations due to increasing amounts and intensity of precipitation. In addition, a simple Cost-Benefit Analysis is carried out, comparing the costs of protecting Holstebro against flooding under a 1000 year event with the benefits of avoided damages on the built environment.

The analysis is based on a choice experiment distributed in a 2014 survey to farmers in the catchment area of the watercourse 'Storåen' – Denmark's second longest watercourse. The survey was developed and implemented by Aarhus University's BASE team. The choice experiment aims to estimate farmers' willingness to participate in water management schemes by including their land in the municipality inundation planning. The experiment aims to estimate the costs of getting farmers to participate in the schemes and therefore the costs of reducing climate change problems in Holstebro.

Choice Experiments (CE) belong to stated preference methods and is based on consumer choice theory. CE simulates an ordinary trade situation in the markets where a farmer in a choice situation selects the good, characterised by a number of attributes that would bring him/her the highest utility (i.e. satisfaction). The goods are characterised by a bundle of positive and negative attributes. CE makes it possible to estimate the average preference for each of the selected attributes and for the levels of the attributes compared with one another. It also allows for a ranking or a monetary valuation of the different alternatives compared to each other.

Attributes and their levels described in the survey include:

Table 5.1. Attributes and level applied in choice experiment

Attribute	**Level description**
Restriction on crop choices	Requirement to have flood resistant crops
	No requirement to have flood resistant crops
Yearly payment for making area available for flooding under 5 year events	500 dkk/ha
	1000 dkk/ha
	2000 dkk/ha
	3000 dkk/ha
Coverage of losses of crops during inundations on contracted area	No coverage of crop losses
	Value of crop losses assessed by professional valuer
Negotiation situation	Individual negotiation with your municipality
	Collective negotiation together with other farmers from your sub-catchment

Farmers were asked to answer six consecutive choice cards. An example choice card is presented below:

Table 5.2. Example choice card

	Contract A	Contract B	Status Quo
Crop choice restriction	Requirement to use flood resistant crops	No requirements to use flood resistant crops	No restrictions
Yearly payment for making area available for flooding under 5 year events	2000 dkk	1000 dkk	No payment
Coverage of losses of crops during inundations on contracted area	No coverage of crop losses	Value of crop losses assessed by professional valuer	No coverage
Negotiation situation	Individual negotiation with your municipality	Collective negotiation with other farmers from your sub-catchment	No negotiation
My Choice (pls. tick only once)			

67 farmers completed the choice experiment (449 farmers were contacted). This is statistically a sufficient number of respondents to derive an estimate of social costs of initiating such a climate adaptation scheme. Of the 67 farmers, five turned out not to own the farm and were therefore excluded from the dataset. A total of 17 respondents (26,2 %) chose the non-contract option in all six choice occasions (so-called serial non-participants). This is not particularly high compared with other CE studies. We retain 62 respondents in the subsequent analysis.

Results of the conditional logit indicate that farmers on average do not prefer a contract (asc_change coefficient is positive) nor would they like to negotiate the contract individually. Farmers prefer compensation and payment, as can be expected. Requirements on specific flood resistant crops proved to be statistically insignificant.

Table 5.3. Conditional Logit Regression results

Variable	Coefficients (Std. Errors)	
	Protesters excluded (N=62)	
asc_change	1,4810 ***	(0,2020)
Specific Crop Requirement	-0,0936	(0,0768)
Compensation	0,2944 ***	(0,0768)
Individual negotiation	-0,1244 *	(0,0756)
Payment	0,0006 ***	(0,8319D-04)
Log-likelihood	-367,62	
ρ^2	0,08	

*** significant at p < 0.01, ** significant at p < 0.05, * significant at p < 0.10

Estimating monetary values based on the CE

This regression analysis of the responses from farmers can be utilised to generate the following types of quantitative information:

- Marginal farmer willingness to accept individual attributes = public costs of paying for individual attributes in the CE (e.g. EUR/ha for having a crop restriction; EUR/ha for a yearly payment etc.);
- Average farmer willingness to accept a full contract to allow flooding on his/her land, specified in euros per hectare. This average value indicates the public costs of having this type of adaptation measure to protect infrastructure and urban areas; and
- Ranking of farmer preferences for different contents of water management contracts.

Based on the coefficients from the conditional logit regression, we calculate both the marginal willingness to accept individual attributes of the contract and the average willingness to accept a full contract with the municipality.

The marginal willingness to accept is calculated as below, where β_1 is the attribute to be valued and β_c is the payment coefficient, which represents the marginal utility of income. We multiply the coefficient of the attribute to be valued by 2 because all attributes with the exception of payment is effects coded (i.e. the marginal value is compared to the base level):

The two marginal farmer willingness to accept comprise the average impact on farmer utility by i) having an individual negotiation compared to having a collective negotiation and ii) a contract that allows for individual compensation of specific crop losses compared to no specific crop losses. This is calculated by taking the utility change between the baseline level and a particular characteristic of the contract (e.g. individual negotiation) and dividing it by the compensation coefficient.

$$MWTA_i = \left(\frac{\beta_i - \beta_0}{\alpha}\right),$$

where $MWTA_i$ represents the willingness to accept a contract based on an individual compensation (compensation for crop loss) compared to a collective negotiation (no compensation of crop loss). β_i is the utility coefficient value associated with attribute i, β_0 the utility coefficient value of the specified baseline, and α represents the utility coefficient value for a unit of subsidy. The coefficient α is positive as people normally gain utility as the price of an attribute decreases.

Table 5.4. Marginal WTA results

Attribute	Marginal WTA (EUR)
Individual negotiation	-59
Compensation at crop loss	139

These marginal willingnesses to accept represent the utility that farmers would obtain if a contract would consist of individual negotiation (in this case farmers would have a utility increase of EUR59 if the negotiation were collectively made with other farmers). Likewise, if a contract would contain the possibility to have a compensation made for crop losses, assessed by an expert, this would increase the utility of farmers by EUR139.

In order to estimate the average willingness to accept a full contract with the municipality, we need to comprise the share of farmers, not willing to enter a contract, otherwise the payments would not indicate a realistic average level of payments needed. The WTA of a contract is calculated by adding the coefficients of the attributes and subtracting the alternative specific constant (as this indicates opposition to the contract) and dividing by the marginal utility of income (here the coefficient of the payment attribute:

$$WTA\ of\ full\ constract = \frac{\beta_{compensation} + \beta_{negotiation} - \beta_{ASC}}{\beta_{payment}}$$

The resulting payment that the average farmer would accept range between EUR250 and EUR447 per ha per year depending on the conditions in the contract.

Table 5.5. WTA results

Contract	WTA/ha (EUR)
collective negotiation + compensation at crop loss – alternative specific constant	-250
Individual negotiation + compensation at crop loss – alternative specific constant	-309
collective negotiation + no compensation at crop loss – alternative specific constant	-389
individual negotiation + no compensation at crop loss – alternative specific constant	-447

Cost Effectiveness of the measure 'Farmers as Water Manager'

In order to estimate cost efficiency of the measure 'farmers as water manager' (see section 1) we would need a specification of how much land would be able to retain how much water. This measure would only function as a whole, just like a dam would need to be constructed fully before it can fill out its purpose.

One of the ten options (see step 2 section) that the Municipality of Holstebro is considering to protect the town against fluvial flooding is the construction of a dam. This would entail the construction of a dam facility in the upstream area of Storå relative to Holstebro. In case of risk of flooding in Holstebro, a damper in the dam will be closed in order to hold back water until it can safely be released again. This will cause flooding upstream the dam, e.g. on farmland.

The amount of water needed to be held back for an incidence that will happen statistically once in every 100 years is estimated to be 3 million m^3. For a 1000 year incidence it is 5-10 million m^3 (Vestforsyning 2014).

The calculated 100- and 1000-year incidences are calculated based on status quo, i.e. based on measured watercourse data in the recent past. Hence the calculations are not based on future climate scenarios and the subsequent levels of 100 or 1000-year incidences as they would appear by 2050 or 2100. The municipality is aware that although the life span of the dam is set to 75 years, this is not realistic, given that the dam is not laid out for a 100 or 1000 year incidence in 75 years. The municipality sees the construction of the dam as a preliminary short term solution (i.e. for the next 30 years. Depending on the volume of fluvial flooding) that serves to buy time and make way for a more permanent long term solution (75 years and longer). The municipality does not reckon that the dam would be subject to wear and tear if more than one extreme event were to follow another.

Vestforsyning (2014) suggest six similar dam constructions, which differ mainly in location. It has not yet been decided politically (as of January 2015) which one to proceed with, if any. Two solutions can hold back around 3 million m^3 of water. The first, holding back 2,9 million m^3 water, would need 156 hectares of land for periodical

flooding, while the second, holding back 3 million m^3 water, would need 148 hectares[7]. The largest suggested solution, which has capacity of holding back 4,7 million m^3 water, would need 200 hectares.

Assuming that the town of Holstebro would decide to construct a dam that could resist a 100 year event, the cost-effective measure would cost between EUR12.340 and EUR22.070 per million m3 retained depending on the contractural content and dam solution. These costs only include the costs of paying farmers to retain water on their fields, not costs of the dam included (please see cost benefit analysis below).

Table 5.6. Cost effectiveness of Farmer as Water Manager, 100-year event, costs per year

Farm land required (ha)	Million M3 retain capacity	Contract cost/ha (EUR)	total costs (EUR)	costs/Million m3 retained (EUR)
156	2,9	250-447	39.021-69.789	13.455-24.065
148	3	250-447	37.020-66.211	12.340-22.070

Estimations of costs and benefits of constructing a dam and flooding farmland under extreme events

Total expected costs related to a 1000 year flooding in Holstebro has been estimated by Holstebro Municipality to be 0,763 million DKK per year (Holstebro Municipality, 2013). We assume numbers are in 2013-values.

The suggested dam construction would be able to withstand a 1-in-100 year incidence. Withstanding a 100 year event represents retaining an additional $17m^3$/second (equalling a total water flow of $67m^3$/second in Storåen). A 1-in-1000 year event has been calculated to represent an additional $17m^3$/second more than a 100 year event (equalling a total water flow of $84m^3$/second). With the dam construction, a 1-in-1000 year event would cause damage equalling damage costs of a 1-in-100 year event, i.e. damage costs would be significantly reduced.

In the following calculation, we compare costs and benefits of constructing a dam that can withstand a 100 year event and we assume a 1000 year event that has an interval frequency of 0,003 (Orbicon, 2013). Thanks to the dam, the damages from the 1000 year event are reduced to the level of damages of a 100-year event. The analysis is calculated over 75 years, which is the estimated life time of the dam construction. Benefits (i.e. avoided damages) remain fixed as the dam is not continuously increased as climate change effects progress. The dam is assumed to withstand a 100 year event under current climate with no wear and tear or risk of collapse during events that overflow the dam.

Given the available data, we are not able to calculate the CBA for increases in avoided damages as climate change effects progress, as we do not have data on costs of increasing the level of the dam. However, current level of damages may be more costly in the future because of higher economic values involved. In order to calculate the increases in avoided damages given higher economic values, we use the average yearly

[7] The locations for the 2.9 million m^3 water and 3.0 million m^3 water are different, which may explain the higher area needed for the lowest amount of water

development in GDP under two storylines: SSP2 and SSP5, as a proxy for the increased value. Table 5.7 below summarises the elements of the CBA.

Table 5.7. Elements of CBA

Cost Elements	**Value**
Payment to farmers (lowest level) (EUR/ha/yr)	250
Payment to farmers (highest level) (EUR/ha/yr)	447
Benefit Elements	
Accumulated avoided damage costs per event (MEUR for a 1-in-100 year event) (2013 values under current climate)	3,13
Yearly avoided damage costs when avoiding 1-in-100 year events (MEUR/yr) (2013 values under current climate)	0,093
Yearly average increase in avoided damage costs when avoiding 1-in-100 year events under SSP2 (%) *	1,7
Yearly average increase in avoided damage costs when avoiding 1-in-100 year events under SSP5 (%)*	2,5
Other elements	
Average annual growth rate of benefit values under SSP2, Denmark (%)	1,7
Average annual growth rate of benefit values under SSP5, Denmark (%)	2,7
Frequency interval of a 1000 year event (%)	0,3
Dam construction costs (capacity: 3M m3) (MEUR)	3
Area flooded (ha)	159

* Based on IIASA SSP Database, OECD Env-Growth Model, Denmark, SSP 2 and SSP 5 2015-2090.

We apply the Danish guidance on discount rates[8] for long term projects as well as 1 % and 5 % discount rates for sensitivity analysis.

Table 5.8 below clearly indicates that assuming current levels of avoided costs and in the event of a 1-in-1000 year flooding under a protection level for a 1-in-100 year event, adaptation costs outweigh benefits, independently of farmer level payments. These results are robust across the different discount rates applied. Applying the national decreasing discount rates, results range between MEuro-2,45 to MEuro-1,70 for high and

[8] 4% 0-35years; 3% 36-70years; 2% above 70 years

low level farm payments respectively. This decreases but stays negative when applying a 1% discount rate and increases when applying a 5% discount rate for sensitivity purposes.

If, however, we take future economic growth and hence the increase in values of infrastructures and property into account, based on the development of GDP in Denmark under the SSP2 and SSP5 scenarios, the balance moves in favour of adaptation (i.e. avoided damages increase). This result is robust across discount rates and level of farmer payment. As SSP2 entails a lower economic growth than SSP5, net benefits are naturally higher under the SSP5 scenario. Under SSP2, positive net benefits range between MEur0,69 and Meur1,45 when applying the national decreasing discount rates (for high and low level farm payment respectively), increasing to between MEur6,13 and MEur7,77 under a 1% discount rate application and decreasing to negative benefits of MEur0,25 under high level payments and positive benefits of MEur0,35 under low level payments under a 5% discount rate. Under SSP5, net benefits are in all instances higher and positive.

Table 5.8. Cost Benefit Results of Different SSP Scenarios and Discount rates (Net Present Values in MEuro)

Scenario	**Discount rate**		
	Decreasing*	1%	5%
Assuming current level of benefits			
Highest compensation level	-2,45MEuro	-1,80MEuro	-2,57Meuro
Lowest compensation level	-1,70MEuro	-0,21MEuro	-1,97MEuro
Assuming levels of benefit following economic development under SSP 2			
Highest compensation level	0,69Meuro	6,13Meuro	-0,25Meuro
Lowest compensation level	1,45MEuro	7,77MEuro	0,35MEuro
Assuming levels of benefit following economic development under SSP 5			
Highest compensation level	1,31Meuro	8,02Meuro	0,16Meuro
Lowest compensation level	2,06MEuro	9,61MEuro	0,75MEuro

*4% (0-35 years); 3% (36-70 years); 2% (>70 years) (Ministry of Finance, 2013)

It should be noted, that avoided damage costs only include direct costs (e.g. damages on different types of buildings and infrastructure) and do not include indirect costs (e.g. loss of income and health costs).

Step 1 – Preliminary Risk Assessment and identification of adaptation tipping points (max 1500 words)

(some of these questions might be already answered in section 1 – if so, just copy&paste)

What is the climate change related problem/risk you would like to reduce by adaptation?

- *Which problems already exist, what is/are the current risk/s?*
- *Which assets and sectors are at risk under current climate variability?*
- *Which adaptation or protection measures are already in place? (refer to typology of measures in D6.1, table 2)*
- *How do these risks presumably change due to climate and socio-economic change?*
- *What are the main drivers, impacts and affected sectors (refer to BASE impact and sector categories, see also Table 1 of D6.1)*
- *Which climate and socio-economic scenarios are used?*

The problem addressed in the Holstebro case study is flooding due to precipitation. Both Holstebro Municipality and parts of the island of Lolland are situated in those risk areas that Denmark has appointed following the guideline in EU's Directive 2007/60/EC (Ministry of Environment and Ministry of Transport 2011) and based on scenarios from the IPCC and the Danish Meteorological Institute. The main climate adaptation problem in Holstebro is that the watercourse Storåen runs through Holstebro City and floods the city when there are e.g. extreme precipitation events, which threatens buildings, infrastructure etc. in the city. Some Holstebro farmers might also experience flooding problems on their fields during same type of events – 29 pct. of the farmers in the Holstebro survey reports that they have experienced increased frequency of extreme precipatation during the years they have been working on their current farm (see below).

Holstebro City experiences severe flooding events app. every 9th year. Floodings have happened due to snow melt and/or longer periods of rain filling up the natural reservoirs and increasing the water level in Storåen. On the other hand, local cloudbursts (defined by more than 15 mm in 30 mins.) haven't been causing flooding problems (Aarhus University 2014: 18).

The municipality is currently protecting the city from flooding by: Regulating the watercourse according to the legislation; assessing sewers (non-structural measure, see BASE D6.1 table 1); climate adapt public buildings when they are renovated (structural measure); include flooding related prevention in the local planning process (non-structural measure); participate in development and transversal cooperations on physical measures to delay water upstream Holstebro city (non-structural measure) (Holstebro Municipality 2014b).

Denmark expects more extreme precipitation and more precipitation on average (in particular during Winter – during Summer precipitation is expected to decrease). In the optimistic scenario (IPCC's RCP2.6 scenario) average precipitation changes will be 1,6 pct. from the reference period (1986-2005) to 2081-2100. In the high scenario (RCP8.5) average changes will be 6,9 pct. (Danish Meteorological Institute & Ministry of Climate, Energy and Building 2014). Consequently, the flooding risk for Holstebro is expected to increase over time.

Photo 5.1. Storåen flooding in Holstebro (photo: Jakob Stoktoft Oddershede 2014)

The watercourse Storåen has a very narrow passage in the city of Holstebro (see photo above). Consequently, during heavy rainfall, snow melting etc. Holstebro city is flooded. Last severe incident was January 2011, which was the most severe incident since 1970. Climate changes are expected to affect precipitation in Holstebro city by causing more precipitation during winter and less during summer. During summers there can be both periods with drought and periods with heavy rainfalls. Holstebro will have to prepare for: Cloudbursts, extreme run-off due to long rain periods, extreme run-off due to sudden snow melting. Additionally, it is expected that the water table will rise over the next 100 years and sea level will increase 30-140 cm what will increase the flooding problems (Holstebro Municipality 2014a). Flooding events are expected to become more frequent and and more intense. Holstebro can't avoid flooding problems totally – the aim is that flooding problems will not be experienced 'too often' (ibid).

A risk map has been developed for Holstebro, where risk is defined as flooding probability and multiplied with the potential loss of value (100x100 metre squares). 'Value' consists of four parameters: (BBR-register on Danish buildings, public service functions, roads/transportation and cultural heritage). Furthermore, a flooding map has been developed for Holstebro, indicating where rainwater will store after heavy rainfalls (ibid).

Farmers might experience the flooding problems themselves but they can also be part of the solution to the problem. By letting their fields flood (upstream), in exchange for a subsidy (non-structural measure, economic incentive), they can help solving the problems in Holstebro City. Furthermore, autonomously they can adapt to a changing climate by changing crops etc.

Which adaptation tipping points can be identified?

- *Can adaptation tipping points, critical levels for adaptation, be defined for this current strategy? (=when objectives are not met anymore due to changes)*
  Refer to otherwise expand on Table 3 of D6.1
- *When (roughly) will these critical levels be reached due to climate change or socio-economic change*
- *Give appropriate period (2015-2030, 2030-2050, after 2050) for each considered combination of climate and socio-economic scenario.*

A tipping point for Holstebros flood protection would be that protection standards can no longer be met financially, as flood risk and required investments in protection are becoming too high (see BASE D6.1 table 2). There has been no assessment of when that tipping point would be reached.

Step 2 – Identification of Adaptation Measure and Adaptation Pathways (max 1500 words)

(some of these questions might be already answered in section 4 – if so, just copy&paste)

What are the alternative adaptation measures?

- *What are the primary and secondary objectives of adaptation?*

Holstebro: Holstebro's climate adaptation plan has two primary purposes: i) Overview and systematised climate adaptation efforts by mapping and prioritising focus areas, ii) holistic climate adaptation effort coordinated with neighbouring municipalities, utility companies and rescue service (Holstebro Municipality 2014a).

After the 2011 floodings in the city of Holstebro, the municipality started developing measures to cope with the problems. There are two main types of solutions: i) improve the watercourse Storåens flow through the city, ii) improve upstream water retention (ibid). Holstebros climate adaptation plan lists 11 climate adaptation measures (see table 5.9).

Table 5.9. Proposed climate adaptation measures in Holstebros Climate Adaptation Plan 2014 (measure #7 is the focus of the case study)

#	Measure	Purpose	Idea owner	Price	Expected effect
1	Widening of Storå at Storebro + increasing depth of Storå at the stretch below Storebro (structural)	Local lowering of water level in Storåen by improving the flow of water in Storåen	Holstebro Municipality	DKK 8.8 million	Minimum 4 cm lowering of water level upstream Storebro
2	Establishing bridge at overflow ramp (structural)	Local lowering of water level in Storåen by improving the flow of water in Storåen. The project was implemented 2013	Holstebro Municipality	DKK 0.5 million	Unknown (unclear description in Holstebro Municipality 2014a, p.18).

3	Increasing depth of Storå at the stretch upstream Østrbrogade to the allotments (structural)	Local lowering of water level in Storåen by improving the flow of water in Storåen	Holstebro Municipality	DKK 3-5 million (including transportation of digged up material and protection of river banks)	Local lowering (only at the specific stretch of Storå) of water level for 600.000 DKK pr. cm
4	High water level protection at Vigen (structural)	Local high water level protection of residential area (app. 50 households) in Holstebro city. Through establishing plug wall and bank of earth. The proposed project is a matter of principle because the municipality establishes protection of private properties, if the project is implemented.	Holstebro Municipality	DKK 1.3 million excl. VAT. (costs for purchasing land or giving compensation to plot owners are not included. Neither are costs establishment of 'kontraklapper' and running the pumps)	Unknown
5	High water level protection of the Music Theatre (structural)	Protection of the municipalities own building – the Music Theatre – and infra structures towards intrusion of water from Storå. Project has been approved	Holstebro Municipality	DKK 0.6 million	Better protection of Music Theatre
6	Extended watercourse routing in Lægård Bæk and Frøjk Bæk (structural)	Lowering the hydraulic load from surface water ending up in Storå through two smaller streams. Project included in Waste Water Plan 2011-16	Vestforsyning/Holstebro Municipality	Unknown	Retention of surface water before it reaches Storå
7	The farmer as water manager (structural (water retention, delaying, storing) and non-structural (economic incentives))	Project collaboration to uncover agricultures role in retaining water in Storåens catchment area	Knowledge Centre for Agriculture	Unknown	Unknown
8	Local dam to retain water east of Vandkraftsøen (structural)	Avoid flooding in Holstebro city. Demands EIA and in depth analysis of consequences	Holstebro Municipality	DKK 15-25 million	Basin expected to retain up to 5 million m3 of water
9	Retaining water through decentral dam solutions (structural)	Avoid flooding in Holstebro city through retention and river valleys in the municipalities of Holstebro and Herning	Vestforsyning/Holstebro Municipality	Unknown	Apparently retention of 11.28 million m3 (unclear descrption)
10	SMS flooding warnings to citizens (non-structural)	Information service to citizens with warnings for risk for flooding	Holstebro Municipality	Unknown	Citizens wth low-lying properties will have some hours to protect their property
11	Citizen report portal (non-structural)	Systematic registration of citizens' flooding experiences	Holstebro Municipality	Unknown	Unknown

Source: Holstebro Municipality (2014a). Note: Each measure is described in more detail in Holstebro Municipality (2014a). Note 1: Regarding measure #7 a number of sub-measures have been developed within the Farmer as Water Manager Network. Note 2: Holstebro Municipality has estimated that there is a need to withhold app. 3 million m3 of water (Holstebro Municipality 2014b).

- *What is your baseline option (the "business-as-usual"-option)?*
    - *What is the ambition level of this baseline strategy?: Maintaining current risk levels or current protection levels (implying with CC risks may increase)?*

The aim of Holstebros climate adaptation plan is that flooding problems will not be experienced 'too often' (Holstebro Municipality 2014a). A business-as-usual-option would be that current protection levels are maintained – implying a risk for more frequent floodings in the future.

- Is current backlog of investments for adaptation measures included or excluded[9]?

See note 9.

- *Does it include only planned adaptation or also autonomous, non-planned adaptation?*

The above mentioned measures are planned. Farmers' autonomous adaptation is analysed below.

- *Are there complementary measures? Is it appropriate to bundle these measures?*

It is possible to complement the measure with other climate adaptation measures. For instance, building a dam and 'farmer as water manager' can be combined.

What are alternative adaptation pathways?

- *What is the "sell-by"-date of the measures or bundles of measures? I.e. when will they – under conditions of climate change – not any longer be able to meet the defined objectives?*
- *What would be alternative measures or bundles of measures at these "tipping points"?*

It can't be assessed at the moment based on the information available from Holstebro Municipality. For instance, Holstebro Municipality's aim that flooding problems will not be experienced 'too often' is very vague.

[9] We don't understand the question in this context

Step 3 - Evaluation Criteria and Method (max 2000 words)

Step 3a Selection of evaluation criteria

Which evaluation criteria should be used?

- *What are the relevant positive and negative properties of the measures (costs and benefits) to be considered in the evaluation process (economic, ecological and social effects)?*
- *(see D4.1, chapter 4 for examples)*
- *What is the appropriate unit to measure each of these criteria? Is the performance of the adaptation options measured in qualitative, monetary or other quantitative terms?*

We investigate the costs to society of letting farmers inundate their land such that urban infrastructures are protected (partly or wholly) from inundations. We look at the economic component of this type of measure. Data is not developed to date (December 2014) on the total effects of this measure at catchment level. This is work on-going among external partners outside the scope of the BASE project. We hope that it will be possible to have access to this information in 2015.

Step 3b Selection of evaluation method(s)

What is the appropriate evaluation method?

- *Is it possible to express all relevant cost and benefit criteria in monetary terms?*
  (→ cost-benefit analysis)
  No, not at the moment. See step 4.

- *Is it possible to express the positive effect (objective) by a single non-monetary indicator?*
  (→ cost-effectiveness analysis)
- *Are there several relevant criteria which cannot or cannot easily be expressed in monetary terms?*
  (→ multi-criteria analysis, PCBA)

Cost-effectiveness analysis and simple CBA have been performed.

Step 3c Weighting of evaluation criteria (applicable only to multi-criteria analysis)

What are the preferences of stakeholders regarding the different evaluation criteria?

- *Are there different stakeholder groups with varying preferences regarding the evaluation criteria?*
- *Which weight do stakeholders and/or decision makers attach to a substantial change in the performance of the adaptation options regarding each evaluation criterion?*
  (see D4.1, chapter 4.10.2 for guidance for the Swing-Weight method)

Not applicable.

Step 4 - Data collection (max 2000 words)

What are the costs and what are the benefits of the alternative adaptation options?

- *What potential data sources are available, including damage & impact assessment methods or existing CBA studies on adaptation measures?*
- *If no relevant data sources are available and modelling cannot be undertaken: Which experts can estimate proxies for assessing the performance of measures regarding the respective criterion?*
- *How do the adaptation options perform with regard to each of the cost and benefit criteria selected in step 3a?*

In this case study, we only look at one adaptation measure: the combination of a dam and flooding of agricultural land to reduce damages of a 1000-year event to the level of a 100-year event. We can therefore not compare with the costs and benefits of other measures. Avoided damage costs and dam cost construction are based on secondary data (consultancy reports made for the local municipality).

The primary aim of the quantitative analysis has been on the costs associated with farmers as water managers. The subsequent CBA is therefore simplistic and quite crude. There are no agreed upon approach in DK in the way and scope to include damage costs of climate change. This is done on a case by case basis. Most often, indirect and health effects and costs are not included in adaptation feasibility studies.

Costs in terms of paying farmers to agree to let their cropland be flooded in case of extreme events has been estimated to 250-447 EUR/ha/yr based on a choice experiment survey (please see above description in beginning of Section 5). For data on avoided damage costs, please see Section 5.

What is the evaluation time frame?

- *What is the lifespan of the measure with the longest lifetime?*

Farmers as water managers provide in theory yearly services by letting their land be inundated. Contracts are likely to be set up for specific weather events (e.g. 5-year flooding events) with a possibility for compensation when actual events occur. Payments to farmers for agreeing to such contracts are yearly. The choice experiment did not contain attributes on the duration of the contracts. Most likely, such contracts would be time limited and then subject to renewed negotiations. It's very rare to make voluntary contracts run for eternity.

Which discount rate should be applied?

- *Which discount rate is recommended by national guidelines for climate change adaptation measures (or public investments)?*
- *Is it a linear discount rate or any other type (i.e. declining, hyperbolic, etc.)*
- *(In addition, for testing the sensitivity of the results with regard to the discount rate(s) used, also apply a low and high discount rate (1% and 5%)).*

Denmark's official discount rates on projects with a long life time are (Ministry of Finance 2013):

- 4 pct. for year 0 to 35.
- 3 pct. for year 36 to 70.
- 2 pct. for year 70 and beyond.

How to deal with data uncertainty?

- Can uncertainties related to the performance of the measures regarding certain evaluation criteria be described by a range (min-max), a triangular distribution (min, most likely, max) or any other kind of probability distribution?

We haven't had access to effects of measures combined on the ground for the specific catchment area; hence it has been impossible to say anything about the uncertainty of the effects of the measures as we don't have the exact effects of the measures (untested in reality).

Step 5 – Evaluation and Priorization (max 1500 words)

What is the ranking order of alternative adaptation options (measures, bundles of measures or pathways)?

- For cost-benefit analysis:
  What is the net-present value (discounted benefits – discounted costs) of the alternative options?
  What is the benefit-cost ratio?
- For cost effectiveness analysis:
  Which alternative achieves a defined objective at lowest costs?
  What is the cost-effectiveness ratio?
- For multi-criteria analysis:
  Which adaptation option performs best?
  (e.g. for PROMETHEE approach: which option has the highest net flow?)
- What are the uncertainties associated with the performance of the different options?
- Is there and, if so, to what extent uncertainty in the ranking of options?
- Is it possible to determine which option most likely performs best or is it necessary to gather further information to reduce uncertainty (go back to step 4)?

We have only looked at one option, hence no ranking has been possible.

The case study has investigated the costs of voluntary contracts with farmers followed by a crude CBA (See section 5). We haven't undertaken MCA.

Holstebro will probably operate with a range of options that together form the adaptation measures, rather than either or solutions. E.g. flooded farmland and dikes etc.

6. Implementation Analysis

The aim of this section is to establish whether adaptation measures can be implemented in the real world context of case studies, and what the key obstacles and opportunities are in doing so. To ensure the answers provided in this section are comprehensive and in line with WP2 and WP7, a checklist is provided below with the main factors that all case holders need to consider in their answers If relevant to the implementation of your case study.

Checklist

When answering the main questions below ensure you consider each factor listed in the checklist below that might have had a role in the implementation of your case study work. Write in the table how important each factor has been to the implementation of your BASE work and adaptation in general at your case study; where 1 = unimportant, 2 = slightly important, 3 = Important, 4 = Very important, and 5 = Critical). The checklist might not be all-inclusive, so feel free to discuss other factors that are not listed.

Key factors:	Rank from 1 – 5
i. **Knowledge and information about climate adaptation**	4
ii. **Actors** (e.g. leadership, perceptions, understanding of climate adaptation, participation, decision making, stakes, conflicts/synergies)	5
iii. **Framing of climate adaptation** (e.g. as sustainability concern, (urban) planning or environmental issue, disaster risk mitigation topic)	3
iv. **Local and regional context** (e.g. culture, history, geography, environment, economy)	4
v. **European, national, regional and local regulatory framework** (e.g. be specific about laws, strategies, policies)	5
vi. **Institutional context** (e.g. integration of adaptation into existing structures/activities/strategies, decision making, conflicts/synergies, governance arrangements, incentives for engagement)	4
vii. **Resources** (e.g. financial, human)	5
viii. **Nature of adaptation measures** (e.g. no regret, flexibility, important co-benefits, side-effects)	4
ix. **Other** (specify _____)	

In this implementation analysis we only provide *detailed* information on 'the farmer as water manager' measure in Holstebro Municipality. Above, Lollands climate adaptation processen have also been analysed, but as no specific adaptation measures directed towards Lolland farmers have been planned or implemented yet, we are only reporting Lolland results regarding implementation briefly below. As part of the Danish case study, Danish farmers', in general, perception and actions regarding climate adaptation have also been analysed, we also report these results briefly from an implementation perspective.

Lolland – a decision not to implement any adaptation measures at farmland so far

Lolland is interesting as a case illustrating a decision *not* to implement public adaptation measures directed towards farmers, despite the fact that Lolland farmers have experienced severe flooding problems in recent years. According to Lolland Municipality, the Danish Act on Coast Protection and the Act on Watercourses leaves no room for the municipality to protect single farmers by implementing public adaptation measures. If the regulation was not a barrier, the next problem, according to Lolland Municipality, would be how to finance climate adaptation measures in a relatively poor municipality as Lolland (Interview Lolland Municipality 2014).

Additionally, the Lolland case study illustrates the importance of getting a common ground of knowledge among different actors. At Lolland, it has been very important for the common understanding of flooding problems at farmland that a hydraulic model was developed in common between different actors (municipality, farmers, water supply, holiday home owner representatives, the land reclamation guild etc.) because it gives the different actors an understanding of how the water 'behaves' in the open landscape at Lolland. The model has not been used to develop any specific adaptation measures yet, but will probably be a valuable tool in the future.

According to several actors, it is problematic from a farmer perspective that the EU Flood Directive (Directive 2007/60/EC), which requires Member States to assess if water courses and coast lines are at risk from flooding, and to map the flood extent and assets and humans at risk in these areas, is focused on land areas with high economic value. For instance the directive states that: "Flood risks in certain areas within the Community could be considered not to be significant, for example in thinly populated or unpopulated areas or in areas with limited economic assets or ecological value" (Directive 2007/60/EC, (11)). Due to the directive, the authorities are very focused on cities when making climate adaptation plans and risk management plans, and not rural areas (farmland), because the cities are where the highest economic values are (Interview Agricultural consultancy Lolland area 2015; Interview Lolland farmer 2015; Interview Knowledge Centre for Agriculture 2015).

Key factor v (regulatory framework) and **vii** (financial resources) have been important for the decision not to implement any farmland measures yet at Lolland.

Danish farmers' autonomous climate adaptation

As part of the Lolland and Holstebro case studies the AU research team has also analysed autonomous farmer climate adaptation as part of the BASE project through a national farmer survey, a Holstebro farmer survey and a Lolland farmer survey (see section 5). We have not reported the finding of this below, as the analysis framework doesn't fit very well to autonomous climate adaptation analysis as (individual) action here is very diverse and more dependent on climate change perception, adaptive capacity, perception of barriers etc. of the farmers.

Among the findings are that Danish farmers largely believe in global climate change, but, in general, are not very concerned about climate change impacts though they perceive many barriers to adaptation (see section 8). According to the farmers, the largest barriers for autonomous climate adaptation are perceived to be environmental/climate/farming policy regulations and economic losses connected to change farming practice (see chapter 8; see also Woods et al. 2015) **(Key factor ii, v and vii seems to be the most important here).** A comparative analysis of survey results from the Czech Republic, Denmark and Spain shows that Holstebro farmers in general are less concerned about climate changes than Czech farmers in the Ústí region and Spanish farmers in the Tagus region (Pedersen et al. 2015). The Danish farmers agree more that global climate change is occuring than Spanish and Czech farmers, but take less action due to climate changes (Pedersen et al. 2015). Data indicate that the reason is that although Danish farmers believe that climate changes are happening, they have much less experience at their specific farm with negative effects of climate changes and are less concerned about future negative effects than Spanish and Czech farmers (Pedersen et al. 2015). 51 pct. of Danish farmers expect long-term climate changes to be neutral for their farm (11 pct. expect positive effects, 17 pct. negative effects).

On average, Danish farmers have the perception that initiating activities to protect the farm from potential negative climate change effects is both a responsibility for the government and the farmers, but the farmers are divided. In the national survey, 40 pct. of the farmers score 4 or 5 on a scale from 1 (not at all) to 5 (to a very high degree) on government responsibility for initiating protection activities, 30 pct. scores 1 or 2. Regarding own (farmer) responsibility, 50 pct. scores 4 or 5, while 20 pct. scores 1 or 2.

Holstebro implementation analysis

Below is an implementation analysis of the proposed measure for Holstebro Municipality – the farmer as water manager. Until now, the measure has only been proposed as a potential measure and not been implemented.

Summary Information Holstebro (based on your answers to the questions below)

a) *Specify sectors covered (e.g. coast, city, agriculture):*
Agriculture, (city)

b) *Specify adaptation measures covered (e.g. altering cultivation practices, building defences; explain why they were chosen):*
The farmer as water manager, (autonomous farmer climate adaptation)

c) *Specify climate change impacts covered (e.g. flooding, heat stress, sea level rise):*
Flooding

d) *Specify main results of activities (e.g. changes, outputs):*
The farmer as water manager measure is still under development.

Questions

Answer these six questions giving specific evidence and examples where possible. In principle all implementation activities should be included, i.e. adaptation activities supported by BASE partners as well as those by other actors. If it is possible to inform about the implementation of those adaptation measures assessed for task 5.2, it is very important to do so in order to comply with the DoW. The measures covered can be extensive and/or particular to a case study. They can include for example, the development of plans and strategies, vulnerability/risk assessments, economic assessments such as CBA, MCA, the development of participatory processes/public dialogue, through to the implementation of actual measures including physical measures such as engineering developments and land use change, incentives/subsidies for behavioural change, etc. This list is not all-inclusive and is merely a guide. Your own case study may have very different measures. However, ***you must be clear what measures you are refereeing to when answering these questions.***

1. *How have climate change adaptation measures and strategies been advanced in the case study? Describe the process! Note: Retrospective case studies will not answer this question, but have to update their answer to question 1 E of this document on the history of adaptation at their case study. (Approximately 500 words)*

See section 1E and 3E.

2. *What and who drives (or enables) the adoption and implementation of adaptation measures and strategies/policies? Please explicitly refer to the factors mentioned in the checklist, highlighting the factor in bold, and be specific about any relevant policies! (Approximately 500 – 1000 words)*

Holstebro Municipality's climate adaptation plan was developed partly in response to the EU flooding directive. Directive 2007/60/EC requires Member States to assess if water courses and coast lines are at risk from flooding, and to map the flood extent and assets and humans at risk in these areas. And to to take adequate and coordinated measures to reduce this flood risk [**key factor v]**. Holstebro Municipality include areas which are among those ten Danish areas which in 2011 was appointed by the Danish Government, based on historical data and the criteria in Directive 2007/60/EC, as areas which might experience extreme climate events in the future (Ministry of Environment and Ministry of Transport 2011) [**key factor i+iv**]. Furthermore, as a response to an agreement between Local Government Denmark and the Danish Government, all Danish municipalities were obliged to develop local climate adaptation plans [**key factor v**]. Finally, the municipality has experienced several significant flooding events in which the center of Holstebro City was flooded. Holstebro City experiences severe flooding events app. every 9th year. Floodings have happened due to snow melt and/or longer periods of rain filling up the natural reservoirs and increasing the water level in Storåen (Aarhus University 2014: 18). [**key factor i+iv**]. Hence, the Holstebro Climate Adaptation Plan focuses primarily on water management, particularly how to prevent and deal with flooding [**key factor iii**] . The Climate Adaptation Plan (Holstebro Municipality 2014a) was adopted by the Holstebro City Council in June of 2014 as an addendum to the Municipal Plan [**key factor vi**] which lays out the general direction and guidelines for physical and land use development for a 12 year period. Adoption followed a 3-months public hearing as required by the Danish Planning Act [**key factor v**].

'The farmer as water manager' project came about as network cooperation between the Knowledge Centre for Agriculture (now SEGES), municipalities in selected areas of Jutland and agricultural organizations [**key factor I + ii + vii**]. Holstebro Municipality is a participant in this network, but so far SEGES has played the key role in developing the concept of the 'Farmer as Water Manager' as well as organizing network activities and participation. The idea and the network grew out of an EU-interreg-funded research project, Aquarius, and the

network received partial funding (app. 1 million DKK) from a Danish government program, The Green Development and Demonstration Program [**key factor vii**]. The network has organized a number of meetings and workshops, with participation from municipalities, among these the three municipalities located in the Storå catchment, agricultural organizations and other stakeholders and has also involved experts from universities and consultancies. The aim has been to develop ideas, exchange knowledge and experience and to provide a forum for dialogue, but not to decide on or implement any specific projects [**key factor ii**]. Hence, while the project is mentioned in the Holstebro Climate Adaptation plan and while it has explored project ideas for the Storå catchment no specific proposals have been develop yet. As for the process, the many meetings and workshops indicate a rather participatory approach, particularly as regards agricultural organizations, knowledge organisations and municipalities. But also nature and recreational organizations have been invited to presentations of the project ideas [**key factor ii**]. But the attention is only now beginning to turn to individual farmers with land in the Storå catchment, who may actually be affected by the project.

3. What obstacles were encountered during the adoption or implementation of adaptation measures and strategies/policies? Please explicitly refer to the factors mentioned in the checklist, highlighting the factor in bold, and be specific about any relevant policies! (Approximately 500 – 1000 words)

- For Farmer as Water Manager to succeed, all or most farmers in the area must sign up. This is a challenge both with regards to steering of the project but also introduces an element of uncertainty. **[key factors ii, vi]**
- There are questions as to how much the measure could contribute to solution of the flooding issues in Holstebro City **[key factors i, iii, viii]**
- The measure requires participation of municipalities and/or farmers in two upstream communities. Some farmers in these municipalities already experience problems with poor drainage from their land and would not be likely to enter an agreement to allow more flooding.This exacerbates coordination issues and uncertainty. **[key factors ii, iv, vi]**
- The dialogue with potential participants in the farmer as water manager measure has not yet been undertaken due to time constraints **[key factor vii];** and it is unclear how expensive the measure would be, since farmers typically only say that they will participate if the compensation is 'satisfactory', when asked. However, the choice experiment (see section 5) demonstrates that the farmers on average would need an economic compensation in the range of 250 to 447 EUR/ha/yr. There is no knowledge on whether this is cost-effective compared to other potential measures – but basically, it might be cheaper to have climate adaptation measures at farmland than measures within the city borders (Interview Knowledge Centre for Agriculture 2015) **[key factors i; ii; vii].** Due to the lack of specific negotiations, farmers do not have enough information yet to be able to commit or indicate a non-hypothetic interest **[key factor i]**.
- Farmers are hesitant to commit to an agri-environmental scheme that may jeopardize their EU single farm payment; hence, any measures that would involve taking farmland out of production permanently would generally be unappealing to farmers; furthermore, the farmers will not take the risk not being able to meet EU cross-compliance demands, and they fear that they will no longer be part of livestock-land-regulation (Aarhus University 2014) **[key factor ii, v, viii].** If the conditions change, e.g. if more of the farmers fields are flooded than anticipated by the authorities, farmers want to have the possibility to opt out of the contract (Aarhus University 2014) **[key factor viii]**. This is not necessarily a barrier (but a potential).

- It will probably be difficult to get the necessary subsidies funded through the EU Rural Development Programme. Consequently, it would be the Danish public water supply companies who should provide the financial resources – here it might be a challenge that water supply companies in less populated municipalities do not have as many financial resources as water supply companies in more densely populated municipalities (Interview Knowledge Centre for Agriculture 2015) **[key factor iv, vii]**
- *If,* in principle, it is possible to finance the measure through the Rural Development Programme there might be other barriers (Christensen et al. 2011): i) subsidy schemes tend to exhaust national budgets for environmental purposes rather quickly, ii) at the same time as the use of AES is encouraged by EU regulation, the regulation sets a ceiling on the remuneration scheme of 20% above direct costs, which necessarily limits the compensation for transaction costs (Christensen et al. 2011), iii) increasing payments in subsidy schemes does not ensure increasing scheme attractiveness for all farmers, especially for those who do not optimize only in economic values (see also Pedersen et al. 2012) **[key factor v, vii]**
- When there are extreme precipitation events, run-off like sewage and heavy metals from wastewater treatment plants might end up at the fields, what can lead to future restrictions on use (Aarhus University 2014). If the crop is used for consumption, run-off from wastewater treatment is a no go (Interview Knowledge Centre for Agriculture 2015) **[key factor iv, vi]**
- Lack of awareness about climate change (effects) among farmers. The average Danish farmers do not generally perceive high risks connected to a changing climate (see chapter 8) what might make them reluctant to be part of climate adaptation measures **[key factor i, ii]**
- Organisation of the local municipality and organisational position of climate adaptation measures is generally a medium-level challenge that inhibits attention and prioritization of climate adaptation at the local level **[key factor vi]**
- Political interest at the local level in the project has not yet been significant in part due to lack of attention and interest **[key factor ii, iv, viii].** It is clear that climate adaptation and particular measures require political and executive leadership to become reality.
- There is a fear among farmers that they will be worse-off regarding insurance conditions if they voluntarily let their fields flood (Aarhus University 2014). The field needs to be in a certain condition to get the EU single payment and if there is no single payment you can't get insured against loosing it (Interview Knowledge Centre for Agriculture 2015). **[key factor ii, vii]**
- Uncertainties regarding burden of proof when fields are flooded – if it is the farmer who has to satisfy the burden of proof regarding specific floodings this might be a barrier (Aarhus University 2014) **[key factor ii, v, vii]**

4. If any obstacles were overcome, how was this achieved? (Approximately 500 words)

The farmer as water manager network has been an important facilitator in maturing the idea of using farmland as a climate adaptation measure against flooding in the city of Holstebro (see chapter 3) – an idea which from the outset could have been controversial, as taking farmland out of production is normally a controversial issue among Danish farmers and agricultural organisations **[key factor ii]**. The aim of the network has been to develop ideas in common among the different actors, exchange knowledge and experience and to provide a forum for dialogue, but not to decide on or implement any specific projects **[key factor i]**. It is too early to point to other obstacles overcome since the adaptation measure is neither decided or implemented yet.

5. What are the future prospects of the climate change adaptation activities in the case study? (Approximately 200 – 500 words)

This is difficult to assess at the moment (June 2015). As described under question 3, a number of obstacles have to be overcome. Many obstacles are related to the regulatory framework and financial constraints **[key factor v, vii]**. However, in the end, as 'farmer as water manager' is a voluntary measure: if farmers are not interested in being part of the measure **[key factor ii]**, there will be no measure, unless the Danish authorities decide to expropriate farmers, what is very unlikely. Consequently, the realisation of the measure is very dependent on the type of incentives provided to the farmers for being part of the measure **[key factor viii]**, and on the ability and will of the farmers to participate in this agri-environmental scheme - and this is complex since different farmers might have different ability and will. However, an initiative like the farmer as water manager network **[key factor ii]**, which is born bottom-up by an agricultural organisation, and includes many different actors, has the potential of maturing the idea of 'farmers as water managers'.

6. What is the key message from this case study (and which could work in other cases as well)? Don't forget to consider any specific policy recommendations that arise in your case study! (Approximately 200 – 500 words)

The farmer as water manager measure has a potential to be copied to the agricultural sector in other countries, because it is way to let the farmland have multiple functions and increases the flexibility of the land. During extreme precipitation events, the fields can be climate adaptation measures, and when the fields are dry again, they can return to being farmland producing crops. However, for a voluntary measure like this, certain conditions need to be met. First and foremost the regulatory framework (vertically (EU-level, national level, local level) and horisontally (between different sectors)) must not put up obstacles for the measure **[key factor v]**. In particular, there are some obstacles in EU's Common Agricultural Policy which probably need to be removed to make the farmers have the will to be water managers. Secondly, needless to say, financial resources is a prerequisite **[key factor vii, viii]** – if the farmers don't get a satisfactory compensation, there will be no adaptation measure. Finally, in the end, the success of the measure is dependent on the ability and will of the farmers (and will and ability are varying) **[key factor ii]**. Creating the right incentives (both financial and other types of incentives) is the be-all and end-all of this type of measure. In influencing the ability and will of the farmers to participate, bottom-up initiatives like the 'farmer as water manager network' might prove very important **[key factor ii]**.

7. Development of new tools for adaptation planning and implementation

(Please describe the development and use of new tools for climate change adaptation planning and implementation which you have used under BASE research project and report on their SWOT analysis and overall feedback. Máx 2000 words)

New tool(s) developed and used during BASE:

There might be some new insights from our choice experiment on farmers as water managers

Description for each New tool (Máx 50 words/each):

The choice experiment (CE) allows us to deduct preferences of farmers to participate in a voluntary performance contract in a quantitative way. This has not been tested before on this type of activity. CE has been applied a number of times in Denmark and internationally on farmer contracts.

8. Analysis of Danish farmers' autonomous climate adaptation through three surveys

Aarhus University has implemented three online farmer surveys as part of the BASE project:

- Online survey to farmers along Storåen (Holstebro and neighbouring municipalities) distributed through a local agricultural consultancy in April-May 2014. 449 farmers were contacted. 81 participated. But for most questions only about 65-70 farmers have answered
- Online survey to farmers in the Municipality of Lolland distributed through a local agricultural consultancy in May-April 2014. 225 farmers were contacted. For most questions 32-36 farmers have answered.
- National survey. Aspecto Market Research & Consultancy ran the survey using a rolling distribution online through a farmer panel consisting of approximately 3,000 Danish farmers. The survey was distributed in April-May 2014. The survey was sent to a total of 2,937 farmers and the final number of responses was 1,053. This survey was financed by the research project NORDSTAR, where Aarhus University is among the partners. In the sample, for instance larger farms were overrepresented. Weights were generated to correct for sample overrepresentation (based on farmer age, farm size, and region) and the models re-estimated with weighted observations using proc surveylogistic in SAS. This did not affect the qualitative results, although some small changes parameter and variance estimates were observed. Below, we report primarily the weighted data – in some tables we report the unweighted data too.

In all three surveys, farmers were incentivized to participate through incentive gifts.

In the Danish case areas the farmer surveys were run online at approximately the same time (April-May 2014). The response rates are not high, but on the other hand not uncommon for farmer questionnaires. A plausible explanation for the response rate not being higher was that it was send out at a very busy time of the farming year (Spring). Response rates were highest in the national survey – this might be explained by the fact that farmers in a panel might be more motivated for answering a survey than other farmers. Furthermore, the average incentive gifts in the national survey have probably been higher than in the surveys in the two municipalities.

About the data

Based on literature survey and knowledge from earlier research on farmer perceptions/behaviour in Denmark (see e.g. Pedersen et al. 2012, Christensen et al. 2012, Nielsen 2010) a first version of the questionnaire was drafted by Aarhus University. The draft questionnaire was developed in collaboration between (BASE) and Aarhus University colleagues from the research project NORDSTAR: Nordic Strategic Adaptation Research (Nord-Star). This draft was then discussed with BASE partners and adjusted to ensure its applicability to, and relevance for, other agricultural case studies under the BASE project, including case studies in the Czech Republic, Spain and Portugal. Finally, the questionnaire was tested on four Danish farmers as well as on agricultural experts and an agro-climatologist in other case countries, leading to further minor adjustments.

The survey consisted of the following three sections: i)15 main questions (many of them 'batteries') on perception of climate change/adaptation (e.g. belief that climate change is occurring; experience with extreme weather events, consequences, adaptive responses, concerns, barriers for adaptation etc.); ii) questions related to the specific local

context (e.g. regarding participation in developing local climate adaptation plans); iii) demographic and socio-economic background questions (farm type, sex, age, years at the farm etc.). Additionally, the Holstebro survey included a choice experiment (see section 5 and appendix 2).

In most questions, the answer categories are 5-point scales (e.g. traditional Likert scales going from 'strongly disagree' to 'strongly agree'; or 'very unlikely' to 'very likely' etc.) plus the possibility of answering 'don't know'. In the survey design there are small differences in some of the questions to adapt the survey to the different contexts in the three different countries and to make it possible to answer the whole survey without using too much time as this would have affected the response rate negatively. For instance, some answer categories might be relevant in some countries but not in other. There were differences in how the surveys were run in the different countries – e.g. in Denmark internet usage is more common (95% users) than in Portugal (68%), Spain (77%) and the Czech Republic (79%) (internetworldstats.com); consequently internet surveys are easier to run in Denmark.

Below, we report results from the univariate analyses. When commenting the national results, we primarily refer to the weighted data.

Danish farms in general

As mentioned above, to make data from the national survey generalisable, data have been weighted according to farm size, farmer age and region for the total Danish farmer population (2013 data). Table 8.1 shows the distribution of Danish farms according to size, Table 8.2 according to age of the farmer, and Table 8.3 according to regional location of farms.

Table 8.1. Size of Danish farms (2013 figures)

Farm size (ha)	Number of farms	pct
0-29.9 ha	21,504	53.9
30.0 – 99.9 ha	10,410	26.1
100.0 – 249.9 ha	5,855	14.7
250.0 or larger	2,160	5.4
Total	39,929	100.1

Source: Aspecto (2015) based on data from Statistics Denmark

Table 8.2. Age of farmers in Denmark

Age interval	Number of farmers	Pct
Under 35 years	1,165	2.9
35 - 49 years	12,200	30.6
50 - 64 years	17,356	43.5
65 years or more	9,208	23.1

Source: Aspecto (2015) based on data from Statistics Denmark

Table 8.3. Location of Danish farms according to region

Region	Number of farms	Pct
The Capital Region of Denmark	2,695	6.7
Region Zealand	6,879	17.2
Region of Southern Denmark	10,737	26.9
Central Denmark Region	12,158	30.4
North Denmark Region	7,460	18.7

Source: Aspecto (2015) based on data from Statistics Denmark

Selected results from the surveys

Do farmers (dis)agree that global climate change is occurring

Overall, the three surveys demonstrate that a majority of farmers in Denmark agree that global climate change is occuring (see table 8.4). A minority (11 pct. in the national (weighted) survey) disagree. The Lolland farmers are those that strongest agree (scoring 3.9 on average).

Table 8.4. Please indicate the degree to which you agree or disagree with the following statement: global climate change is occurring. (scale from strongly disagree to strongly agree + don't know)

	Strongly disgree (1)	Disagree (2)	Neither/nor (3)	Agree (4)	Strongly agree (5)	Don't know	Total (n)	Mean score* (excluding don't know)
Lolland	0	6	25	38	25	6	100 (32)	3.9
Holstebro	6	10	28	36	14	7	101 (72)	3.5
National (weighted)	3	8	27	47	10	4	99 (-)	3.6
National (unweighted)	*3*	*8*	*31*	*46*	*9*	*3*	*100 (1053)*	*3.5*

*Mean score calculated with values from 1 (very unlikely) to 5 (very likely)

Experience with heavy/extreme precipitation and loss of crop yield

More Lolland farmers (69 pct) than Holstebro farmers (29 pct) and Danish farmers in general (29 pct.) have experienced more frequent extreme or heavy precipitations in their farming areas within the years they have been working at the farm (Table 8.5). Different hypotheses can be developed to explain this: 1. Weather might have developed differently in the Northwestern part of Denmark (Holstebro), and Denmark on average, compared to the South-Eastern part (Lolland). 2. Lolland farmers perceive the precipitation as more frequent, because they are

situated in an area of Denmark, where farmland is more exposed to flooding caused by precipitation. 3. Lolland farmers perceive the precipitation as more frequent or heavy, because many Lolland farmers suffered crop losses recently (in 2011) due to heavy/extreme precipitation.

A fourth explanation could be that Lolland farmers have been working at their farm more years than Holstebro farmers, but in fact it is opposite – on average, Holstebro farmers have 30 years experience at the farm, Lolland farmers 28 years and in the national survey (weighted data) average is 28 years too (data not shown in tables).

Table 8.5 Have you observed more frequent extreme or heavy precipitations in your farming area within the years you have been working at the farm ?

Pct.	**Yes**	**No**	**Don't know**	**Total (n)**
Lolland	69	28	3	100 (36)
Holstebro	29	52	19	100 (80)
National (weighted)	29	56	15	100 (-)
National (unweighted)	*31*	*56*	*13*	*100 (1053)*

Among those farmers who have observed more frequent precipitation, almost all have experienced a crop loss due to the worst of such precipitation events. When asked about the worst of such precipitation events, there are regional differences though. 79 pct. of the Lolland farmers who have experienced more precipitation events, have suffered losses of minimum 10 pct. of annual crop yield of the crop that was hardest struck. In contrast, only 35 pct. of those Holstebro farmers who experienced more precipitation events, and 35 pct. of farmers nationwide, have suffered losses within the same range.

Table 8.6 Think about the worst of such precipitation events - how much did that event affect the crop which was hardest struck? (Question only posed to farmers who answered yes to the question in table 8.5)

Pct.	No effect on crop yield	A loss of 1 to 9 pct. in annual crop yield	A loss of 10 to 29 pct. in annual crop yield	A loss of 30 to 49 pct. in annual crop yield	A loss of more than 50 pct. in annual crop yield	Don't know	Total (n)
Lolland	0	17	58	13	8	4	100 (24)
Holstebro	13	44	22	9	4	9	101 (23)
National (weighted)	22	35	23	7	5	8	100 (-)
National (unweighted)	16	33	29	10	7	5	100 (329)

In Holstebro, among those farmers having lost crop, 50 pct. suffered highest losses in spring barley; 28 pct. in potatoes. Among Lolland farmers having suffered losses the hardest struck crop was winter wheat (35 pct.) and spring barley (26 pct.). At national level, hardest struck crops were spring barley (31 pct) and winter wheat (30 pct).

Table 8.7. Which crop suffered the greatest damage

Crop	Lolland	Holstebro	National (weighted)
	Pct (n)	Pct (n)	Pct (n)
Spring barley	26	50	31
Winter barley	-	-	3
Oats	-	-	1
Spring wheat	-	6	1
Winter wheat	35	-	30
Spring rapeseed	-	-	1
Winter rapeseed	-	6	11
Rye	-	-	2
Corn	-	11	5
Beets/turnips	13	-	2
Sugar beets	9	-	-
Potatoes	4	28	3
Grass seed	-	-	2
Other crops	13	-	9
	100 (23)	101 (18)	101 (201)

To estimate the crop loss in spring barley we examined the share of crop loss among Holstebro farmers by the number of hectares grown with spring barley (Table 8.8). The farmers who indicated losses on spring barley grew a total of 336 ha., or a mean of 42 ha per farm. The greatest loss, up to 49 pct., was sustained on 62 hectares, while the yield was reduced by 10 to 29 pct. on another 74 hectares.

Table 8.8. Share of crop lost by size of area grown with that crop – spring barley, Holstebro farmers

	Mean no. of ha	Total ha w/spring barley	N
Loss of 1 to 9 pct. of physical yield	31.5	126	4
Loss of 10-29 pct. of physical yield	74.3	148.6	2
Loss of 30 to 49 pct. of physical yield	31	62	2
Total	42.1	336.6	8

Another five Holstebro farmers had suffered their greatest losses in potato fields. But only three of these farmers listed how many ha of potatoes they were growing. This amounted to a total of 232 ha or a mean per farm of 77ha.

Table 8.9. Crosstabulation of the the share of crop loss with the area cultivated with potatoes, Holstebro farmers

Q3	Mean no. of ha	N
Loss of 1 to 9 pct. of physical yield	60	1
Loss of 10-29 pct. of physical yield	150	1
Loss of 30 to 49 pct. of physical yield	22	1
Total	77	3

Experience with climate change related effects

Below tables (8.11-8.13) with farmer experiences with climate change related effects are illustrated for each survey.

Table 8.10 During the years you have been working on the farm have you experienced any of the following, scale from 1(not at all) to 5 (to a very high degree). Lolland results

LOLLAND, PCT	1 (not at all)	2	3	4	5 (to a very high degree)	Don't know	Total (n)	Mean score (excluding don't know)
Increased frequency of heavy storms causing damage to buildings/trees	6	20	34	26	11	3	100 (35)	3.2
Increased frequency of heavy storms causing flooding on or near the farm	53	15	15	12	3	3	101 (36)	1.9
More insects/pests/ weeds	15	27	29	21	6	3	101 (36)	2.8
Greater variation in temperatures from year to year	3	18	41	29	6	3	100 (34)	3.2
Greater variations in water availability from year to year	12	15	41	18	6	9	101 (34)	2.9
Other changes	9	12	9	12	6	53	101 (34)	Not calculated due to many 'don't know'

Table 8.11. During the years you have been working on the farm have you experienced any of the following, scale from 1(not at all) to 5 (to a very high degree). Holstebro results

HOLSTEBRO, PCT	1 (not at all)	2	3	4	5 (to a very high degree)	Don't know	Total (n)	Mean score (excluding don't know)
Increased frequency of heavy storms causing damage to buildings/trees	12	29	26	25	8	1	101 (77)	2.9
Increased frequency of heavy strong storms causing flooding on or near the farm	61	22	8	5	1	3	100 (77)	1.6
More insects/pests/ weeds	34	26	23	4	3	10	100 (77)	2.1
Greater variation in temperatures from year to year	20	22	25	17	7	10	100 (77)	2.7
Greater variations in water availability from year to year	30	21	29	4	5	12	100 (77)	2.3
Other changes	40	0	10	0	10	40	100 (10)	-

Table 8.12. During the years you have been working on the farm have you experienced any of the following, scale from 1(not at all) to 5 (to a very high degree). National results, weighted data

NATIONAL, PCT	1 (not at all)	2	3	4	5 (to a very high degree)	Don't know	Total (n)	Mean score (excluding don't know)
Increased frequency of heavy storms causing damage to buildings/trees	18	22	26	22	9	2	99 (-)	2.8
Increased frequency of heavy storms causing flooding on or near the farm	69	18	6	3	2	2	100 (-)	1.5
More insects/pests/ weeds	42	23	18	7	1	9	100 (-)	1.9
Greater variation in temperatures from year to year	22	24	26	17	2	9	100 (-)	2.5
Greater variations in water availability from year to year	32	20	21	13	4	10	100 (-)	2.3

Note: Very few answered 'other' – therefore not reported here.

Table 8.13. During the years you have been working on the farm have you experienced any of the following, scale from 1 (not at all) to 5 (to a very high degree). Comparison of mean scores

Mean score	Lolland	Holstebro	National (weighted)
Increased frequency of storms causing damage to buildings/trees	3.2	2.9	2.8
Increased frequency of storms causing flooding on or nar the farm	1.9	1.6	1.5
More insects/pests/ weeds	2.8	2.1	1.9
Greater variation in temperatures from year to year	3.2	2.7	2.5
Greater variations in water availability from year to year	2.9	2.3	2.3
Other changes	-		
N=	34-36	77	

For all types of climate change related effects, mean scores are higher for Lolland than for Holstebro and the national survey. In all three surveys, experiences with 'Increased frequency of storms causing damage to buildings/trees' and 'Greater variation in temperatures from year to year' are higher than for other types of effects. In general, there is quite a lot of variation within each of the three surveys regarding the farmer experiences.

Autonomous adaptation. Actions and responsibilities

Farmers can autonomously adapt to some types of climate changes by introducing new crops. Consequently, questions on introduction/test of new crops were included in the surveys. Additionally, the farmers were asked about the causes of the introduction. A minority of farmers (18-34%) have stopped growing a crop(s) permanently and a minority have introduced new crops permanently (27-36%) or as a test (13-19%).

Table 8.14. Within the years you have been working at the farm, have you stopped growing a crop(s) permanently?

Pct.	Yes	No	Don't know	Total (n)
Lolland	18	82	0	100 (33)
Holstebro	34	64	3	101 (77)
National (weighted)	25	73	2	100 (-)
National (unweighted)	*33*	*65*	*2*	*100 (1053)*

Table 8.15. Within the years you have been working at the farm, have you introduced one or more new crops permanently?

Pct.	Yes	No	Don't know	Total (n)
Lolland	33	67	0	100 (33)
Holstebro	36	61	3	100 (77)
National (weighted)	27	72	2	101 (-)
National (unweighted)	*35*	*64*	*1*	*100 (1053)*

Table 8.16. Within the years you have been working at the farm, have you introduced one or more crops as a test?

Pct.	Yes	No	Don't know	Total (n) (n)
Lolland	18	82	0	100 (33)
Holstebro	13	84	3	100 (77)
National (weighted)	19	80	2	101 (-)
National (unweighted)	*25%*	*73%*	*2%*	*100 (1053)*

A few farmers answered that they had made other changes of the crop besides introducing new crops permanently or as a test (not illustrated in tables).

Those farmers who indicated that they had stopped, introduced and/or tested crops were asked about the causes for their decision (table 8.17, 8.18, 8.19). Average scores are compared in table 8.20.

Table 8.17. How important were each of the following for your decisions to change crops? Lolland results

Pct.	1 (not at all)	2	3	4	5 (to a very high degree)	Don't know	Total (n)	Mean score (excluding don't know)
Possibility of higher yield	11	17	17	39	17	0	101 (18)	3.4
Better price for the crop	6	6	0	33	50	6	101 (18)	4.2
Changes in precipitation	33	16	44	0	6	0	99 (18)	2.3
Changes in temperature	50	17	17	11	0	6	101 (18)	1.9
Changes in salinity/groundwater	67	17	11	0	0	6	101 (18)	1.4
Changes in land productivity	6	11	22	44	17	0	100 (18)	3.6
Changes in labour availability/cost	44	22	17	6	6	6	101 (18)	2.0
Changes in environmental, climate and/or agricultural policies	39	22	22	0	11	6	100 (18)	2.2
Changes in weed/pests/ diseases	56	17	17	5	0	5	100 (18)	1.7
Risk of resistance	39	22	22	11	6	0	100 (18)	2.2
Changes in draining conditions	61	6	17	11	6	0	101 (18)	2.0
Other	6	6	0	19	13	56	100 (16)	Not calculated due to many 'don't know'

Table 8.18. How important were each of the following for your decisions to change crops? Holstebro results

Pct.	1 (not at all)	2	3	4	5 (to a very high degree)	Don't know	Total (n)	Mean score (excluding don't know)
Possibility of higher yield	30	9	25	11	25	0	100 (44)	2.9
Better price for the crop	36	9	11	27	14	2	99 (44)	2.7
Changes in precipitation	46	16	18	14	2	6	100 (44)	2.1
Changes in temperature	43	27	16	9	2	2	99 (44)	2.0
Changes in salinity/groundwater	64	18	5	5	0	9	101 (44)	1.5
Changes in land productivity	46	7	18	14	14	2	101 (44)	2.4
Changes in labour availability/cost	50	23	9	5	11	2	100 (44)	2.0
Changes in environmental, climate and/or agricultural policies	34	16	9	21	16	5	101 (44)	2.7
Changes in weed/pests/ diseases	55	14	14	9	2	7	101 (44)	1.8
Risk of resistance	57	16	11	11	2	2	99 (44)	1.8
Changes in draining conditions	59	16	14	7	5	0	101 (44)	1.8
Other	40	0	7	7	40	7	101 (15)	3.1

Table 8.19. How important were each of the following for your decisions to change crops? National results, weighted

Pct.	1 (not at all)	2	3	4	5 (to a very high degree)	Don't know	Total (n)	Mean score (excluding don't know)
Possibility of higher yield	14	6	17	25	36	3	101 (-)	3.7
Better price for the crop	13	5	15	28	35	3	99 (-)	3.7
Changes in precipitation	47	21	18	6	4	5	101 (-)	1.9
Changes in temperature	49	16	18	6	3	8	100 (-)	1.9
Changes in salinity/groundwater	70	12	7	1	1	10	101 (-)	1.3
Changes in land productivity	21	12	18	23	20	6	100 (-)	3.1
Changes in labour availability/cost	51	12	14	11	7	5	100 (-)	2.1
Changes in environmental, climate and/or agricultural policies	38	12	17	15	12	6	100 (-)	2.5
Changes in weed/pests/ diseases	45	15	17	12	5	6	100 (-)	2.1
Risk of resistance	46	11	18	13	7	5	100 (-)	2.2
Changes in draining conditions	55	12	15	7	7	4	100 (-)	1.9
Other								

Table 8.20. How important were each of the following for your decisions to change crops? Comparison of mean scores

	Lolland	Holstebro	National (weighted)
Possibility of higher yield	3.4	2.9	3.7
Better price for the crop	4.2	2.7	3.7
Changes in precipitation	2.3	2.1	1.9
Changes in temperature	1.9	2.0	1.9
Changes in salinity/groundwater	1.4	1.5	1.3
Changes in land productivity	3.6	2.4	3.1
Changes in labour availability/cost	2.0	2.0	2.1
Changes in environmental, climate and/or agricultural policies	2.2	2.7	2.5
Changes in weed/pests/ diseases	1.7	1.8	2.1
Risk of resistance	2.2	1.8	2.2
Changes in draining conditions	2.0	1.8	1.9

Note: 'Other' category not included

The answers are relatively similar in the three surveys although Lolland farmers in general indicates higher scores than Holstebro farmers. In all three surveys, 'possibility of higher yield', 'better price for the crop' and 'changes in land productivity' are among the top-three-scorers with the only exception that 'land productivity' is not in top three in Holstebro, where 'changes in policies' is more important.

The farmers were also asked, who should be responsible for initiating activities to protect their farm from potential negative impacts caused by climate change (table 8.21, 8.22, 8.23). Average scores are compared in table 8.24.

Table 8.21. In your opinion who should be responsible for initiating activities to protect your farm from potential negative impacts caused by climate change? Scale 1-5 1 'not at all' to 5 'to a very high degree' + don't know. Lolland results

Lolland	1 (not at all)	2	3	4	5 (to a very high degree)	Don't know	Pct (N)	Mean score (excluding don't know)
The government	3	13	3	22	56	3	100 (32)	4.2
You	3	3	31	38	22	3	100 (32)	3.8
Others	4	0	13	8	17	58	100 (32)	Mean score not calculated – high number of don't know

Table 8.22. In your opinion who should be responsible for initiating activities to protect your farm from potential negative impacts caused by climate change? Scale 1-5 1 'not at all' to 5 'to a very high degree' + don't know. Holstebro results

Holstebro	1 (not at all)	2	3	4	5 (to a very high degree)	Don't know	Pct (N)	Mean score (excluding don't know)
The government	12	19	25	14	23	7	100 (73)	3.2
You	10	16	29	16	23	6	100 (73)	3.3
Others	24	4	0	4	28	40	100 (25)	Mean score not calculated – high number of don't know

Table 8.23. In your opinion who should be responsible for initiating activities to protect your farm from potential negative impacts caused by climate change? Scale 1-5 1 'not at all' to 5 'to a very high degree' + don't know. National results, weighted

National, weighted	1 (not at all)	2	3	4	5 (to a very high degree)	Don't know	Pct (N)	Mean score (excluding don't know)
The government	14	16	25	18	22	5	100 (-)	3.2
You	8	12	25	24	26	4	99 (-)	3.5
Others	16	2	2	5	13	63	101 (-)	Mean score not calculated – high number of don't know and low number of answers

Table 8.24. In your opinion who should be responsible for initiating activities to protect your farm from potential negative impacts caused by climate change? Scale 1-5 1 'not at all' to 5 'to a very high degree' + don't know. Comparison 'the government' vs 'you'. Mean scores

	The government	You	N=
Lolland	4.2	3.8	32
Holstebro	3.2	3.3	73
National, weighted	3.2	3.5	-

It is evident from table 8.24 that the Lolland farmers have a stronger opinion that the government should initiate activities to protect the farm (score 4.2) than farmers in the Holstebro survey and the national survey (scores 3.2 in both surveys). One explanation might be that the Lolland farmers have experienced more climate change related problems.

Farmers were also asked how likely it is that they will change practises due to positive/negative impacts of climate changes (table 8.25, 8.26, 8.27). Average scores are compared in table 8.28.

Table 8.25. Consider the following practices. Please rank each of these practices according to how likely you would be to adopt them in order to protect your farm from possible **negative/positive** future impacts of climate change (Scale 1 very unlikely, 2 unlikely, 3 neither, 4 likely, to 5 very likely + don't know). Lolland results

LOLLAND	Very unlikely (-2)	Unlikely (-1)	Neither/ nor (0)	Likely (1)	Very likely (2)	Don't know	Total (n)	Mean score* (excluding don't know)
RESPONSE TO NEGATIVE EFFECTS:								
- Take out more or better insurance polices	6	9	38	47	0	0	100 (32)	3.3
- Increase crop rotation	9	16	44	28	3	0	100 (32)	3.0
- Change irrigation practices	0	6	19	47	25	3	100 (32)	3.9
- Change your use of pesticides	0	6	16	69	9	0	100 (32)	3.8
- Take arable land out of production	19	44	22	16	0	0	101 (32)	2.3
- Other**	5	5	9	9	0	73	101 (32)	Not calculated. Many don't know
RESPONSE TO POSITIVE EFFECTS:								
- Introduce new crops	3	6	19	56	13	3	100 (32)	3.7
- Extend the growing season	9	3	22	56	9	0	99 (32)	3.5
- Introduce intercropping	6	28	44	16	3	3	100 (32)	2.8
- Expand arable area	3	6	44	28	16	3	100 (32)	2.5
- Other	4	4	9	13	0	70	100 (32)	Not calculated. Many don't know

*Mean score calculated with values from 1 (very unlikely) to 5 (very likely)

**Other: improving drainage

Table 8.26. Consider the following practices. Please rank each of these practices according to how likely you would be to adopt them in order to protect your farm from possible **negative/positive** future impacts of climate change (Scale 1 very unlikely, 2 unlikely, 3 neither, 4 likely, to 5 very likely + don't know). Holstebro results

HOLSTEBRO	Very unlikely (-2)	Unlikely (-1)	Neither/ nor (0)	Likely (1)	Very likely (2)	Don't know	Total (n)	Mean score* (excluding don't know)
RESPONSE TO NEGATIVE EFFECTS:								
- Take out more or better insurance polices	22	26	39	10	0	3	100 (72)	2.4
- Increase crop rotation	21	17	36	21	0	6	101 (72)	2.6
- Change irrigation practices	29	14	21	26	7	3	100 (72)	2.7
- Change your use of pesticides	26	13	21	29	4	7	100 (72)	2.0
- Take arable land out of production	46	19	19	11	1	3	99 (72)	1.9
- Other	30	5	10	0	5	50	100 (20)	
RESPONSE TO POSITIVE EFFECTS:								
- Introduce new crops	15	11	24	36	10	4	100 (72)	3.1
- Extend the growing season	18	8	28	31	10	6	101(72)	3.1
- Introduce intercropping	21	19	32	18	6	4	100 (72)	2.7
- Expand arable area	35	22	29	4	7	3	100 (72)	2.2
- Other	35	12	12	0	6	35	100 (72)	

*Mean score calculated with values from 1 (very unlikely) to 5 (very likely)

Table 8.27. Consider the following practices. Please rank each of these practices according to how likely you would be to adopt them in order to protect your farm from possible **negative/positive** future impacts of climate change (Scale 1 very unlikely, 2 unlikely, 3 neither, 4 likely, to 5 very likely + don't know). National results, weighted

NATIONAL, WEIGHTED	Very unlikely (-2)	Unlikely (-1)	Neither/ nor (0)	Likely (1)	Very likely (2)	Don't know	Total (n)	Mean score* (excluding don't know)
RESPONSE TO NEGATIVE EFFECTS:								
- Take out more or better insurance polices	22	19	38	16	2	3	100 (-)	2.6
- Increase crop rotation	17	18	36	23	2	4	100 (-)	2.7
- Change irrigation practices	20	14	29	27	7	3	100 (-)	2.9
- Change your use of pesticides	16	13	31	30	4	6	100 (-)	2.9
- Take arable land out of production	40	26	21	8	1	4	100 (-)	2.0
- Other	19	4	8	1	4	65	101 (-)	Not calculated. Many don't know and many not answered
RESPONSE TO POSITIVE EFFECTS:								
- Introduce new crops	12	14	29	36	6	4	101 (-)	3.1
- Extend the growing season	13	14	30	33	6	4	100 (-)	3.1
- Introduce intercropping	21	25	30	17	3	5	101 (-)	2.5
- Expand arable area	26	28	26	13	4	3	100 (-)	2.4
- Other	19	4	4	0	0	72	101 (-)	Not calculated. Many don't know and many not answered

*Mean score calculated with values from 1 (very unlikely) to 5 (very likely)

Table 8.28. Consider the following practices. Please rank each of these practices according to how likely you would be to adopt them in order to protect your farm from possible **negative/positive** future impacts of climate change (Scale 1 very unlikely, 2 unlikely, 3 neither, 4 likely, to 5 very likely + don't know). Comparison. Mean scores

NATIONAL	Lolland	Holstebro	National, weighted
RESPONSE TO NEGATIVE EFFECTS:			
- Take out more or better insurance polices	3.3	2.4	2.6
- Increase crop rotation	3.0	2.6	2.7
- Change irrigation practices	3.9	2.7	2.9
- Change your use of pesticides	3.8	2.0	2.9
- Take arable land out of production	2.3	1.9	2.0
- Other	-	-	-
RESPONSE TO POSITIVE EFFECTS:			
- Introduce new crops	3.7	3.1	3.1
- Extend the growing season	3.5	3.1	3.1
- Introduce intercropping	2.8	2.7	2.5
- Expand arable area	3.5	2.2	2.4
- Other	-	-	-
N=			

*Mean score calculated with values from 1 (very unlikely) to 5 (very likely)

In general, it is not 'very likely' that substantial amounts of farmers will adopt new practises in order to protect/gain advantage of possible **negative/positive** future impacts of climate change. However, regarding some practises Lolland farmers on average have relatively high scores.

Expectations regarding future climate changes

In this section, the results regarding the farmers' expectations for the future are reported.

Table 8.29. Which of the following statements best describes your opinion regarding how long-term climate change will affect your farm?

	Climate change will be positive for my farm	Climate change will be neutral for my farm	Climate change will be negative for my farm	Don't know	Total (n)
Lolland	28	31	25	16	100 (32)
Holstebro	7	24	40	29	100 (72)
National, weighted	11	51	17	21	100 (-)

It is quite interesting that more Lolland farmers expect positive effects of climate changes than farmers in the other two surveys as Lolland farmers have experienced e.g. more extreme/heavy precipitation than other farmers (see above). However, it looks like these negative experiences are outweighed by other more positive expectations for 28 pct. of the Lolland farmers.

Table 8.30 (below) relates to table 8.10-8.13 (see above). In table 8.10-8.13 above the farmers were asked about their *experience* with weather related events. In the table below the farmers were asked about their *concern* about being affected by the same events.

Table 8.30. How concerned are you that your farm may be affected by any of the following climate-related events? Lolland results

	1 (not at all)	2	3	4	5 (to a very high degree)	Don't know	Total (n)	Mean score (excluding don't know)
Severe storms causing damage to structures or trees	3	41	31	9	13	3	100 (32)	2.9
Severe storms causing flooding at the farm or nearby	31	22	19	19	9	0	100 (32)	2.5
More insects/fungi/weeds in the crop	13	28	19	22	13	6	101 (32)	2.9
Increased variation in temperatures from year to year	6	22	34	25	9	3	99 (32)	3.1
Greater variations in water availability from year to year	16	19	31	19	13	3	101 (32)	2.9

Table 8.31. How concerned are you that your farm may be affected by any of the following climate-related events? Holstebro results

	1 (not at all)	2	3	4	5 (to a very high degree)	Don't know	Total (n)	Mean score (excluding don't know)
Severe storms causing damage to structures or trees	24	26	22	22	4	3	101 (74)	2.5
Severe storms causing flooding at the farm or nearby	55	28	10	1	3	3	100 (74)	1.6
More insects/fungi/weeds in the crop	35	30	15	8	4	8	100 (74)	2.1
Increased variation in temperatures from year to year	26	30	24	14	4	3	101 (74)	2.4
Greater variations in water availability from year to year	34	22	26	11	5	3	101 (74)	2.3

Table 8.32. How concerned are you that your farm may be affected by any of the following climate-related events? National results, weighted

	1 (not at all)	2	3	4	5 (to a very high degree)	Don't know	Total (n)	Mean score (excluding don't know)
Severe storms causing damage to structures or trees	25	23	22	18	9	2	99 (-)	2.6
Severe storms causing flooding at the farm or nearby	55	22	12	6	3	2	100 (-)	1.8
More insects/fungi/weeds in the crop	35	24	23	12	3	4	101 (-)	2.2
Increased variation in temperatures from year to year	27	28	24	14	3	4	100 (-)	2.3
Greater variations in water availability from year to year	33	24	19	17	4	4	101 (-)	2.3

Table 8.33. How concerned are you that your farm may be affected by any of the following climate-related events? Comparison mean scores (scale 1 (not at all) -5 (to a very high degree))

	Lolland	Holstebro	National (weighted)
Severe storms causing damage to structures or trees	2.9	2.5	2.6
Severe storms causing flooding at the farm or nearby	2.5	1.6	1.8
More insects/fungi/weeds in the crop	2.9	2.1	2.2
Increased variation in temperatures from year to year	3.1	2.4	2.3
Greater variations in water availability from year to year	2.9	2.3	2.3

The general picture in the comparison is that the Danish farmers are not very concerned about future climate-related events. The Lolland farmers are the most concerned, but on the other hand, many of them expect more positive effects than negative effects (as we saw in table 8.29 above).

Factors potentially affecting farm economy

A range of factors have the potential to affect farm income positively/negatively. Figure 8.34-8.37 illustrates how climate change related factors are ranked in comparison with a number of other factors.

Table 8.34. What is the magnitude of the potential of each of these factors to affect your farm income, either positively or negatively. Scale 1 (not at all) to 5 (to a very high degree). Pct. and mean. Lolland results

	1	2	3	4	5	Don't know	Pct (N)	Mean score (excluding don't know)
Price volatility of crops	0	0	9	16	75	0	100 (32)	4.7
Marketing opportunities	6	3	19	28	44	0	100 (32)	4.0
Changes in input costs	3	6	31	19	41	0	100 (32)	3.9
Gradual climate change	3	28	31	31	6	0	99 (32)	3.1
Extreme weather/ natural disasters	3	16	22	28	31	0	100 (32)	3.7
Debt	13	6	34	13	31	3	100 (32)	3.4
Political measures	0	0	3	22	72	3	100 (32)	4.7
New technology	0	9	34	25	25	6	99 (32)	3.7

Table 8.35. What is the magnitude of the potential of each of these factors to affect your farm income, either positively or negatively. Scale 1 (not at all) to 5 (to a very high degree). Pct. and mean. Holstebro results

	1	2	3	4	5	Don't know	Pct (N)	Mean score (excluding don't know)
Price volatility of crops	7	4	27	18	42	3	101 (71)	3.9
Marketing opportunities	12	7	26	19	33	3	100 (71)	3.5
Changes in input costs	7	10	26	21	34	3	101 (71)	3.7
Gradual climate change	19	33	25	12	4	7	100 (68)	2.5
Extreme weather/ natural disasters	22	26	21	16	11	4	100 (70)	2.7
Debt	25	16	30	8	19	1	99 (72)	2.8
Political measures	7	4	11	22	53	3	100 (71)	4.1
New technology	6	15	37	15	18	10	101 (66)	3.3

Table 8.36. What is the magnitude of the potential of each of these factors to affect your farm income, either positively or negatively. Scale 1 (not at all) to 5 (to a very high degree). Pct. and mean. National results

	1	2	3	4	5	Don't know	Pct	Mean score (excluding don't know)
Price volatility of crops	6	6	14	21	49	3	99	4.0
Marketing opportunities	10	10	21	23	33	3	100	3.6
Changes in input costs	5	9	23	30	30	3	100	3.7
Gradual climate change	19	24	34	14	5	5	101	2.6
Extreme weather/ natural disasters	16	24	26	18	12	5	101	2.9
Debt	20	13	20	17	26	4	100	3.2
Political measures	4	6	15	23	49	3	100	4.1
New technology	7	15	34	21	17	6	100	3.3

Table 8.37. Comparison. What is the magnitude of the potential of each of these factors to affect your farm income, either positively or negatively. Scale 1 (not at all) to 5 (to a very high degree). Mean scores excluding 'don't know' (average 3.0)

	Lolland	**Holstebro**	**National**
Price volatility of crops	4.7	3.9	4.0
Marketing difficulties	4.0	3.5	3.6
Changes in input costs	3.9	3.7	3.7
Gradual climate change	3.1	2.5	2.6
Extreme weather/ natural disasters	3.7	2.7	2.9
Debt	3.4	2.8	3.2
Political measures	4.7	4.1	4.1
New technology	3.7	3.3	3.3
N=	32	66-72	-

In general, gradual climate change and extreme weather/natural disasters are low on the list among factors that have a potential to affect farm income positively/negatively (table 8.37). The exception is Lolland farmers' ranking of extreme weather/natural disasters which scores 3.7 on average. Again, the relative recent flooding problems in 2011 might be the explanation why the ranking is higher at Lolland. Political measures and price volatility of the crops are the two factors scoring the highest average in all three surveys.

Barriers for adaptation measures

Barriers for implementing adaptation measures was also a subject in the surveys (table 8.38-8.41).

Table 8.38. The following statements might be barriers for adaptation measures, please tell me whether you agree/disagree? Lolland results

	LOLLAND	Totally disagree (1)	Disagree (2)	Neither/nor (3)	Agree (4)	Totally agree (5)	Don't Know	Total (n)	Mean score (scale 1-5)
1	Financial constraints at the farm	0	13	34	38	16	0	101 (32)	3.6
2	Economic losses in relation to changing practice	0	0	22	63	16	0	101 (32)	3.9
3	Economic losses from fewer/smaller subsidies	3	3	25	47	16	6	100 (32)	3.7
4	Uncertainty regarding the magnitude of climate changes	0	6	31	38	16	9	100 (32)	3.7
5	Lack of information on climate change adaptation methods	0	6	38	44	6	6	100 (32)	3.5
6	Farming policy regulations	0	9	19	31	41	0	100 (32)	4.0
7	Water scarcity constraints	0	13	38	31	13	6	101 (32)	3.5
8	Environmental and climate change regulations	0	3	16	31	47	3	100 (32)	4.3
9	Access to climate information (weather forecasts and early warning)	3	19	38	19	16	6	101 (32)	3.3
10	Availability of new technologies (e.g. Genetic modification, pro biotics and feed additives)	0	22	28	28	13	9	100 (32)	3.4
11	Shortage of labour	3	31	47	9	0	9	101 (32)	2.7
12	Shortage of land	0	3	38	31	16	13	101 (32)	3.7
13	Poor potential for irrigation	0	9	41	34	6	9	99 (32)	3.4
14	Others (please specify them)	4	4	4	9	4	74	99 (23*)	-

*n is lower here because this question was optional. Average score for 'others' not calculated due to many 'don't know'/no answers

Table 8.39. The following statements might be barriers for adaptation measures, please tell me whether you agree/disagree? Holstebro results

	HOLSTEBRO	Totally disagree (1)	Disagree (2)	Neither/nor (3)	Agree (4)	Totally agree (5)	Don't Know	Total (n)	Mean score (scale 1-5)
1	Financial constraints at the farm	13	4	27	27	17	11	99 (70)	3.4
2	Economic losses in relation to changing practice	9	1	30	27	20	13	100 (70)	3.6
3	Economic losses from fewer/smaller subsidies	10	1	33	24	21	10	99 (70)	3.5
4	Uncertainty regarding the magnitude of climate changes	12	3	33	29	7	16	100 (69)	3.2
5	Lack of information on climate change adaptation methods	14	10	36	24	1	14	99 (70)	2.9
6	Farming policy regulations	9	4	17	39	17	14	100 (70)	3.6
7	Water scarcity constraints	13	15	28	20	12	13	101 (69)	3.0
8	Environmental and climate change regulations	7	4	20	30	26	13	100 (70)	3.7
9	Access to climate information (weather forecasts and early warning)	19	10	21	30	6	14	100 (70)	2.9
10	Availability of new technologies (e.g. Genetic modification, pro biotics and feed additives)	11	13	17	24	16	19	100 (70)	3.3
11	Shortage of labour	16	21	26	14	4	19	100 (70)	2.6
12	Shortage of land	14	11	24	16	19	16	100 (70)	3.2
13	Poor potential for irrigation	14	10	21	17	24	13	99 (70)	3.3
14	Others (please specify them)	23	0	8	0	0	69	100 (13)	

Average score for 'others' not calculated due to many 'don't know'/no answers

Table 8.40. The following statements might be barriers for adaptation measures, please tell me whether you agree/disagree? National results, weighted

	NATIONAL	Totally disagree (1)	Disagree (2)	Neither/nor (3)	Agree (4)	Totally agree (5)	Don't Know	Total (n)	Mean score (scale 1-5)
1	Financial constraints at the farm	7	11	29	32	12	8	99 (-)	3.3
2	Economic losses in relation to changing practice	4	6	23	44	15	9	101 (-)	3.7
3	Economic losses from fewer/smaller subsidies	4	8	29	34	15	10	100 (-)	3.5
4	Uncertainty regarding the magnitude of climate changes	5	6	38	31	9	11	100 (-)	3.4
5	Lack of information on climate change adaptation methods	6	12	41	24	4	12	99 (-)	3.1
6	Farming policy regulations	3	6	20	35	26	9	99 (-)	3.8
7	Water scarcity constraints	9	17	36	22	7	10	101 (-)	3.0
8	Environmental and climate change regulations	5	5	19	36	26	11	102 (-)	3.8
9	Access to climate information (weather forecasts and early warning)	10	16	36	24	5	8	99 (-)	3.0
10	Availability of new technologies (e.g. Genetic modification, pro biotics and feed additives)	6	14	36	28	5	11	100 (-)	3.1
11	Shortage of labour	20	24	34	9	4	9	100 (-)	2.5
12	Shortage of land	9	13	35	23	11	9	100 (-)	3.2
13	Poor potential for irrigation	13	18	32	19	7	11	100 (-)	2.9
14	Others (please specify them)	Not calculated							

Average score for 'others' not calculated due to many 'don't know'/no answers

Table 8.41. The following statements might be barriers for adaptation measures, please tell me whether you agree/disagree? Comparison of mean scores

		Lolland	Holstebro	National, weighted
1	Financial constraints at the farm	3.6	3.4	3.3
2	Economic losses in relation to changing practice	3.9	3.6	3.7
3	Economic losses from fewer/smaller subsidies	3.7	3.5	3.5
4	Uncertainty regarding the magnitude of climate changes	3.7	3.2	3.4
5	Lack of information on climate change adaptation methods	3.5	2.9	3.1
6	Farming policy regulations	4.0	3.6	3.8
7	Water scarcity constraints	3.5	3.0	3.0
8	Environmental and climate change regulations	4.3	3.7	3.8
9	Access to climate information (weather forecasts and early warning)	3.3	2.9	3.0
10	Availability of new technologies (e.g. Genetic modification, pro biotics and feed additives)	3.4	3.3	3.1
11	Shortage of labour	2.7	2.6	2.5
12	Shortage of land	3.7	3.2	3.2
13	Poor potential for irrigation	3.4	3.3	2.9
14	Others (please specify them)	Not calculated		
	N=	32	70	-

The farmers experience quite a lot of different barriers for adaptation measures (table 8.41). The four largest barriers in all three surveys are: Environmental and climate change regulations (highest average score in all three surveys); Farming policy regulations (second highest average score in all three surveys); Economic losses in relation to changing practice; and Economic losses from fewer/smaller subsidies.

On all variables Lolland farmers have a higher average score than in the Holstebro survey and the national survey. In other words, Lolland farmers find barriers more severe than other farmers.

Background data

In addition to the data reported above, the surveys included a lot of background information regarding e.g. farm income, sex of the farmer, education etc. etc. These data are not reported in this document.

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Appendix 1. National questionnaire (in Danish)

b01. Køn …

Mand
Kvinde

b02. Fødselsår …

Årstal noteret
Årstal noteret - gennemsnits fødselsår …

b03a. Bedriften ligger i region …

Hovedstaden
Sjælland
Syddanmark
Midtjylland
Nordjylland

b03c. Postnummer…

Postnummer noteret
Postnummer noteret - gennemsnits postnummer …

b03b. Bedriften ligger i kommune …

Albertslund
Allerød
Ballerup
Bornholm
Brøndby
Christiansø
Dragør
Egedal
Fredensborg
Frederiksberg
Frederikssund
Furesø
Gentofte
Gladsaxe
Glostrup
Gribskov
Halsnæs
Helsingør
Herlev

Hillerød
Hvidovre
Høje - Taastrup
Hørsholm
Ishøj
København
Lyngby - Taarbæk
Rudersdal
Rødovre
Tårnby
Vallensbæk
Faxe
Greve
Guldborgsund
Holbæk
Kalundborg
Køge
Lejre
Lolland
Næstved
Odsherred
Ringsted
Roskilde
Slagelse
Solrød
Sorø
Stevns
Vordingborg
Assens
Billund
Esbjerg
Fanø
Fredericia
Faaborg - Midtfyn
Haderslev
Kerteminde
Kolding
Langeland
Middelfart
Nordfyns
Nyborg
Odense
Svendborg
Sønderborg

Tønder
Varde
Vejen
Vejle
Ærø
Aabenraa
Favrskov
Hedensted
Herning
Holstebro
Horsens
Ikast - Brande
Lemvig
Norddjurs
Odder
Randers
Ringkøbing - Skjern
Samsø
Silkeborg
Skanderborg
Skive
Struer
Syddjurs
Viborg
Århus
Brønderslev
Frederikshavn
Hjørring
Jammerbugt
Læsø
Mariagerfjord
Morsø
Rebild
Thisted
Vesthimmerlands
Aalborg

b04a. Bedriftens landbrugsareal i hektar(inkl. tilforpagtning og ekskl. bortforpagtning) …

Areal drevet i omdrift noteret
Areal uden for omdrift noteret
Totalt areal noteret

Areal drevet i omdrift noteret - gennemsnitsareal i omdrift
Areal uden for omdrift noteret - gennemsnitsareal uden for omdrift

Totalt areal noteret - gennemsnitsareal totalt

b04b. Uddybende kommentarer til bedriftens landbrugsareal …

Kommentar

b04c. Afgrøder dyrket på bedriften i 2013 …

Vårbyg
Vinterbyg
Havre
Vårhvede
Vinterhvede
Vårraps
Vinterraps
Rug/Triticale
Majs
Roer
Sukkeroer
Kartofler
Græsfrø
Græs
Andre afgrøder
Dyrker ingen afgrøder

b05a. Hvilken af nedenstående beskrivelser passer bedst på dig?

Jeg er fuldtidslandmand
Jeg er deltidslandmand uden anden lønnet beskæftigelse
Jeg er deltidslandmand og har anden lønnet beskæftigelse
Jeg er fritidslandmand
Andet

b05b. Hvilken af nedenstående beskrivelser passer bedst på din bedrift?

Overvejende/udelukkende planteavl
Overvejende/udelukkende kvægbrug
Overvejende/udelukkende svinebrug
Blandet kvæg - og svinebrug
Anden animalsk produktion kombineret med planteavl
Overvejende fjerkræsbrug
Overvejende pelsdyrbrug
Andet

b05c. Har din bedrift økologisk produktion?

Ja, min bedrift har udelukkende økologisk produktion
Ja, min bedrift har økologisk, men også traditionel produktion
Ja, min bedrift er under omlægning til økologisk produktion

Nej, men jeg vil inden for de kommende to år begynde at omlægge min bedrift til økologisk produktion

Nej, men jeg overvejer at omlægge min bedrift til økologisk produktion

Nej og jeg vil ikke omlægge min bedrift til økologisk produktion

b06. Hvad er din relation til bedriften?

Ejer med daglig driftsledelse
Ejer uden daglig driftsledelse
Ansat
Andet

b07. Landbrugsmæssig uddannelse …

Agrarøkonom
Agronom
Landbrugstekniker
Landmand (Det Grønne Bevis)
Andet
Har ikke en landbrugsmæssig uddannelse
Ved ikke/vil ikke svare

b08. Hvor mange år har du arbejdet på bedriften?

Antal år noteret
Antal år noteret - gennemsnits arbejdsår på bedriften

b09. Hvor mange fuldtidsansatte er der på bedriften?

Antal fuldtidsansatte noteret
Antal fuldtidsansatte noteret - gennemsnits antal fuldtidsansatte

b10a. Bedriftens bruttofortjeneste …

[25] Mindre end kr. 500.000
[75] Kr. 500.000 - 999.999
[150] Kr. 1.000.000 - 1.999.999
[250] Kr. 2.000.000 - 2.999.999
[350] Kr. 3.000.000 - 3.999.999
[450] Kr. 4.000.000 - 4.999.999
[550] Kr. 5.000.000 - 5.999.999
[650] Kr. 6.000.000 - 6.999.999
[750] Kr. 7.000.000 - 7.999.999
[850] Kr. 8.000.000 - 8.999.999
[950] Kr. 9.000.000 - 9.999.999
[1125] Kr. 10.000.000 - 12.499.999
[1375] Kr. 12.500.000 - 14.999.999
[1625] Kr. 15.000.000 - 17.499.999

[1875] Kr. 17.500.000 - 19.999.999
[2500] Kr. 20.000.000 og derover
[-] Ønsker ikke oplyse
[-] Ved ikke

Gennemsnits bruttofortjeneste i kr.

b10b. Hvor stor en andel af husstandens bruttoindtægt kommer fra landbrugsproduktion?
[12] Under 25 %
[37] 25 - 49 %
[63] 50 - 75 %
[88] 76 - 100 %
[-] Ved ikke

Gennemsnit i % af bruttofortjeneste kommer fra landbrugsproduktion

b11. Har din bedrift vandingstilladelse?
Ja
Nej

q01. Har du, i den periode du har været på bedriften, oplevet, at tilfældene af kraftig nedbør på bedriftens arealer er blevet hyppigere?
Ja
Nej
Ved ikke

Basis: Ja, har oplevet, at tilfældende af kraftig nedbør på bedriftens arealer er blevet hyppigere …

q02. Tænk på den værste hændelse med kraftigt nedbør du har oplevet på din bedrift - hvor meget påvirkede den hændelse dit fysiske udbytte af den afgrøde, som var hårdest ramt?
[-] Ingen effekt på mit udbytte i marken
[5] Jeg led et tab på 1 - 9% af bedriftens totale årlige fysiske udbytte af den afgrøde som var hårdest ramt.
[20] Jeg led et tab på 10 - 29% af bedriftens totale årlige fysiske udbytte af den afgrøde som var hårdest ramt.
[40] Jeg led et tab på 30 - 49% af bedriftens totale årlige fysiske udbytte af den afgrøde som var hårdest ramt.
[75] Jeg led et tab på 50% eller mere af bedriftens totale årlige fysiske udbytte af den afgrøde som var hårdest ramt.
[-] Ved ikke

Gennemsnitstab i %

Basis: Led et tab på bedriftens totale årlige fysiske udbytte …

q03. Hvilken afgrøde var hårdest ramt af hændelsen?

Vårbyg
Vinterbyg
Havre
Vårhvede
Vinterhvede
Vårraps
Vinterraps
Rug/Triticale
Majs
Roer
Sukkeroer
Kartofler
Græsfrø
Andre afgrøder

Basis : Alle

q04.1. Har du, i den periode du har været på bedriften, oplevet flere kraftige storme der har medført skader på bygninger eller træer … ?

[1] Nej, slet ikke
[2] 2
[3] 3
[4] 4
[5] Ja, i meget høj grad
[-] Ved ikke

Gennemsnit

q04.2. Har du, i den periode du har været på bedriften, oplevet flere kraftige storme der har medført oversvømmelser på bedriften eller i nærheden af bedriften … ?

[1] Nej, slet ikke
[2] 2
[3] 3
[4] 4
[5] Ja, i meget høj grad
[-] Ved ikke

Gennemsnit

q04.3. Har du, i den periode du har været på bedriften, oplevet flere insekter/svampe/ukrudt i afgrøden … ?

[1] Nej, slet ikke
[2] 2
[3] 3
[4] 4
[5] Ja, i meget høj grad
[-] Ved ikke

Gennemsnit

q04.4. Har du, i den periode du har været på bedriften, oplevet større variation i temperaturerne fra år til år … ?

[1] Nej, slet ikke
[2] 2
[3] 3
[4] 4
[5] Ja, i meget høj grad
[-] Ved ikke

Gennemsnit

q04.5. Har du, i den periode du har været på bedriften, oplevet større variation i adgangen til vand fra år til år pga flere tørre år/våde år … ?

[1] Nej, slet ikke
[2] 2
[3] 3
[4] 4
[5] Ja, i meget høj grad
[-] Ved ikke

Gennemsnit

q04.97. Har du, i den periode du har været på bedriften, oplevet andet (noteret) … ?

[1] Nej, slet ikke
[2] 2
[3] 3
[4] 4
[5] Ja, i meget høj grad
[-] Ved ikke

Gennemsnit

q05a. Har du, i den periode du har været på bedriften stoppet permanent med at dyrke en afgrøde/flere afgrøder?

Ja, noteret

Nej
Ved ikke

q05b. Har du, i den periode du har været på bedriften introduceret en eller flere nye afgrøder permanent?
Ja, noteret
Nej
Ved ikke

q05c. Har du, i den periode du har været på bedriften introduceret en eller flere nye afgrøder som en test?
Ja, noteret
Nej
Ved ikke

q05d. Har du, i den periode du har været på bedriften foretaget andre ændringer af afgrøder?
Ja, noteret
Nej
Ved ikke

Basis: Har stoppet permanent med at dyrke afgrøde/introduceret ny afgrøde permanent/introduceret ny afgrøde på testbasis/foretaget andre ændringer af afgrøder …

q06.1. Hvor vigtigt har mulighed for større fysisk udbytte været for dine beslutninger om at skifte afgrøder … ?
[1] Slet ikke vigtigt
[2] 2
[3] 3
[4] 4
[5] I meget høj grad vigtigt
[-] Ved ikke

Gennemsnit

q06.2. Hvor vigtigt har bedre pris på afgrøden været for dine beslutninger om at skifte afgrøder … ?
[1] Slet ikke vigtigt
[2] 2
[3] 3
[4] 4
[5] I meget høj grad vigtigt
[-] Ved ikke

Gennemsnit

q06.3. Hvor vigtigt har ændringer i nedbør været for dine beslutninger om at skifte afgrøder … ?

[1] Slet ikke vigtigt
[2] 2
[3] 3
[4] 4
[5] I meget høj grad vigtigt
[-] Ved ikke

Gennemsnit

q06.4. Hvor vigtigt har temperaturændringer været for dine beslutninger om at skifte afgrøder … ?

[1] Slet ikke vigtigt
[2] 2
[3] 3
[4] 4
[5] I meget høj grad vigtigt
[-] Ved ikke

Gennemsnit

q06.5. Hvor vigtigt har ændringer i saltindhold/grundvand været for dine beslutninger om at skifte afgrøder … ?

[1] Slet ikke vigtigt
[2] 2
[3] 3
[4] 4
[5] I meget høj grad vigtigt
[-] Ved ikke

Gennemsnit

q06.6. Hvor vigtigt har ændringer i markudbytte været for dine beslutninger om at skifte afgrøder … ?

[1] Slet ikke vigtigt
[2] 2
[3] 3
[4] 4
[5] I meget høj grad vigtigt
[-] Ved ikke

Gennemsnit

q06.7. Hvor vigtigt har ændringer i udbuddet af arbejdskraft/prisen på arbejdskraft været for dine beslutninger om at skifte afgrøder … ?

[1] Slet ikke vigtigt
[2] 2
[3] 3
[4] 4
[5] I meget høj grad vigtigt
[-] Ved ikke

Gennemsnit

q06.8. Hvor vigtigt har ændringer i miljø - , klima - og/eller landbrugsreguleringen været for dine beslutninger om at skifte afgrøder … ?

[1] Slet ikke vigtigt
[2] 2
[3] 3
[4] 4
[5] I meget høj grad vigtigt
[-] Ved ikke

Gennemsnit

q06.9. Hvor vigtigt har ændringer i skadevoldere været for dine beslutninger om at skifte afgrøder … ?

[1] Slet ikke vigtigt
[2] 2
[3] 3
[4] 4
[5] I meget høj grad vigtigt
[-] Ved ikke

Gennemsnit

q06.10. Hvor vigtigt har risiko for at udvikle resistens været for dine beslutninger om at skifte afgrøder … ?

[1] Slet ikke vigtigt
[2] 2
[3] 3
[4] 4
[5] I meget høj grad vigtigt
[-] Ved ikke

Gennemsnit

q06.11. Hvor vigtigt har ændringer i dræningsforhold været for dine beslutninger om at skifte afgrøder … ?

[1] Slet ikke vigtigt

[2] 2
[3] 3
[4] 4
[5] I meget høj grad vigtigt
[-] Ved ikke

Gennemsnit

q06.97. Hvor vigtigt har andet (noteret) været for dine beslutninger om at skifte afgrøder … ?
[1] Slet ikke vigtigt
[2] 2
[3] 3
[4] 4
[5] I meget høj grad vigtigt
[-] Ved ikke

Gennemsnit

Basis : Alle

q07.1. Hvor bekymret er du for at bedriften udsættes for kraftige storme der medfører skader på bygninger eller træer … ?
[1] Slet ikke bekymret
[2] 2
[3] 3
[4] 4
[5] I meget høj grad bekymret
[-] Ved ikke

Gennemsnit

q07.2. Hvor bekymret er du for at bedriften udsættes for kraftige storme der medfører oversvømmelser på bedriften eller i nærheden af bedriften … ?
[1] Slet ikke bekymret
[2] 2
[3] 3
[4] 4
[5] I meget høj grad bekymret
[-] Ved ikke

Gennemsnit

q07.3. Hvor bekymret er du for at bedriften udsættes for flere insekter/svampe/ukrudt i afgrøden … ?

[1] Slet ikke bekymret
[2] 2
[3] 3
[4] 4
[5] I meget høj grad bekymret
[-] Ved ikke

Gennemsnit

q07.4. Hvor bekymret er du for at bedriften udsættes for mere variation i temperaturerne fra år til år … ?

[1] Slet ikke bekymret
[2] 2
[3] 3
[4] 4
[5] I meget høj grad bekymret
[-] Ved ikke

Gennemsnit

q07.5. Hvor bekymret er du for at bedriften udsættes for mere variation i adgangen til vand fra år til år … ?

[1] Slet ikke bekymret
[2] 2
[3] 3
[4] 4
[5] I meget høj grad bekymret
[-] Ved ikke

Gennemsnit

q07.97. Hvor bekymret er du for at bedriften udsættes for andet (noteret) ... ?

[1] Slet ikke bekymret
[2] 2
[3] 3
[4] 4
[5] I meget høj grad bekymret
[-] Ved ikke

Gennemsnit

q08.1. Angiv venligst i hvor høj grad prisændringer på afgrøden har potentiale til at påvirke bedriftens økonomi positivt eller negativt?

[1] Slet ikke påvirke økonomi

[2] 2
[3] 3
[4] 4
[5] I meget høj grad påvirke økonomi
[-] Ved ikke

Gennemsnit

q08.2. Angiv venligst i hvor høj grad afsætning har potentiale til at påvirke bedriftens økonomi positivt eller negativt?
[1] Slet ikke påvirke økonomi
[2] 2
[3] 3
[4] 4
[5] I meget høj grad påvirke økonomi
[-] Ved ikke

Gennemsnit

q08.3. Angiv venligst i hvor høj grad ændringer i dyrkningsomkostninger har potentiale til at påvirke bedriftens økonomi positivt eller negativt?
[1] Slet ikke påvirke økonomi
[2] 2
[3] 3
[4] 4
[5] I meget høj grad påvirke økonomi
[-] Ved ikke

Gennemsnit

q08.4. Angiv venligst i hvor høj gradvise klimaændringer har potentiale til at påvirke bedriftens økonomi positivt eller negativt?
[1] Slet ikke påvirke økonomi
[2] 2
[3] 3
[4] 4
[5] I meget høj grad påvirke økonomi
[-] Ved ikke

Gennemsnit

q08.5. Angiv venligst i hvor høj grad ekstreme vejrhændelser og/eller naturkatastrofer har potentiale til at påvirke bedriftens økonomi positivt eller negativt?
[1] Slet ikke påvirke økonomi
[2] 2

[3] 3
[4] 4
[5] I meget høj grad påvirke økonomi
[-] Ved ikke

Gennemsnit

q08.6. Angiv venligst i hvor høj grad gæld har potentiale til at påvirke bedriftens økonomi positivt eller negativt?
[1] Slet ikke påvirke økonomi
[2] 2
[3] 3
[4] 4
[5] I meget høj grad påvirke økonomi
[-] Ved ikke

Gennemsnit

q08.7. Angiv venligst i hvor høj grad ny lovgivning vedrørende landbrug, miljø og/eller klima har potentiale til at påvirke bedriftens økonomi positivt eller negativt?
[1] Slet ikke påvirke økonomi
[2] 2
[3] 3
[4] 4
[5] I meget høj grad påvirke økonomi
[-] Ved ikke

Gennemsnit

q08.8. Angiv venligst i hvor høj grad teknologiudvikling har potentiale til at påvirke bedriftens økonomi positivt eller negativt?
[1] Slet ikke påvirke økonomi
[2] 2
[3] 3
[4] 4
[5] I meget høj grad påvirke økonomi
[-] Ved ikke

Gennemsnit

q09.1. Har det offentlige efter din mening ansvaret for at iværksætte tiltag, der kan beskytte din bedrift mod potentielle skader forårsaget af klimaforandringer ... ?
[1] Slet ikke
[2] 2
[3] 3

[4] 4
[5] I meget høj grad
[-] Ved ikke

Gennemsnit

q09.2. Har du selv efter din mening ansvaret for at iværksætte tiltag, der kan beskytte din bedrift mod potentielle skader forårsaget af klimaforandringer ... ?

[1] Slet ikke
[2] 2
[3] 3
[4] 4
[5] I meget høj grad
[-] Ved ikke

Gennemsnit

q09.97. Har andre (noteret) end det offentlige og dig selv efter din mening ansvaret for at iværksætte tiltag, der kan beskytte din bedrift mod potentielle skader forårsaget af klimaforandringer ... ?

[1] Slet ikke
[2] 2
[3] 3
[4] 4
[5] I meget høj grad
[-] Ved ikke

Gennemsnit

q10.1. Hvor sandsynligt er det, at du vil tegne flere/bedre forsikring(er) for at beskytte bedriften mod eventuelle fremtidige negative effekter af klimaforandringer?

[1] Meget usandsynligt
[2] Usandsynligt
[3] Hverken/ eller
[4] Sandsynligt
[5] Meget sandsynligt
[-] Ved ikke

Gennemsnit

q10.2. Hvor sandsynligt er det, at du vil foretage øget rotation af afgrøder for at beskytte bedriften mod eventuelle fremtidige negative effekter af klimaforandringer?

[1] Meget usandsynligt
[2] Usandsynligt
[3] Hverken/ eller

[4] Sandsynligt
[5] Meget sandsynligt
[-] Ved ikke

Gennemsnit

q10.3. Hvor sandsynligt er det, at du vil ændre afvandingsforholdene for at beskytte bedriften mod eventuelle fremtidige negative effekter af klimaforandringer?
[1] Meget usandsynligt
[2] Usandsynligt
[3] Hverken/ eller
[4] Sandsynligt
[5] Meget sandsynligt
[-] Ved ikke

Gennemsnit

q10.4. Hvor sandsynligt er det, at du vil ændre bekæmpelsesmiddelindsatsen for at beskytte bedriften mod eventuelle fremtidige negative effekter af klimaforandringer?
[1] Meget usandsynligt
[2] Usandsynligt
[3] Hverken/ eller
[4] Sandsynligt
[5] Meget sandsynligt
[-] Ved ikke

Gennemsnit

q10.5. Hvor sandsynligt er det, at du vil tage jord i omdrift ud af produktion for at beskytte bedriften mod eventuelle fremtidige negative effekter af klimaforandringer?
[1] Meget usandsynligt
[2] Usandsynligt
[3] Hverken/ eller
[4] Sandsynligt
[5] Meget sandsynligt
[-] Ved ikke

Gennemsnit

q10.97. Hvor sandsynligt er det, at du vil foretage andet (noteret) for at beskytte bedriften mod eventuelle fremtidige negative effekter af klimaforandringer?
[1] Meget usandsynligt
[2] Usandsynligt
[3] Hverken/ eller
[4] Sandsynligt

[5] Meget sandsynligt
[-] Ved ikke

Gennemsnit

q11.1. Hvor sandsynligt er det, at du vil introducere nye afgrøder for at drage nytte af eventuelle fremtidige positive effekter af klimaforandringer?
[1] Meget usandsynligt
[2] Usandsynligt
[3] Hverken/ eller
[4] Sandsynligt
[5] Meget sandsynligt
[-] Ved ikke

Gennemsnit

q11.2. Hvor sandsynligt er det, at du vil udvide vækstsæsonens længde for at drage nytte af eventuelle fremtidige positive effekter af klimaforandringer?
[1] Meget usandsynligt
[2] Usandsynligt
[3] Hverken/ eller
[4] Sandsynligt
[5] Meget sandsynligt
[-] Ved ikke

Gennemsnit

q11.3. Hvor sandsynligt er det, at du vil dyrke flere afgrøder i samme sæson for at drage nytte af eventuelle fremtidige positive effekter af klimaforandringer?
[1] Meget usandsynligt
[2] Usandsynligt
[3] Hverken/ eller
[4] Sandsynligt
[5] Meget sandsynligt
[-] Ved ikke

Gennemsnit

q11.4. Hvor sandsynligt er det, at du vil Udvide dyrkningsarealet for at drage nytte af eventuelle fremtidige positive effekter af klimaforandringer?
[1] Meget usandsynligt
[2] Usandsynligt
[3] Hverken/ eller
[4] Sandsynligt
[5] Meget sandsynligt

[-] Ved ikke

Gennemsnit

q11.97. Hvor sandsynligt er det, at du vil foretage andet (noteret) for at drage nytte af eventuelle fremtidige positive effekter af klimaforandringer?

[1] Meget usandsynligt
[2] Usandsynligt
[3] Hverken/ eller
[4] Sandsynligt
[5] Meget sandsynligt
[-] Ved ikke

Gennemsnit

q12.1. Hvor enig/uenig er du i at der sker globale klimaændringer … ?

[1] Meget uenig
[2] Uenig
[3] Hverken/eller
[4] Enig
[5] Meget enig
[-] Ved ikke

Gennemsnit

q13. Hvilket af følgende udsagn passer bedst til dine forventninger?

[3] Klimaændringer vil være positive for min bedrift
[2] Klimaændringer vil være neutrale for min bedrift
[1] Klimaændringer vil være negative for min bedrift
[-] Ved ikke

Gennemsnit

q14.1. Bedriftens generelle økonomi ville evt. udgøre en barriere for at gennemføre klimatilpasningstiltag …

[1] Meget uenig
[2] Uenig
[3] Hverken/eller
[4] Enig
[5] Meget enig
[-] Ved ikke

Gennemsnit

q14.2. Økonomiske udgifter forbundet med at ændre praksis ville evt. udgøre en barriere for at gennemføre klimatilpasningstiltag …

[1] Meget uenig
[2] Uenig
[3] Hverken/eller
[4] Enig
[5] Meget enig
[-] Ved ikke

Gennemsnit

q14.3. Økonomisk tab som følge af færre/lavere økonomiske tilskud ville evt. udgøre en barriere for at gennemføre klimatilpasningstiltag …

[1] Meget uenig
[2] Uenig
[3] Hverken/eller
[4] Enig
[5] Meget enig
[-] Ved ikke

Gennemsnit

q14.4. Usikkerhed vedrørende omfanget af klimaændringer ville evt. udgøre en barriere for at gennemføre klimatilpasningstiltag …

[1] Meget uenig
[2] Uenig
[3] Hverken/eller
[4] Enig
[5] Meget enig
[-] Ved ikke

Gennemsnit

q14.5. Manglende information om klimatilpasningsmetoder ville evt. udgøre en barriere for at gennemføre klimatilpasningstiltag …

[1] Meget uenig
[2] Uenig
[3] Hverken/eller
[4] Enig
[5] Meget enig
[-] Ved ikke

Gennemsnit

q14.6. Landbrugslovgivningen ville evt. udgøre en barriere for at gennemføre

klimatilpasningstiltag …

[1] Meget uenig
[2] Uenig
[3] Hverken/eller
[4] Enig
[5] Meget enig
[-] Ved ikke

Gennemsnit

q14.7. Vandmangel ville evt. udgøre en barriere for at gennemføre klimatilpasningstiltag …

[1] Meget uenig
[2] Uenig
[3] Hverken/eller
[4] Enig
[5] Meget enig
[-] Ved ikke

Gennemsnit

q14.8. Miljø- og klimalovgivningen ville evt. udgøre en barriere for at gennemføre klimatilpasningstiltag …

[1] Meget uenig
[2] Uenig
[3] Hverken/eller
[4] Enig
[5] Meget enig
[-] Ved ikke

Gennemsnit

q14.9. Adgang til klimainformation ville evt. udgøre en barriere for at gennemføre klimatilpasningstiltag …

[1] Meget uenig
[2] Uenig
[3] Hverken/eller
[4] Enig
[5] Meget enig
[-] Ved ikke

Gennemsnit

q14.10. Adgang til ny teknologi ville evt. udgøre en barriere for at gennemføre klimatilpasningstiltag …

[1] Meget uenig
[2] Uenig
[3] Hverken/eller
[4] Enig
[5] Meget enig
[-] Ved ikke

Gennemsnit

q14.11. Mangel på arbejdskraft ville evt. udgøre en barriere for at gennemføre klimatilpasningstiltag …

[1] Meget uenig
[2] Uenig
[3] Hverken/eller
[4] Enig
[5] Meget enig
[-] Ved ikke

Gennemsnit

q14.12. Mangel på jord ville evt. udgøre en barriere for at gennemføre klimatilpasningstiltag …

[1] Meget uenig
[2] Uenig
[3] Hverken/eller
[4] Enig
[5] Meget enig
[-] Ved ikke

Gennemsnit

q14.13. Vandingsmuligheder ville evt. udgøre en barriere for at gennemføre klimatilpasningstiltag …

[1] Meget uenig
[2] Uenig
[3] Hverken/eller
[4] Enig
[5] Meget enig
[-] Ved ikke

Gennemsnit

q14.97. Andet (noteret) ville evt. udgøre en barriere for at gennemføre klimatilpasningstiltag …

[1] Meget uenig
[2] Uenig

[3] Hverken/eller
[4] Enig
[5] Meget enig
[-] Ved ikke

Gennemsnit

q15. Hvilket af disse 2 alternativer ville du vælge?

Alternativ 1: Du er garanteret en årlig indkomst i resten af livet svarende til din nuværende årlige indkomst.

Alternativ 2: Kan give en højere indkomst, men det er mere usikkert: Der er 50% sandsynlighed for, at det andet alternativ fordobler din samlede livsindkomst, og en 50% sandsynlighed for at din samlede livsindkomst reduceres med 33% .

Ved ikke

q16. Hvilket af disse 2 alternativer ville du vælge?

Alternativ 1: Du er garanteret en årlig indkomst i resten af livet svarende til din nuværende årlige indkomst.

Alternativ 2: Kan give en højere indkomst, men det er mere usikkert: Der er 50% sandsynlighed for, at det andet alternativ fordobler din samlede livsindkomst, og en 50% sandsynlighed for at din samlede livsindkomst reduceres med 25% .

Ved ikke

q17. Hvilket af disse 2 alternativer ville du vælge?

Alternativ 1: Du er garanteret en årlig indkomst i resten af livet svarende til din nuværende årlige indkomst.

Alternativ 2: Kan give en højere indkomst, men det er mere usikkert: Der er 50% sandsynlighed for, at det andet alternativ fordobler din samlede livsindkomst, og en 50% sandsynlighed for at din samlede livsindkomst reduceres med 10% .

Ved ikke

Basis: Scenarier - Version 1 …

v01s01. Version 1 - Scenario 1 …

Police A - Selvrisiko: 40% - Areal dækket af forsikring: Hele dit areal - Forsikringsbevis: 2% - Tilskud: 25%

Police B - Selvrisiko: 10% - Areal dækket af forsikring: Fleksibelt areal - Forsikringsbevis: 3% - Tilskud: 50%

Fortsætte som nu

v01s02. Version 1 - Scenario 2 …

Police A - Selvrisiko: 20% - Areal dækket af forsikring: Fleksibelt areal - Forsikringsbevis: 3% - Tilskud: 50%
Police B - Selvrisiko: 40% - Areal dækket af forsikring: Hele dit areal - Forsikringsbevis: 2% - Tilskud: 25%
Fortsætte som nu

v01s03. Version 1 - Scenario 3 ...

Police A - Selvrisiko: 30% - Areal dækket af forsikring: Fleksibelt areal - Forsikringsbevis: 2% - Tilskud: 50%

Police B - Selvrisiko: 10% - Areal dækket af forsikring: Hele dit areal - Forsikringsbevis: 3% - Tilskud: 25%

Fortsætte som nu

v01s04. Version 1 - Scenario 4 ...

Police A - Selvrisiko: 20% - Areal dækket af forsikring: Hele dit areal - Forsikringsbevis: 3% - Tilskud: 50%

Police B - Selvrisiko: 40% - Areal dækket af forsikring: Fleksibelt areal - Forsikringsbevis: 2% - Tilskud: 25%

Fortsætte som nu

v01s05. Version 1 - Scenario 5 ...

Police A - Selvrisiko: 30% - Areal dækket af forsikring: Hele dit areal - Forsikringsbevis: 1% - Tilskud: 25%

Police B - Selvrisiko: 20% - Areal dækket af forsikring: Fleksibelt areal - Forsikringsbevis: 5% - Tilskud: 50%

Fortsætte som nu

v01s06. Version 1 - Scenario 6 ...

Police A - Selvrisiko: 10% - Areal dækket af forsikring: Fleksibelt areal - Forsikringsbevis: 5% - Tilskud: 25%

Police B - Selvrisiko: 30% - Areal dækket af forsikring: Hele dit areal - Forsikringsbevis: 1% - Tilskud: 50%

Fortsætte som nu

Basis: Scenarier - Version 2 ...

v02s01. Version 2 - Scenario 1 ...

Police A - Selvrisiko: 10% - Areal dækket af forsikring: Fleksibelt areal - Forsikringsbevis: 1% - Tilskud: 25%

Police B - Selvrisiko: 20% - Areal dækket af forsikring: Hele dit areal - Forsikringsbevis: 3% - Tilskud: 50%

Fortsætte som nu

v02s02. Version 2 - Scenario 2 ...

Police A - Selvrisiko: 10% - Areal dækket af forsikring: Hele dit areal - Forsikringsbevis: 5% - Tilskud: 50%

Police B - Selvrisiko: 30% - Areal dækket af forsikring: Fleksibelt areal - Forsikringsbevis: 1% - Tilskud: 25%

Fortsætte som nu

v02s03. Version 2 - Scenario 3 ...

Police A - Selvrisiko: 20% - Areal dækket af forsikring: Fleksibelt areal - Forsikringsbevis: 1% - Tilskud: 50%

Police B - Selvrisiko: 20% - Areal dækket af forsikring: Hele dit areal - Forsikringsbevis: 5% - Tilskud: 25%

Fortsætte som nu

v02s04. Version 2 - Scenario 4 ...

Police A - Selvrisiko: 40% - Areal dækket af forsikring: Fleksibelt areal - Forsikringsbevis: 3% - Tilskud: 25%

Police B - Selvrisiko: 10% - Areal dækket af forsikring: Hele dit areal - Forsikringsbevis: 1% - Tilskud: 50%

Fortsætte som nu

v02s05. Version 2 - Scenario 5 ...

Police A - Selvrisiko: 40% - Areal dækket af forsikring: Hele dit areal - Forsikringsbevis: 2% - Tilskud: 50%

Police B - Selvrisiko: 30% - Areal dækket af forsikring: Fleksibelt areal - Forsikringsbevis: 5% - Tilskud: 25%

Fortsætte som nu

v02s06. Version 2 - Scenario 6 ...

Police A - Selvrisiko: 30% - Areal dækket af forsikring: Hele dit areal - Forsikringsbevis: 5% - Tilskud: 25%

Police B - Selvrisiko: 40% - Areal dækket af forsikring: Fleksibelt areal - Forsikringsbevis: 2% - Tilskud: 50%

Fortsætte som nu

Basis : Alle

Alder grupperet ...

Under 40 år

40 - 49 år

50 - 59 år

60 - 69 år

70 år og derover

Hektar grupperet ...

Under 30 hektar
30.0 - 39.9 hektar
40.0 - 49.9 hektar
50.0 - 59.9 hektar
60.0 - 74.9 hektar
75.0 - 99.9 hektar
100.0 - 124.9 hektar
125.0 - 149.0 hektar
150.0 - 174.9 hektar
175.0 - 199.9 hektar
200.0 - 249.9 hektar
250.0 - 299.9 hektar
300.0 - 399.9 hektar
400 hektar eller derover

Appendix 2. Local questionnaire, Holstebro (in Danish)

Velkommen til undersøgelsen om klimaforandringer

Hvor mange år har du arbejdet på bedriften?

____

Har du, i den periode du har været på bedriften, oplevet, at tilfældene af kraftig nedbør på bedriftens arealer er blevet hyppigere?

(1) ❑ Ja

(2) ❑ Nej

(3) ❑ Ved ikke

Tænk på den værste hændelse med kraftigt nedbør du har oplevet på din bedrift - hvor meget påvirkede den hændelse det fysiske udbytte af den afgrøde, som var hårdest ramt?

(1) ❑ Ingen effekt på mit udbytte i marken

(2) ❑ Jeg led et tab på 1-9% af bedriftens totale årlige fysiske udbytte af den afgrøde, som var hårdest ramt

(3) ❑ Jeg led et tab på 10-29% af bedriftens totale årlige fysiske udbytte af den afgrøde, som var hårdest ramt

(4) ❑ Jeg led et tab på 30-49% af bedriftens totale årlige fysiske udbytte af den afgrøde, som var hårdest ramt

(5) ❑ Jeg led et tab på 50% eller mere af bedriftens totale årlige fysiske udbytte af den afgrøde, som var hårdest ramt

(6) ❑ Ved ikke

Hvilken afgrøde var hårdest ramt af hændelsen?

(sæt kun ét kryds)

(1) ❑ Vårbyg

(2) ❑ Vinterbyg

(3) ❑ Havre

(4) ❑ Vårhvede

(5) ❑ Vinterhvede

(6) ❑ Vårraps

(7) ❑ Vinterraps

(8) ❑ Rug/Triticale

(9) ❑ Majs

(10) ❑ Roer

(11) ❑ Sukkerroer

(12) ❑ Kartofler

(13) ❑ Græsfrø

(14) ❑ Anden afgrøde; specificer gerne hvilken: _____

Har du, i den periode du har været på bedriften, oplevet følgende ændringer?

Svarskalaen går fra 1 (slet ikke) til 5 (i meget høj grad)

(Sæt venligst kun ét kryds pr række)

	1 (slet ikke)	2	3	4	5 (i meget høj grad)	Ved ikke
Flere kraftige storme der har medført skader på bygninger eller træer	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
Flere kraftige storme der har medført oversvømmelser på bedriften eller i nærheden af	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑

(Sæt venligst kun ét kryds pr række)

	1 (slet ikke)	2	3	4	5 (i meget høj grad)	Ved ikke
bedriften						
Flere insekter/svampe/ukrudt i afgrøden	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
Større variation i temperaturerne fra år til år	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
Større variation i adgangen til vand fra år til år pga. flere tørre år/våde år	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
Andet; specificer venligst hvad:	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑

Har du, i den periode du har været på bedriften, stoppet permanent med at dyrke en afgrøde/flere afgrøder?

(1) ❑ Ja; skriv venligst hvilke afgrøder her:

_____

_____

(2) ❑ Nej

(3) ❑ Ved ikke

Har du, i den periode du har været på bedriften, introduceret en eller flere nye afgrøder permanent?

(1) ❑ Ja; skriv venligst hvilke afgrøder her:

_____

_____

(2) ❑ Nej

(3) ❑ Ved ikke

Har du, i den periode du har været på bedriften, introduceret en eller flere nye afgrøder som en test?

(1) ❑ Ja; skriv venligst hvilke afgrøder her:

_____

_____

(2) ❑ Nej

(3) ❑ Ved ikke

Har du, i den periode du har været på bedriften, foretaget andre ændringer af afgrøder?

(1) ❑ Ja; skriv venligst hvilke afgrøder og ændringer du har foretaget her:

_____

_____

(2) ❑ Nej

(3) ❑ Ved ikke

Hvor vigtige har hvert af følgende forhold været for dine beslutninger om at skifte afgrøder?

Svarskalaen går fra 1 (slet ikke) til 5 (i meget høj grad vigtigt)

(Sæt venligst kun ét kryds pr række)

	1 (slet ikke vigtigt)	2	3	4	5 (i meget høj grad vigtigt)	Ved ikke
Mulighed for større fysisk udbytte	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
Bedre pris på afgrøden	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
Ændringer i nedbør	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
Temperaturændringer	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
Ændringer i saltindhold/grundvand	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
Ændringer i markens udbytte pr. ha	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
Ændringer i udbuddet af arbejdskraft/prisen på arbejdskraft	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
Ændringer i miljø-, klima- og/eller landbrugslovgivningen	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
Ændringer i skadevoldere	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
Risiko for at udvikle resistens	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
Ændringer i dræningsforhold	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
Andet; specificer venligst hvad:	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑

Hvor bekymret er du for, at bedriften udsættes for følgende klimarelaterede forandringer i din fremtid på bedriften?

Svarskalaen går fra 1 (slet ikke bekymret) til 5 (i meget høj grad bekymret)

(Sæt venligst kun ét kryds pr række)

	1 (slet ikke bekymret)	2	3	4	5 (i meget høj grad bekymret)	Ved ikke
Kraftige storme, der medfører skader på bygninger eller træer	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
Kraftige storme, der medfører oversvømmelser på bedriften eller i nærheden af bedriften	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
Flere insekter/svampe/ukrudt i afgrøden	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
Mere variation i temperaturerne fra år til år	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
Mere variation i adgangen til vand fra år til år	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
Andet; specificer venligst hvad:	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑

Angiv venligst i hvor høj grad hver af følgende faktorer har potentiale til at påvirke bedriftens økonomi positivt eller negativt.

Svarskalaen går fra 1 (slet ikke) til 5 (i meget høj grad)

(Sæt venligst kun ét kryds pr række)

	1 (slet ikke)	2	3	4	5 (i meget høj grad)	Ved ikke
Prisændringer på afgrøden	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
Afsætning	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
Ændringer i dyrkningsomkostninger	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
Gradvise klimaændringer	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
Ekstreme vejrhændelser og/eller naturkatastrofer	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
Gæld	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
Ny lovgivning vedrørende landbrug, miljø og/eller klima	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
Teknologiudvikling	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑

Hvem har efter din mening ansvaret for at iværksætte tiltag, der kan beskytte din bedrift mod potentielle skader forårsaget af klimaforandringer (fx oversvømmelse, stormskader eller tørke)?

Svar på en skala fra 1 (slet ikke) til 5 (i meget høj grad)

(sæt kun ét kryds)

	1 (slet ikke)	2	3	4	5 (i meget høj grad)	Ved ikke
Det offentlige	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
Mig selv	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
Andre; specificer venligst hvem:	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑

Hvor sandsynligt er det, at du vil foretage følgende handlinger for at beskytte bedriften mod eventuelle fremtidige negative effekter af klimaforandringer?

Svarskalaen går fra 1 (meget usandsynligt) til 5 (meget sandsynligt)

(Sæt venligst kun ét kryds pr række)

	1 (meget usandsynligt)	2 usandsynligt	3 Hverken/eller	4 sandsynligt	5 (meget sandsynligt)	Ved ikke
Tegne flere/bedre forsikringer	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
Øget rotation af afgrøder	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
Ændre afvandingsforholdene	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
Ændre bekæmpelsesmiddelindsats	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
Tage jord i omdrift ud af produktion	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
Andet; specificer venligst hvad:	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑

Hvor sandsynligt er det, at du vil foretage følgende handlinger for at drage nytte af eventuelle fremtidige positive effekter af klimaforandringer?

Svarskalaen går fra 1 (meget usandsynligt) til 5 (meget sandsynligt)

(Sæt venligst kun ét kryds pr række)

	1 (meget usandsynligt)	2 usandsynligt	3 Hverken eller	4 Sandsynligt	5 (meget sandsynligt)	Ved ikke
Dyrke nye afgrøder	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
Udvide vækstsæsonens længde	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
Dyrke flere afgrøder i samme sæson	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
Udvide dyrkningsarealet	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
Andet; specificer venligst hvad:	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑

Hvor enig er du i følgende udsagn: Der sker globale klimaændringer?

(Sæt venligst kun ét kryds)

meget uenig	uenig	hverken/eller	enig	meget enig	Ved ikke
(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑

Hvilket af følgende udsagn passer bedst til dine forventninger?

(Sæt venligst kun ét kryds)

(1) ❑ Klimaændringer vil være positive for min bedrift

(2) ❑ Klimaændringer vil være negative for min bedrift

(3) ❑ Klimaændringer vil være neutrale for min bedrift

(4) ❑ Ved ikke

Følgende forhold kunne udgøre en barriere for klimatilpasnings-tiltag. Angiv venligst i hvor høj grad du er enig/uenig i at de forskellige forhold udgør en barriere.

Svarskalaen går fra 1 (meget uenig) til 5 (meget enig)

(Sæt venligst kun ét kryds pr række)

	(meget uenig)	uenig	hverken /eller	enig	meget enig	Ved ikke
Bedriftens generelle økonomi	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
Økonomiske udgifter forbundet med at ændre praksis	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
Økonomisk tab som følge af færre/lavere økonomiske tilskud	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
Usikkerhed vedrørende omfanget af klimaændringer	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
Manglende information om klimatilpasningsmetoder	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑

(Sæt venligst kun ét kryds pr række)

	(meget uenig)	uenig	hverken /eller	enig	meget enig	Ved ikke
Landbrugslovgivningen	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
Vandmangel	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
Miljø- og klimalovgivningen	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
Adgang til klimainformation (fx vejrudsigter og varslinger)	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
Adgang til ny teknologi	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
Mangel på arbejdskraft	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
Mangel på jord	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
Vandingsmuligheder	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
Andet; specificer venligst hvad:	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑

Kender du til ideerne om at indgå aftaler med landmænd om at bruge landbrugsarealer til at tilbageholde vand i Storåens opland?

(sæt kun ét kryds)

(1) ❑ Ja

(2) ❑ Nej

Ligger dine jorde i det område, der kan komme i betragtning i forhold til at tilbageholde vand?

(sæt kun ét kryds)

(1) ❑ Ja

(2) ❑ Nej

(3) ❑ Ved ikke

Ville du overveje at indgå en aftale om at tilbageholde vand på dine arealer mod kompensation, hvis du fik muligheden?

(sæt kun ét kryds)

(1) ❑ Ja

(2) ❑ Nej

(3) ❑ Ved ikke

Forventer du, at en aftale om at holde vand tilbage på din bedrift kan skabe nogle af følgende sideeffekter? Svarskalaen går fra 1 (slet ikke) til 5 (i meget høj grad)

(sæt kun ét kryds)

	1 (slet ikke)	2	3	4	5 (i meget høj grad)	Ved ikke
Reducere N-udvaskning	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
Skabe mere natur/biodiversitet	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
Andet; specificer venligst hvad:	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑

Klimaændringerne stiller nye krav til landmænd og kommuner om at kunne håndtere mere regnvand. Der er en øget interesse fra landbrugsorganisationer, landmænd og kommuner om at indtænke landmanden som vandforvalter som del af kommunal klimatilpasning.

Foto: Istock

Landmænd kan imod betaling tilbyde deres kommune at tilbageholde eller forsinke vand på deres jord for at beskytte byområder og infrastrukturer imod oversvømmelse. Det kan være gennem flere forskellige virkemidler, som ud over at håndtere øgede vandmasser også i nogle tilfælde kan have en række andre fordele for natur og miljø. De forskellige virkemidler, der undersøges af

landbrugsorganisationer, konsulentfirmaer og forskere, omfatter:

Opmagasinering af vand i vådområder og andre steder i det åbne land – fx etablering af vådområder i ådale; terrænbestemte retentionsbassiner; kontrolleret oversvømmelse af marker enge og skove i ådale.

Randzoner – fx intelligente randzoner der kan forsinke drænvand.

Tiltag på dyrkningsfladen – fx ændret afgrødevalg med større rodnet; kontrolleret dræning og opstemning af grøfter; ændret jordbearbejdning; ændret dyrkningspraksis; skovrejsning.

Ændringer af vandløbsvedligeholdelse og dimensionering – fx ændret grødeskæring; ændringer i vandløbsprofil; restaurering af vandløb.

Vi vil gerne vide om du på din bedrift ville være interesseret i at indgå en kontrakt med din kommune om at stille (noget af) din dyrkede jord til rådighed for periodisk oversvømmelse mod betaling.

Kommunen er interesseret i kontrakter med landmænd som stiller, deres jord til rådighed under nedbørshændelser der svarer til 5-års hændelser, altså hændelser der statistisk set sker hver 5. år. Kontrakten ville betyde at en servitut bliver lagt på skødet.

Elementerne i kontrakten som du i det følgende kommer til at tage stilling til er flg:

Afgrødevalg – nogle afgrøder afhjælper oversvømmelser ved at reducere afstrømningen. Det kan være fx være afgrøder som græs og pil.

Fast årlig betaling per hektar der stilles til rådighed for periodiske oversvømmelser

Dækning af tab af afgrøder i tilfælde af oversvømmelse der forårsager afgrødeskader

Forhandlingssituation – kan være sammen med alle landmænd i vandoplandet eller hver landmand forhandler individuelt med kommunen.

Der følger nu 6 scenarier omkring en kontrakt med din kommune om at stille (noget af) dit areal til rådighed for oversvømmelse statistisk set hvert 5-år.

Kig godt på de forskellige alternativer og foretag dig det valg under hvert scenarie du synes vil være bedst for din bedrift.

Scenarie 1

Kontrakt A
Kontrakt B

Afgrødevalg
Krav om modstandsdygtige afgrøder
Ingen krav om modstandsdygtige afgrøder

Årlig betaling for rådighed af areal
1.500 kr/ha
1.000 kr/ha

Dækning af tab ved ødelagte afgrøder
Ingen yderligere kompensation
Uvildig sagkyndig taksator ved hændelse

Forhandlingssituation

Individuel forhandling med kommune
Kollektiv forhandling sammen med landmænd i vandopland

Hvilken kontrakt ville du vælge?

(Sæt venligst kun ét kryds)

(1) ❑ Kontrakt A

(2) ❑ Kontrakt B

(3) ❑ Jeg ville ikke vælge nogen af kontrakterne

Scenarie 2

Kontrakt A
Kontrakt B

Afgrødevalg
Krav om modstandsdygtige afgrøder
Ingen krav om modstandsdygtige afgrøder

Årlig betaling for rådighed af areal
1.000 kr/ha
1.500 kr/ha

Dækning af tab ved ødelagte afgrøder
Uvildig sagkyndig taksator ved hændelse
Ingen yderligere kompensation

Forhandlingssituation
Individuel forhandling med kommune

Kollektiv forhandling sammen med landmænd i vandopland

Hvilken kontrakt ville du vælge?

(Sæt venligst kun ét kryds)

(1) ❑ Kontrakt A

(2) ❑ Kontrakt B

(3) ❑ Jeg ville ikke vælge nogen af kontrakterne

Scenarie 3

Kontrakt A
Kontrakt B

Afgrødevalg
Ingen krav om modstandsdygtige afgrøder
Krav om modstandsdygtige afgrøder

Årlig betaling for rådighed af areal
500 kr/ha
2.000 kr/ha

Dækning af tab ved ødelagte afgrøder
Uvildig sagkyndig taksator ved hændelse
Ingen yderligere kompensation

Forhandlingssituation
Kollektiv forhandling sammen med landmænd i vandopland
Individuel forhandling med kommune

Hvilken kontrakt ville du vælge?

(Sæt venligst kun ét kryds)

(1) ❑ Kontrakt A

(2) ❑ Kontrakt B

(3) ❑ Jeg ville ikke vælge nogen af kontrakterne

Scenarie 4

Kontrakt A
Kontrakt B

Afgrødevalg
Ingen krav om modstandsdygtige afgrøder
Krav om modstandsdygtige afgrøder

Årlig betaling for rådighed af areal
2.000 kr/ha
500 kr/ha

Dækning af tab ved ødelagte afgrøder
Ingen yderligere kompensation
Uvildig sagkyndig taksator ved hændelse

Forhandlingssituation
Individuel forhandling med kommune
Kollektiv forhandling sammen med landmænd i vandopland

Hvilken kontrakt ville du vælge?

(Sæt venligst kun ét kryds)

(1) ❑ Kontrakt A

(2) ❑ Kontrakt B

(3) ❑ Jeg ville ikke vælge nogen af kontrakterne

Scenarie 5

Kontrakt A
Kontrakt B

Afgrødevalg
Krav om modstandsdygtige afgrøder
Ingen krav om modstandsdygtige afgrøder

Årlig betaling for rådighed af areal
1.000 kr/ha
1.500 kr/ha

Dækning af tab ved ødelagte afgrøder
Ingen yderligere kompensation
Uvildig sagkyndig taksator ved hændelse

Forhandlingssituation
Kollektiv forhandling sammen med landmænd i vandopland
Individuel forhandling med kommune

Hvilken kontrakt ville du vælge?

(Sæt venligst kun ét kryds)

(1) ❑ Kontrakt A

(2) ❑ Kontrakt B

(3) ❑ Jeg ville ikke vælge nogen af kontrakterne

Scenarie 6

Kontrakt A
Kontrakt B

Afgrødevalg
Ingen krav om modstandsdygtige afgrøder
Krav om modstandsdygtige afgrøder

Årlig betaling for rådighed af areal
500 kr/ha
2.000 kr/ha

Dækning af tab ved ødelagte afgrøder
Ingen yderligere kompensation
Uvildig sagkyndig taksator ved hændelse

Forhandlingssituation
Kollektiv forhandling sammen med landmænd i vandopland
Individuel forhandling med kommune

Hvilken kontrakt ville du vælge?

(Sæt venligst kun ét kryds)

(1) ❑ Kontrakt A

(2) ❑ Kontrakt B

(3) ❑ Jeg ville ikke vælge nogen af kontrakterne

Scenarie 1

Kontrakt A
Kontrakt B

Afgrødevalg
Ingen krav om modstandsdygtige afgrøder
Krav om modstandsdygtige afgrøder

Årlig betaling for rådighed af areal
2.000 kr/ha
500 kr/ha

Dækning af tab ved ødelagte afgrøder
Uvildig sagkyndig taksator ved hændelse
Ingen yderligere kompensation

Forhandlingssituation
Kollektiv forhandling sammen med landmænd i vandopland
Individuel forhandling med kommune

Hvilken kontrakt ville du vælge?

(Sæt venligst kun ét kryds)

(1) ❑ Kontrakt A

(2) ❑ Kontrakt B

(3) ❑ Jeg ville ikke vælge nogen af kontrakterne

Scenarie 2

Kontrakt A
Kontrakt B

Afgrødevalg
Ingen krav om modstandsdygtige afgrøder
Krav om modstandsdygtige afgrøder

Årlig betaling for rådighed af areal
1.000 kr/ha
1.500 kr/ha

Dækning af tab ved ødelagte afgrøder
Ingen yderligere kompensation
Uvildig sagkyndig taksator ved hændelse

Forhandlingssituation
Individuel forhandling med kommune
Kollektiv forhandling sammen med landmænd i vandopland

Hvilken kontrakt ville du vælge?

(Sæt venligst kun ét kryds)

(1) ❑ Kontrakt A

(2) ❑ Kontrakt B

(3) ❑ Jeg ville ikke vælge nogen af kontrakterne

Scenarie 3

Kontrakt A
Kontrakt B

Afgrødevalg
Krav om modstandsdygtige afgrøder
Ingen krav om modstandsdygtige afgrøder

Årlig betaling for rådighed af areal
1.500 kr/ha
1.000 kr/ha

Dækning af tab ved ødelagte afgrøder
Ingen yderligere kompensation
Uvildig sagkyndig taksator ved hændelse

Forhandlingssituation
Kollektiv forhandling sammen med landmænd i vandopland
Individuel forhandling med kommune

Hvilken kontrakt ville du vælge?

(Sæt venligst kun ét kryds)

(1) ❑ Kontrakt A

(2) ❑ Kontrakt B

(3) ❑ Jeg ville ikke vælge nogen af kontrakterne

Scenarie 4

Kontrakt A
Kontrakt B

Afgrødevalg
Krav om modstandsdygtige afgrøder
Ingen krav om modstandsdygtige afgrøder

Årlig betaling for rådighed af areal
500 kr/ha
2.000 kr/ha

Dækning af tab ved ødelagte afgrøder
Uvildig sagkyndig taksator ved hændelse
Ingen yderligere kompensation

Forhandlingssituation
Individuel forhandling med kommune
Kollektiv forhandling sammen med landmænd i vandopland

Hvilken kontrakt ville du vælge?

(Sæt venligst kun ét kryds)

(1) ❑ Kontrakt A

(2) ❑ Kontrakt B

(3) ❑ Jeg ville ikke vælge nogen af kontrakterne

Scenarie 5

Kontrakt A
Kontrakt B

Afgrødevalg
Ingen krav om modstandsdygtige afgrøder
Krav om modstandsdygtige afgrøder

Årlig betaling for rådighed af areal
1.500 kr/ha
1.000 kr/ha

Dækning af tab ved ødelagte afgrøder
Uvildig sagkyndig taksator ved hændelse
Ingen yderligere kompensation

Forhandlingssituation
Individuel forhandling med kommune
Kollektiv forhandling sammen med landmænd i vandopland

Hvilken kontrakt ville du vælge?

(Sæt venligst kun ét kryds)

(1) ❑ Kontrakt A

(2) ❑ Kontrakt B

(3) ❑ Jeg ville ikke vælge nogen af kontrakterne

Scenarie 6

Kontrakt A
Kontrakt B

Afgrødevalg
Krav om modstandsdygtige afgrøder
Ingen krav om modstandsdygtige afgrøder

Årlig betaling for rådighed af areal
2.000 kr/ha
500 kr/ha

Dækning af tab ved ødelagte afgrøder
Uvildig sagkyndig taksator ved hændelse
Ingen yderligere kompensation

Forhandlingssituation
Kollektiv forhandling sammen med landmænd i vandopland
Individuel forhandling med kommune

Hvilken kontrakt ville du vælge?

(Sæt venligst kun ét kryds)

(1) ❑ Kontrakt A

(2) ❑ Kontrakt B

(3) ❑ Jeg ville ikke vælge nogen af kontrakterne

Hvilke af følgende vandvirkemidler kunne være interessante i forhold til nogle af arelaerne på din bedrift under antagelse om, at der oprettes en kontrakt med kommunen med behørig betaling?

Svarskalaen går fra 1 (slet ikke) til 5 (meget interessant)

(sæt kun ét kryds)

	1 (slet ikke interessant)	2	3	4	5 (meget interessant)	Ved ikke
Valg af flerårige afgrøder (fx græs eller pil)	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
Valg af modstandsdygtige kornsorter (fx vinterhvede og rug)	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
Skovrejsning	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
Reduceret jordbearbejdning	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
Bredere randzoner, hvor markdræn skæres over og	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑

(sæt kun ét kryds)

	1 (slet ikke interessant)	2	3	4	5 (meget interessant)	Ved ikke
vand udledes til grøft før randzone så vand kan sive over randzone						
Kontrolleret dræning og opstemning af grøfter	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
Etablering af vådområder i ådale	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
Kontrolleret oversvømmelse af marker, enge og skove i ådale	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
Retentionsbassin i terrænbestemte lavninger	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
Ændret grødeskæring så vand flyder langsommere og å flyder over periodisk	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
Ændrede dimensioner på vandløb fx dobbeltprofil	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑

Har du kendskab til kommunens udkast til handlingsplan for klimatilpasning?

(sæt kun ét kryds)

(1) ❑ Ja

(2) ❑ Nej

I hvilken grad forventer du, at kommunens udkast til handlingsplan for klimatilpasning er tilstrækkelig til at løse de eventuelle klimarelaterede problemer, landbruget i dit område forventer?

Svarskalaen går fra 1 (slet ikke) til 5 (i meget høj grad)

(sæt kun ét kryds)

1 (slet ikke)	2	3	4	5 (i meget høj grad)	Ved ikke
(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑

Har du haft nogle af følgende muligheder for at diskutere kommunens udkast til klimahandlingsplan med kommunen?

(sæt gerne flere kryds)

(1) ❑ Telefonisk kontakt

(2) ❑ Skriftlig kontakt

(3) ❑ Deltagelse i møder/workshops

(4) ❑ Andet; specificer venligst: _____

(5) ❑ Ingen af ovenstående

(6) ❑ Ved ikke

Udnyttede du den mulighed du havde for at diskutere kommunens udkast til klimahandlingsplan med kommunen?

(Sæt venligst kun ét kryds pr række)

	Ja	Nej

(Sæt venligst kun ét kryds pr række)

	Ja	Nej
Jeg udnyttede muligheden for diskussion via telefonisk kontakt	(1) ❑	(2) ❑
Jeg udnyttede muligheden for diskussion via skriftlig kontakt	(1) ❑	(2) ❑
Jeg udnyttede muligheden for diskussion via deltagelse i møder/workshops	(1) ❑	(2) ❑
Jeg udnyttede andre muligheder for diskussion end telefonisk kontakt, skriftlig kontakt og/eller deltagelse i møder/workshops	(1) ❑	(2) ❑

Er det din opfattelse at kommunens udkast til klimahandlingsplan er i konflikt med andre politikker på landbrugsområdet?

Svarskalaen går fra 1 (slet ikke) til 5 (i meget høj grad)

(Sæt venligst kun ét kryds pr række)

1 (slet ikke)	2	3	4	5 (i meget høj grad)	Ved ikke

(Sæt venligst kun ét kryds pr række)

	1 (slet ikke)	2	3	4	5 (i meget høj grad)	Ved ikke
På lokalt plan (fx lokalplaner m.v.)	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
På nationalt plan (fx politikker om arealanvendelse, miljøregulering m.v.)	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
EU's fælles landbrugspolitik (fx krydsoverensstemmelsesregler og landdistriktsordningerne)	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑

Angiv gerne, hvilke politikker, der efter din opfattelse, kan give anledning til konflikter:

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Oplever du, at kommunen er interesseret i dine eventuelle synspunkter vedrørende klimatilpasning?

Svarskalaen går fra 1 (slet ikke) til 5 (i meget høj grad)

(sæt kun ét kryds)

1 (slet ikke)	2	3	4	5 (i meget høj grad)	Ved ikke
(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑

Hvilket af nedenstående passer bedst på dig?

(sæt kun ét kryds)

(1) ❑ Jeg er fuldtidslandmand

(2) ❑ Jeg er deltidslandmand uden anden lønnet beskæftigelse

(3) ❑ Jeg er deltidslandmand med anden lønnet beskæftigelse

(4) ❑ Jeg er fritidslandmand

(5) ❑ Andet; notér: _____

Hvilket af nedenstående passer bedst på bedriftens type?

(sæt kun ét kryds)

(1) ❑ Overvejende/udelukkende planteavl

(2) ❑ Overvejende/udelukkende kvægbrug

(3) ❑ Overvejende/udelukkende svinebrug

(4) ❑ Blandet kvæg- og svinebrug

(5) ❑ Anden animalsk produktion kombineret med planteavl

(6) ❑ Overvejende fjerkræbrug

(7) ❑ Overvejende pelsdyrbrug

(8) ❑ Andet; notér eventuelt: _____

Har bedriften økologisk produktion?

(sæt kun ét kryds)

(1) ❑ Ja, min bedrift har udelukkende økologisk produktion

(2) ❑ Ja, min bedrift har økologisk, men også traditionel produktion

(3) ❑ Ja, min bedrift er under omlægning til økologisk produktion

(4) ❑ Nej, men jeg vil inden for de kommende to år begynde at omlægge min bedrift til økologisk produktion

(5) ❑ Nej, men jeg overvejer at omlægge min bedrift til økologisk produktion

(6) ❑ Nej, og jeg vil ikke omlægge min bedrift til økologisk produktion

Har din bedrift vandingstilladelse?

(1) ❑ Ja

(2) ❑ Nej

(3) ❑ Ved ikke

Hvilke afgrøder blev der dyrket på bedriften i 2013? Angiv ca. antal hektar for de afgrøder, der blev dyrket på bedriften (inkl. tilforpagtning og ekskl. bortforpartning)

(angiv ca. antal ha for hver dyrket afgrøde i 2013)

Vårbyg ____

Vinterbyg ____

(angiv ca. antal ha for hver dyrket afgrøde i 2013)

Havre ____

Vårhvede ____

Vinterhvede ____

Vårraps ____

Vinterraps ____

Rug/Triticale ____

Majs ____

Roer ____

Sukkerroer ____

Kartofler ____

Græsfrø ____

Andre afgrøder ____

Uden for omdrift ____

Totalt areal ____

Hvad er din relation til bedriften?

(sæt kun ét kryds)

(1) ❑ Ejer med daglig driftsledelse

(2) ❑ Ejer uden daglig driftsledelse

(3) ❑ Ansat

(4) ❑ Andet; notér venligst: _____

Angiv venligst bruttofortjenesten for din bedrift, dvs. salg det samlede salg (det samlede salg er alle indtægter fra afgrøder, svin, mælk m.m.) fratrukket vareforbrug (vareforbrug er indkøbt foder, planteværn, gødning, såsæd, dieselolie m.m.). Der skal IKKE fratrækkes renter, arbejdsløn, skat m.m.

(sæt kun ét kryds)

(1) ❑ Mindre end kr. 500.000

500.000-1.000.000

(2) ❑ Kr. 1.000.000 - 1.999.999

(3) ❑ Kr. 2.000.000 - 2.999.999

(4) ❑ Kr. 3.000.000 - 3.999.999

(5) ❑ Kr. 4.000.000 - 4.999.999

(6) ❑ Kr. 5.000.000 - 5.999.999

(7) ❑ Kr. 6.000.000 - 6.999.999

(8) ❑ Kr. 7.000.000 - 7.999.999

(9) ❑ Kr. 8.000.000 - 8.999.999

(10) ❑ Kr. 9.000.000 - 9.999.999

(11) ❑ Kr. 10.000.000 - 12.499.999

(12) ❑ Kr. 12.500.000 - 14.999.999

(13) ❑ Kr. 15.000.000 - 17.499.999

(14) ❑ Kr. 17.500.000 - 19.999.999

(15) ❑ Kr. 20.000.000 og derover

(16) ❑ Ønsker ikke at oplyse

(17) ❑ Ved ikke

Hvor stor en andel af husstandens bruttoindtægt kommer fra landbrugsproduktion?

NB: Brutto eller netto?

(sæt kun ét kryds)

(1) ❑ Under 25%

(2) ❑ 25-49%

(3) ❑ 50-75%

(4) ❑ 76-100%

(5) ❑ Ved ikke

Hvor mange fuldtidsansatte er der på bedriften?

____

Hvilken landbrugsmæssig uddannelse har du?

(sæt gerne flere kryds)

(1) ❑ Agrarøkonom

(2) ❑ Agronom

(3) ❑ Landbrugstekniker

(4) ❑ Landmand (Det Grønne Bevis)

(5) ❑ Anden uddannelse, skriv venligst hvilke(n) her: _____

(6) ❑ Har ikke en landbrugsmæssig uddannelse

(7) ❑ Ved ikke/ønsker ikke at svare

Markér venligst dit køn:

(1) ❑ Mand

(2) ❑ Kvinde

Angiv venligst dit fødeår:

____

Hvilket postnummer ligger din bedrift i?

____

Hvis du har kommentarer til undersøgelsen, eller synspunkter du gerne vil fremføre, så er du velkommen til at skrive dem her.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Nu er der ikke flere spørgsmål. Mange tak for hjælpen!

Hvis du vil deltage i lodtrækningen om tre gavekort a 2.000 kr. til en elektronikforretning, beder vi

dig angive din mailadresse nedenfor. Vi beder dig være opmærksom på, at en eventuel præmie er skattepligtig.

Hvis du ikke ønsker at deltage i lodtrækningen, lader du blot feltet nedenfor stå tomt.

Mailadresse

(Angiv venligst din mailadresse; adressen vil udelukkende blive brugt i forbindelse med lodtrækningen)

_____

Klik på "Afslut" nedenfor for at forlade undersøgelsen.

Appendix 3. Interview guide qualitative interviews (in Danish)

Temaer

Tema	Aktør
1) policy sammenhæng ○ Mellem lokale niveau og nationale planer ○ Mellem klimatilpasning og landbrugspolitikken, herunder konflikter mellem forskellige politikområder, især landbrugspolitikken og klimatilpasning ○ For nationale myndigheder: Sammenhængen mellem national og EU-politik.	Nationalt: Naturstyrelsen NAturerhverv DN VFL KL?? Lokalt Kommuner? Landmænd, landboforeninger DN
2) brugen af viden i design af klimatilpasningsinitiativer og planer, Hvordan dissemineres viden fra top (centralt) til bund (kommuner og landmænd) Hvordan bringes viden op fra landmandsniveau til beslutningsniveau	Nationalt: Naturstyrelsen Fødevaremin DN KL VFL Lokalt

	Kommuner Landmænd, landboforeninger DN
3) Beslutningsprocesserne: hvordan er strategier og konkrete tiltag blevet til [Herunder: • søge viden om design og omkostninger ved det konkrete virkemiddel, og info om hvorvidt det er integreret i den lokale klimahandlingsplan. • spørge ind til om nogle historiske begivenheder har været særligt vigtige for arbejdet i kommunen] • Hvordan opstod idéen om 'landmanden som vandforvalter?	Kommuner Nationalt?
4) Drivkræfter og enablers vedr. tilpasningstiltag og strategier: a) Viden og information b) Hvilke aktører – konfliktlinier, ledelse, deltagere c) Framing d) Lokale kontekstfaktorer e) Policy framework: love, regler, strategier mm. f) Institutionelle ramme: beslutningsstrukturer, konflikter og synergier, incitamenter) g) Ressourcer h) Type adaptation measure)	Nationalt: Naturstyrelsen Fødevaremin DN KL VFL Lokalt Kommuner Landmænd, landboforeninger DN
5) Barrierer i implementeringen af klimahandlingsplan og tilpasningstiltag---- se faktorer oven for. Har barrierer kunnet overvindes.	Nationalt: Naturstyrelsen Fødevaremin

	DN KL VFL Lokalt Kommuner Landmænd, landboforeninger DN
6) Er der noget, du set i bakspejlet gerne ville have gjort om. 7) Fremtidsperspektiver – hvordan ser du processen videre frem.	
PARTICIPATION	
Democratic and political tradition for participation: 7) demokratiske og politiske traditioner vedr. involvering af eksperter, stakeholders og borgere i planlægningsbeslutninger, nationalt og lokalt ? 8) Hvordan passer KTP ind i det? Er der konkrete begivenheder der har formet eller danner grundlag for deltagelse i klimatilpasningsbeslutninger	(Vi spørger embedsmænd, ikke politikere). Kommunale embedsmænd. Naturstyrelsen
Institutionelle ramme **9)** Hvilken myndighed har ansvar for stakeholder og borgerinddragelse på klimatilpasningsområdet 10) er der formelle regler for eller principper vedr. Borgerinddragelse, I så fald hvilke 11) hvem har konkret været involveret i KTP og i initiativer omkring landbrugets klimatilpasning – og hvor i processen	**Naturstyrelsen** **Kommuner** **Kommuner, organisationer**
Processen og magtfordeling 12) Hvilke deltagelsesformer har været i anvendelse (høringer, workshops osv.)	**Kommuner, organisationer**

13) Har jeres organisation haft/har indflydelse på beslutningerne i kommunen, hvornår i processen og er I blevet inddraget på den rigtige måde og rigtige tidspunkt 14) Kan inddragelse og deltagelse forbedres, hvordan?	
Økonomiske assessments 15) Har økonomiske vurderinger været inddraget i den del af processen du har været med i? hvor vigtige er og bør økonomiske kriterier være ift. andre kriterier?	Kommuner, landboforeninger DN

Spørgsmål fra CSLD som primært besvares kvantitativt:

- How do farmers perceive climate adaptation and the need for climate adaptation actions? What is their risk perception? How are farmers motivated?
- What climate adaptation actions have farmers already taken (if any)? And what are the costs? Are there any experienced benefits? (this information is needed for WP3 and WP6)?