Climate Change measures in a holistic planning setting

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International Virtual Seminar
WATER AND CLIMATE

Overview

Topics for the lecture:

- Climate change and scenarios for the future
- Raising awareness
- Climate change aspects in spatial planning
- Data and tools
- Use case

Exercise

Climate change

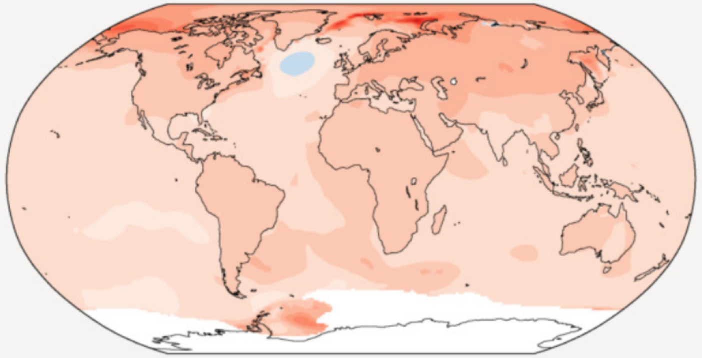
- The global average temperature has risen by approximately 0.85°C since 1880
- The UN Intergovernmental Panel on Climate Change (IPCC) is responsible for the international co-operation on climate change
- The IPCC produces regular reports called Assessment reports
- IPCC predicts a global mean temperature increase of 0.3-1.7ºC over a 100-year period for the lowest scenario, and 2.6-4.8ºC for the highest
- The climate scenarios are developed using complex models describing the whole Earth systems with land, oceans and the atmosphere
- The future is in principle unknown, but to provide input to the models a set of societal developing paths are used
- These are called SSP –Shared Socioeconomic Pathways


★ SSP 5
(Mitigation challenges dominate)
Fossil-fueled development
Taking the Highway
★ SSP 3
(High challenges)
Regional rivalry
A Rocky Road
★ SSP 2
(Intermediate challenges)
Middle of the road
★ SSP 1
(Low challenges)
Sustainability
Taking the Green Road
★ SSP 4
(Adaptation challenges dominate)
Inequality
A Road Divided
Socio-economic challenges for mitigation
Socio-economic challenges for adaptation

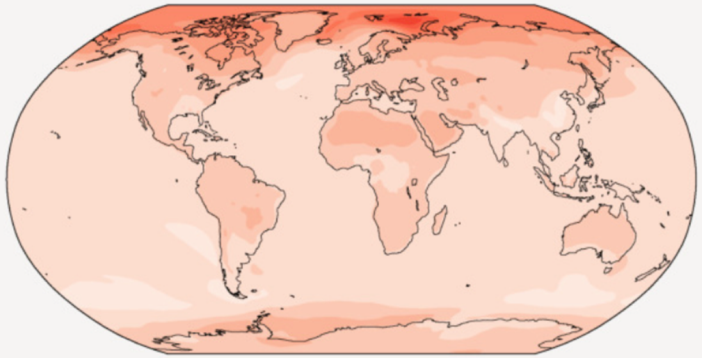
a) Annual mean temperature change (°C) at 1 °C global warming

Warming at 1 °C affects all continents and is generally larger over land than over the oceans in both observations and models. Across most regions, observed and simulated patterns are consistent.

Observed change per **1 °C** global warming



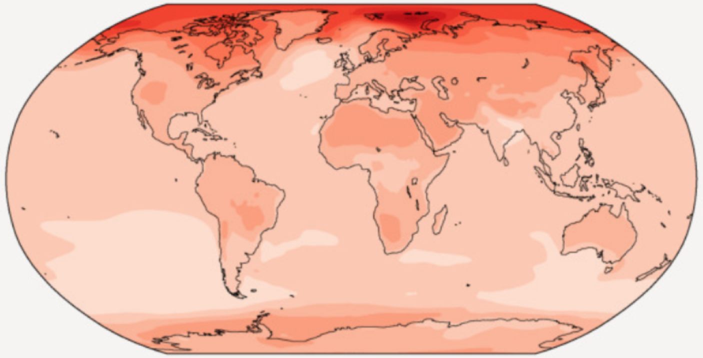
Simulated change at **1 °C** global warming



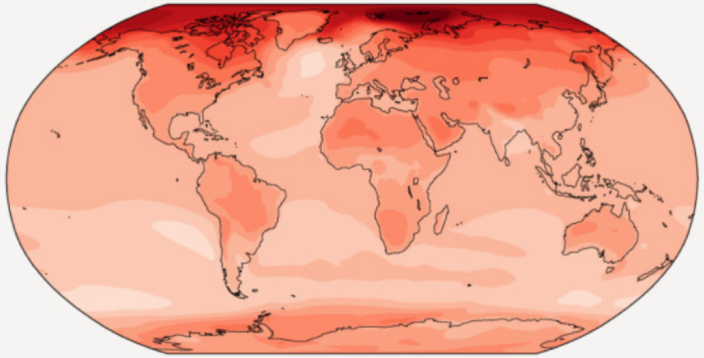
b) Annual mean temperature change (°C) relative to 1850-1900

Across warming levels, land areas warm more than oceans, and the Arctic and Antarctica warm more than the tropics.

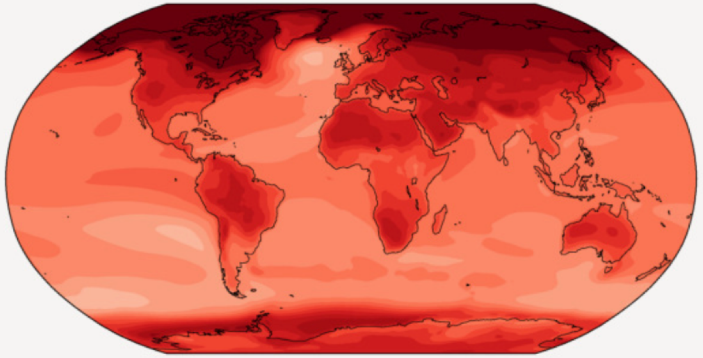
Simulated change at **1.5 °C** global warming

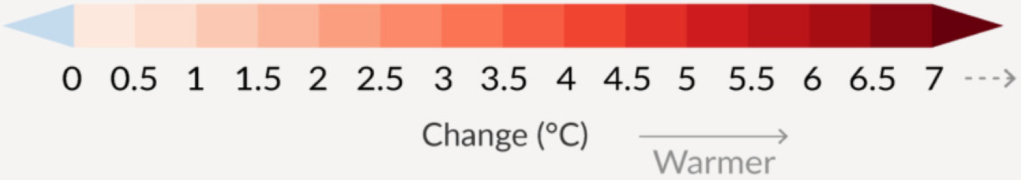


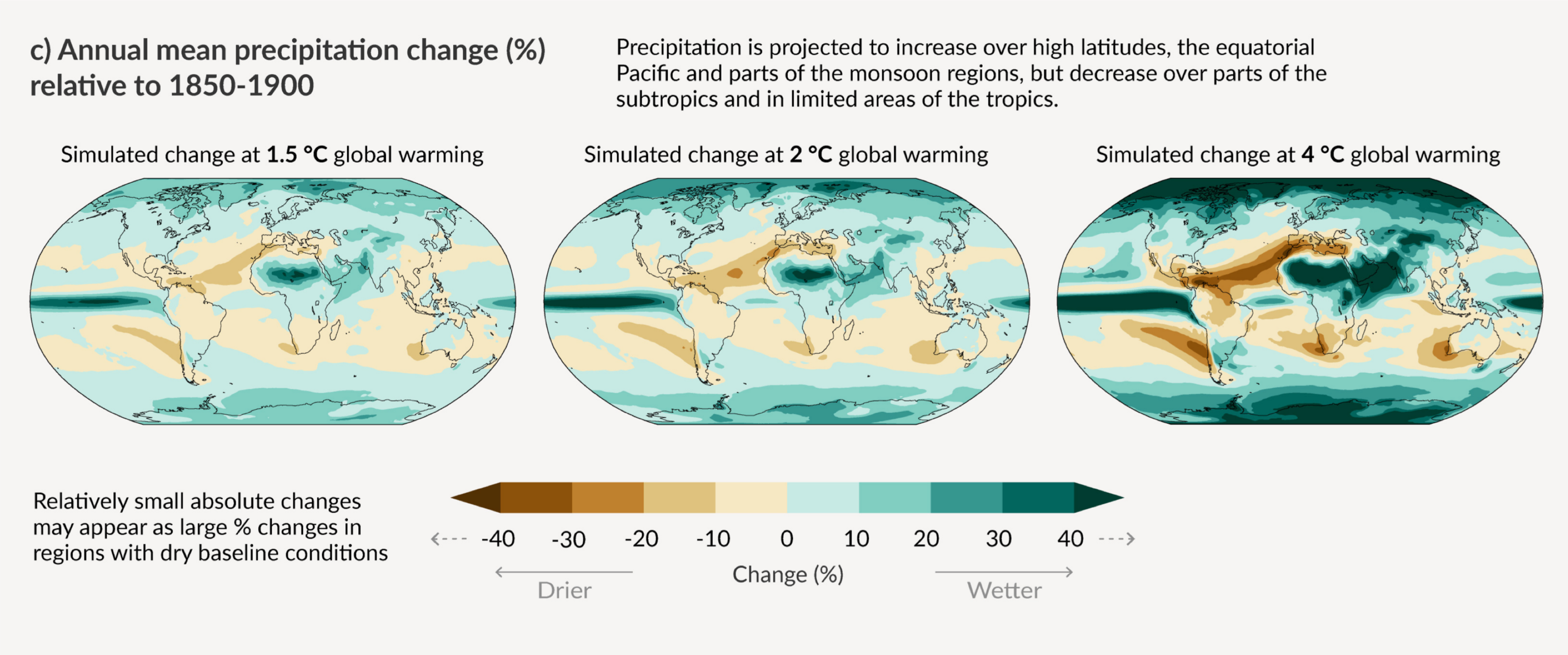
Simulated change at **2 °C** global warming



Simulated change at **4 °C** global warming







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Arctic region
- Temperature rise much larger than global average
- Decrease in Arctic sea ice coverage
- Decrease in Greenland ice sheet
- Decrease in permafrost areas
- Increasing risk of biodiversity loss
- Some new opportunities for the exploitation of natural resources and for sea transportation
- Risks to the livelihoods of indigenous peoples

Coastal zones and regional seas
- Sea level rise
- Increase in sea surface temperatures
- Increase in ocean acidity
- Northward migration of marine species
- Risks and some opportunities for fisheries
- Changes in phytoplankton communities
- Increasing number of marine dead zones
- Increasing risk of water-borne diseases

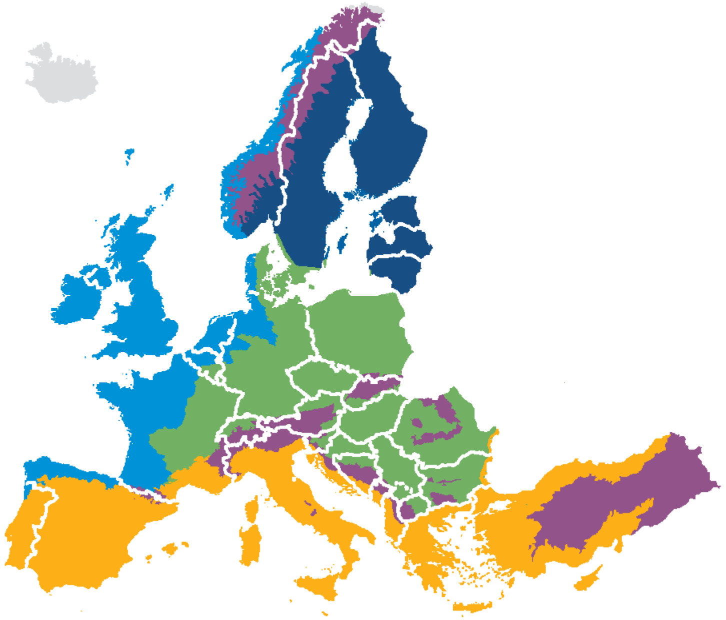
Mediterranean region
- Large increase in heat extremes
- Decrease in precipitation and river flow
- Increasing risk of droughts
- Increasing risk of biodiversity loss
- Increasing risk of forest fires
- Increased competition between different water users
- Increasing water demand for agriculture
- Decrease in crop yields
- Increasing risks for livestock production
- Increase in mortality from heat waves
- Expansion of habitats for southern disease vectors
- Decreasing potential for energy production
- Increase in energy demand for cooling
- Decrease in summer tourism and potential increase in other seasons
- Increase in multiple climatic hazards
- Most economic sectors negatively affected
- High vulnerability to spillover effects of climate change from outside Europe

Atlantic region
- Increase in heavy precipitation events
- Increase in river flow
- Increasing risk of river and coastal flooding
- Increasing damage risk from winter storms
- Decrease in energy demand for heating
- Increase in multiple climatic hazards

Boreal region
- Increase in heavy precipitation events
- Decrease in snow, lake and river ice cover
- Increase in precipitation and river flows
- Increasing potential for forest growth and increasing risk of forest pests
- Increasing damage risk from winter storms
- Increase in crop yields
- Decrease in energy demand for heating
- Increase in hydropower potential
- Increase in summer tourism

Mountain regions
- Temperature rise larger than European average
- Decrease in glacier extent and volume
- Upward shift of plant and animal species
- High risk of species extinctions
- Increasing risk of forest pests
- Increasing risk from rock falls and landslides
- Changes in hydropower potential
- Decrease in ski tourism

Continental region
- Increase in heat extremes
- Decrease in summer precipitation
- Increasing risk of river floods
- Increasing risk of forest fires
- Decrease in economic value of forests
- Increase in energy demand for cooling



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[Aalborg University]

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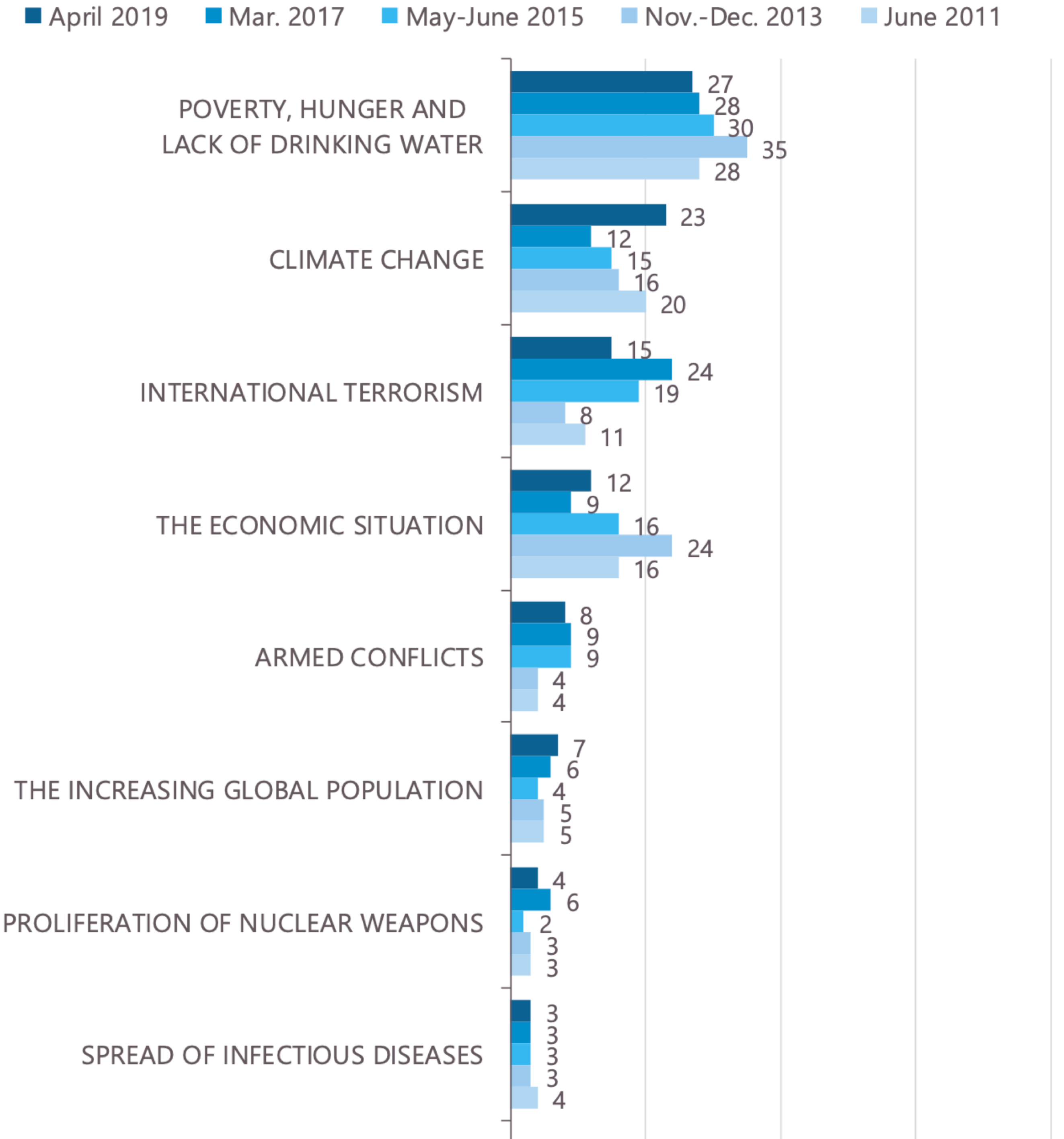
Raising awareness about climate change

Which of the following do you consider to be the single most serious problem facing the world as a whole



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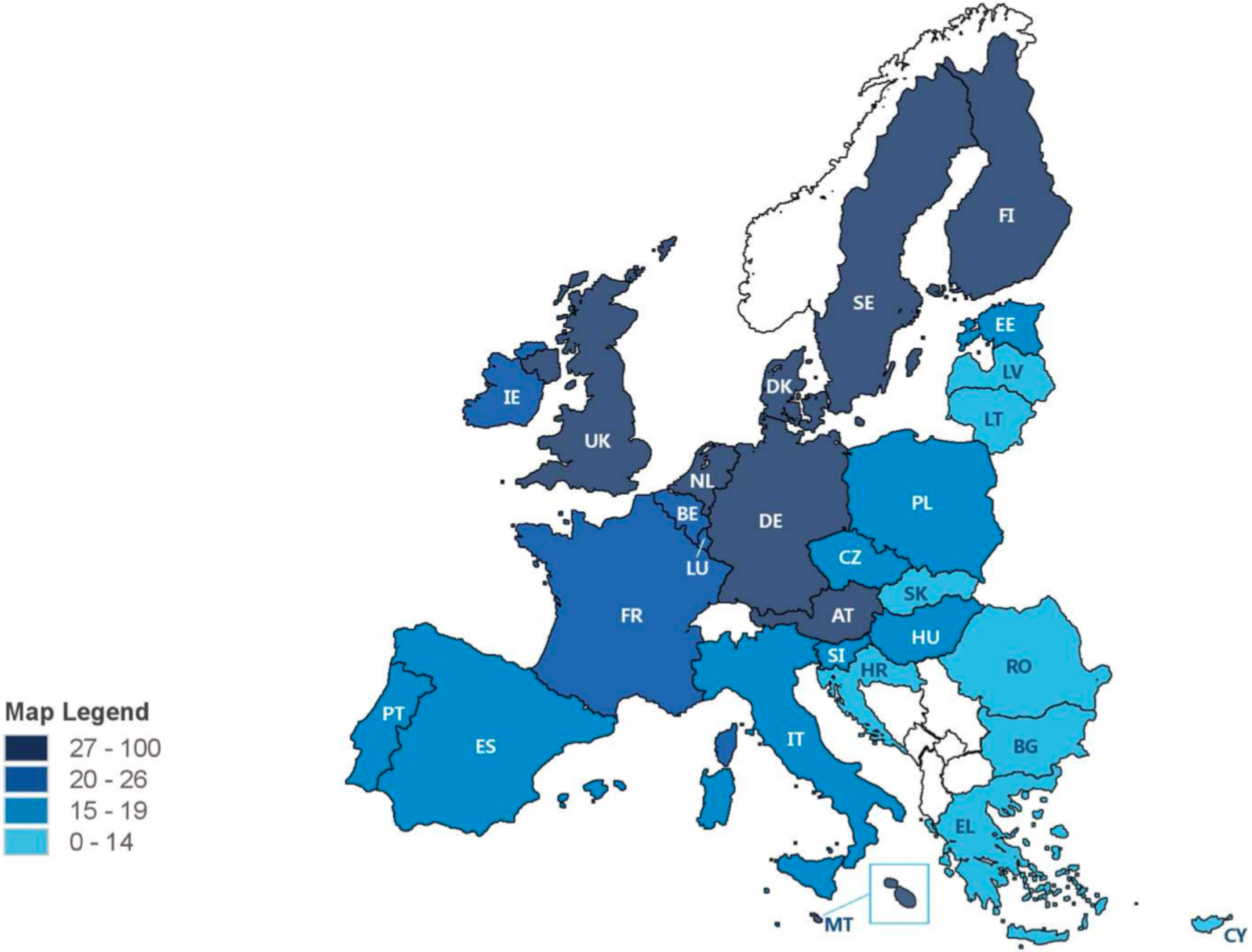
Raising awareness about climate change



[Aalborg University]

Which of the following do you consider to be the single most serious problem facing the world as a whole

% climate change

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EU policies and legislation - 1

– Forging a climate-resilient Europe - the new EU Strategy on Adaptation to Climate Change (*Adopted 24th February 2021*)

– The Strategy aims to build a climate resilient society by improving knowledge of climate impacts and adaptation solutions

EUROPEAN
COMMISSION

Brussels, 24.2.2021
COM(2021) 82 final

COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS

Forging a climate-resilient Europe - the new EU Strategy on Adaptation to Climate Change

EU policies and legislation - 2

- The adaptation strategy pursues three objectives and proposes a range of actions
- Smarter adaptation: Improving knowledge and manage uncertainty
  - Pushing the frontiers of adaptation knowledge
  - More and better climate loss data
  - Enhancing and expanding Climate-ADAPT as the European platform for adaptation knowledge
- More systemic adaptation: Supporting policy development at all levels and all relevant policy fields
  - Macro-fiscal policy;
  - Nature-based solutions; and
  - Local adaptation actions
- Faster adaptation: Speed up adaptation implementation across the board

The EU Climate Law

- The European Climate Law writes into law the goal set out in the European Green Deal for Europe’s economy and society to become climate-neutral by 2050
- The law also sets the intermediate target of reducing net greenhouse gas emissions by at least 55% by 2030, compared to 1990 levels
- Climate neutrality by 2050 means achieving net zero greenhouse gas emissions for EU countries as a whole, mainly by cutting emissions, investing in green technologies and protecting the natural environment
- The law aims to ensure that all EU policies contribute to this goal and that all sectors of the economy and society play their part
- The European Climate Law was published in the Official Journal on 9 July 2021 and entered into force on 29 July 2021

EU Floods directive

- The floods directive (2007) basically prescribes a three-step procedure
  - First step: Preliminary Flood Risk Assessment: The Floods Directive requires Member States to engage their government departments, agencies and other bodies to draw up a Preliminary Flood Risk Assessment
  - Second step: Risk Assessment: The information in this assessment will be used to identify the areas at significant risk which will then be modelled in order to produce flood hazard and risk maps
  - Third step: Flood Risk Management Plans: Flood Risk Management Plans are meant to indicate to policy makers, developers, and the public the nature of the risk and the measures proposed to manage these risks. However, they are not formally binding

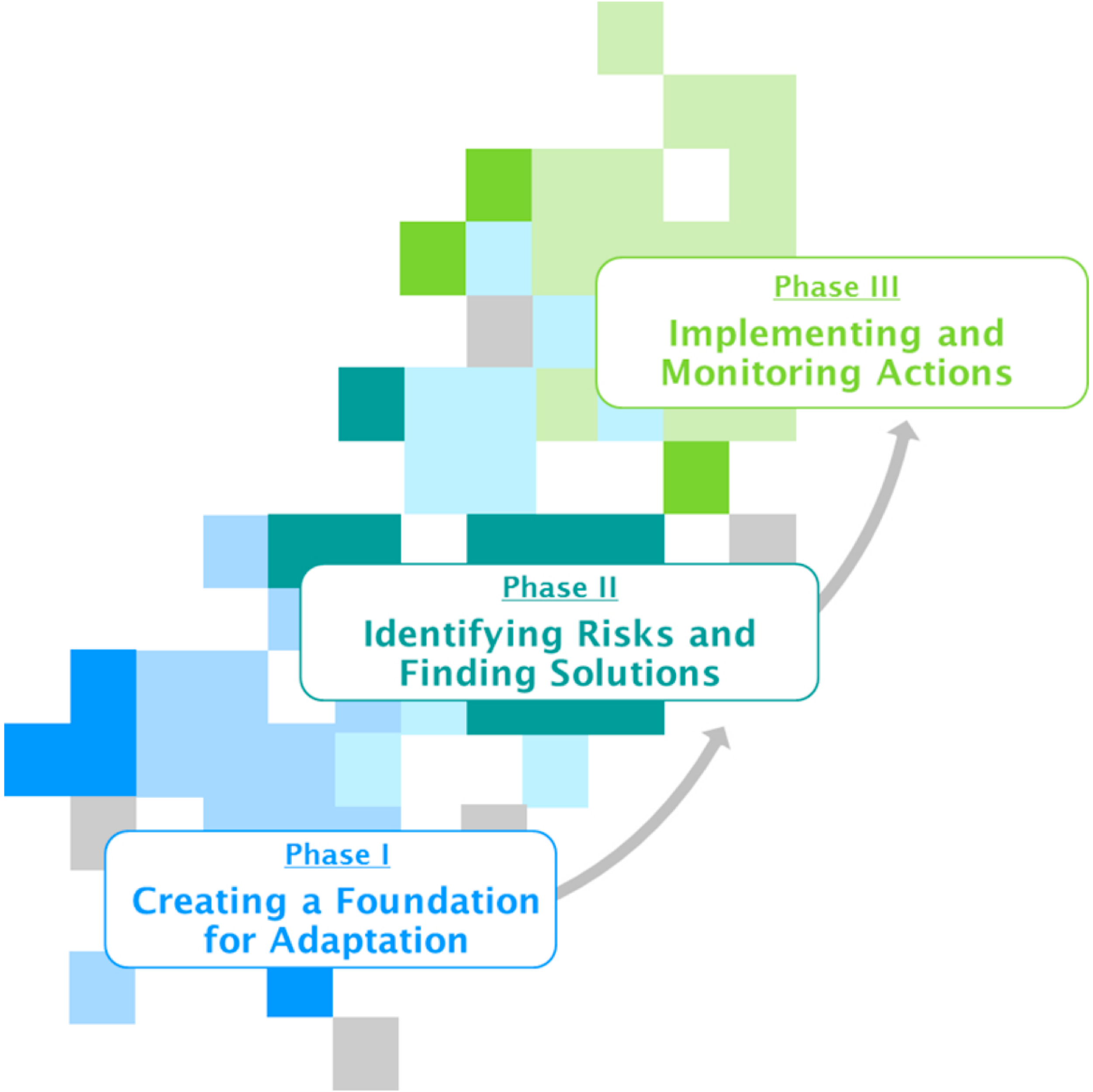
Adaptation as a nessary second piller of climate policy

– The European Union’s climate policy seeks to limit global warming to 2°C above pre-industrial levels

– To achieve this goal, climate change mitigation measures must be enacted worldwide

– But even with an immediate significant reduction in greenhouse gas emissions or a stabilization of emissions at current levels, a further temperature increase over the coming decades is no longer avoidable

– Therefore, in addition to indispensable measures to reduce greenhouse gas emissions, strategies and measures for adaptation must also be developed and implemented


Phase III
Implementing and Monitoring Actions
Phase II
Identifying Risks and Finding Solutions
Phase I
Creating a Foundation for Adaptation

Creating a foundation for adaptation

– Problems related to climate change must be recognised as important at the political level due to

  – Insufficient awareness or lack of awareness among relevant decision-makers

  – Disputed priorities where other issues are often higher prioritised

  – The added value crrated by adaptation strategies and measures is often unclear

Identifying risks and finding solutions

- When a climate change issue has reached the political agenda, it is up to the relevant political actors to agree upon the formulation and implementation of measures, but the following challenges can critically hinder progress:
  - Lack of expertise - even when the costs and benefits of certain adapta- tion measures are clarified, the responsible actors frequently lack the expertise to translate ideas into concrete measures or strategies
  - Conflicting values and interests - agreement on a common formulation or decision is especially vulnerable to conflicts over values or interests in this phase
  - Unsatisfactory choice of measures - the available measures fail to meet the expectations and needs of decision-makers and are therefore not pursued further

Implementation and supporting actions

- After a decision is made the following challenges must be overcome
  - Adaptation strategies are politically or administratively not realizable: Measures must be compatible with the political and administrative framework and practices
  - Although adaptation problems should in principle be technologically resolvable, the potential solutions may not be available to the responsible parties - e.g. due to financial viability
  - The legal situation can obstruct the implementation of measures
  - In many cases, the outcomes of implemented measures are difficult to assess, especially when the effect become evident only in the long term
  - Actors have not yet had sufficient experience with the monitoring and evaluation of adaptation policies

The relationship between climate change and spatial planning

- Spatial planning in particular is capable of playing a key role in addressing climate change
- It can promote climate adaptation as a framework for the coordination of various activities over a specific territory and a mechanism for the implementation of adaptation measures on the ground
- This is true for the entire spectrum of spatial planning, from regulatory to strategic
- The ecosystem approach based on ecosystem services (ES) brings land into the epicenter of the effort towards climate adaptation and disaster risk reduction
- The role of ecosystems in climate adaptation and disaster risk reduction has highlighted the catalytic role of nature in this relationship and has led to the elaboration of nature-based solutions (NBS)

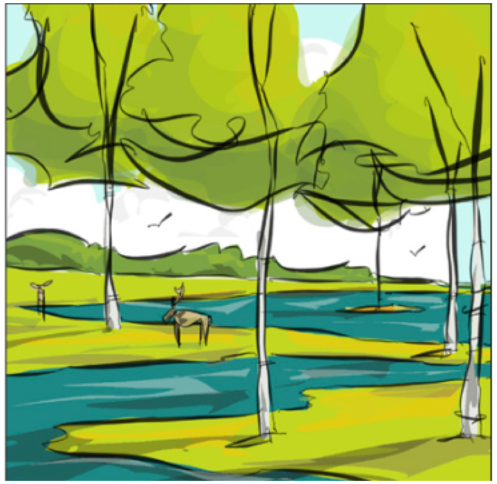
Categories of nature based solutions

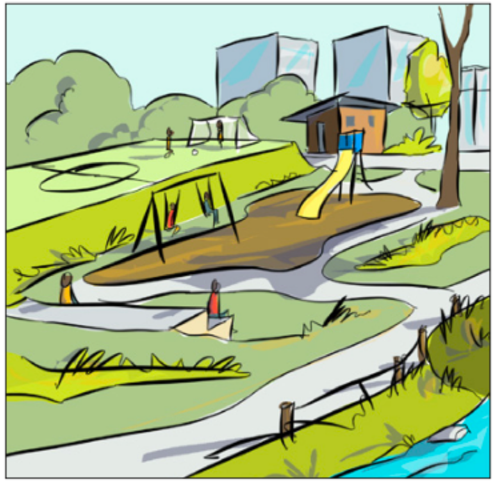
– **Watershed or landscape scale**: Interconnected systems of natural areas and open space. These are large-scale practices that require long-term planning and coordination

– **Neighbourhood or site scale**: Distributed stormwater management practices that manage rainwater where it falls. These practices can often be built into a site, corridor, or neighbourhood without requiring additional space

– **Coastal areas**: Nature-based solutions that stabilize the shoreline, reducing erosion and buffering the coast from storm impacts. While many watershed and neighbourhood-scale solutions work in coastal areas, these systems are designed to support coastal resilience

Watershed or landscape scale





Wetland restoration and protection

Restoring and protecting wetlands can improve water quality and reduce flooding. Healthy wetlands filter, absorb, and slow runoff. Wetlands also sustain healthy ecosystems by recharging groundwater and providing habitat for fish and wildlife

Stormwater parks

Stormwater parks are recreational spaces that are designed to flood during extreme events and to withstand flooding. By storing and treating floodwaters, stormwater parks can reduce flooding elsewhere and improve water quality

Neighbourhood or site scale

Rain garden

A rain garden is a shallow, vegetated basin that collects and absorbs runoff from rooftops, sidewalks, and streets. Rain gardens can be added around homes and businesses to reduce and treat stormwater runoff

Green streets

Green streets use a suite of green infrastructure practices to manage stormwater runoff and improve water quality. Adding green infrastructure features to a street corridor can also contribute to a safer and more attractive environment for walking and biking

Coastal areas

Coastal wetlands

Coastal wetlands are found along ocean, estuary, or freshwater coastlines. They are often referred to as “sponges” because of their ability to absorb wave energy during storms or normal tide cycles

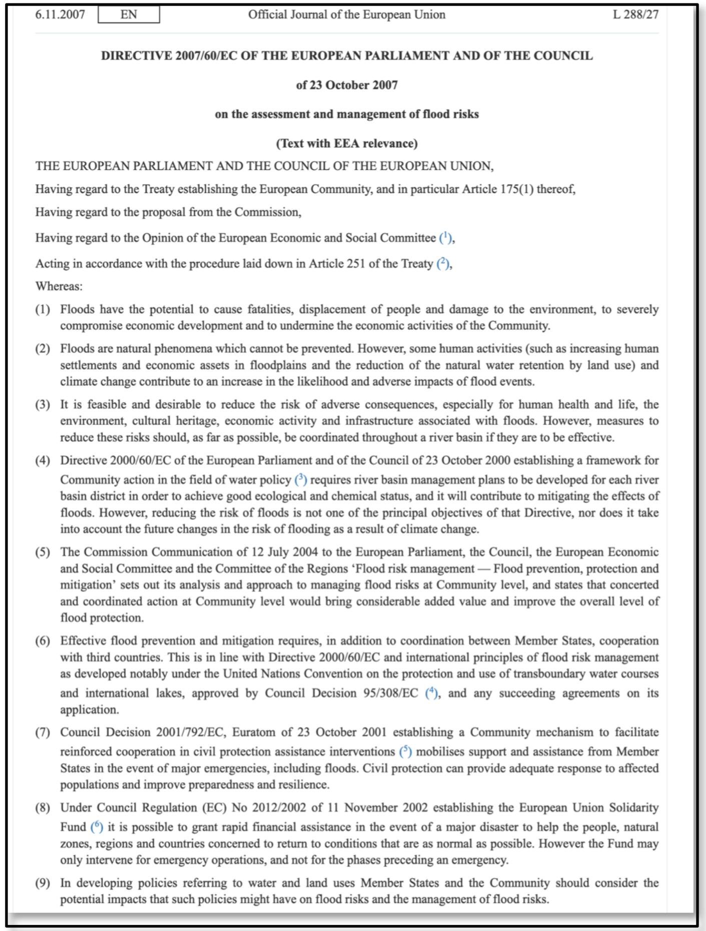
Waterfront parks

Waterfront parks in coastal areas can be intentionally designed to flood during extreme events, reducing flooding elsewhere. Waterfront parks can also absorb the impact from tidal or storm flooding and improve water quality.

Climate change a Danish context

- The average temperature in Denmark has risen by 1.5°C since 1873 and precipitation has increased by 15%
- The annual average temperature increases by around 3.4˚C throughout Denmark. There will be no major regional variation
- Precipitation in winter increases by almost 25%. With temperatures increasing too, relatively much of this precipitation will fall as rain
- Summers will see around the same precipitation volume as today, but more often in the form of heavy showers.
- The mean sea level increases, and at an accelerating pace. The increase is lowest in northern Jutland and highest in south-west Jutland due to isostatic rebound after the last Ice Age
- Storm surges hit harder ss the mean sea level rises, storm surges can cause much more serious damage

Balancing needs – in the coastal zone



6.11.2007 EN Official Journal of the European Union L 288/27

DIRECTIVE 2007/60/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL

of 23 October 2007

on the assessment and management of flood risks

(Text with EEA relevance)

THE EUROPEAN PARLIAMENT AND THE COUNCIL OF THE EUROPEAN UNION,

Having regard to the Treaty establishing the European Community, and in particular Article 175(1) thereof,

Having regard to the proposal from the Commission,

Having regard to the Opinion of the European Economic and Social Committee ([1]),

Acting in accordance with the procedure laid down in Article 251 of the Treaty ([2]),

Whereas:

(1) Floods have the potential to cause fatalities, displacement of people and damage to the environment, to severely compromise economic development and to undermine the economic activities of the Community.

(2) Floods are natural phenomena which cannot be prevented. However, some human activities (such as increasing human settlements and economic assets in floodplains and the reduction of the natural water retention by land use) and climate change contribute to an increase in the likelihood and adverse impacts of flood events.

(3) It is feasible and desirable to reduce the risk of adverse consequences, especially for human health and life, the environment, cultural heritage, economic activity and infrastructure associated with floods. However, measures to reduce these risks should, as far as possible, be coordinated throughout a river basin if they are to be effective.

(4) Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy ([3]) requires river basin management plans to be developed for each river basin district in order to achieve good ecological and chemical status, and it will contribute to mitigating the effects of floods. However, reducing the risk of floods is not one of the principal objectives of that Directive, nor does it take into account the future changes in the risk of flooding as a result of climate change.

(5) The Commission Communication of 12 July 2004 to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions 'Flood risk management — Flood prevention, protection and mitigation' sets out its analysis and approach to managing flood risks at Community level, and states that concerted and coordinated action at Community level would bring considerable added value and improve the overall level of flood protection.

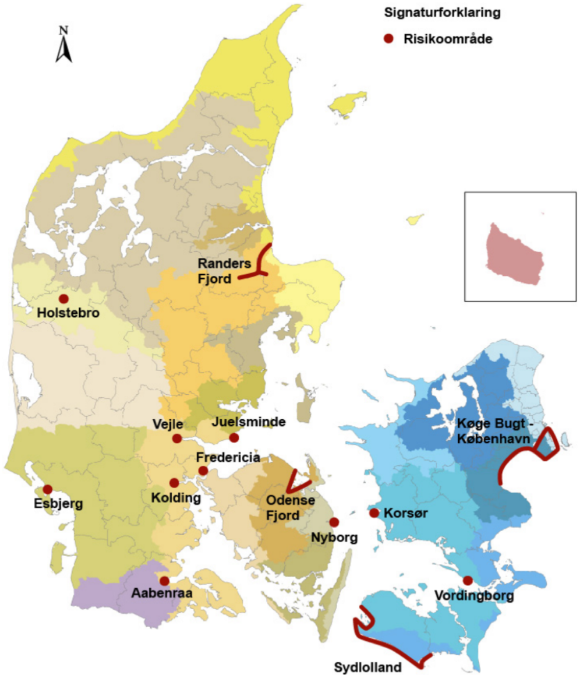
(6) Effective flood prevention and mitigation requires, in addition to coordination between Member States, cooperation with third countries. This is in line with Directive 2000/60/EC and international principles of flood risk management as developed notably under the United Nations Convention on the protection and use of transboundary water courses and international lakes, approved by Council Decision 95/308/EC ([4]), and any succeeding agreements on its application.

(7) Council Decision 2001/792/EC, Euratom of 23 October 2001 establishing a Community mechanism to facilitate reinforced cooperation in civil protection assistance interventions ([5]) mobilises support and assistance from Member States in the event of major emergencies, including floods. Civil protection can provide adequate response to affected populations and improve preparedness and resilience.

(8) Under Council Regulation (EC) No 2012/2002 of 11 November 2002 establishing the European Union Solidarity Fund ([6]) it is possible to grant rapid financial assistance in the event of a major disaster to help the people, natural zones, regions and countries concerned to return to conditions that are as normal as possible. However the Fund may only intervene for emergency operations, and not for the phases preceding an emergency.

(9) In developing policies referring to water and land uses Member States and the Community should consider the potential impacts that such policies might have on flood risks and the management of flood risks.

https://eur-lex.europa.eu/eli/dir/2007/60/oj?locale=en



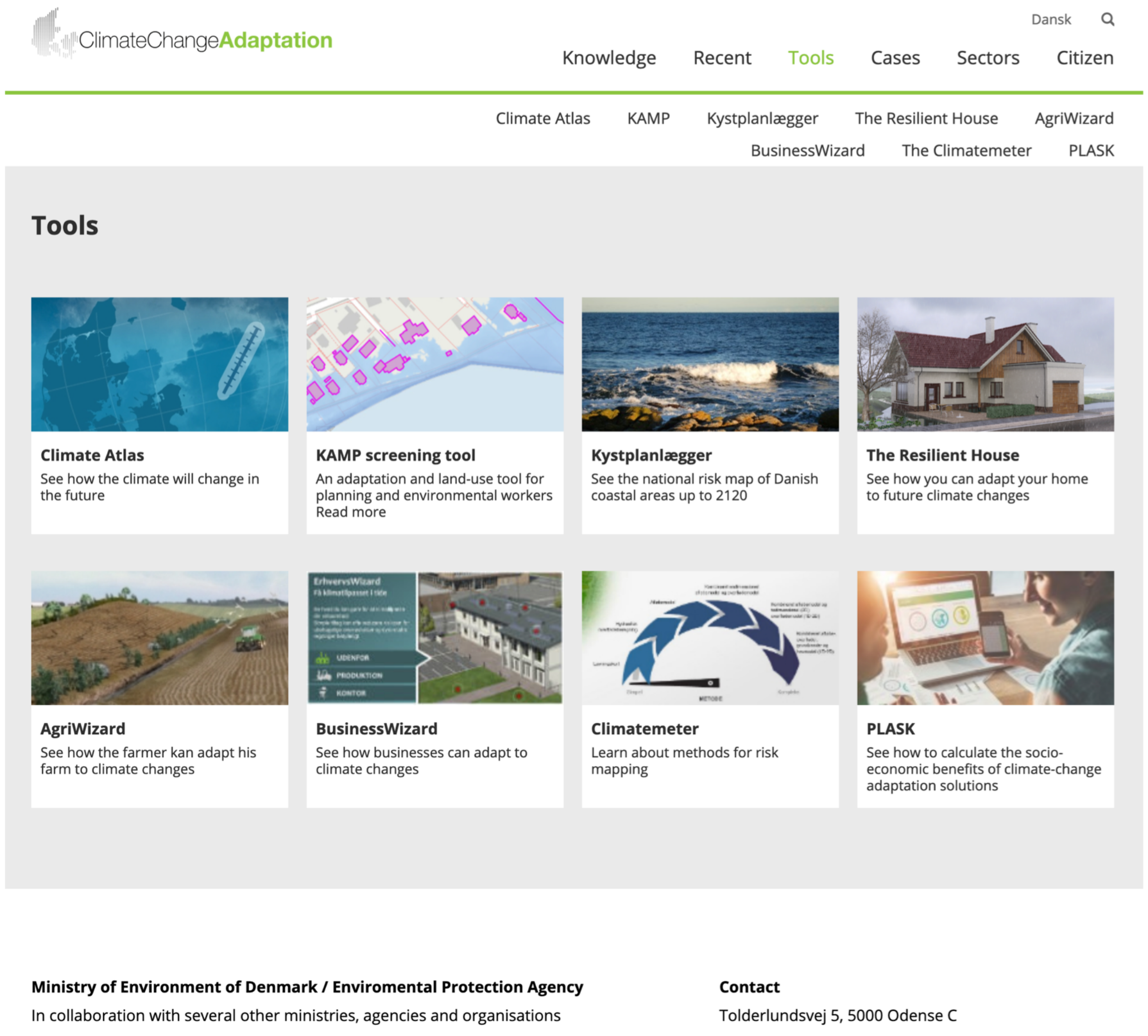
https://oversvommelse.kyst.dk/

Coastline 2019 (green) in the bay of Vorupoer, estimated coastline 2050 due to erosion (red) and the line of flooding (yellow). Source: Danish Coastal Aurhority and Thisted Municipality.

Køge harbour 2017

Klimatilpasningsplan 2014

Balancing needs – in the coastal zone


ClimateChangeAdaptation

Dansk

Knowledge Recent Tools Cases Sectors Citizen

Climate Atlas KAMP Kystplanlægger The Resilient House AgriWizard BusinessWizard The Climatemeter PLASK

Tools

Climate Atlas
See how the climate will change in the future

KAMP screening tool
An adaptation and land-use tool for planning and environmental workers
Read more

Kystplanlægger
See the national risk map of Danish coastal areas up to 2120

The Resilient House
See how you can adapt your home to future climate changes

AgriWizard
See how the farmer kan adapt his farm to climate changes

BusinessWizard
See how businesses can adapt to climate changes

Climatemeter
Learn about methods for risk mapping

PLASK
See how to calculate the socio-economic benefits of climate-change adaptation solutions

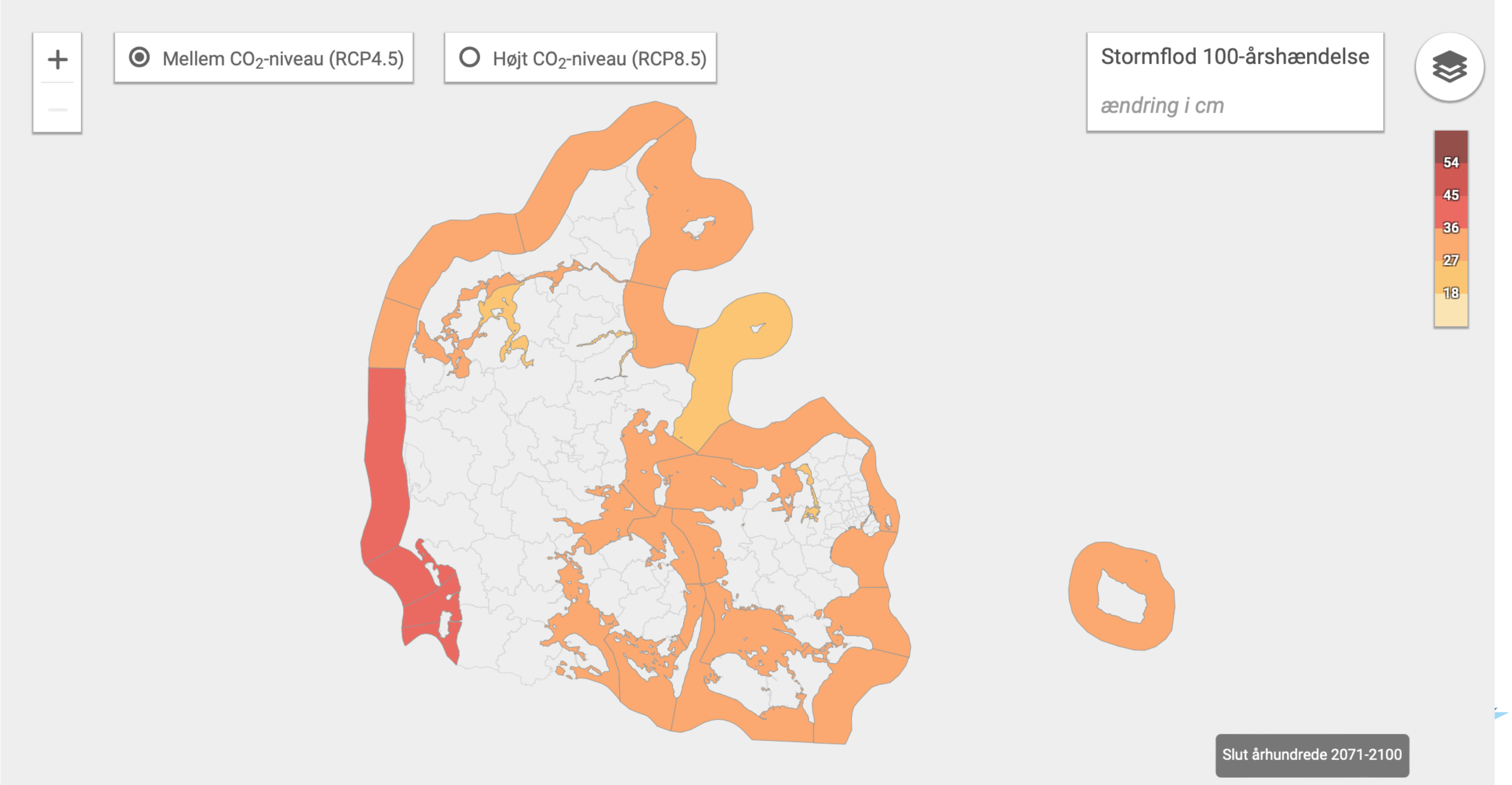
Ministry of Environment of Denmark / Enviromental Protection Agency
In collaboration with several other ministries, agencies and organisations

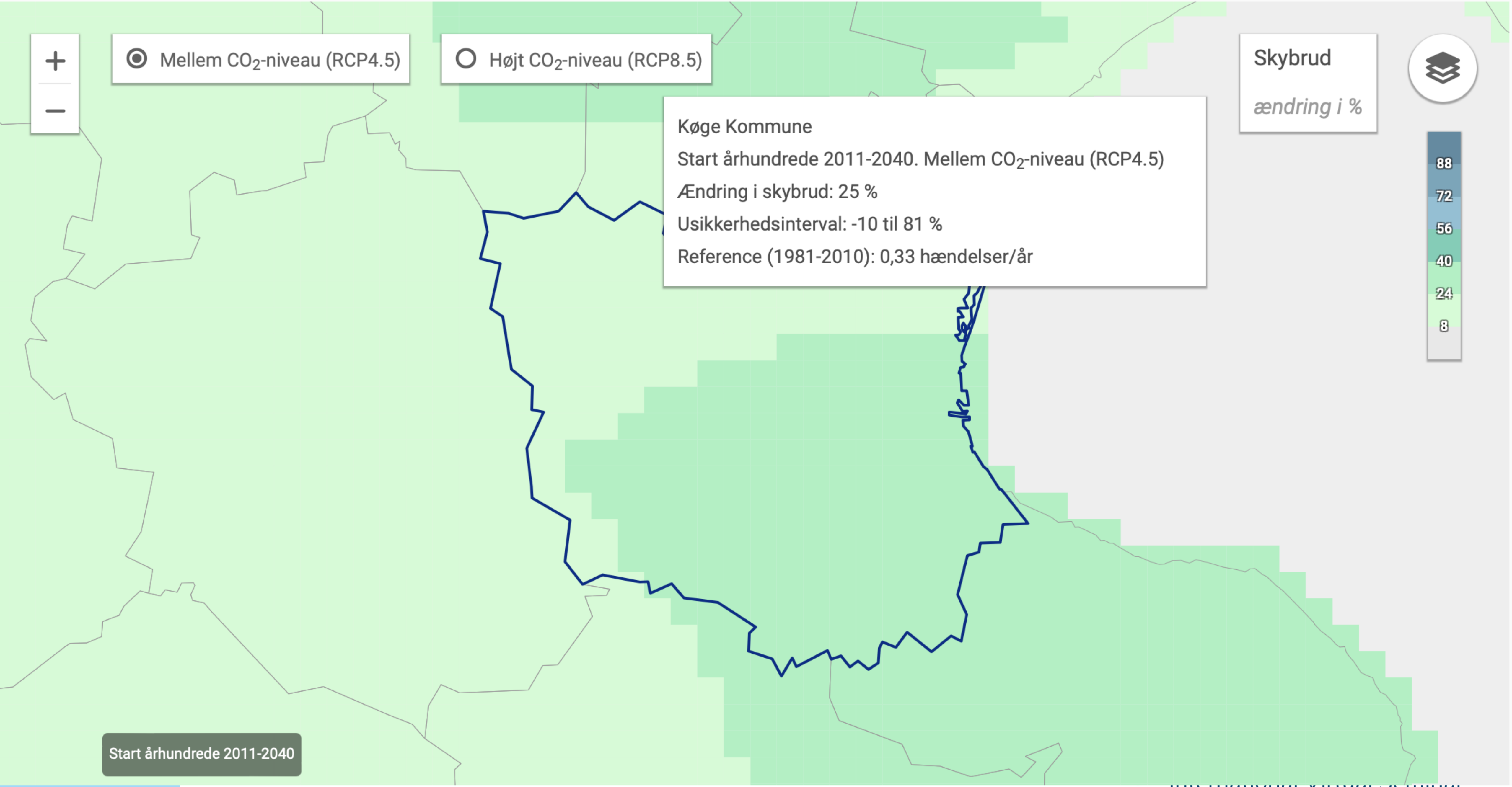
Contact
Tolderlundsvej 5, 5000 Odense C

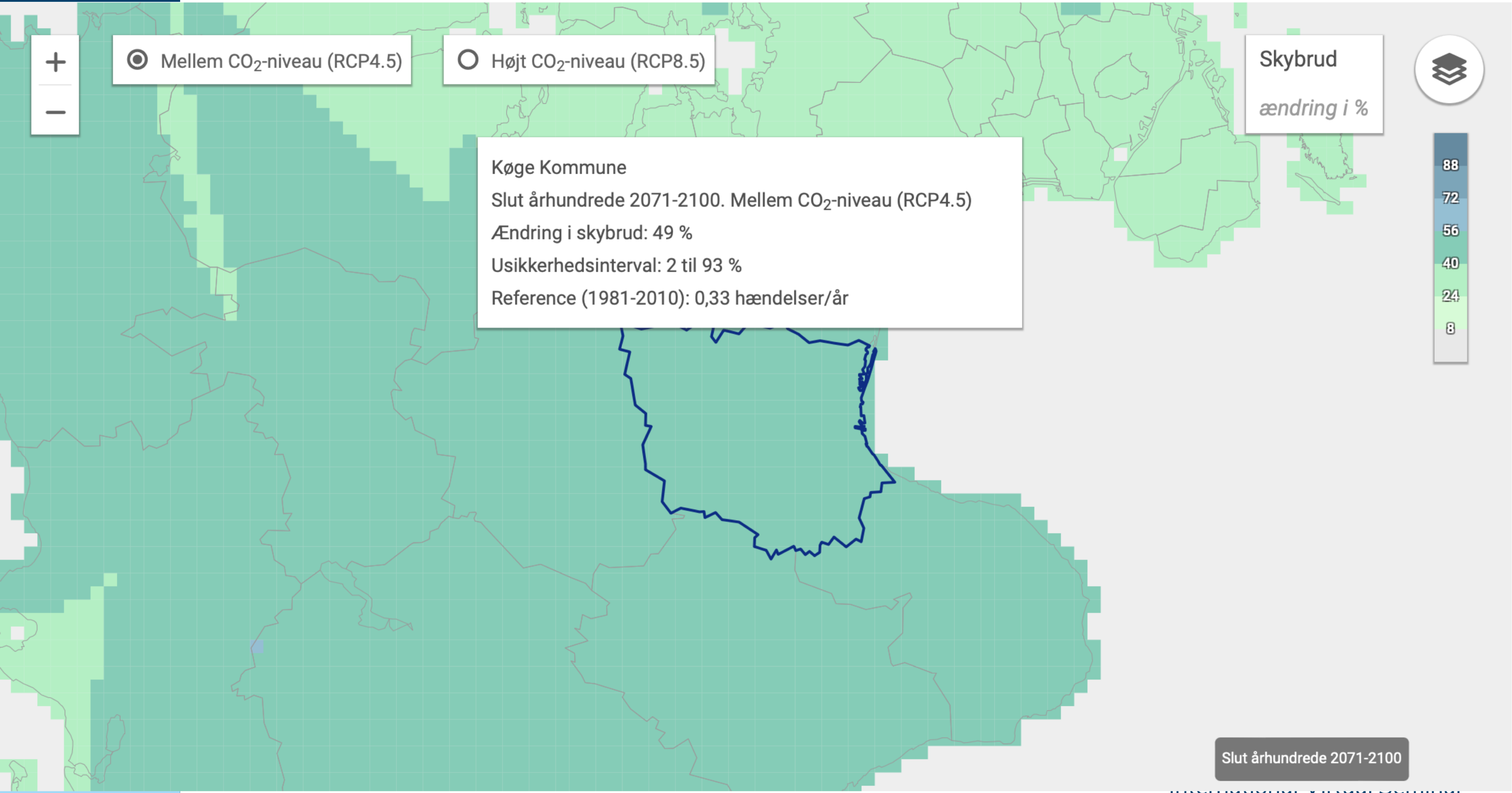
https://en.klimatilpasning.dk/tools/

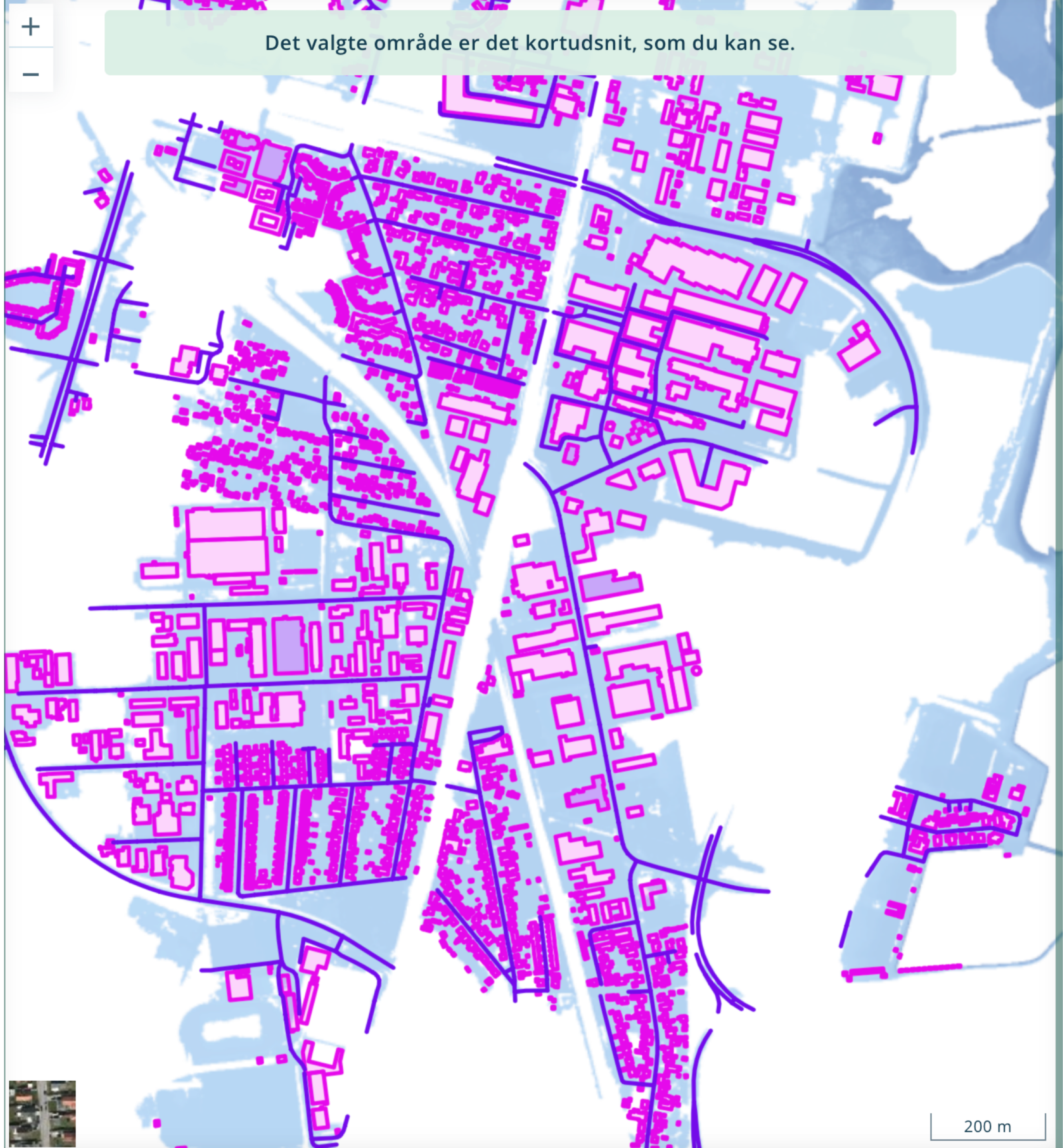
Ændring i vandstand og stormflod i ...område i forhold til referenceperioden 1981-2010

Før musen ind over kortet for at se detaljer




+
−
Mellem CO_2-niveau (RCP4.5)
Højt CO_2-niveau (RCP8.5)
Køge Kommune
Start århundrede 2011-2040. Mellem CO_2-niveau (RCP4.5)
Ændring i skybrud: 25 %
Usikkerhedsinterval: -10 til 81 %
Reference (1981-2010): 0,33 hændelser/år
Skybrud
ændring i %
88
72
56
40
24
8
Start århundrede 2011-2040


Mellem CO_2-niveau (RCP4.5)
Højt CO_2-niveau (RCP8.5)
Skybrud
ændring i %
88
72
56
40
24
8
Køge Kommune
Slut århundrede 2071-2100. Mellem CO_2-niveau (RCP4.5)
Ændring i skybrud: 49 %
Usikkerhedsinterval: 2 til 93 %
Reference (1981-2010): 0,33 hændelser/år
Slut århundrede 2071-2100



KAMP

PÅVIRKNING

Hav Luk

Havvand på land
SDFE

Forhøjet vandstand i meter:

0 2 m 6

Ved Køge Bugt svarer en 20 års hændelse til 1,98 m, en 50 års hændelse til 2,06 m og en 100 års hændelse til 2,11 m i perioden 2070-2100 RCP 8.5 ifølge Klimatlas

Resultat:

Viser resultat for **aktuelt kortudsnit**

- **36** bygninger med kælder potentielt påvirket
- **1985** bygninger uden kælder potentielt påvirket

Totalt er **2021 af 2844** bygninger potentielt påvirket, med en estimeret offentlig bygningsværdi på 1.478 mio. kr.

- **24 km** vej potentielt påvirket

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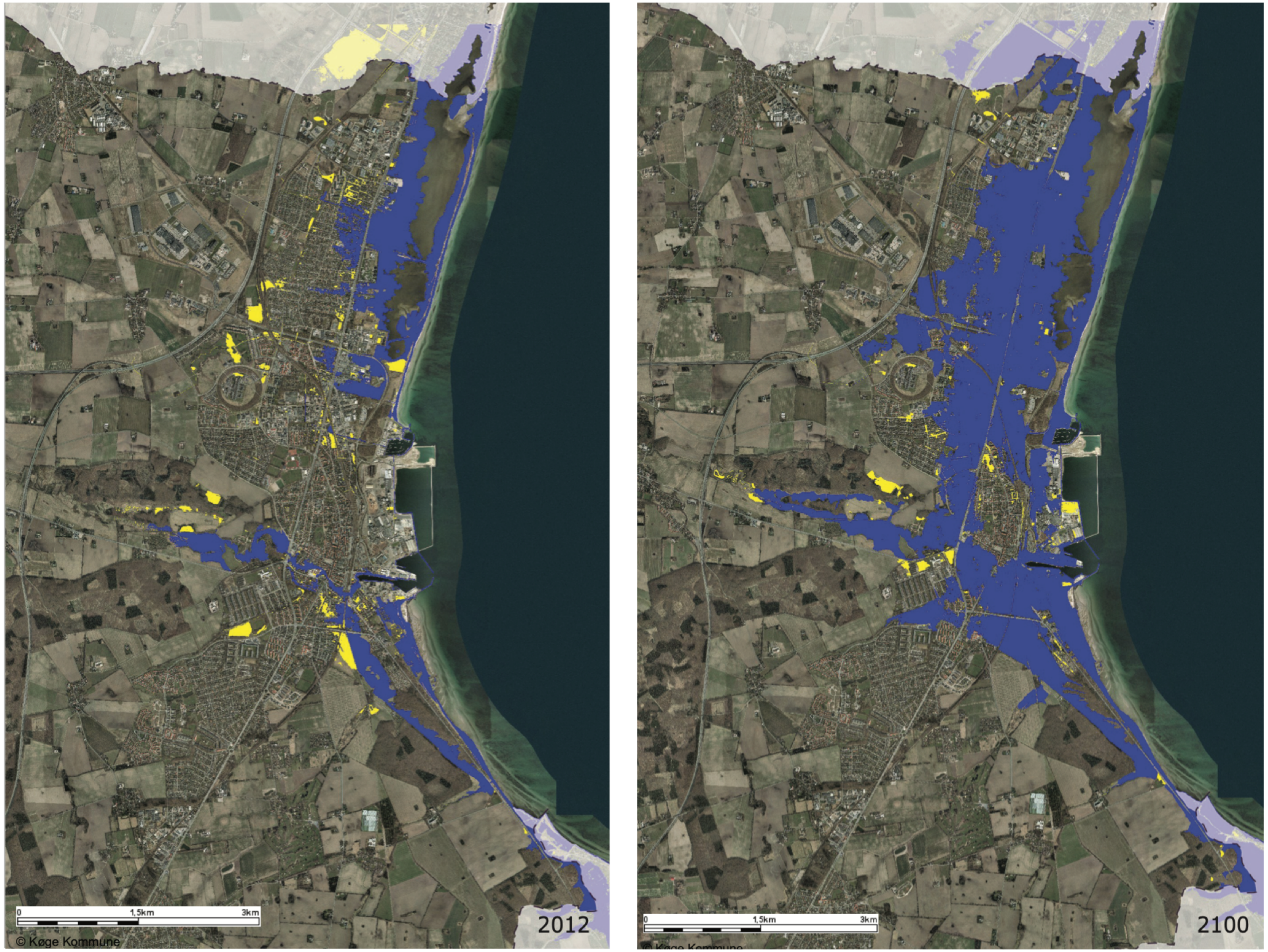
Flooding from the sea



Figur A
Forventet omfang af en 100 års stormflodsepisode i henholdsvis 2012 og 2100.

Figur B
Oversvømmede områder
Terrænet ligger under maksimal stormflodshøjde.

Køge dike

- Køge Dike is one of Denmark's largest and most ambitious coastal protection projects
- When finished the dike will, extend over the main part of municipality's coast from the northern border to the south beyond Køge harbour
- The aim of the project is to protect residential areas housing about 16.000 people and values for up to 3.9 bio. kr. in the coastal zone in case of flooding
- The costs for establishing the dike will be paid by the property owners where the highest payment load is put on the owners in the high risk zone
- The dike is expected to be finalised by the end of 2023

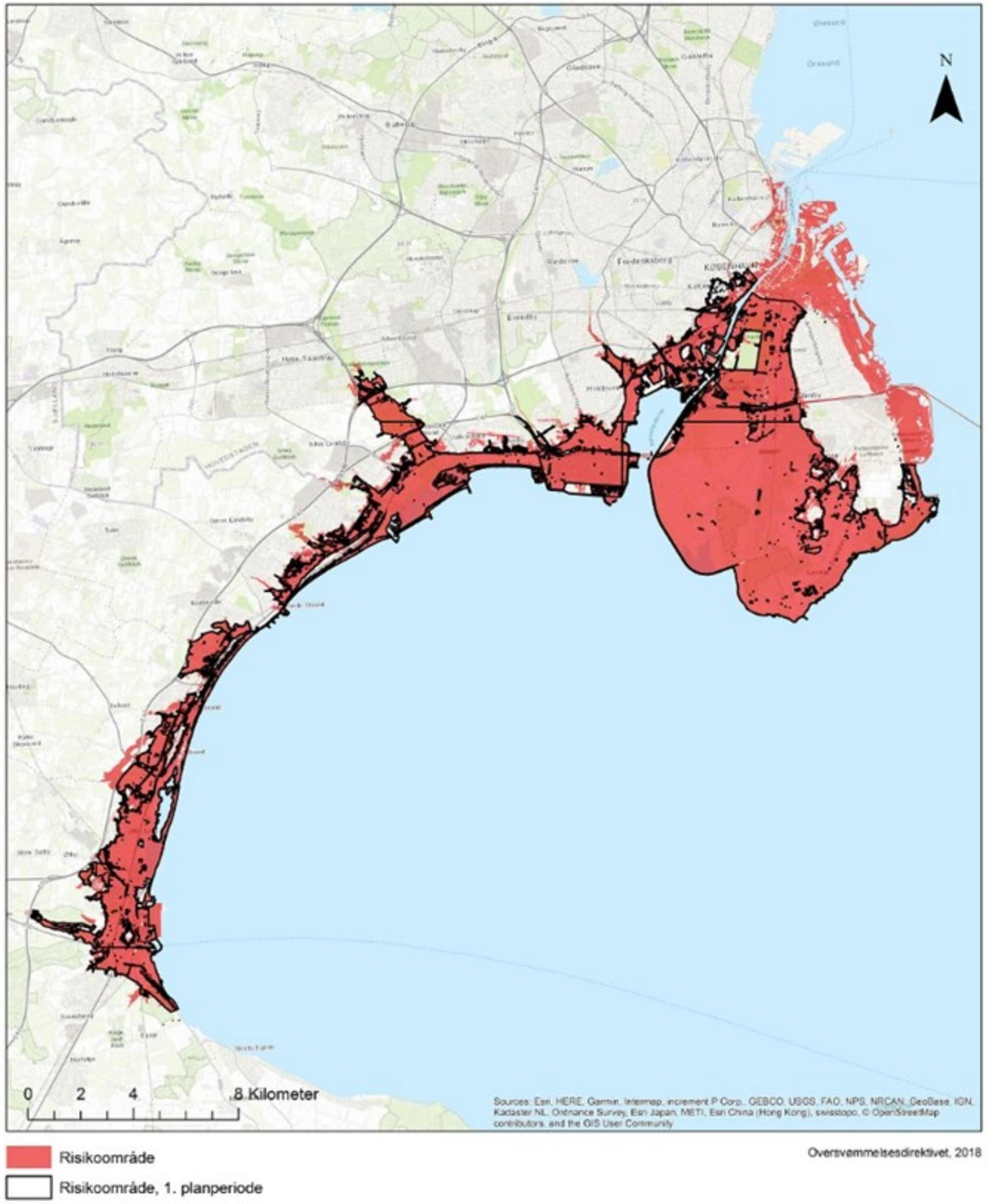

Signaturforklaring
Clay dike
High water wall
Sluice
Bicycle road
Område 1
Ølsemagle Strand
Ølsemagle
Lynghuse
Ølby Lyng
Køge
Ølsemaglevej
Nylandsvej
Egedesvej
Åmarken
Cordozavej
Jersie Strandvej
Nordstjernen
Køge Nord St
Ølby St
Lykkebækvej
Tigervej
Norsvej
Stenbjerg
Vestergade
Arctic Kaj

Køge dike

Regional collaboration

- Strong collaboration with neighbouring municipalities are needed for successful adaptation measures
- Particular flooding protection requires collaboration because water does not stop at borders between municipalities
- In 2011 the land around Køge Bay was designated as risk area for flooding according to the EU Floods Directive
- Due the common challenges and risk a close collaboration between the municipalities is established

Afgrænsning af Risikoområde Køge Bugt - København



Local contributions to mitigating climate change

- While protection against sea level rise or heavy precipitation events are easy to understand and having a direct impact at the local level, mitigation is more complicated

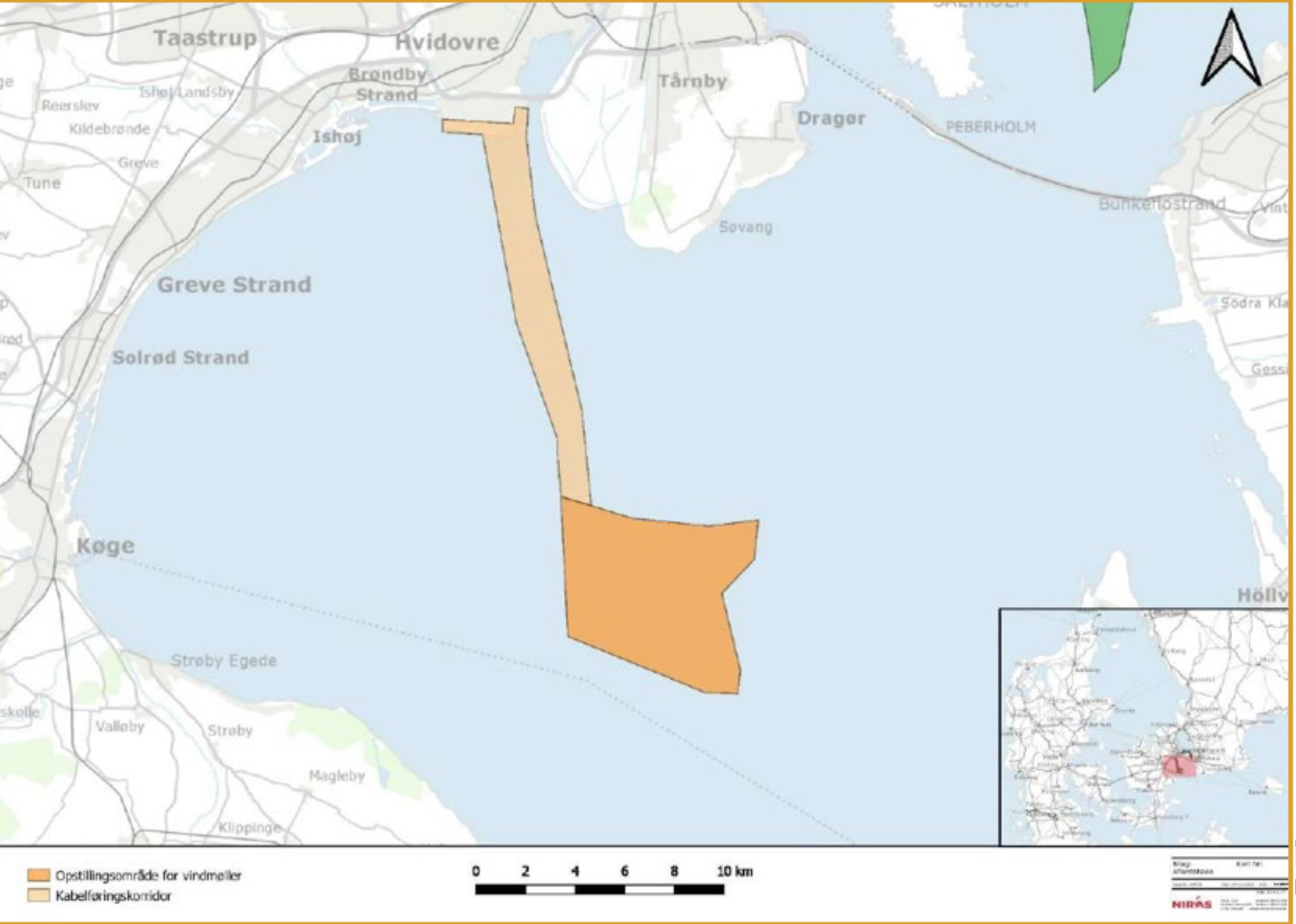
- First global efforts are needed – your local efforts are of limited use if the biggest CO2 emission countries like USA and China do not deliver on the required emission reductions

- However, the EU Commission have set very ambitious reduction goals to at least 55% below 1990 levels by 2030 and some member states have defined even heavier cuts – e.g. Denmark with 70% by 2030 compared to 1990

- This requires major changes in the way we live and consume

The role of spatial planning in climate change mitigation

- Spatial planning can contribute to reduced greenhouse gas emission in the following ways
  - Make reservations for wind turbine parks – land-based and offshore
  - Make reservations for solar panel parks
  - Take out lowland soils from agriculture
  - Improve and prioritise public transport



Aflandshage
wind park

300 MW
300,000 households

Solar panel parks

Issues to consider

– Cost - he initial cost of purchasing a solar system is fairly high

– Weather dependent

– Uses a Lot of Space

– Changes the natural landscape

– Can have mirroring effects on the neighbourhood

– Absorb energy increasing temperature locally


DK2020 KLIMAPLAN
REDUKTION AF DRIVHUSGASUDLEDNINGER
OG KLIMATILPASNING
CO_2-REDUKTION
VARMEFORSYNING
ELSYSTEM
LANDBRUG
MOBILITET
KLIMAVENLIGT FORBRUG
KLIMATILPASNING
GODKENDT
DK2020
AF C40 & CONCITO
Herfra til CO_2-neutralitet i 2050
KØGE KOMMUNE

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Exercise

Choose your own country or another country as an example

1. Describe briefly how climate change is addressed in the sptial planning in the chosen country:

- Responsibilities – national, regional, and local
- The legal framework
- Supporting tools available

2. Reflect on the challenges regarding the use of nature-based solutions for combined adaptation and mitigation efforts

THANK YOU FOR YOUR ATTENTION

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