Climate change, impacts and vulnerability in Europe
EU climate change adaptation policy

- **EU Strategy** on Adaptation to Climate Change *evaluation* by European Commission in 2017/2018
- Member States ‘**Adaptation preparedness scoreboard**’ to be prepared by European Commission
- **Mainstreaming** in many relevant EU policies
- Reflect on changes needed due to the Paris agreement

**EEA supports** the evaluation through products and services

Minimum of 20% of EU funds for climate action
EEA products and services on climate change impacts, vulnerability and adaptation

Impacts and vulnerability

National adaptation

Urban adaptation

Sectoral adaptation

2017: Climate change adaptation and disaster risk reduction

All supported by a European Topic Centre, see: http://cca.eionet.europa.eu/
**Input to evaluation of EU adaptation strategy**

- **More than 60 authors and contributors:**
  - European Environment Agency (coordinator)
  - European Topic Centres
  - JRC, WHO, ECDC
  - Other organisations

- **Content:**
  - 35 indicators (past trends and projections)
  - Multi-sectoral vulnerability and risks
  - Global and European policy context
  - Development of the adaptation knowledge base

- **Data sources:**
  - International databases and reports
  - European research projects and data centres
  - Academic publications

- **External Advisory Group and external reviews**
  - Experts, European research projects, EEA scientific committee
  - Commission services
  - Member countries
What is new in the 2016 EEA CCIV report?

- **All key findings from the 2012 EEA CCIV report are still valid**
- Several long-term climate ‘records’ (e.g. global and European temperatures, global sea level, Arctic sea ice).
- More observations of wide-ranging impacts on ecosystems, economic sectors and human health.
- Improved attribution of observed changes in extreme weather events to global climate change (e.g. observed increase in heavy precipitation).
- Improved attribution of observed impacts to climate change (e.g. disease outbreaks, migration of tree species, establishment of invasive species).
- More knowledge on projected future increases of climatic hazards (e.g. heat waves, droughts, top wind speeds, storm surges) and their impacts.
- Increased knowledge and awareness of Europe's vulnerability to climate events outside Europe (e.g. droughts as one of the triggers for conflict and population displacement).
Climate change is breaking records globally and in Europe

**Global temperature**
(1850–2015/16)

2016: 1.1–1.3 °C above pre-industrial level

**European land temperature**
(1850–2015)

Sources: HadCRUT4 (Met Office), NOAA Global Temp, NASA GISTEMP
Melting of polar ice sheets is speeding up sea level rise

### Cumulative ice loss

**Greenland**

**Antartica**

### Global mean sea level

(1880–2015)

Sources:
Shepherd et al. (2015),
Church and White (2011),
Masters et al. (2012)
Differences between wet and dry regions will further increase

Precipitation
(projected change for 2080s, RCP8.5)

Source: EURO-CORDEX (Jacob et al., 2014)
Meteorological droughts are increasing in southern Europe.

Drought frequency (trend for 1950–2012)

Drought severity (trend for 1950–2012)

Source: JRC (2016)
European seas are rising, warming and acidifying; oxygen-depleted ‘dead zones’ are expanding

Relative sea level (1970–2014)

Sea surface temperature (1870-2015)

Ocean ‘dead zones’ (Baltic Sea, 1906–2012)

Ocean acidification (1988-2014)

A decreasing pH value implies increasing acidity

Source:
- Carstensen et al. (2014)
- Updated from Dore (2012)
- PSMSL (2016)
- HadISST1, CMEMS
Many extreme weather events are getting stronger

**Exceptionally warm days** (1960–)

- Exceptionally warm days (1960–2015)
- Source: EURO-CORDEX (Jacob et al., 2014)

**Heavy daily precipitation** (projected change for 2080s, RCP 8.5)

- Heavy daily precipitation (1951–2013)
- Source: HadEX2 (Donat et al., 2013)

**Heavy daily precipitation** (projected change for 2080s, RCP 8.5)

- Heavy daily precipitation (1951–2013)
- Source: Fischer & Knutti (2016)

- Source: EURO-CORDEX (Jacob et al., 2014)
Ecosystems are changing in response to climate change – but most species cannot follow the pace of climate change

Change in bird and butterfly communities

(community temperature index, 1990–2008)

9490 bird communities:
37 km „northward“ on average

2130 butterfly communities:
114 km „northward“ on average

Climate zones:
250 km northward

Abundance of bird species in Europe
(1980–2010)

CST+:
Species expected to respond positively to regional climate change → no trend

CST-:
Species expected to respond negatively to regional climate change → declining trend

Source:
Devictor et al. (2012)

Source:
Stephens et al. (2016)
Climate change threatens agriculture and forests – Southern Europe is most affected

**Yield of three staple crops**
(projected change for 2050, A1B)

Source: Iglesias et al. (2012), Ciscar et al. (2011)

**Forest fire risk**
(projected change for 2080s, A1B)

Source: JRC (Camia, 2012)
Increasing floods are threatening human lives

‘Very severe’ inland floods in Europe
(1980–2010)

Deaths from flooding


Source: WHO (2016), EMDAT (2016)
Extreme climate events are costly and life-threatening

Impacts of extreme events in EEA member countries
(climate-related and geophysical hazards; 1980–2015)

Fatalities
114,807

Total economic losses
EUR 520 billion (2015 prices)

Insured losses
EUR 155 billion (2015 prices)

Source: Munich RE NatCatSERVICE
There is no clear trend in the overall economic losses from extreme climate events – but losses from convective storms are increasing.

Economic losses from extreme events in EEA member countries (1980–2015)

Source: Munich RE NatCatSERVICE
Climate change is facilitating the spread of infectious diseases

**Vibrio infections**
(Baltic sea region, 1983–2010)

Source: Baker-Austin et al. 2012

**West Nile fever**
(observed, 2014)

Source: ECDC (Semenza et al. 2014)

**West Nile fever**
(projected, 2050)

Source: ECDC
The energy sector is crucial for climate change mitigation – but it also needs to adapt to climate change

**Cooling degree days** (trend for 1981–2014)

CDD: Cooling degree days

Source: JRC (Spinoni et al. 2015)
Climate change is affecting all European regions – but adaptation needs differ across regions

**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

**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

**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

**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

**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
Europe is also vulnerable to climate change impacts outside Europe

**Trade (non-agricultural commodities)**
- Risks for raw materials supply
- Risks for manufacturing industry
- Arctic sea transportation

**Trade (agricultural commodities)**
- Global food price volatilities
- Reliability of supply and distribution

**Infrastructure**
- Risks for energy supply
- Vulnerable energy infrastructure
- Transportation network disruptions

**Human mobility**
- Changing tourism flows
- Climate-induced migration
- Critical role of Africa

**Geopolitical risks**
- Climate and armed conflict
- Climate and security strategies
- Rights and access to Arctic resources

**Finance**
- Economic repercussions due to extreme events
- Insurance systems

Source: EEA (2016)
Climate change will continue throughout the century – ambitious mitigation is required to limit the long-term risks.

Increase in temperature

Change in precipitation

Ambitious mitigation scenario (RCP2.6)

High emissions scenario (RCP8.5)

Source: IPCC (2013)
National adaptation policy processes in Europe (updated 2017)

- **Voluntary reporting** by countries to the Commission and EEA end 2016/early 2017

- Information included on **Climate-ADAPT country pages**

- 23 EU MS and 3 EEA member countries have a **national adaptation strategy** and 13 and 2 respectively also have **action plans** (national and/or multi-sectoral)

- Some countries are in the **implementation stage**

- Some countries have systems for **monitoring and reporting** in place, but few have performed **evaluations**

- **Providing information and mainstreaming** in sectors are the most reported policies

- **Main policy drivers**: extreme weather events and damage costs, EU policies, research

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- White: No policy
- Green: National adaptation strategy (NAS) in place
- Green with white: National adaptation strategy (NAS) and national and/or sectoral adaptation plans (NAP/SAP) in place
- *: National Adaptation Strategy (NAS) updated

Note:
- 2017 (1) information last updated April 2017
Cities have started to act (1)

- **Knowledge** on CC impacts, vulnerability and adaptation options **has rapidly increased but many cities**, especially smaller, **lack the capacity** to access knowledge and select appropriate available tools.

- **Adaptation has started** in many cities; mainly at planning stage, implementation in few cases by front-runner cities.

- **Low cost and ‘soft’ solutions** are predominant – cities are coping with climate variability or making incremental changes.

- **Public funds** for adaptation measures are **difficult to find**.

- **Integrating climate adaptation** requirements when replacing old or building new infrastructure for basic services **will save money** in the long term.
Cities have started to act (2)

- Highlighting **ecosystem-based measures** (‘green infrastructure’), with multiple benefits (e.g. nature protection, recreation, adaptation). These can **increase** the **chance of securing funding**

- **Few cities** recognise the **need for transformative adaptation** – a long-term, systemic approach – to anticipate future climate impacts and other changes

- **Key new EU initiative Global Covenant of Mayors for Climate and Energy** provides support (as well as city networks)
For info or further questions on this seminar and the activities of the JASPERS Networking Platform, please contact:

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