OPERANDUM

# Nature-based Solutions for hydro-meteorological hazards

NbS Concepts and Approaches

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EU funded project
GA no. 776848

# Learning objectives

*This lecture is devoted to understand:*

- NbS definition
- The climate change context
- How NbS could be applied to manage HMH
- How OPERANDUM Open Air Laboratories test NbS solutions to manage HMH
- The benefits and value of NbS in tackling HMH



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# What are Nature-based Solutions (NbS)?

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## By the European Commission:

*"Solutions that are inspired and supported by nature, which are cost-effective, simultaneously provide environmental, social and economic benefits, and help build resilience. Such solutions bring more, and more diverse, nature and natural features and processes into cities, landscapes and seascapes, through locally adapted, resource-efficient and systemic interventions."*

## By the IUCN:

*"… actions to protect, sustainably manage and restore natural or modified ecosystems, which address societal challenges (e.g., climate change, food and water security or natural disasters) effectively and adaptively, while simultaneously providing human well-being and biodiversity benefits."*

## By the UN Environment (2022)

*"… actions to protect, conserve, restore, sustainably use and manage natural or modified terrestrial, freshwater, coastal and marine ecosystems, which address social, economic and environmental challenges effectively and adaptively, while simultaneously providing human well-being, ecosystem services and resilience and biodiversity benefits."*




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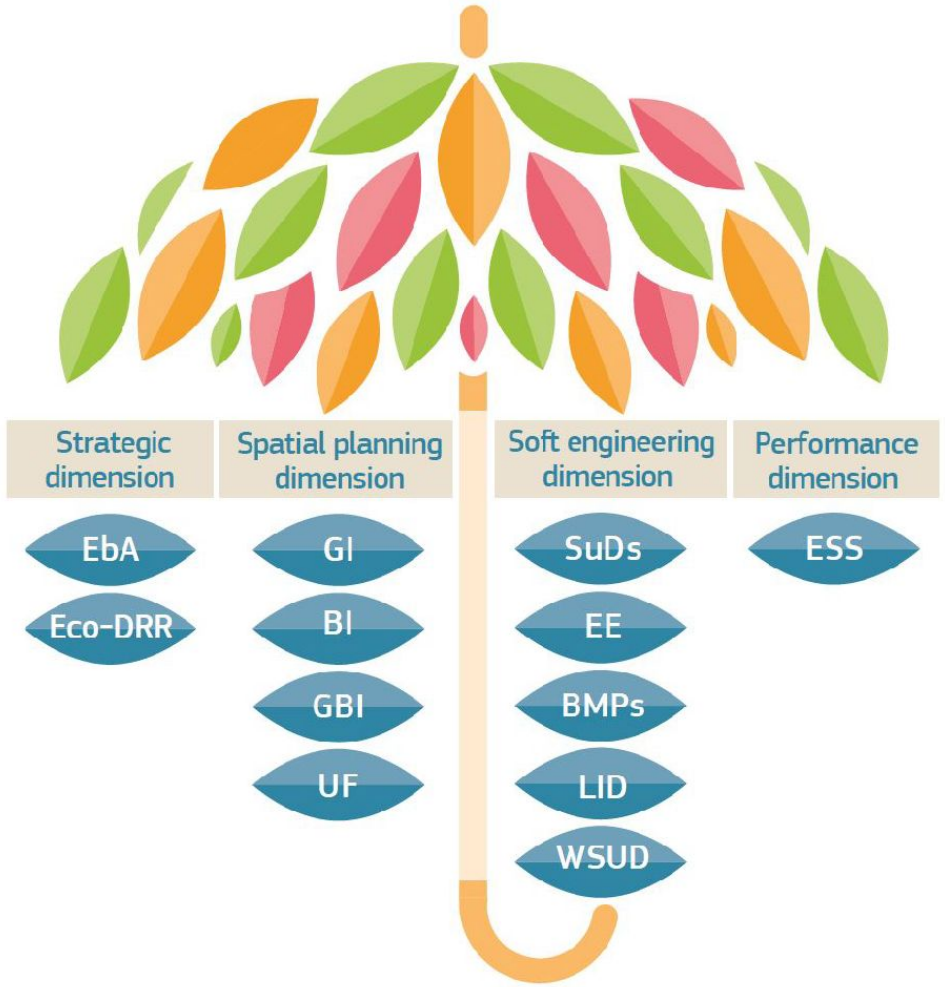
# NbS concept & broad definitions




**Nature-based solutions as an umbrella concept** (retrospectively looking) and the relation of NBS to key existing concepts.

**EbA** = ecosystem based adaptation;
**Eco-DRR** = ecosystem-based disaster risk reduction;
**GI** =green infrastructure;
**BI** = blue infrastructure;
**GBI** = green-blue infrastructure;
**UF** = urban forestry;
**SuDS**= sustainable urban drainage systems;
**EE** = ecological engineering;
**BMPs** = best management practices;
**LID** = low-impact design;
**WSUD** = water-sensitive urban design;
**ESS** = ecosystem services.

*Source: European Commission, Directorate-General for Research and Innovation, Evaluating the impact of nature-based solutions : a handbook for practitioners, Publications Office of the European Union, 2021, https://data.europa.eu/doi/10.2777/244577*



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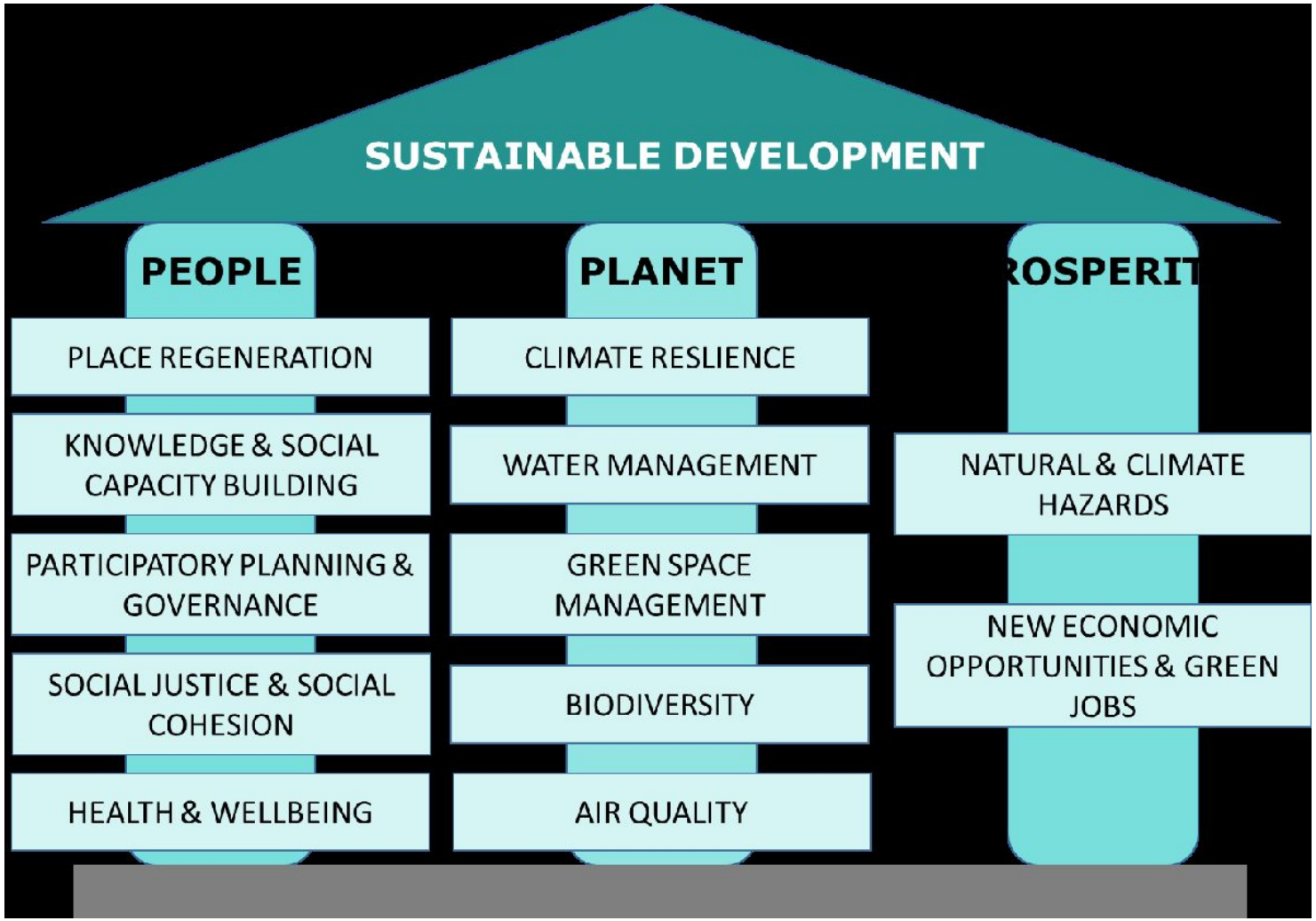
# Sustainable development & NbS



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# What are hydro-meteorological hazards and risks?

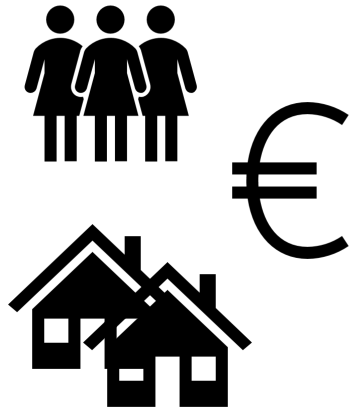
**Hydro-meteorological hazard (HMH)**

*Naturally occurring global meteorological/climatological/ hydrological events (for example: drought, flood, storm surge, landslide).*

X

**Exposure**

*People and value of assets present at the time of the hazard*



X

**Vulnerability**

*The extent of an individual, social, or ecological degradation arising from the hazard*

=

**Hydro-meteorological risk (HMR)**

*The sum of all estimated negative consequences from the hazard*

IPCC AR6 WG2 Glossary: *Vulnerability* = The propensity or predisposition to be adversely affected. Vulnerability encompasses a variety of concepts and elements including sensitivity or susceptibility to harm and lack of capacity to cope and adapt



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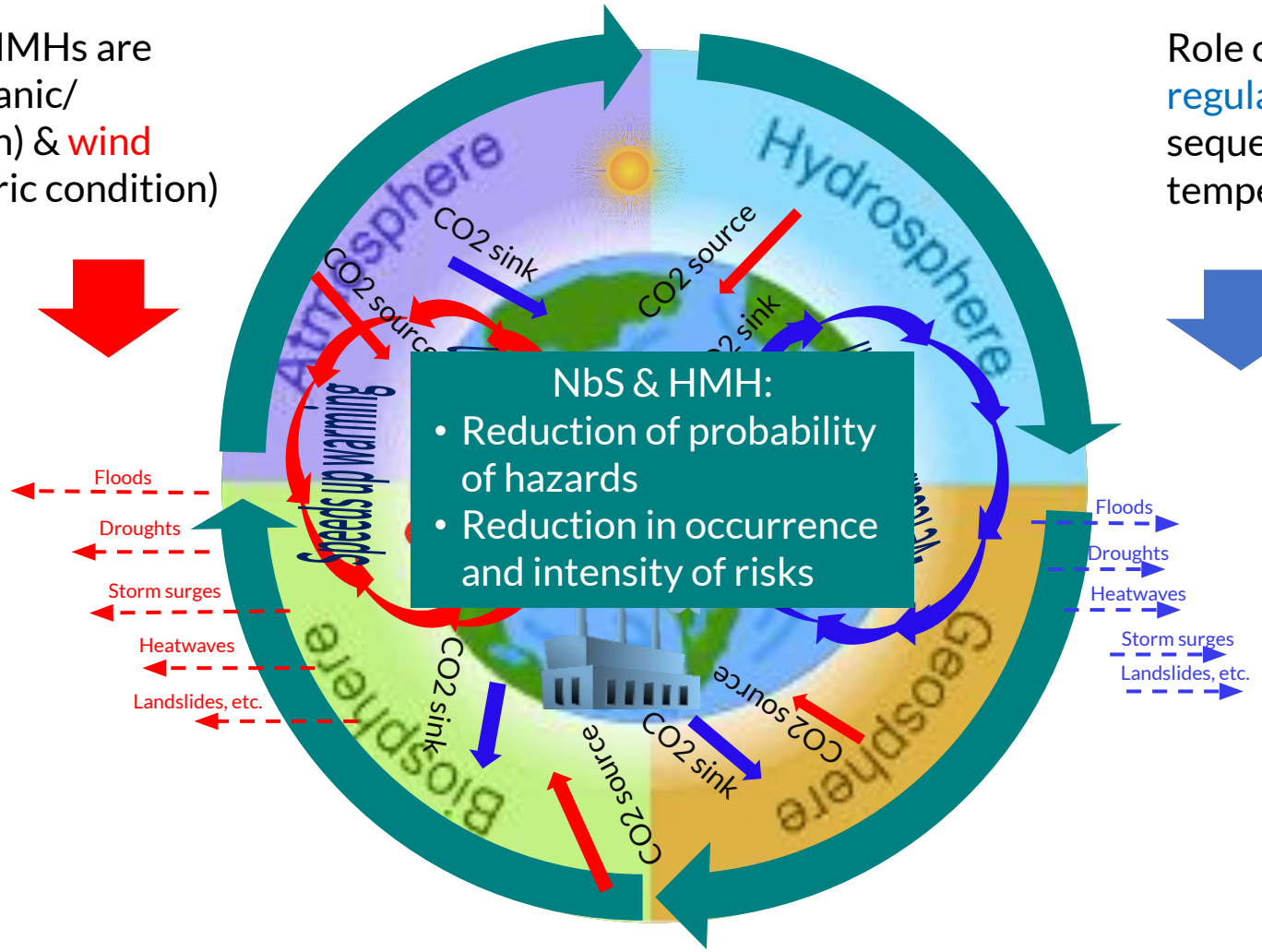
# NbS & Hydro-Meteorological Hazards (HMH)

Primary causes of all HMHs are water (anomalous oceanic/ hydrospheric condition) & wind (anomalous atmospheric condition)

**Triggering natural hazards**




Role of Nature-based Solutions is climate regulation (carbon sequestration, humidity, and temperature)

**Regulating natural hazards**

Background figure : https://www.tes.com/lessons/bLat7mY87gnzLQ/earth-systems



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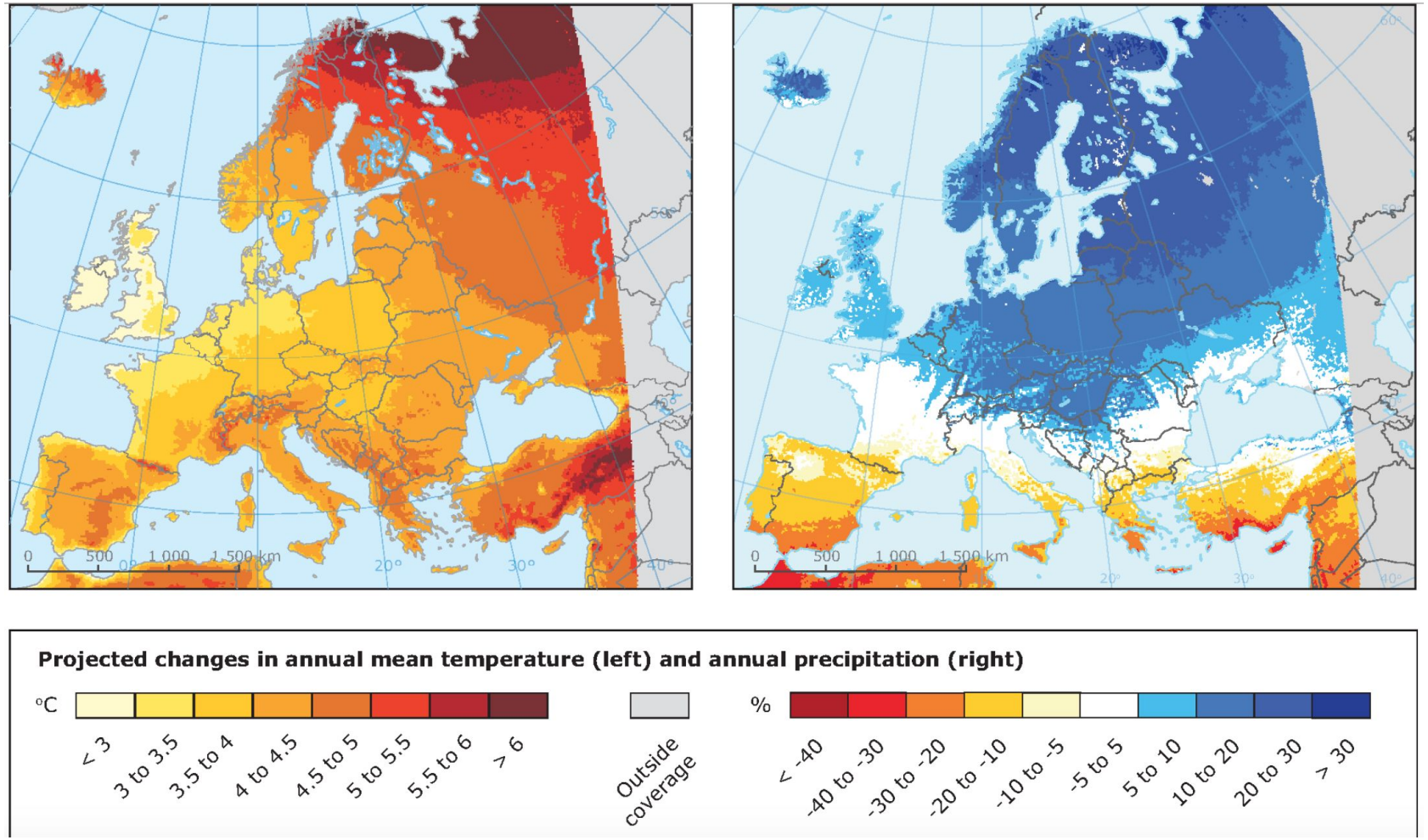
# What are the expected hazards associated to expected warming?



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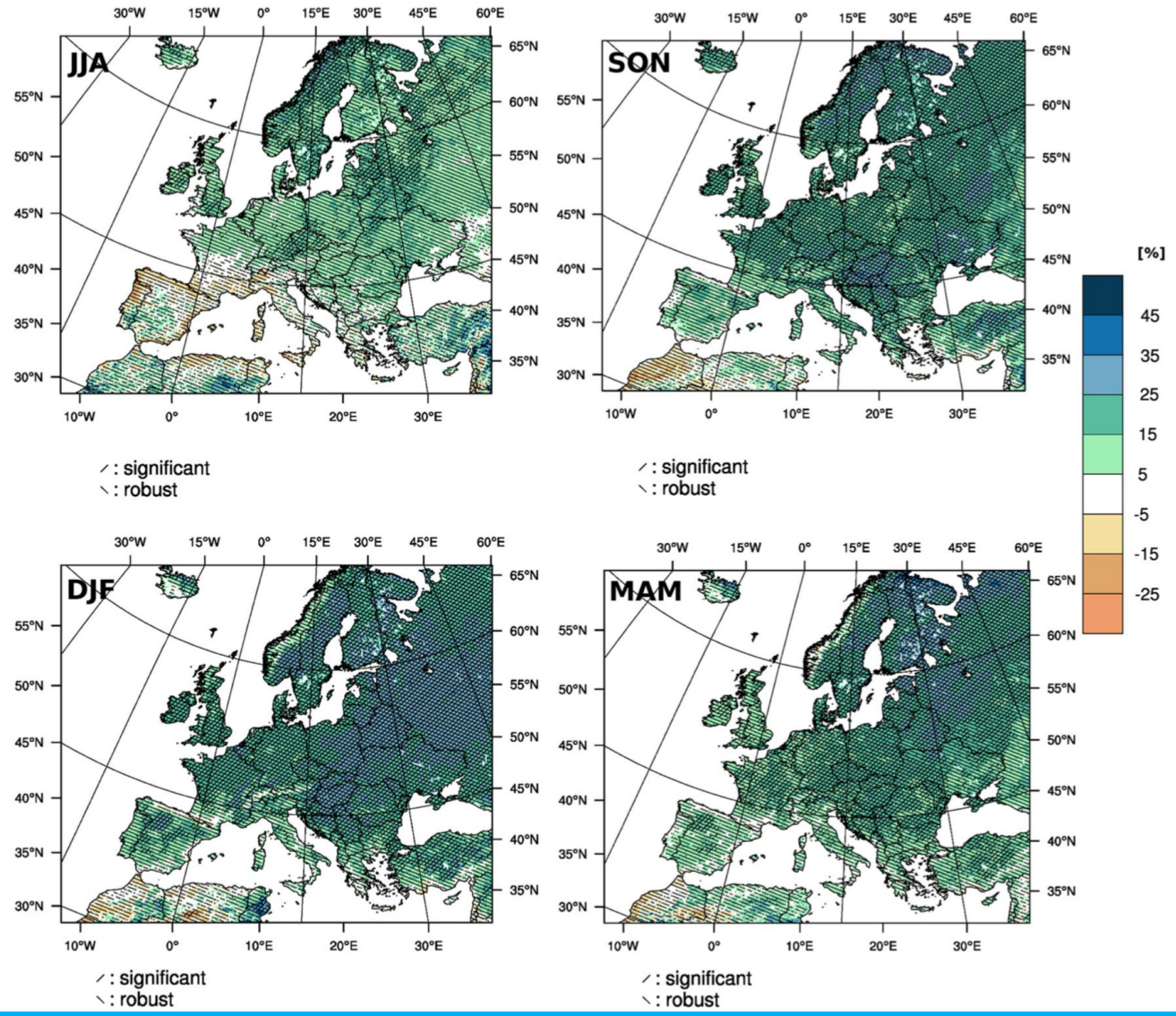
# Hazard: precipitation extremes in Europe




Projected seasonal Change of heavy precipitation (%) based on RCP8.5 scenario (2071-2100 vs 1971-2000)

Jacob et al., 2014



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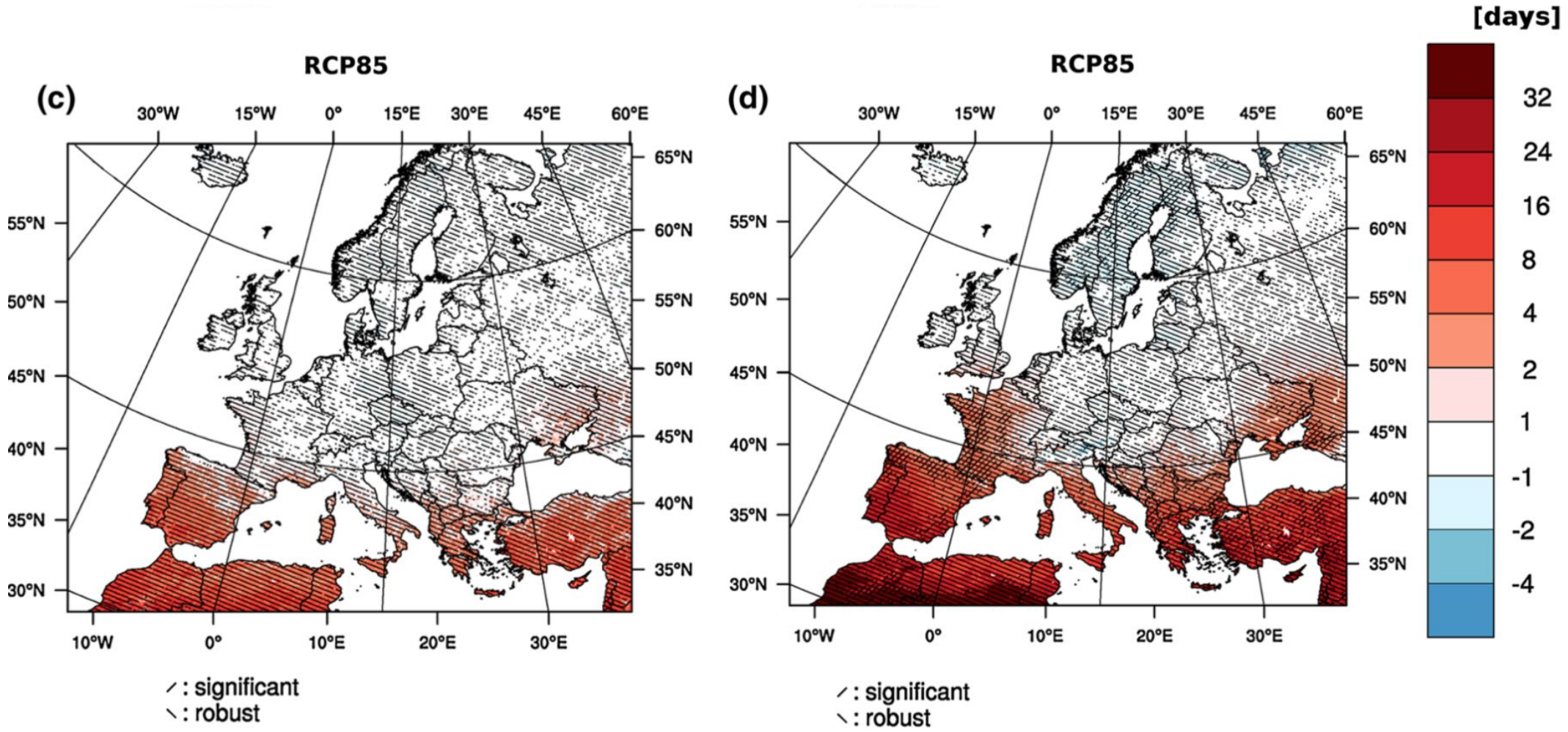
# Hazard: Drought extremes in Europe




Projected change in the length of dry spells based in RCP8.5 scenario

Jacob et al., 2014



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# Hazard: Heat waves from 1979 to 2019

Processing the maximum air temperature from ERA5 data to an European domain with spatial resolution of 0.25° between 1979 and 2019;

The total of **Heat Wave** events per year is computed from daily-averaged data as the 95$^{th}$ percentile of the 2-m maximum air temperature probability density function at each grid point (Stefanon et al., 2012)


***Fig.*** *Number of HW events per year from 1979 to 2019*

***Hazard:*** The probability density function is computed for each day (e.g., *D)* using the temperature data of the 30-year climatology between *D* − 10 days and *D* + 10 days. For example, to compute the 95th percentile on 10 August 2000 at a given grid point, we use the local temperature values between 1 and 21 August of the 30 years between 1979–2019. The same procedure is applied to each day of each year between 1979 and 2019

# Hazard mitigation & NbS approaches

**Intervention of natural hazards**

## Grey Approach

Hard, engineered structures. This approach includes all engineering structures, e.g., canals, pipes and tunnels of the drainage system; dikes; wastewater treatment plants, etc.

## Hybrid Approach

Combination of ecosystem elements and hard engineering interventions for addressing development and disaster risk reduction objectives.

## Natural Approach (Green/Blue)

Creation, protection or restoration of only ecosystem elements for addressing development and disaster risk reduction objectives.

**Nature-based Solutions (NbS)**



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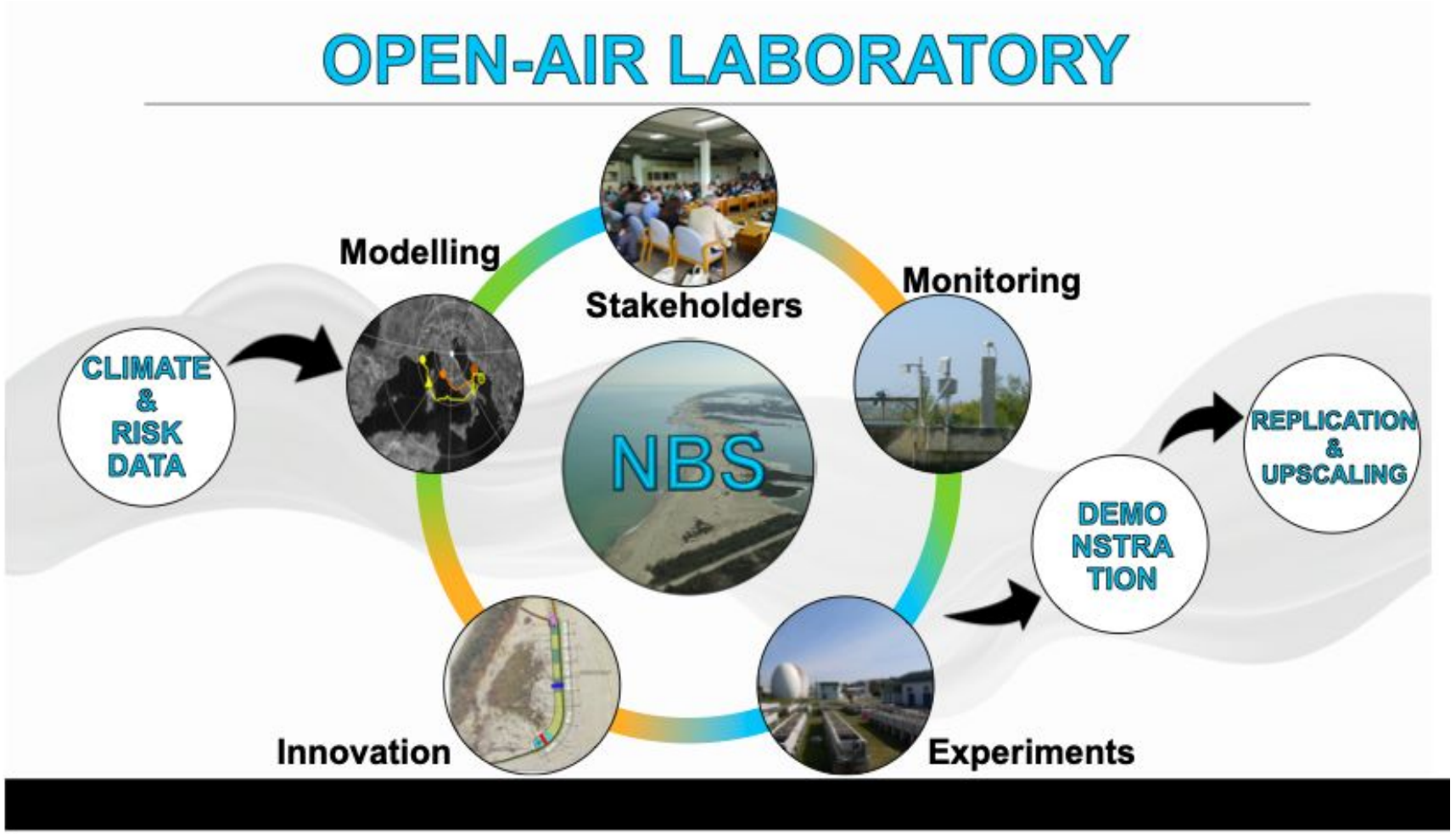
# The OPEN-AIR LAB concept




The Open-Air Laboratories (OALs) are 'living labs' where Nature-Based Solutions are **co-developed** and **demonstrated** with local stakeholders.

The OAL is an innovative approach to adaptation to climate change



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# Bringing Climate Science into the territory

CLIMATE & RISK DATA

## Climate information

Climate Change Service

climate.copernicus.eu

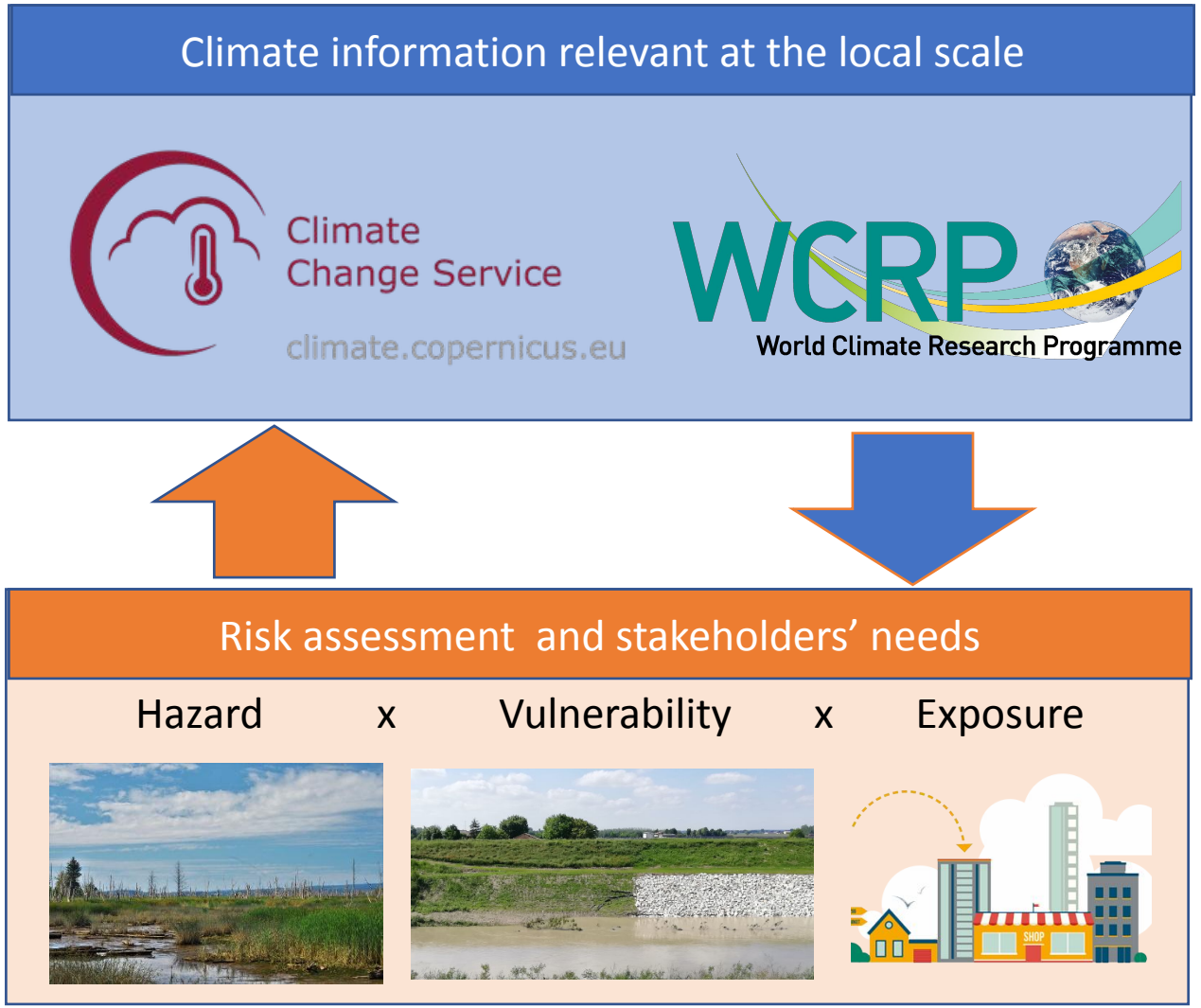
WCRP World Climate Research Programme

## Risk assessment and stakeholders' needs

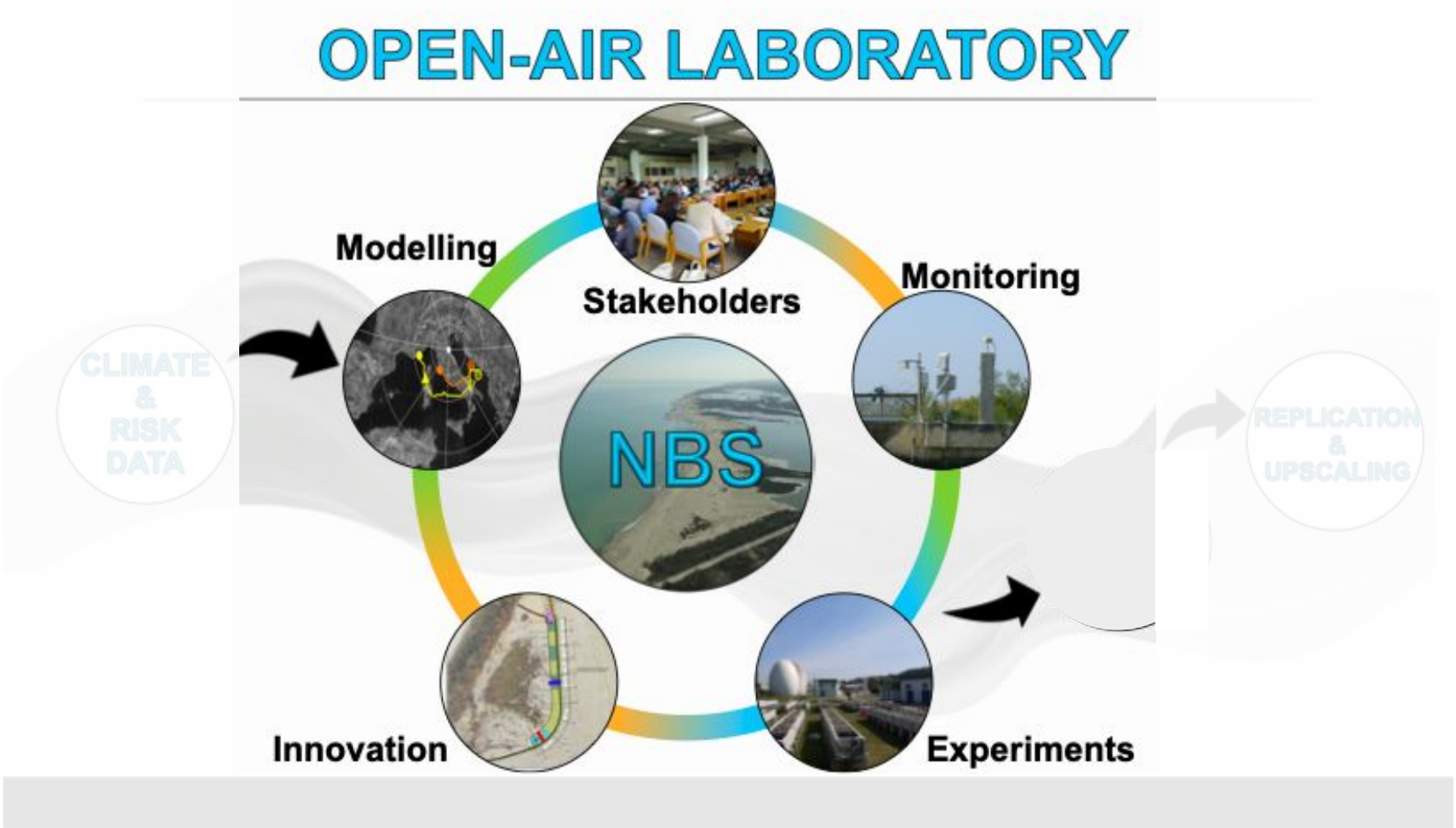
Hazard x Vulnerability x Exposure

# Bringing Climate Science into the territory

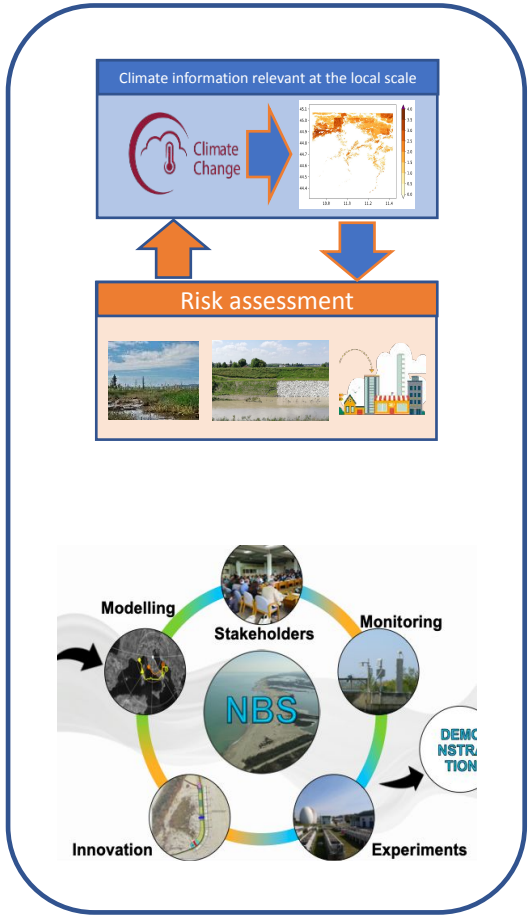
A bottom-up approach to climate risk that starts from the decision context and builds relevant information that is meaningful at the local scale



# The workflow of the OAL

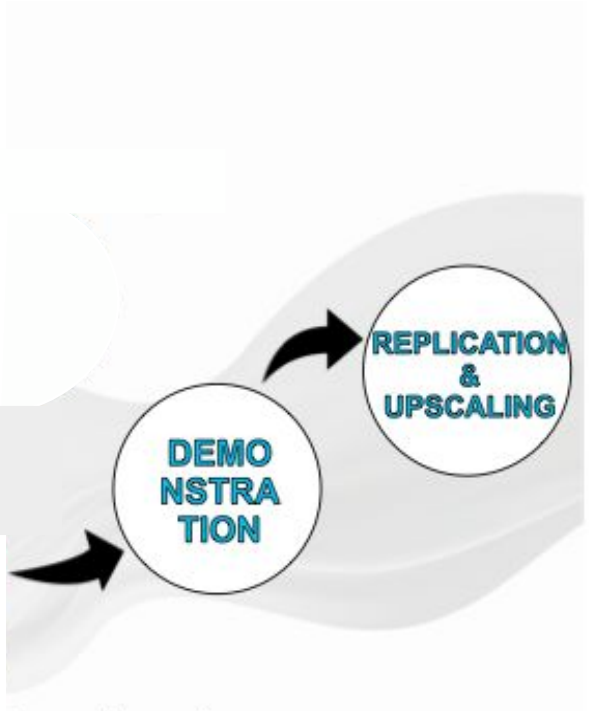


# Building the evidence and the methodology

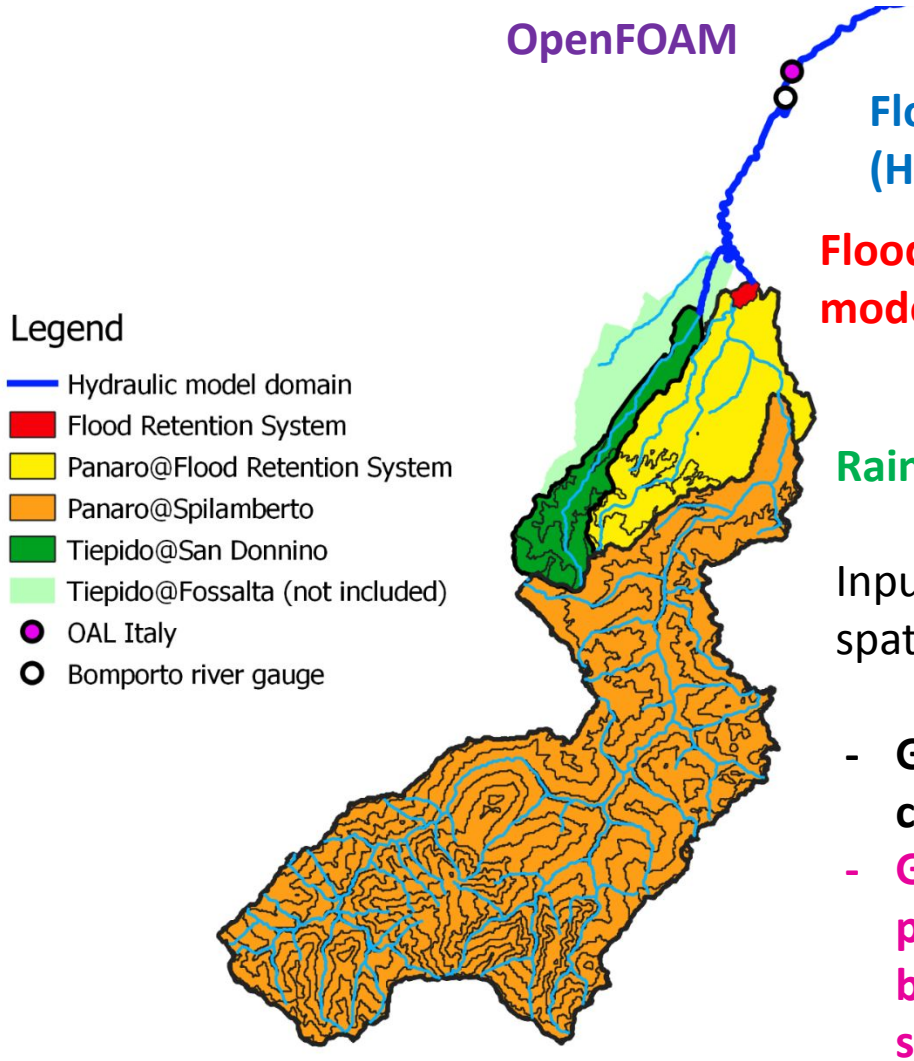



Evidence-based assessment

Integrated Knowledge



# Example of modelling chain




**OpenFOAM**

**Flow propagation modeling (HEC-RAS)**

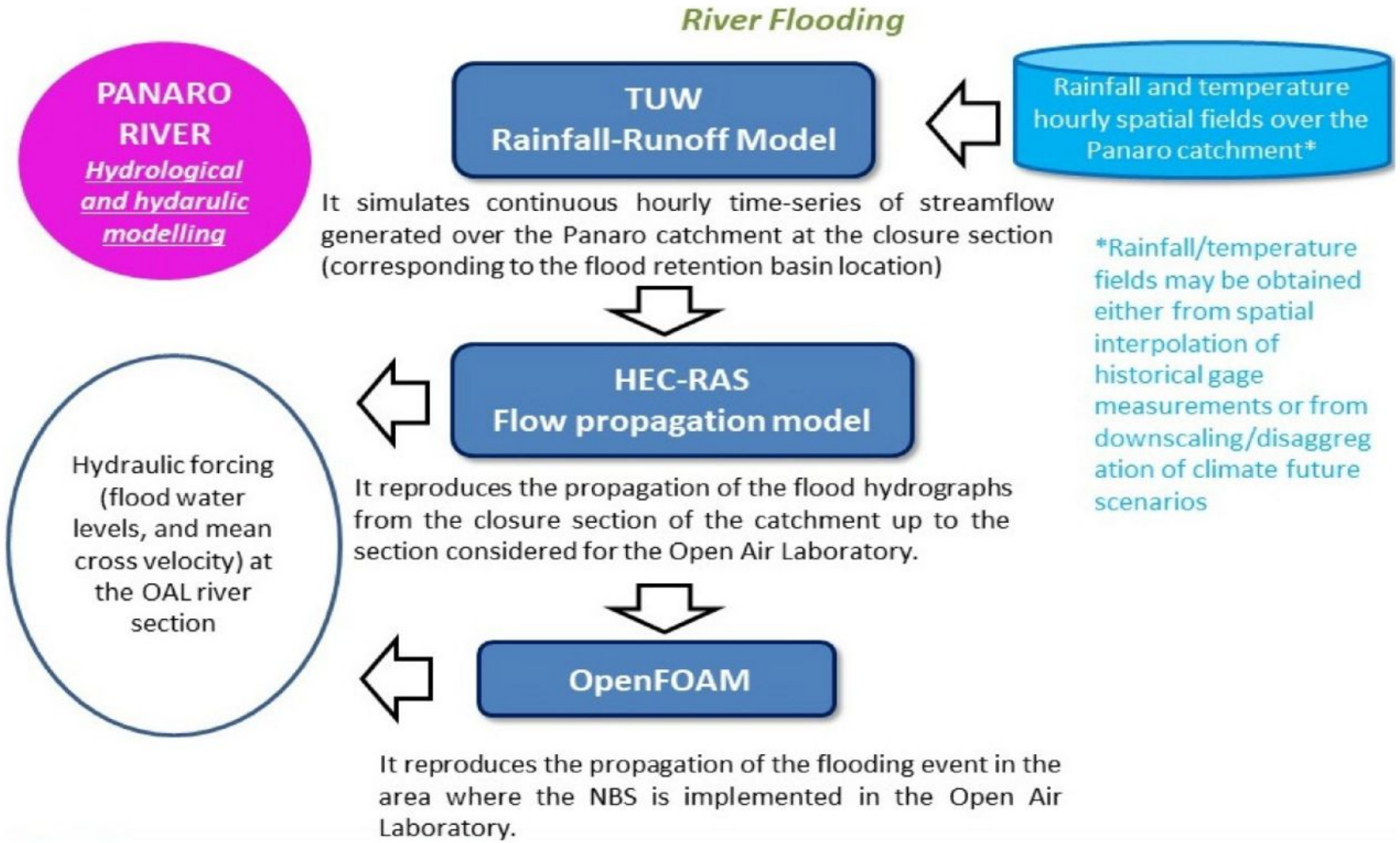
**Flood retention system modeling (in HEC-RAS)**

**Rainfall-runoff modelling (TUW model)**

Input: precipitation and temperature spatial fields:

- **Gauge observations (historical – control period)**
- **GCM-RCM modelling chains (control period and future climate): bias-correction of hourly climate series CMCC**

# Example of modelling chain



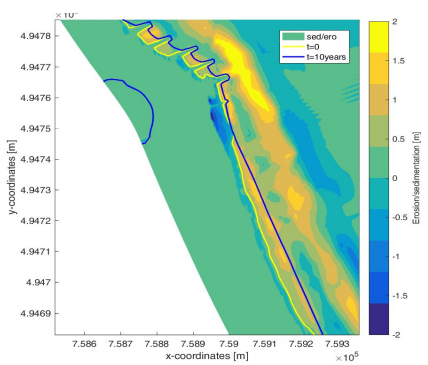

Modelling chain in the Panaro river

Source: Gallotti et al. 2020

# Challenge: evidence building

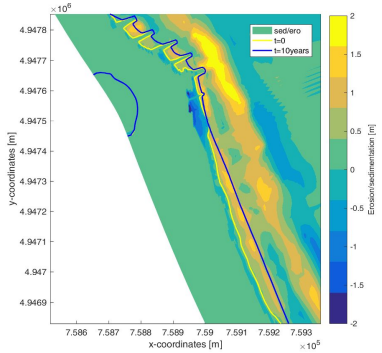
## Present scenario 2010-2019

### Run without NBS



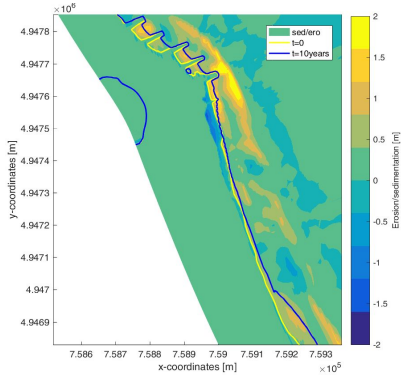

### Run with Dune

- 29%
benefit in reducing erosion behind the dune



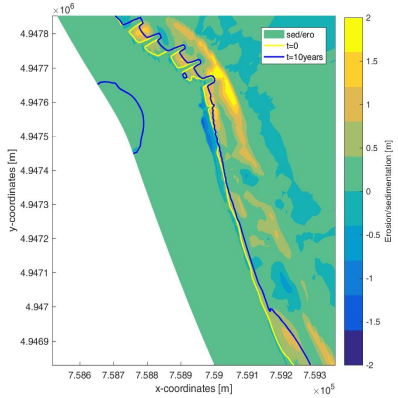

### Run with Seagrass

+100%
benefit in reducing erosion behind the dune



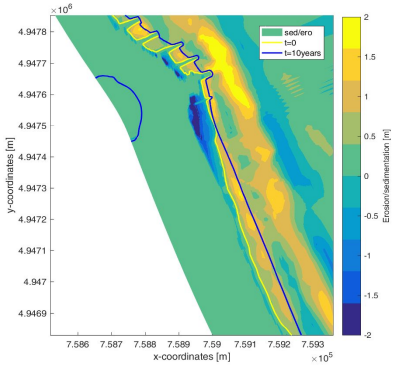

### Run with NBS integration

+100%
benefit in reducing erosion behind the dune



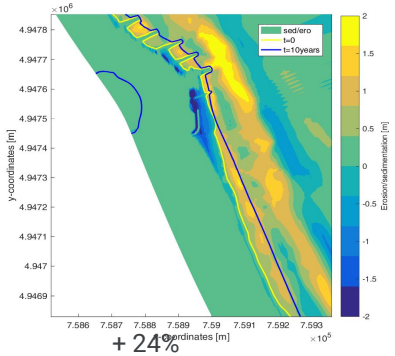

## Future scenario 2040-2049

### Run without NBS



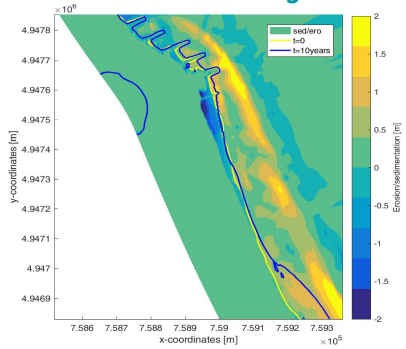

### Run with Dune

+ 24%
benefit in reducing erosion behind the dune



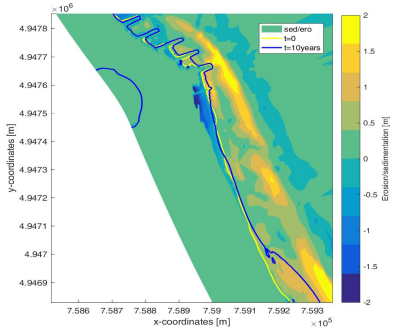

### Run with Seagrass

+93%
benefit in reducing erosion behind the dune




### Run with NBS integration

+88%
benefit in reducing erosion behind the dune



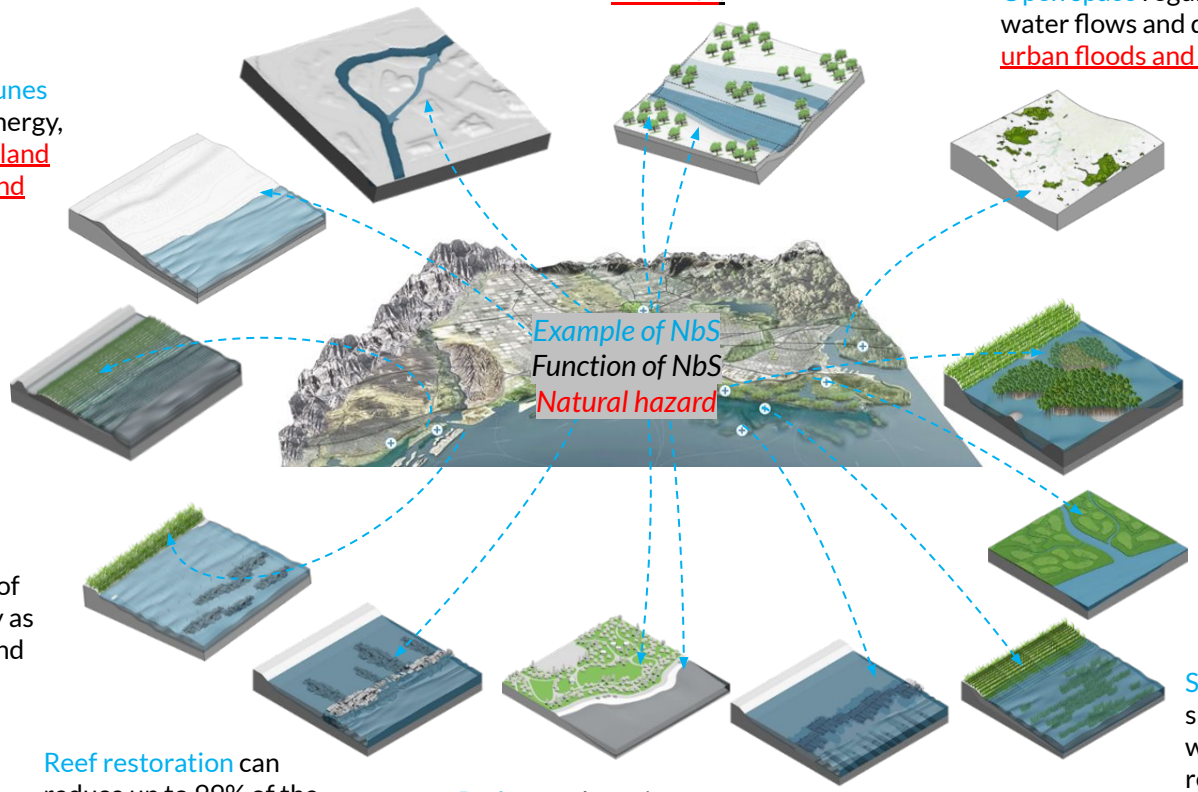
# Examples of Nature-based Solutions for HMH

Flood bypasses can redirect flood waters around a community without reducing the natural connectivity of a river and reduce riverine flood risk.

Floodplains vegetation's slow down and store floodwaters and reducing erosion and flood risk.

Open space regulate air and water flows and decrease urban floods and heatwaves

Beaches and dunes reduce wave energy, help prevent inland storm surges and associate risks.




Mangrove belt can reduce wave height by 13 to 66% and decreases storm surge, coastal flooding & erosion

Coastal habitats like marshes reduce wave energy and height & decreases storm surge and coastal flooding.

Coastal marshes can reduce storm waves heights by over 50%, decrease coastal flooding and erosion

Oyster reefs are reducing the energy of high-power waves by as much as 76 to 93% and decrease coastal flooding.

Seagrasses slowing down wave energy and reduce coastal erosion and landslides

Reef restoration can reduce up to 99% of the wave energy & reduces storm surge & coastal flooding.

Parks regulate air and water flows may ameliorate heatwave & flooding

Coral Reefs can reduce as much as 97% of total wave energy and decrease storm surge & coastal flooding



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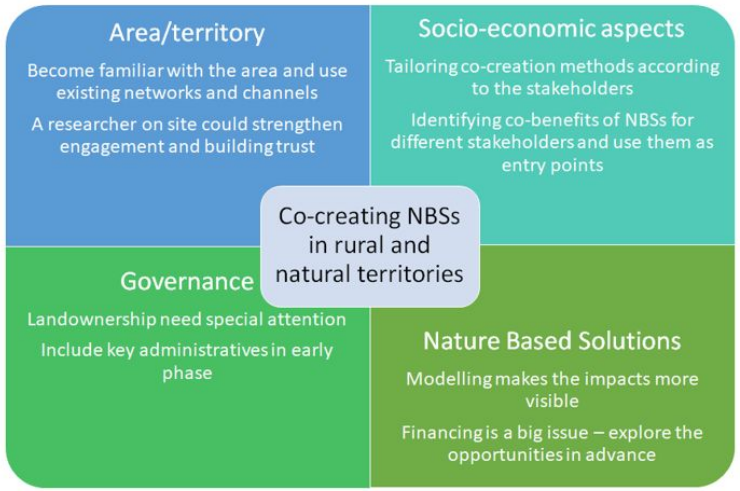
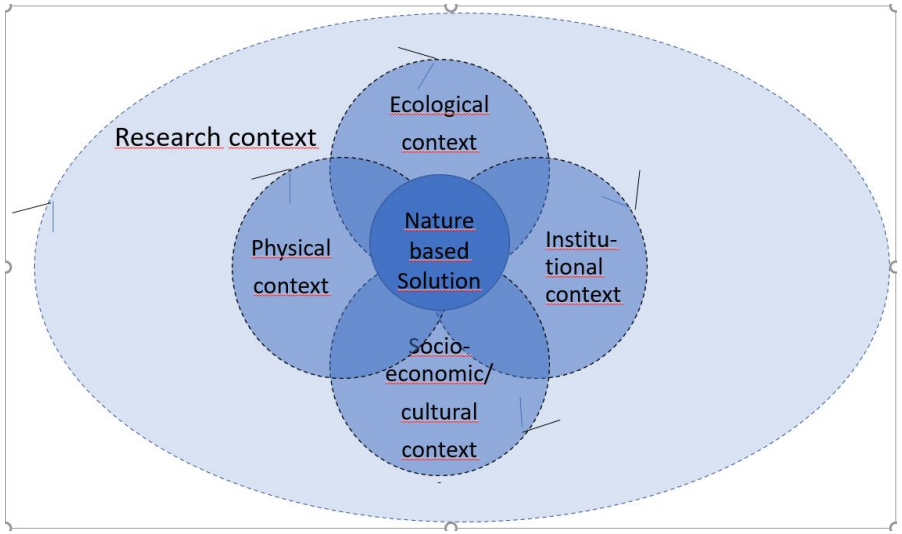
# NBS in rural territory




Rural – urban differences

- Visibility of the hazard and its social-economic impacts
- Space for NbS
- Physical proximity/accessibility of different types of stakeholders
- Institutional arrangements
- Participatory planning culture
- Added values and co-benefits

Soini et al. manuscript

# PUBLIC ACCEPTANCE

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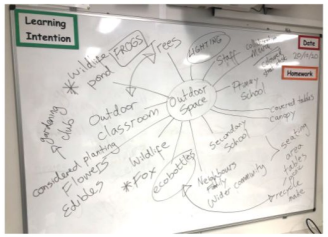
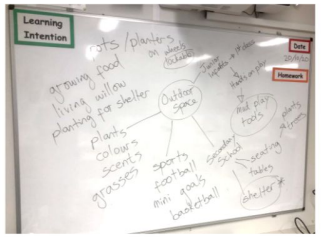
Long term impact:
make the citizens PART of the solution

**Co-design**
- Identifying the problem
- brainstorming ideas




Educate Together
primary and secondary schools




1

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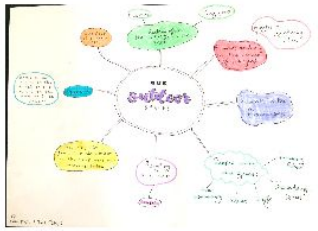
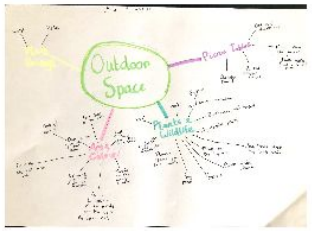
No tunnel vision:
create **INNOVATION** from the bottom-up

**Co-develop**
- Defining the solution(s) to be implemented
- Planning the solutions






2

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I hear, I know. I see, I remember.
I do, I **UNDERSTAND**

**Co-deploy**
- Implementing the solution(s)
- Testing the solution(s)


3

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Data as a **BRIDGE** between nature and people

**Co-monitor**
- Monitoring the solution(s)
- Citizen science



4

# Evidence building

## Supporting co-development phase of Nature Based Solution by combined use of Earth Observation and modeling

EGU21-14269

The combination between remote sensing (RS) data and modeling gives a screening to support the definition of the location and the dimension of artificial dunes to prevent coastal flooding.

Methods

**Historical storm surge events**: Literature review + meteo analysis

**Historical impacts:** Processing of remote sensing satellite data

OTSU –NDWI thresholding (Bangira et al, 2019)

**NBS Efficiency** Modeling of flood advancement from a water point

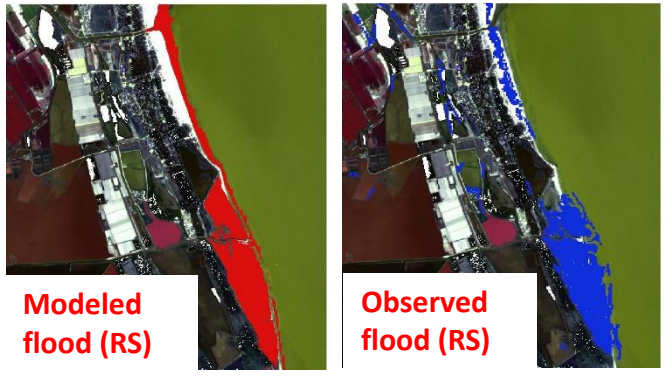
Coast-Def Model https://github.com/zdb999/coast-def

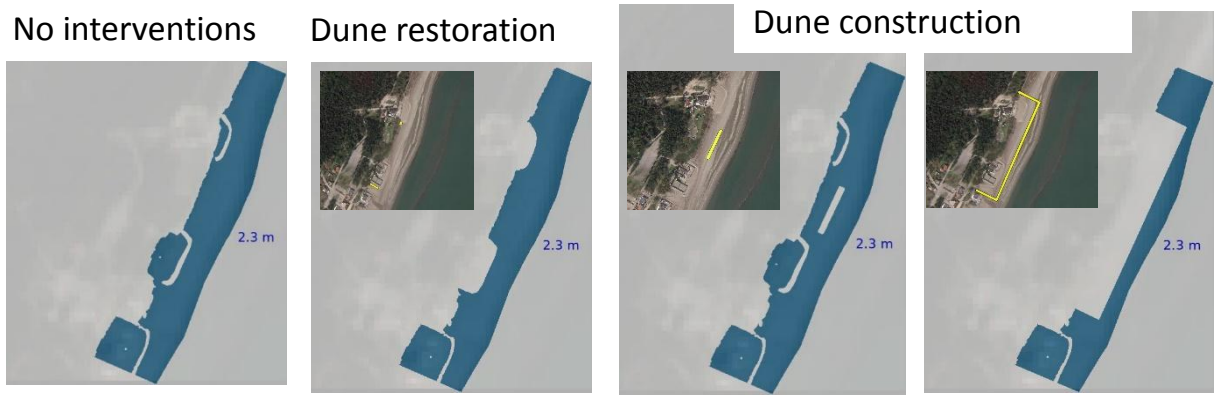
Digital Elevation Model

Multispectral images

Results

### Volano Beach




Dune height: 3 m

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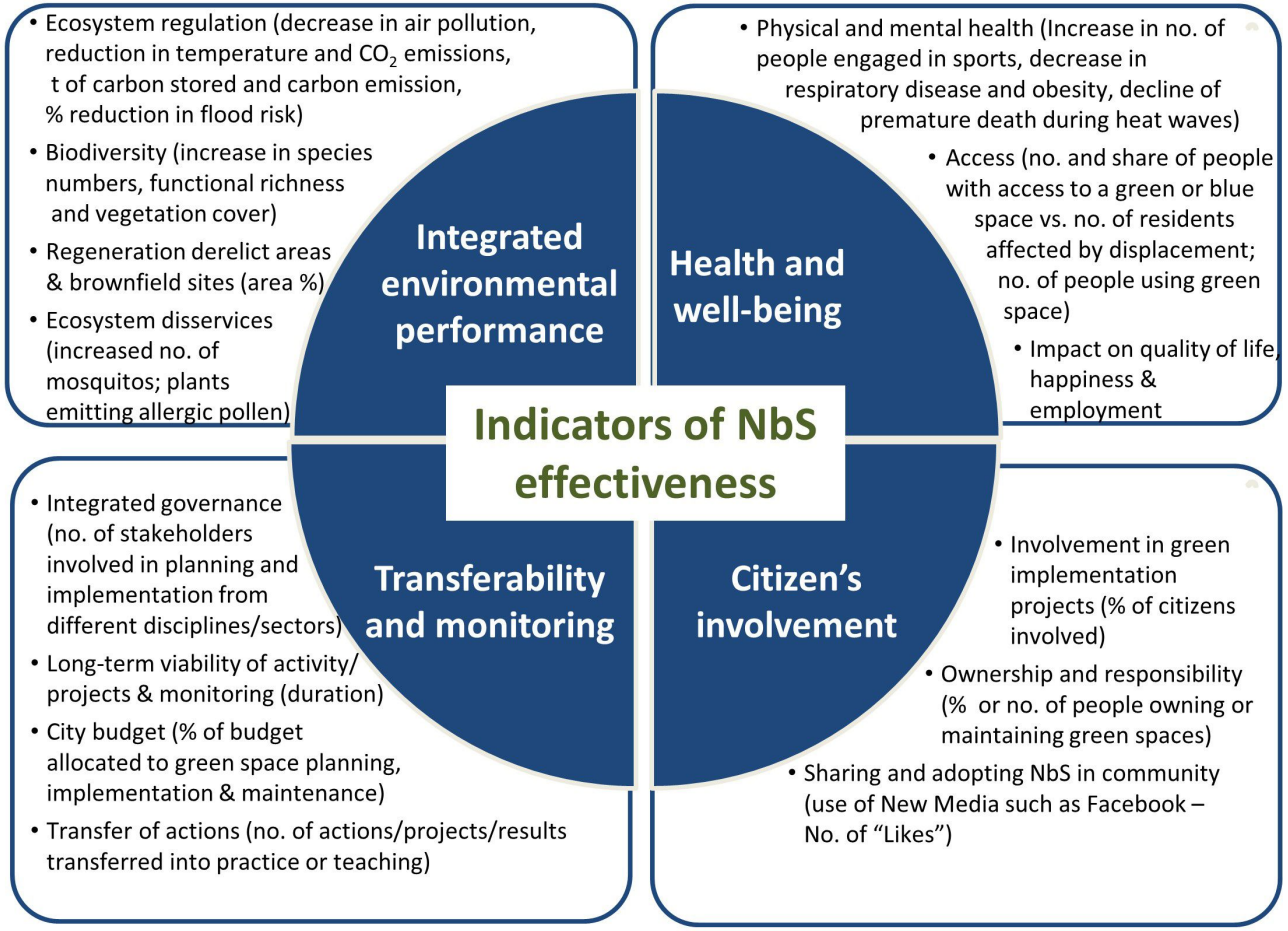
# NBS co-benefits

## Effectiveness of NBS for climate change adaptation & mitigation and associated co-benefits




*Kabisch et al. 2016. Ecology and Society 21(2):39.*



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# NbS approaches & benefits

**Intervention of natural hazards**

## Grey Approach

1. Expensive to build
2. Lack sustainability in a longer time frame
3. Their failure can have catastrophic impact
4. Single-objective oriented designs with limited co-benefits
5. Long term influences ecosystem

## Hybrid Approach

## Natural Approach (Green/Blue)

**Nature-based Solutions (NbS)**

1. Cost-effective and resource-efficient
2. Help build resilience and sustainability
3. Flexible and resilient with on-going urbanization and climate change
4. Multifunctional – they deliver manifold services at the same time
5. Environmentally friendly and systemic interventions



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# Nature-based Solutions & Hydro-Meteorological Hazards

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1) Nature-based Solutions are "… actions to protect, sustainably manage and restore natural or modified ecosystems, which address societal challenges". There are different approaches for Nature-based Solutions: Green/Blue (natural approaches), Hybrid (green/blue in combination with engineering).
*For example: Green roofs, river restoration*

2) Hydro-meteorological hazards are naturally occurring global meteorological / climatological / hydrological events (i.e. primarily caused by water and/or wind). These hazards turn into risks by considering exposure and vulnerability.
*For example: droughts, floods, storm surges, landslides, etc.*

3) Nature-based Solutions for hydro-meteorological hazards can decrease the probability of hazards, their occurrence and the intensity of risks.

*For example: Green roofs and walls to reduce flood and heat wave risks.*



Next up: *Why do we need Nature-based Solutions?*

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# Why do we need Nature-based Solutions?

1) The climate is changing, and this leads to more weather extremes (for example, higher temperatures, and changes in precipitation).

2) Demonstrating the efficacy is done using an OAL-based approach where hard science (monitoring and modelling are integrated) is re-interpreted using outcome from the soft science perspective (acceptance and social innovation)



**Next up:** *Nature-based Solutions benefits, performance and value*

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# Nature-based Solutions benefits, performance and value

1) Compared to grey solutions, nature-based solutions are cost-effective and resource-efficient, help build resilience and sustainability, flexible and resilient with on-going urbanisation climate change, multifunctional, and environmentally friendly and systemic interventions.

2) Nature-based solutions are implemented to reduce hydro-meteorological hazards. In Europe, 56% of NBS aim to manage flooding risks and 44% are designed to manage the other HMHs.

3) Comparison between NBS and grey measures show ~85% of HMHs management using NBS were cost-effective



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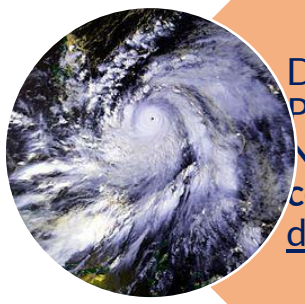
# Further reading


**Kumar, P.,** Debele, S. E., Sahani, J., Aragão, L., Barisani, F., Basu, B., Bucchignani, E., Charizopoulos, N., Di Sabatino, S., Domeneghetti, A., Edo, A. S., Finér, L., Gallotti, G., Juch, S., Leo, L. S., Loupis, M., Mickovski, S. B., Panga, D., Pavlova, I., Pilla, F., Prats, A. L., Renaud, F. G., Rutzinger, M., Sarkar, A., Shah, M. A. R., Soini, K., Stefanopoulou, M., Toth, E., Ukonmaanaho, L., Vranic, S., Zieher, T., 2020. **Towards an operationalisation of nature-based solutions for natural hazards**. *Science of the Total Environment*: doi:10.1016/j.scitotenv.2020.138855.



Debele, S.E., **Kumar, P.,** Sahani, J., Marti-Cardona, B., Mickovski, S.B., Leo, L.S., Porcù, F., Bertini, F., Montesi, D., Vojinovic, Z., Di Sabatino, S., 2019. **Nature-based solutions for hydro-meteorological hazards: Revised concepts, classification schemes and databases**. *Environmental Research*: doi:10.1016/j.envres.2019.108799.


Sahani, J., **Kumar, P.,** Debele, S., Spyrou, C., Loupis, M., Aragão, L., Porcù, F., Shah, M.A.R., Di Sabatino, S., 2019. **Hydro-meteorological risk assessment methods and management by nature-based solutions**. *Science of the Total Environment*: doi:10.1016/j.scitotenv.2019.133936.

**G Gallotti,** M.A. Santo, I Apostolidou,J Alessandri,A Armigliato,B Basu, S Debele, A Domeneghetti, A Gonzalez-Ollauri, P Kumar, A Mentzafou, F Pilla, B Pulvirenti, P Ruggieri 1,J Sahani,A Salmivaara, A S Basu, C Spyrou, N Pinardi,E Toth, S Unguendoli,U P Ayyappan Pillai,A Valentini, G Varlas, G Verri, F Zaniboni, S Di Sabatino **On the Management of Nature-Based Solutions in Open-Air Laboratories: New Insights and Future Perspectives.** *Resources* **2021**, *10*(4), 36; **https://doi.org/10.3390/resources10040036**

**J Ommer** E Bucchignani, L. S. Leo, M Kalas, S Vranić, S Debele, P Kumar, H L Cloke, S Di Sabatino**. Quantifying co-benefits and disbenefits of Nature-based Solutions targeting Disaster Risk Reduction.** *International Journal of Disaster Risk Reduction 75, 2022, 102966.* https://doi.org/10.1016/j.ijdrr.2022.102966



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# Nature-based Solutions for hydro-meteorological hazards

## NbS co-benefits

*Fabrice Renaud (University of Glasgow)*

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OPERANDUM Summer School

# Definition of Ecosystem Services and Ecosystems

- **Ecosystems**

"A dynamic complex of plant, animal, and microorganism communities and their non-living environment interacting as a functional unit"

- **Ecosystem Services**

"The benefits people obtain from ecosystems"

Source: Millennium Ecosystem Assessment (2005): Ecosystems and Human Well-being: Current State and Trends, Volume 1. Island Press, Washington, DC: https://www.millenniumassessment.org/en/Condition.html#download

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# Initial consideration of ecosystem services

- Ecosystem services:
  - Are essential to civilization
  - Due to their complexity, cannot be replaced by technology
  - Require biodiversity to be maintained
  - Are impaired by human activity
  - When overexploited for short-term gains we lose the much larger long term benefits

Source: Adapted from Daily et al (1997): Ecosystem Services: Benefits supplied to human societies by natural ecosystems. Issues in Ecology 2:1-16

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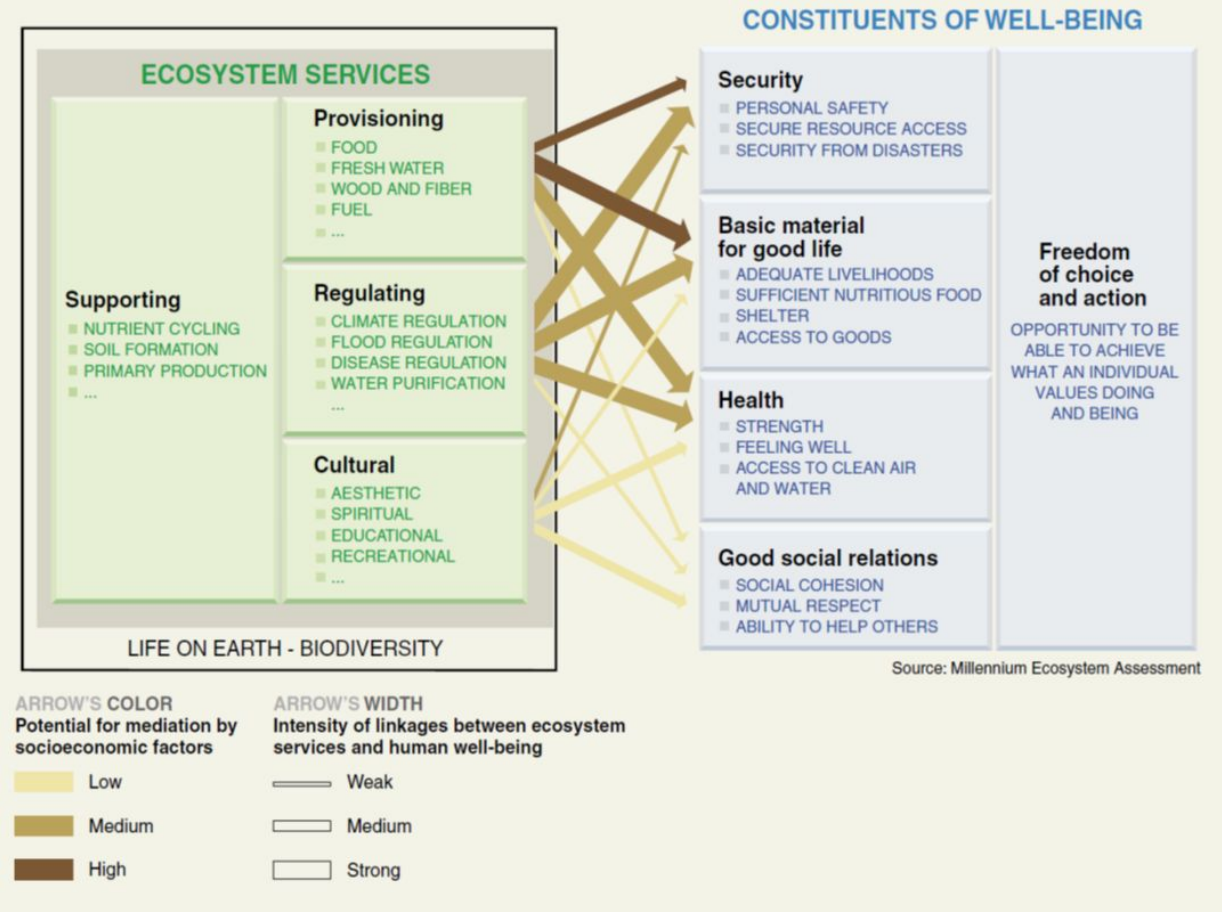
# Ecosystem Services




Source: Millennium Ecosystem Assessment. 2005. Human Well-being: Synthesis. Island Press, Washington, DC: https://www.millenniumassessment.org/en/Synthesis.html

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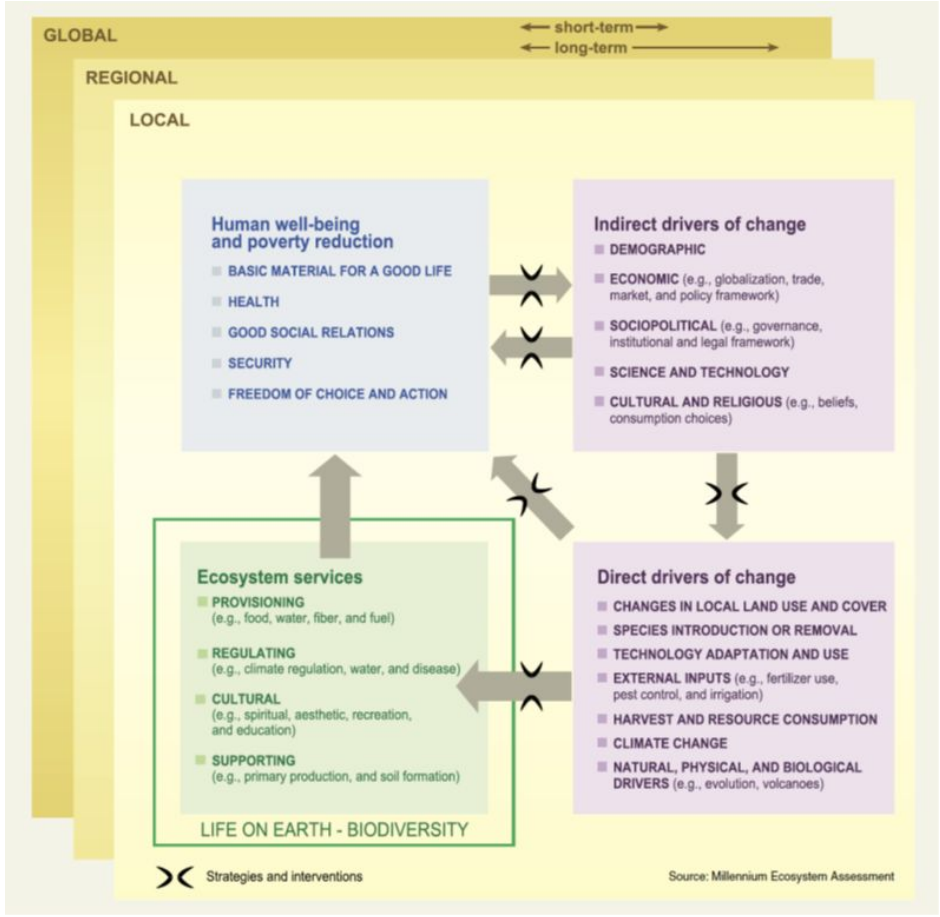
# Ecosystem Services – Link to drivers of change




Source: Millennium Ecosystem Assessment. 2005. Human Well-being: Synthesis. Island Press, Washington, DC: https://www.millenniumassessment.org/en/Synthesis.html

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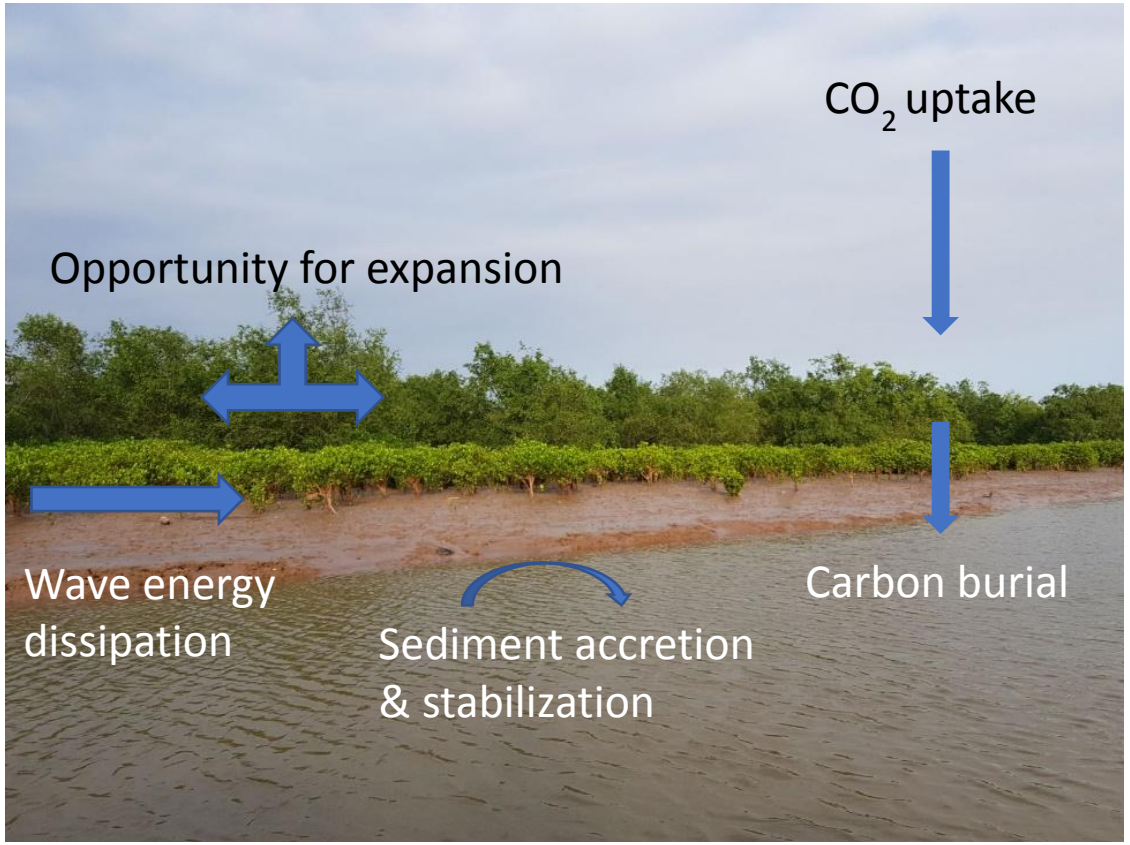
# Multiple ecosystem services: Examples from mangroves

- Regulating services
  - ✔ Carbon storage
  - ✔ Erosion regulation
  - ✔ Environmental hazard regulation
  - ✔ Exposure reduction




**Some services provided by mangroves**

Photo: Fabrice Renaud/University of Glasgow (2020)

Ecosystem services adapted from Duarte et al (2013): The role of coastal plant communities for climate change mitigation and adaptation. Nature Climate Change DOI: 10.1038/NCLIMATE1970

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# Multiple ecosystem services: Examples from mangroves

- Regulating services
  - ✔ Carbon storage
  - ✔ Erosion regulation
  - ✔ Environmental hazard regulation
  - ✔ Exposure reduction
- **Provisioning services**
  - ✔ **Fish and seafood**
  - ✔ **Fire wood**

**Collecting food from mangroves**
Photo: Fabrice Renaud/UNU-EHS

**Checking beehives in mangrove area**
Photo: Fabrice Renaud/University of Glasgow

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# Multiple ecosystem services: Examples from mangroves

- Regulating services
  - ✔ Carbon storage
  - ✔ Erosion regulation
  - ✔ Environmental hazard regulation
  - ✔ Exposure reduction
- Provisioning services
  - ✔ Fish and seafood
  - ✔ Timber
- **Cultural services**
  - ✔ **Recreation & tourism**
  - ✔ **Cultural heritage**

Photos: Fabrice Renaud/UNU-EHS

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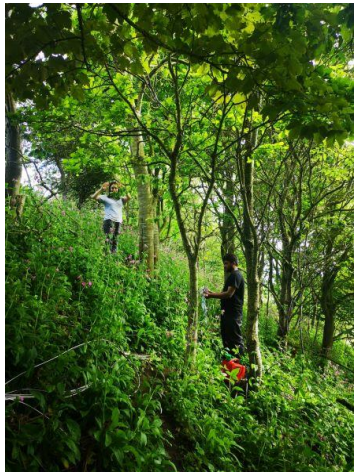
# OAL UK: Catterline Bay, Aberdeenshire, Scotland

High density vegetation

Live pole drain

Source: OAL Explorer (operandum-project.eu)

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# OAL Ireland: Dublin

Source: OAL Explorer (operandum-project.eu)

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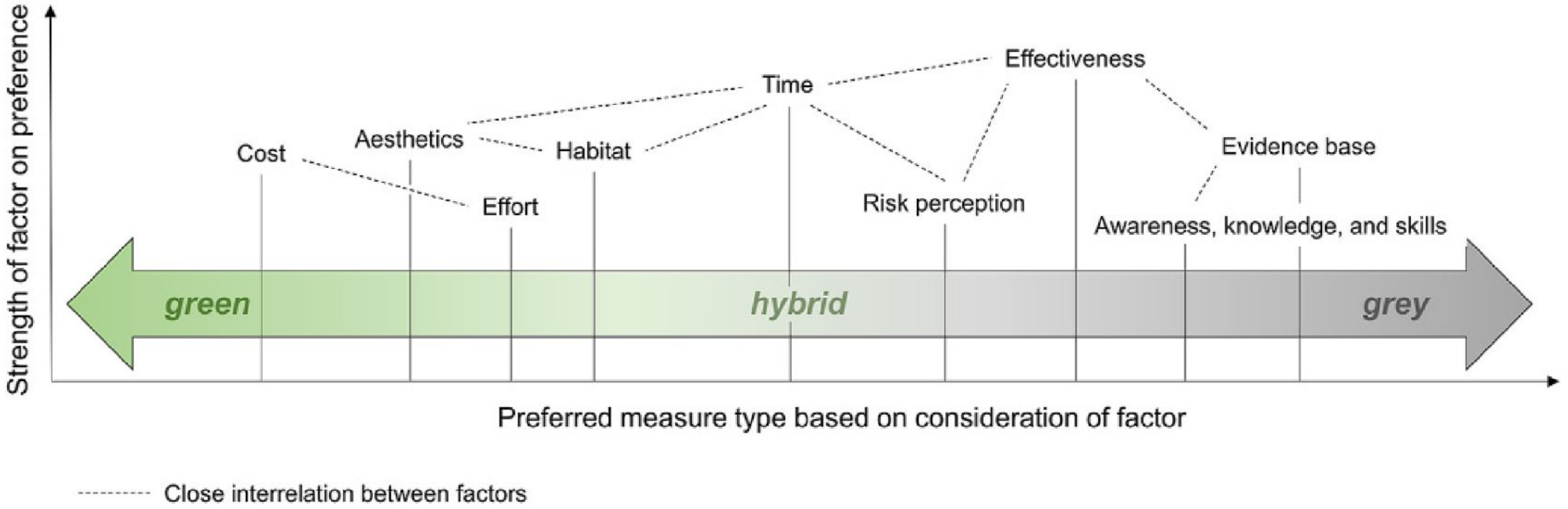
# Public perception: Factors that influence preferences towards green, hybrid, or grey measures




Source: Anderson *et al.* (2022). Green, hybrid, or grey disaster risk reduction measures: What shapes public preferences for nature-based solutions? *Journal of Environmental Management 310:114727*

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# Public Acceptance of Nature-based Solutions framework (PA-NbS)

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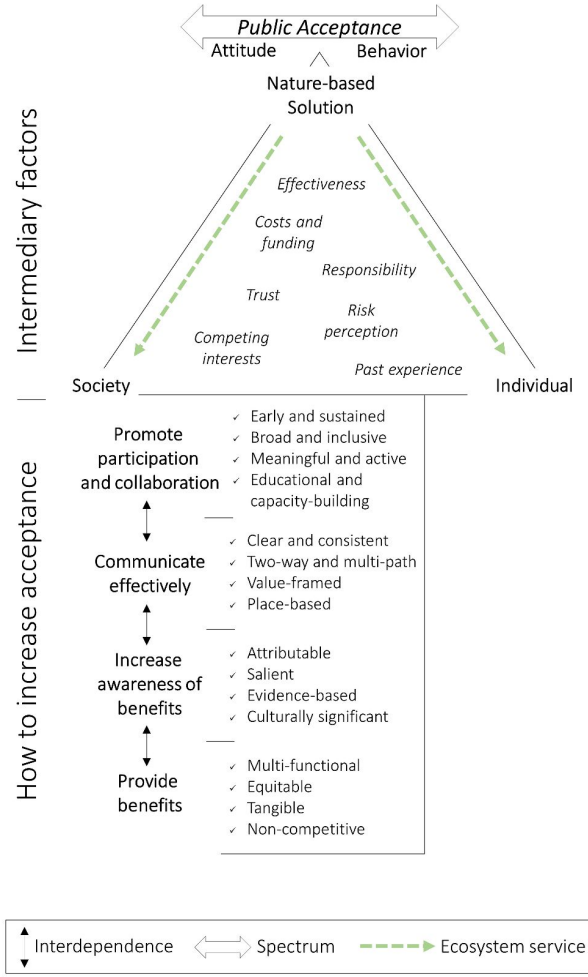
OPEn-air labs fOr Nature baseD solUtions to Manage hydro-meteo risks

## Public Acceptance of Nature-based Solutions framework (PA-NbS)




Source: Anderson and Renaud (2020). A review of public acceptance of Nature-based Solutions: the 'why', 'when', and 'how' of success for disaster risk reduction measures. *Ambio 50:1552–1573.*

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# Nature-based Solutions for hydro-meteorological hazards: policy overview

*Irina Pavlova, UNESCO*

OPERANDUM Summer school

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# DISCLAIMER

**During the upcoming 30 minutes**

<u>You will not:</u>

- Become an environmental policy expert

but <u>you will</u>

- Have an overview of complexity of policy related processes
- Understand the place of NBS concept in modern international environmental agenda

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# Environmental policy: historical overview


- Environmental policy is the commitment of an organization or government to the laws, regulations, and other policy mechanisms concerning environmental issues.


- The main goal of environmental policy is to regulate resource use or reduce pollution to promote human welfare and/or protect natural systems.

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# Environmental policy: historical overview


## What is the Stockholm Declaration?

Description of the Function → First document in international environmental law to recognize the *right* to a healthy environment

Environmental Issues Affected:

- ★ Man has the power to protect/shape the environment
- ★ Protection/improvement of nature determines people's & economy's well-being
- ★ Population growth must be taken into consideration
- ★ Citizens/Communities at every level of power must work to maintain health of environment (opposite of Tragedy of the Commons)

Paris summit 1972

Statement from the Paris Summit (19 to 21 October 1972)

- 3. Economic expansion is not an end in itself. Its first aim should be to enable disparities in living conditions to be reduced. It must take place with the participation of all the social partners. It should result in an improvement in the quality of life as well as in standards of living. As befits the genius of Europe, particular attention will be given to intangible values and to protecting the environment, so that progress may really be put at the service of mankind

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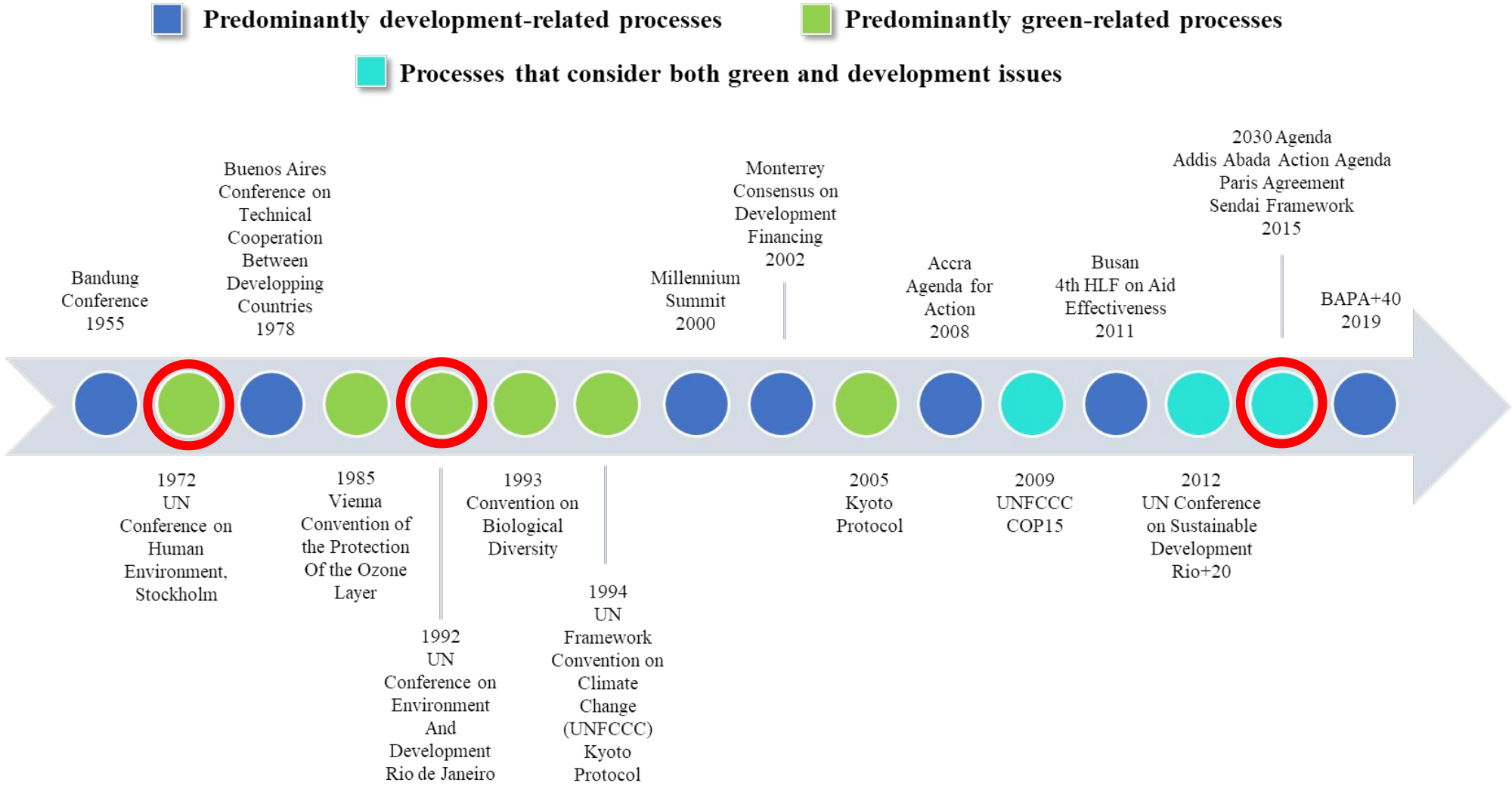
# Environmental policy: historical overview




Source: Casado-Asensio, Juan & Piefer, Nadine & Aigues, Néstor. (2019). *Green Triangular Co-operation Policy Paper: An Accelerator to Sustainable Development*. 10.1787/24140929.

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# Environmental policy: global perspective

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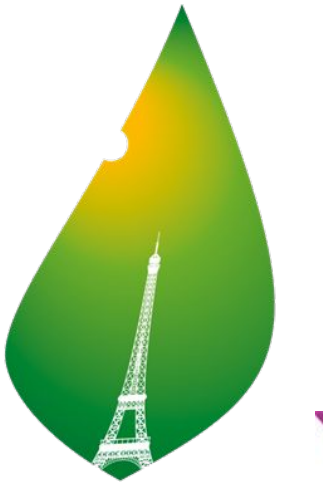

COP21 · CMP11
PARIS 2015
UN CLIMATE CHANGE CONFERENCE



SEVEN TARGETS TO ACHIEVE BY 2030
SENDAI FRAMEWORK
FOR DISASTER RISK REDUCTION 2015-2030

Convention on Biological Diversity


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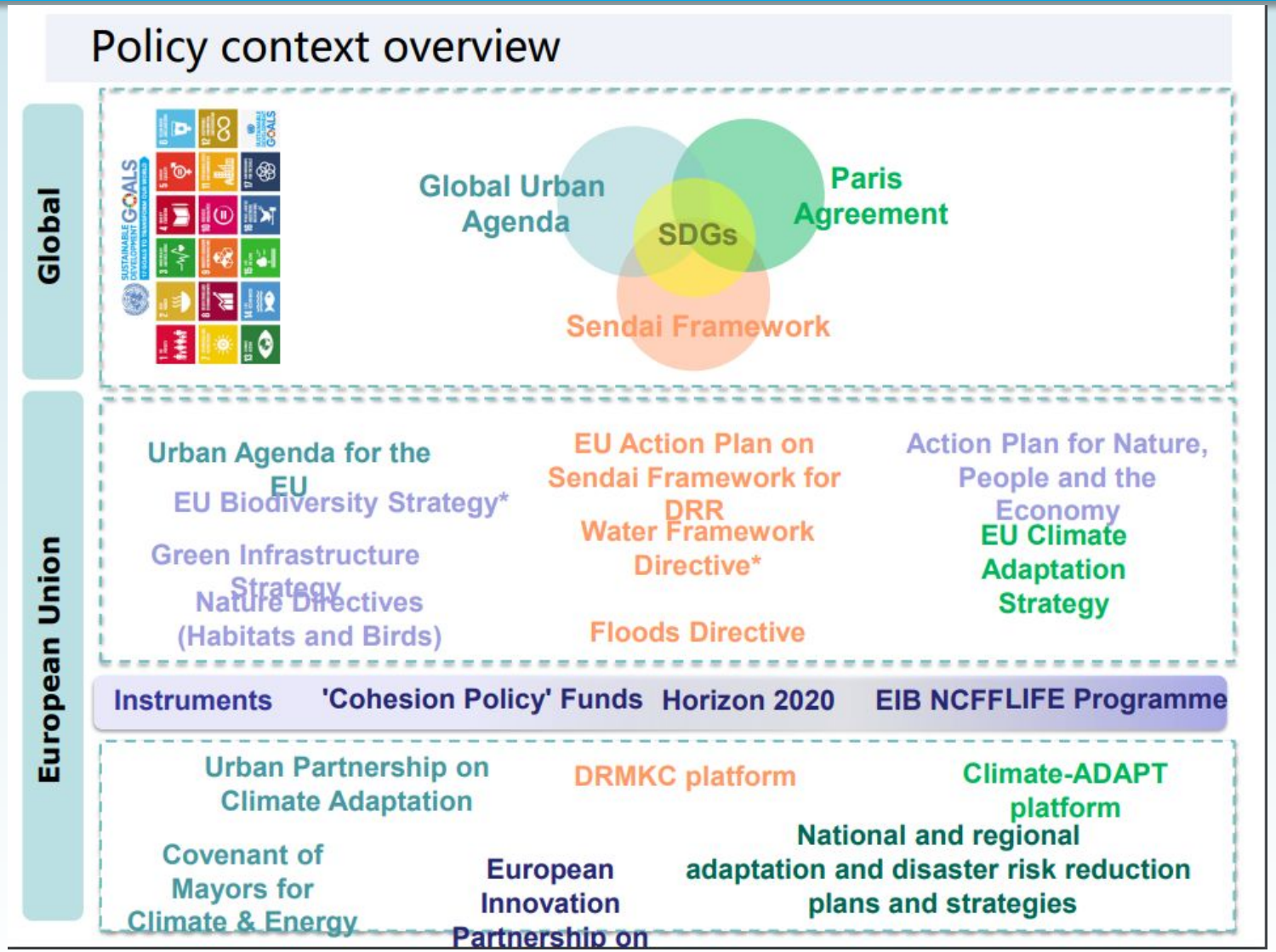
# Environmental policy : regional level



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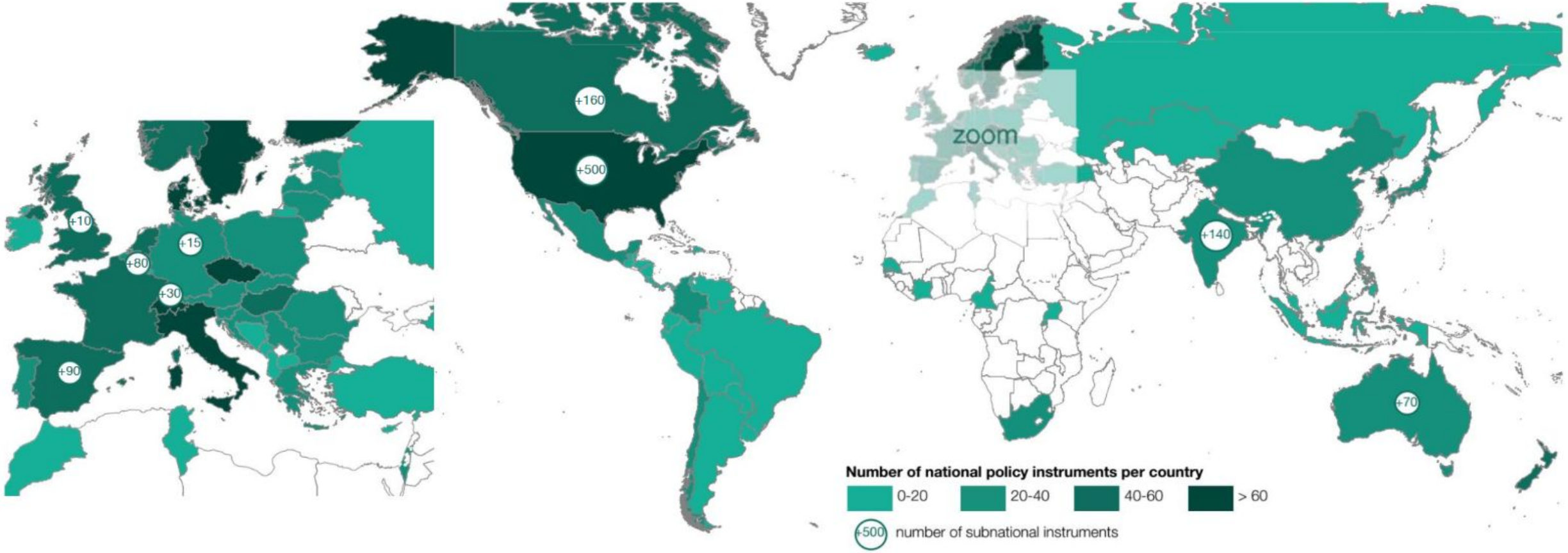
# Environmental policy : National level




https://www.oecd.org/env/indicators-modelling-outlooks/policy-instrument-database/

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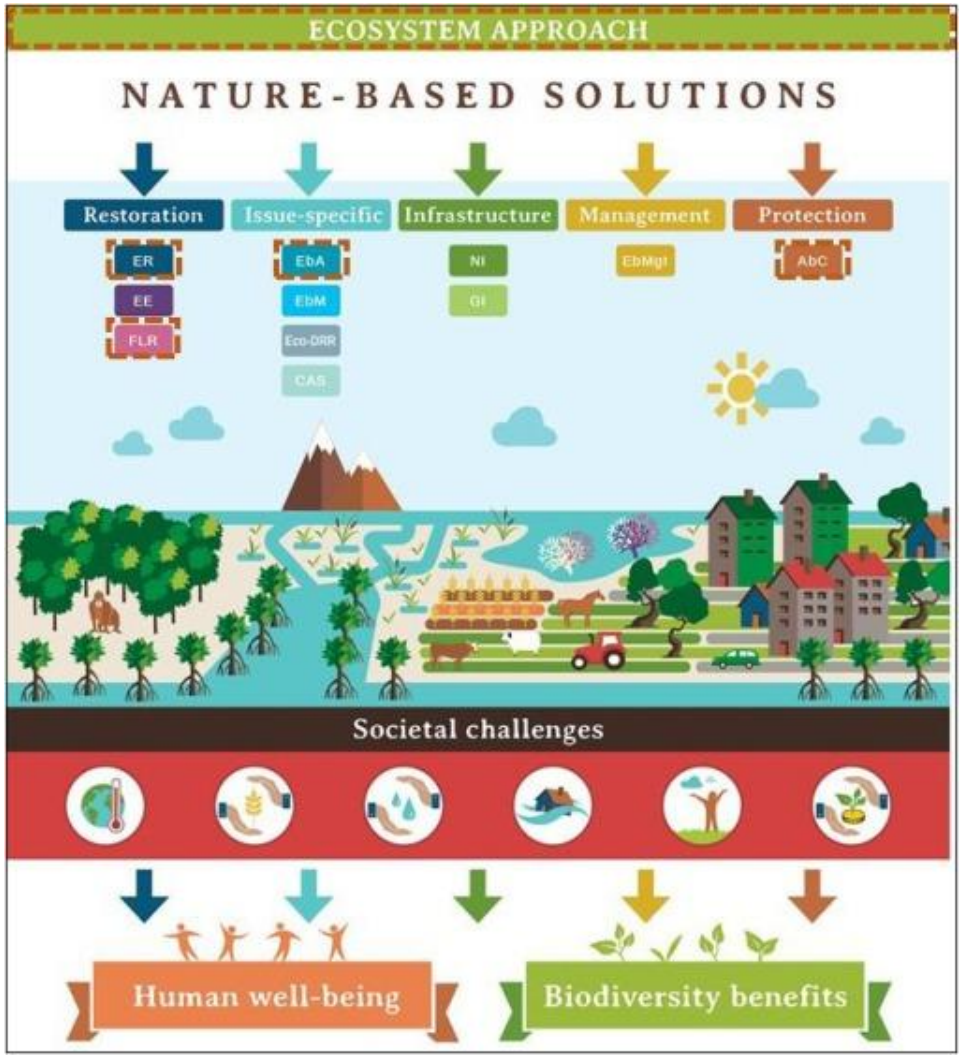
# Nature-based solutions concepts




Nature-based Solutions were put forward by IUCN in the context of the climate change negotiations in Paris “as a way to mitigate and adapt to climate change, secure water, food and energy supplies, reduce poverty and drive economic growth.”

NBS address societal challenges through "the protection, sustainable management and restoration of both natural and modified ecosystems, benefiting both biodiversity and human well-being. They target major challenges like climate change, disaster risk reduction, food and water security, biodiversity loss and human health, and are critical to sustainable economic development." (*IUCN*)

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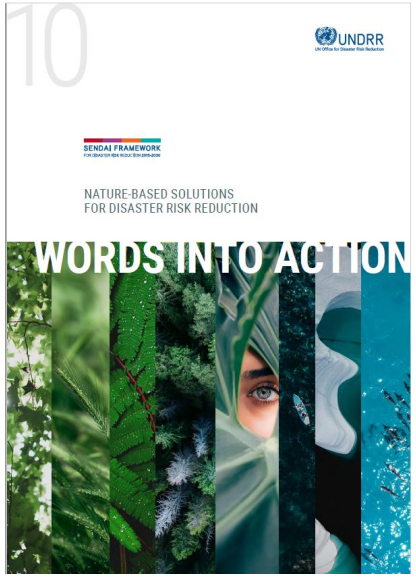
# Nature-based solutions concepts: NBS4DRR

PEDRR
Ecosystems for Disaster Risk Reduction and Adaptation

PEDRR seeks to promote and scale-up implementation of Ecosystem-based Disaster Risk Reduction (Eco-DRR) where partners implement collectively planned initiatives and activities.
PEDRR is more than a knowledge exchange network. It is a global advocate for increasing investments in ecosystem-based approaches to reducing disaster- and climate risks.

EVIDENCE & KNOWLEDGE ▾ EDUCATION & TRAINING COURSES ▾ CONNECT & NETWORK ▾





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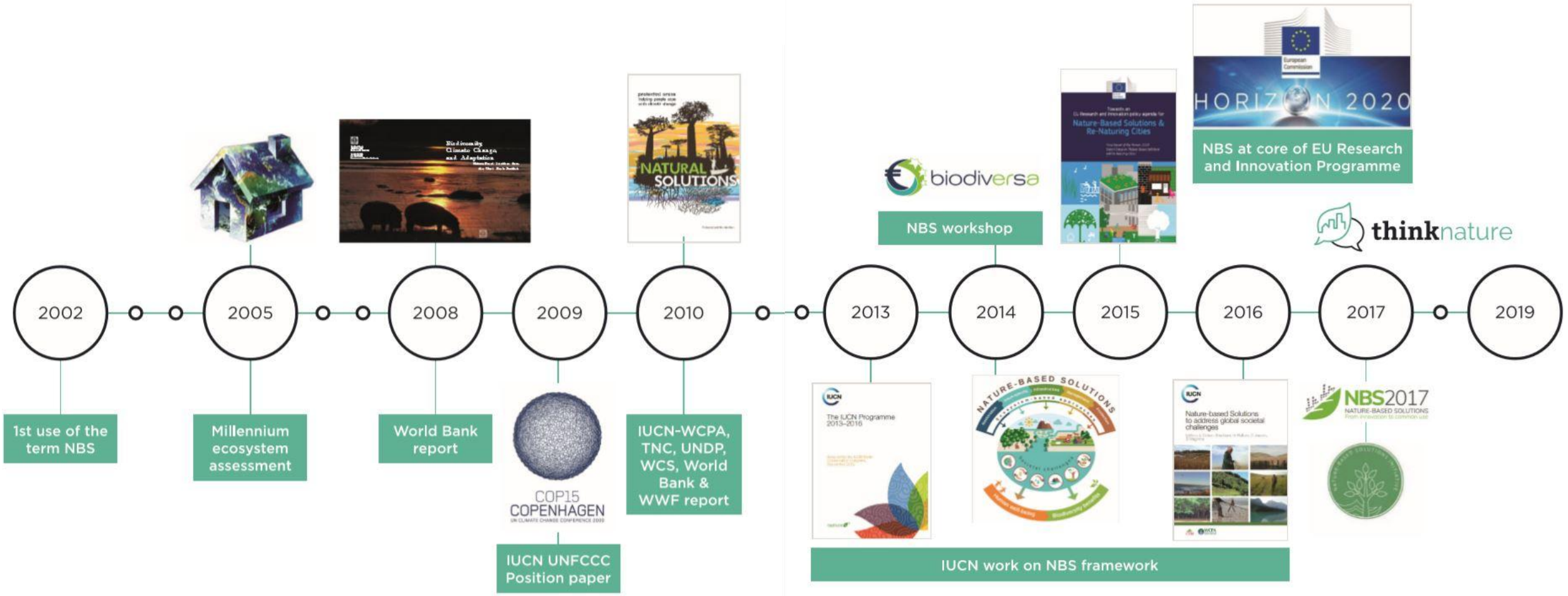
# Nature-based solutions concepts: timeline




Somarakis, G., Stagakis, S., & Chrysoulakis, N. (Eds.). (2019 Thinknature Nature-Based Solutions Handbook.

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# Nature-based solutions concepts: global

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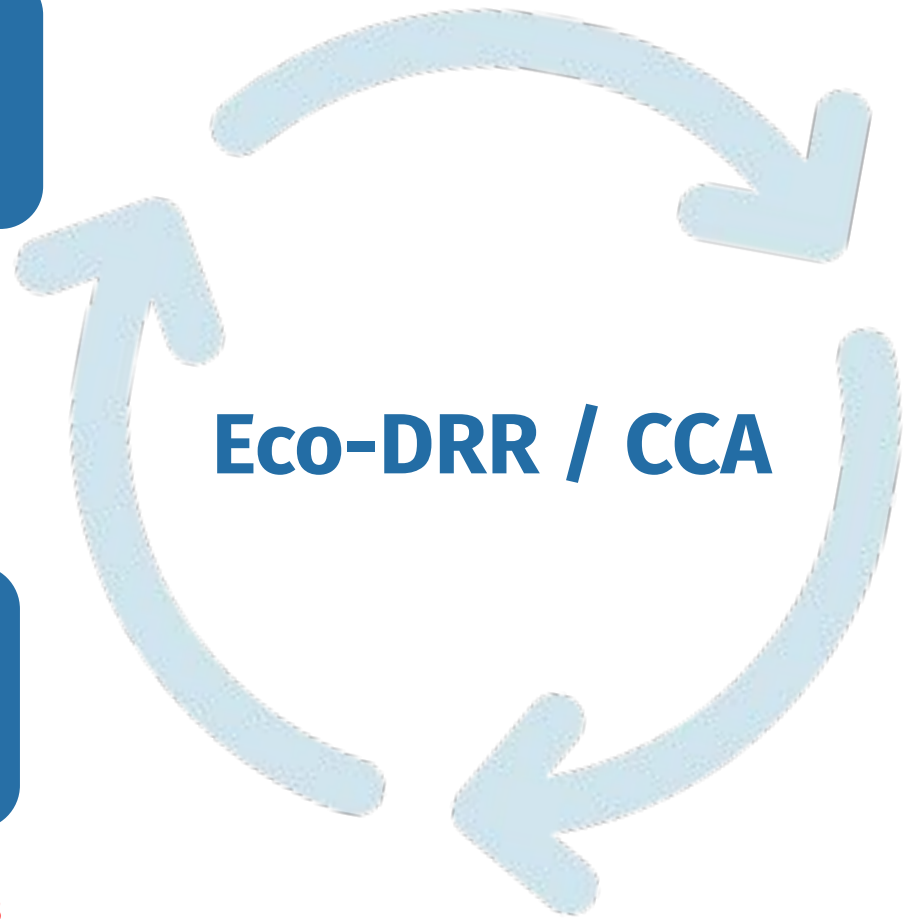
UN World Conference on Disaster Risk Reduction
2015 Sendai Japan

**Disaster Risk Reduction**
Sendai Framework for DRR (UNDRR)

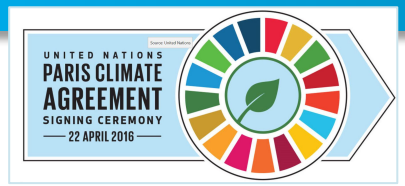
Priorities for Action 1-3


**Sustainable Development**
Sustainable Development Goals (UN)

SDG Targets 2.4, 6.5, 6.6, 11.4, 11a, 13.1, 13.2, 13.3, 14.2, 15.1, 15.3



## Eco-DRR / CCA




**Climate Change Adaptation**
Paris Agreement (UNFCCC)

Preservation of ecosystems for adaptation

Ramsar Wetlands for our future

Convention on Biological Diversity

**Environmental and Biodiversity Conservation Outcomes, Decisions and Targets**

Aichi Target 15, CBD COP 12 Decision, Ramsar Decision XII/13

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# Nature-based solutions concepts: global

| Global policy | NbS-related terms | | | | | | | Reference to DRR | Reference to CCA | Level of support |
|---|---|---|---|---|---|---|---|---|---|---|
| | NbS | EA/EbAp | GI/BGI | EbA | SM/EBM/ SFM | NWRM | Eco-DRR | | | |
| SFDRR 2015-2030 | | ✓ | | ✓ | | | ✓ | ✓ | ✓ | Strong explicit |
| SDGs | | | | | ✓ | | | ✓ | ✓ | Medium |
| UNFCCC (a) | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | Strong explicit |
| CBD (a) | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | Strong explicit |
| UNCCD (a) | ✓ | | | ✓ | ✓ | | ✓ | ✓ | ✓ | Medium |
| New urban agenda | ✓ (b) | ✓ | ✓ | ✓ | ✓ | | | ✓ | ✓ | Strong explicit |
| Ramsar Convention (a) | | ✓ | | ✓ | ✓ | | ✓ | ✓ | ✓ | Medium |

**Note:** (a) The original agreements/treaties, as well as relevant subsequent conclusions, resolutions and decisions, were reviewed.
(b) Uses the term 'nature-based innovation'.

**Source:** EEA.

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GA no. 776848

# Environmental policy : EU level

| EU policy | NbS-related terms | | | | | | | Reference to DRR | Reference to CCA | Level of support |
|---|---|---|---|---|---|---|---|---|---|---|
| | NbS | EA/EbAp | GI/BGI | EbA | SM/EbM/SFM | NWRM | Eco-DRR | | | |
| European Green Deal | ✓ | | | | | | | ✓ | ✓ | Strong explicit |
| Bioeconomy strategy (update) | ✓ | ✓ | ✓ | | ✓ | | | | ✓ | Medium |
| Biodiversity strategy for 2030 | ✓ | | ✓ | | ✓ | | | ✓ | ✓ | Strong explicit |
| Green infrastructure strategy | ✓ | ✓ | ✓ | ✓ | | | ✓ | ✓ | ✓ | Strong explicit |
| Forest Strategy | | | ✓ | | ✓ | | | | ✓ | Medium |
| LULUCF Regulation | | | | | ✓ | | | ✓ | ✓ | Medium |
| Action plan on the Sendai Framework | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | Strong explicit |
| Adaptation strategy | ✓ | | ✓ | | ✓ | | | ✓ | ✓ | Strong explicit |
| Floods Directive | | | | | ✓ | ✓ | | ✓ | ✓ | Strong implicit |
| Water Framework Directive | | | | | ✓ | | | | ✓ | Medium |
| Urban agenda | ✓ | | ✓ | | | | | ✓ | ✓ | Medium |
| Farm-to-fork strategy | ✓ | | | | ✓ | | | | ✓ | Medium |
| Common agricultural policy | | | | | ✓ | | | ✓ | ✓ | Medium |

**Note:** LULUCF, Land use, land use change and forestry.

**Source:** EEA.

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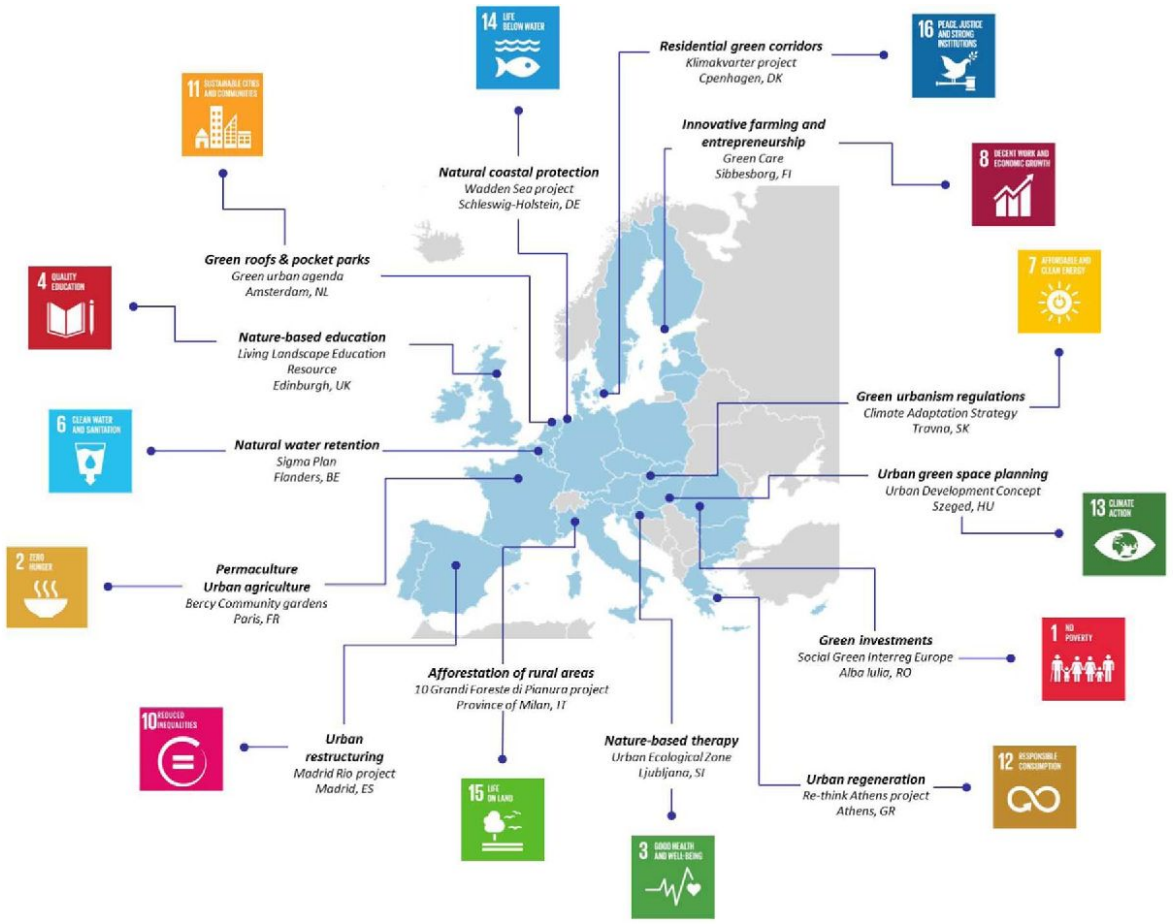
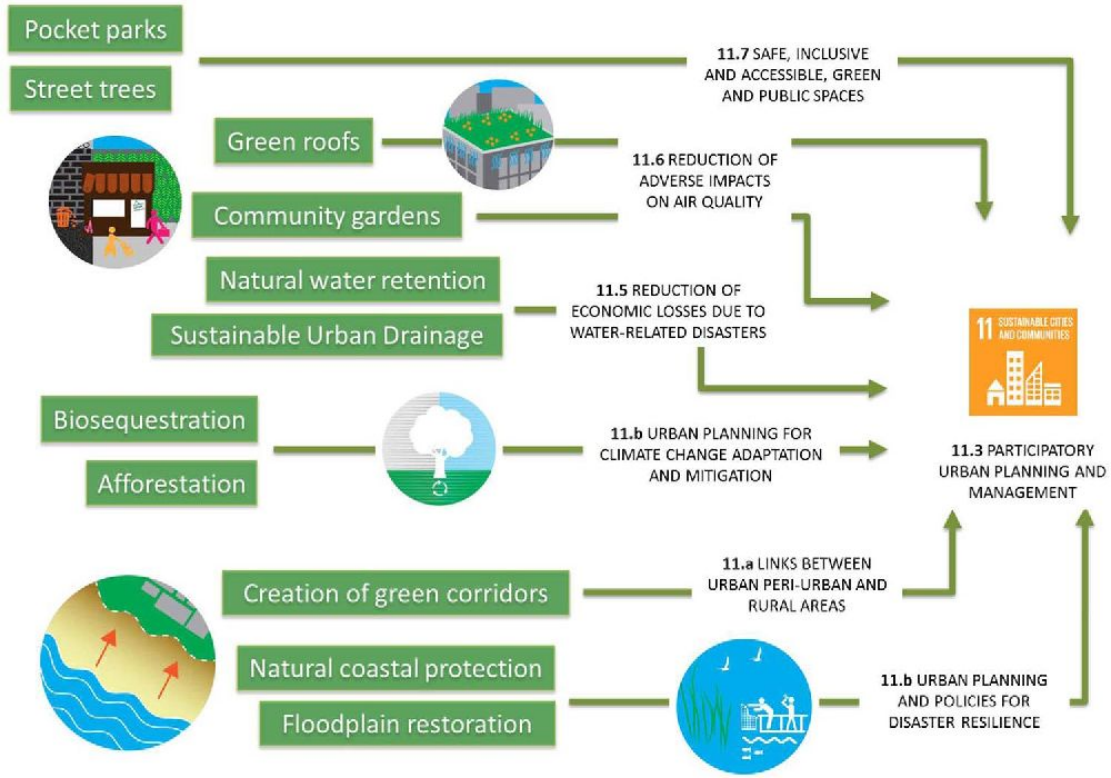
# Nature-based solutions concepts: global




low Nature-Based Solutions address sustainable development goals: examples of approaches that use Nature-Based Solutions and measures linked to SDGs across

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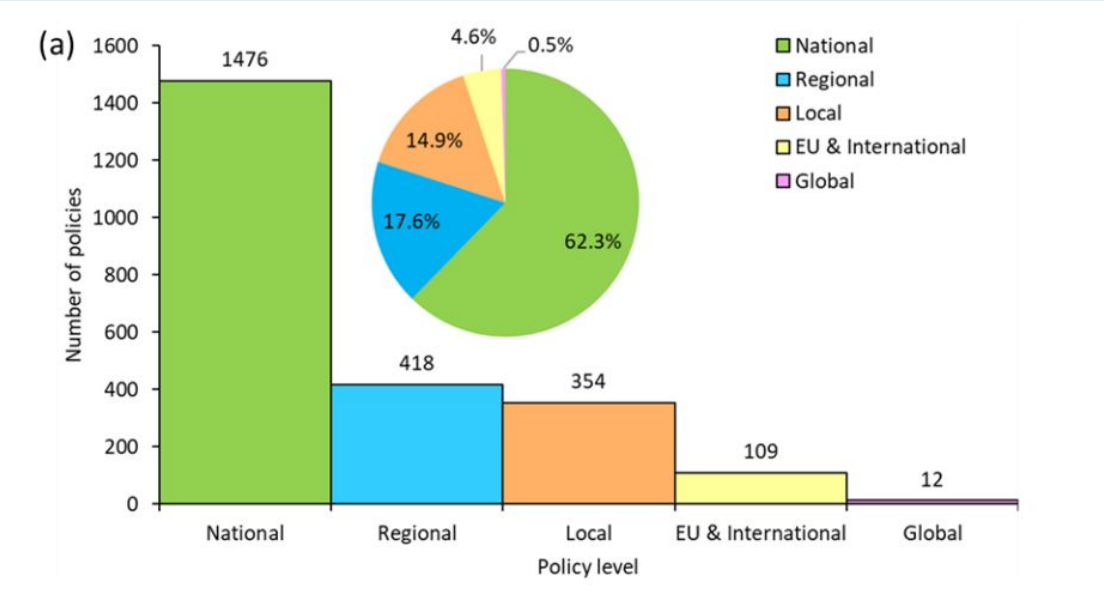
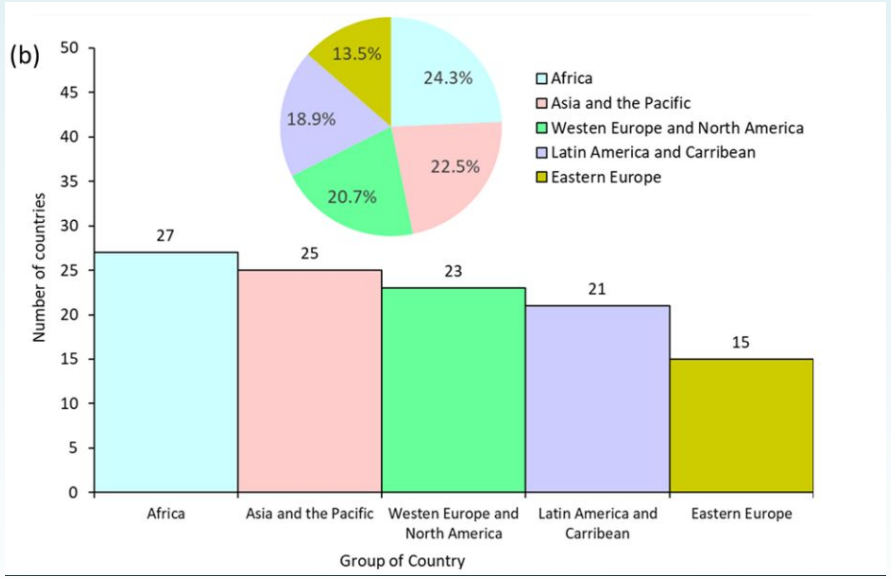
# GeoIKP policy catalogue: global

| No | Location | Habitat | Hazard | NBS type | NBS intervention | NBS approach | Target | Policy | Reference/sources |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Marseille, France | Coastal | Flood | Blue | Manage stormwater | Protection | Water management (SDG 6) | Regional | http://www.marseille-provence.fr/index.php/competences/eau-et-domaine-public/assainissement/l-eau-et-la-preservation-de-l-environnement |
| | | | Storm Surge | | Construction of retention/basins | Implementation | Coastal resilience and marine protection (SDG 14) | Local | |
| | | | | | | Improvement | Environmental quality, including air quality and waste management (SDG 13) | | |
| | | | | | | | Health and well-being (SDG 3) | | |
| | | | | | | | Economic development and decent employment (SDG 8) | | |

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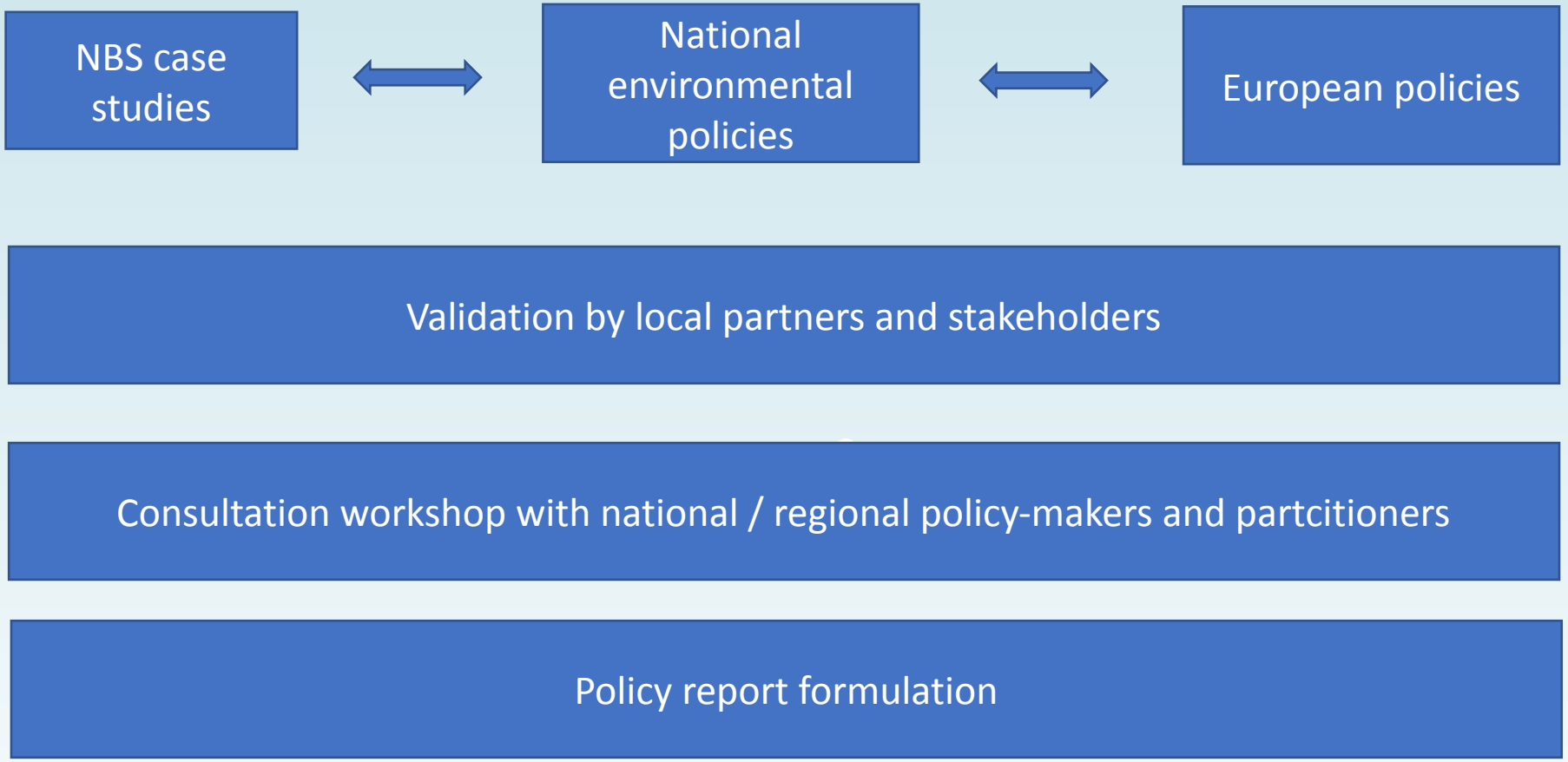
# GeoIKP policy catalogue: global

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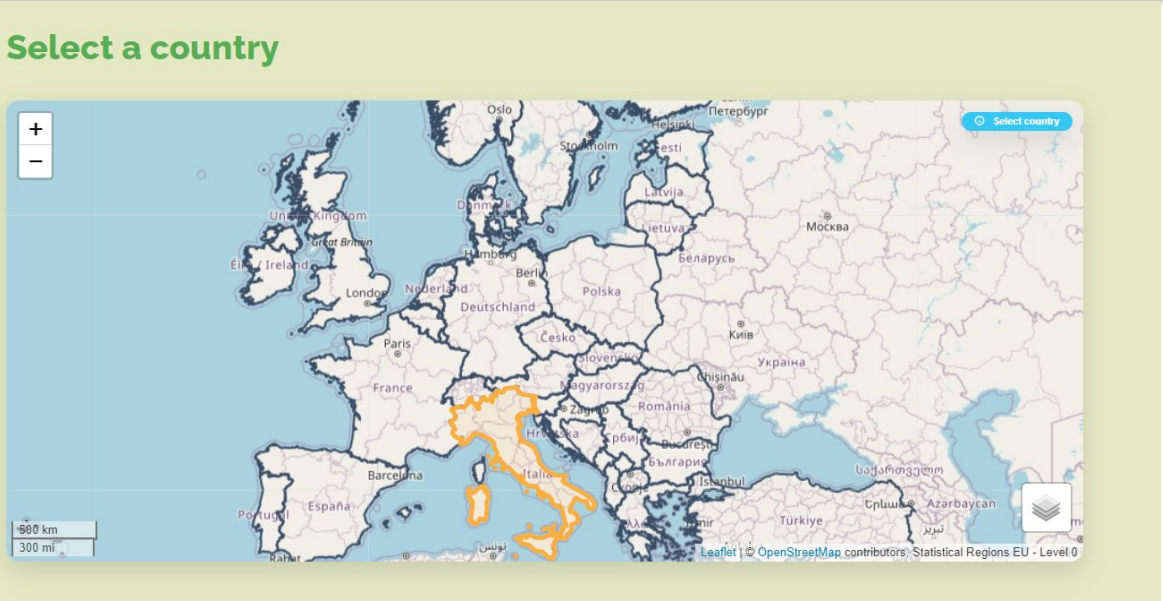
# GeoIKP policy catalogue: national




- In Italy environmental policies are developed and implemented by a multilevel system that involves a wide variety of actors, including the **Ministry of Ecological Transition, the Regions, interregional and local authorities, technical agencies and research institutes**.
  - In regards to environmental issues Italy can be seen to share powers between its **central government, regional and local governments**.
  - Environmental issues, and in particular permits, are managed by governmental agencies dealing with environment or even more specific agencies, as in the case of the **Agenzia Regionale per la Protezione Ambientale (ARPA) or the Agenzia Interregionale per il fiume Po (AIPO)**.
- The national environmental policy context is **heavily influenced by EU legislative and policy frameworks**.
-

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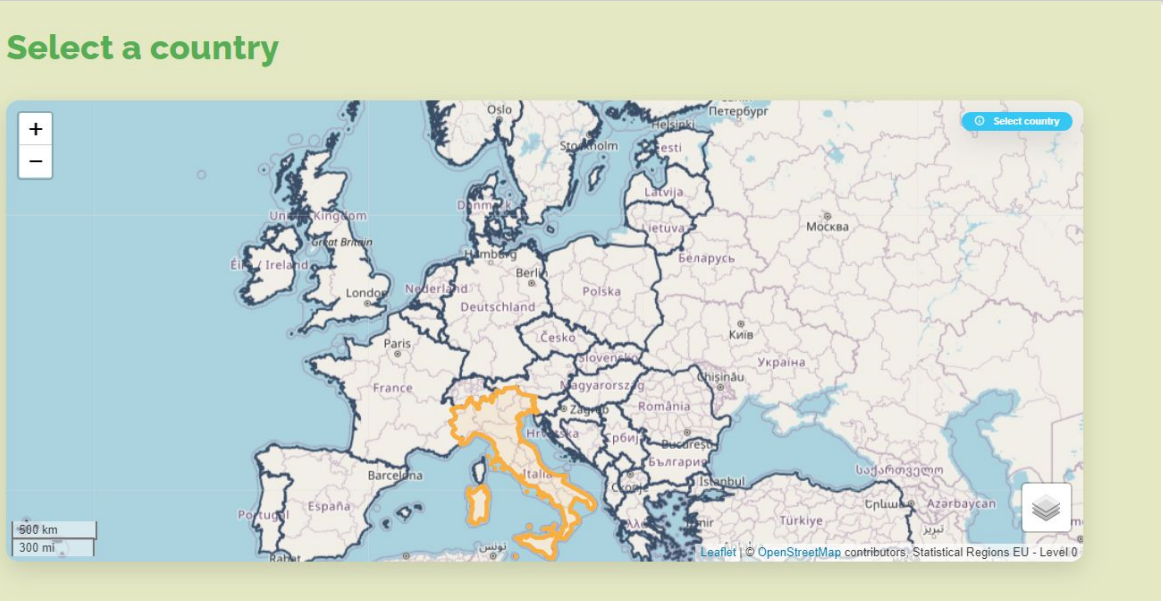
# GeoIKP policy catalogue: national




- the Action Plan on the Sendai Framework for Disaster Risk Reduction 2015-2030 A disaster risk-informed approach for all EU policies (EU Action Plan on the Sendai Framework),
- Directive (2011/92/EU) on the assessment of the effects of certain public and private projects on the environment (Environmental Impact Assessment (EIA) Directive),
- Directive (2000/60/EC) establishing a framework for Community action in the field of water policy (EU Water Framework Directive),
- (COM/2013/0216 final) An EU Strategy on adaptation to climate change (EU Strategy on adaptation to climate change),
- (COM/2012/0673 final) A Blueprint to Safeguard Europe's Water Resources (Blueprint to Safeguard Europe's Water Resources),
- Directive (2007/60/EC) on the assessment and management of flood risks (EU Floods Directive),
- Directive (2001/42/E) on the assessment of the effects of certain plans and programmes on the environment (EU Strategic Environmental Assessment (SEA) Directive),
- Decision No (1386/2013/EU) on a General Union Environment Action Programme to 2020 'Living well, within the limits of our planet' (7th Environment Action Programme (EAP)),
- Directive (92/43/EEC) on the conservation of natural habitats and of wild fauna and flora (EU Habitats Directive), and
- (COM/2011/0244 final) Our life insurance, our natural capital: an EU biodiversity strategy to 2020 (EU Biodiversity Strategy).

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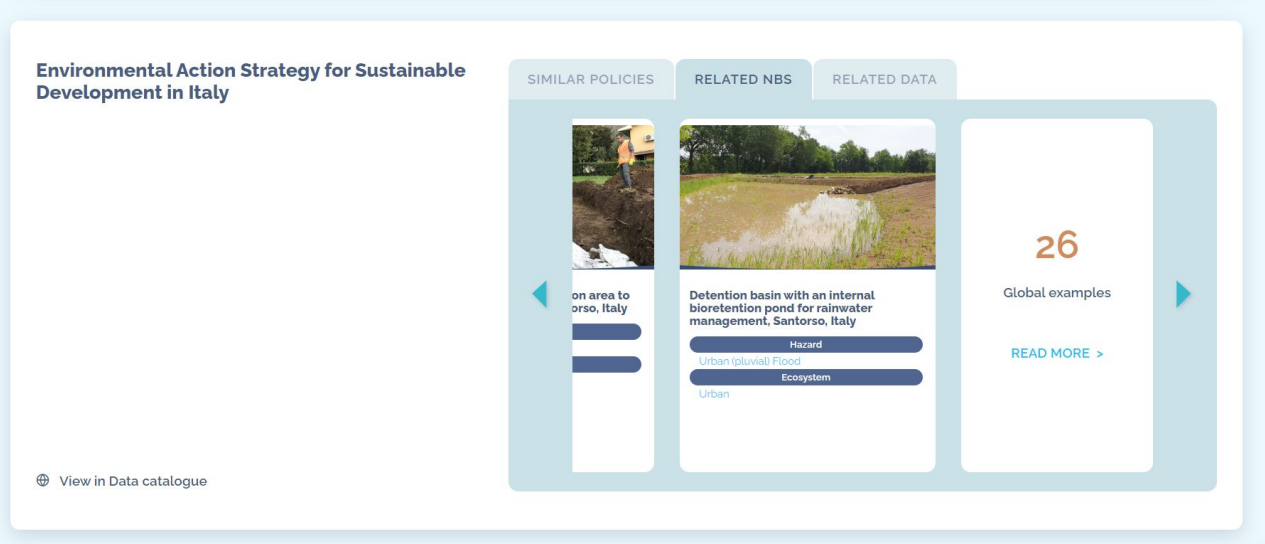
# GeoIKP policy catalogue: national




Environmental Impact Assessment (EIA) Directive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# GeoIKP policy catalogue: national

**<u>Artificial dune for coast protection, Lido di Volano, Italy</u>**

Aimed at reducing both coastal erosion and flooding

Societal challenges: climate change adaptation and resilience, coastal resilience, cultural and natural heritage, flood management and habitat conservation and restoration

**Global policy**

- A Blueprint to Safeguard Europe's Water Resources
- Convention on Biological Diversity (1992)
- Paris Agreement (UNFCCC, 2015)
- Sendai Framework (UNISDR, 2015)
- Sustainable Development Goals (UNDP, 2012)
- United Nations Convention to Combat Climate change (UNFCCC, 1992)

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# GeoIKP policy catalogue: national

**EU level policy**

- Environmental Impact Assessment (EIA) Directive (2011/92/EU)
- EU Action Plan on the Sendai Framework for Disaster Risk Reduction (SWD(2016)205)
- EU Biodiversity Strategy (COM/2011/0244 final)
- EU Floods Directive (2007/60/EC)
- EU Habitats Directive (92/43/EEC)
- EU Strategy on adaptation to climate change (COM/2013/0216 final)
- EU Water Framework Directive (2000/60/EC)
- Strategic Environmental Assessment (SEA) Directive (2001/42/EU)

**National policy**

- D.lgs. 104/2017 modifying and integrating D.Lgs 152/2006: Implementing the EIA Directive
- D.lgs.152/2006 Codice dell'Ambiente, Italian Environment Act - D.lgs. 128/2010: Implementing the SEA Directive (2001/42/EC)
- DPR 357/97 - Regulation implementing Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora
- Environmental Action Strategy for Sustainable Development in Italy
- Italian National Adaptation Strategy to Climate Change (NAS), adopted in June 2015
- Legislative decree 49/2010 Transposing Directive 2007/60/EC (Floods Directive)
- National Law 221/2015 - Collegato Ambientale - Italy

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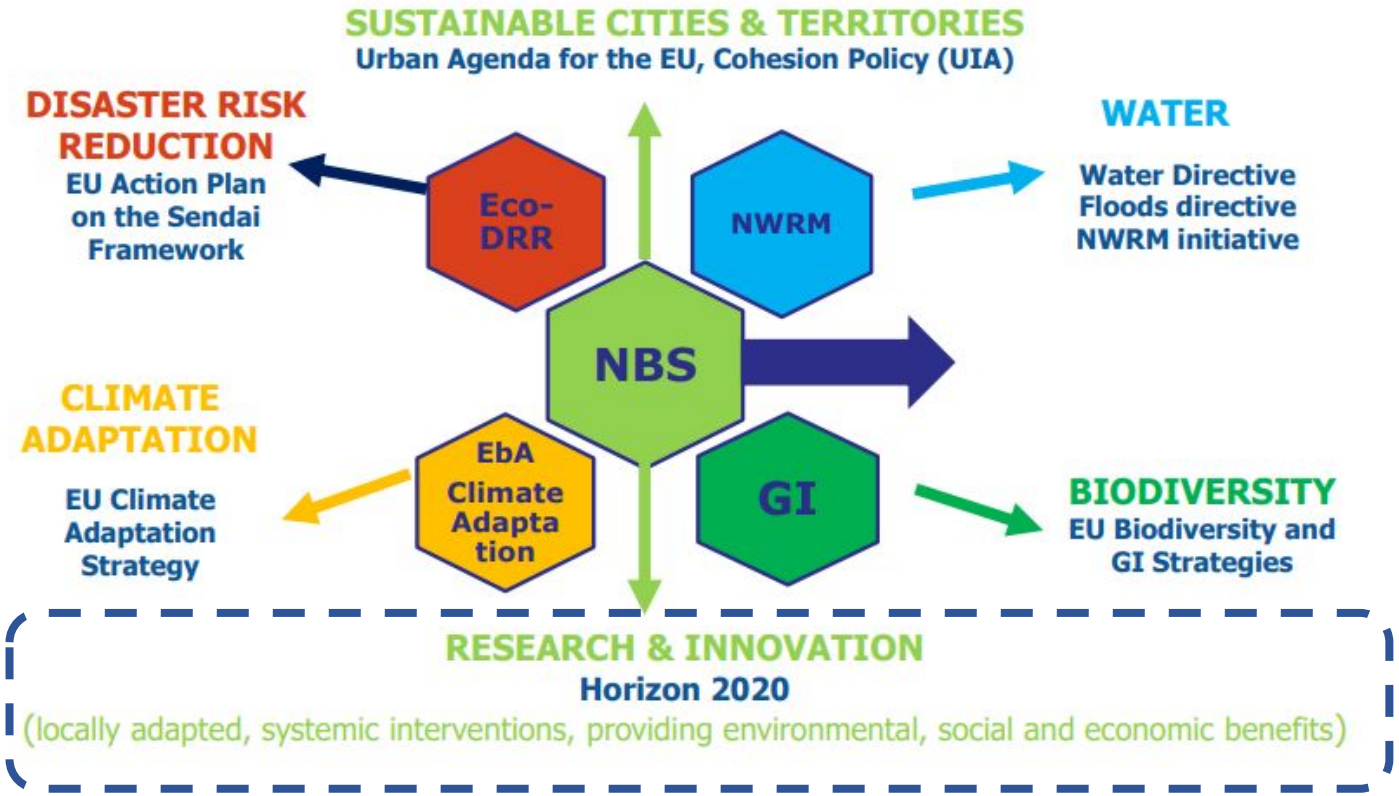
# Nature-based solutions concepts: EU approach




**EU R&I: the NBS roadmap**

1. Enhance the framework conditions for NBS at EU policy level
2. Develop a **European community of innovators** through awareness and engagement
3. Provide the evidence and knowledge base for nature-based solutions
4. Advance the development, uptake and upscale of innovative nature-based solutions through systemic innovation and co-design, co-development, co-implementation of solutions and leverage of funding (large demos)
5. Mainstream nature-based solutions within the international R&I agenda.

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# Nature-based solutions concepts: EU approach

Horizon 2020 calls on Nature-Based Solutions

- Demonstrating innovative nature- based solutions in cities: NBS for climate and water resilience in cities (SCC-02-2016-2017)
- New governance, business, financing models and economic impact assessment tools for sustainable cities with nature-based solutions (urban re-naturing) (SCC-03-2016)
- Operationalising insurance value of ecosystems (SC5-09-2016)
- Multi-stakeholder dialogue platform to promote innovation with nature to address societal challenges (SC5-10-2016)
- Large-scale demonstrators on nature-based solutions for hydrometeorological risk reduction (SC5-08-2017)


To ensure the EU added value of the Horizon 2020 projects in the area by:
o providing consolidated evidence base on NBS
o supporting mainstreaming of NBS (guidance/tools/methods)

# Nature-based solutions concepts: EU approach

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- **SO1** - Integrate knowledge about **NBS efficacy** against hydro-meteorological risks

- **SO2** - Strengthen technology **innovation** in the area of NBS

- **SO3** - Improvement of **acceptance** of NBS based implementation

- **SO4** - Enhancement of market demand and **increase of competitiveness** of NBS

- **SO5** - **Strengthening** the adoption of NBS in **national policies** for **DRR** land planning, **EIP Water**

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# Nature-based solutions concepts: EU approach

OPERANDUM

OPERANDUM

- **SO5 - Strengthening** the adoption of NBS in **national policies** for **DRR** land planning, **EIP Water**

| | National | EU regional | International |
|---|---|---|---|
| Evidence building | OAL implementation | Development of innovative methodologies | |
| Building capacities | Summer school<br>Regional consultations outside EU | | |
| Advocacy | High-level events<br>Information Sessions | | |

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# Thank you

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# Thank you!

NbS Concepts and Approaches

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