# NATURE BASED SOLUTIONS IN EUROPEAN CITIES

## RESILIENT PRACTICES

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**September 17, 2020**

**IUC-Asia Climate Adaptation Workshop**
**Urban Sustainability and Wetland Reservation with Nature-based Solutions**

# AGENDA

**01** Ramboll's resilience approach

**02** Nature Based Solutions –
Current research and innovation

**03** NBS examples from Denmark

1) Odense, Denmark
2) Aarhus, Denmark

**04** NBS Governance

**05** Q&A

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# RAMBOLL'S RESILIENCE APPROACH



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# NBS – CURRENT RESEARCH AND INNOVATION












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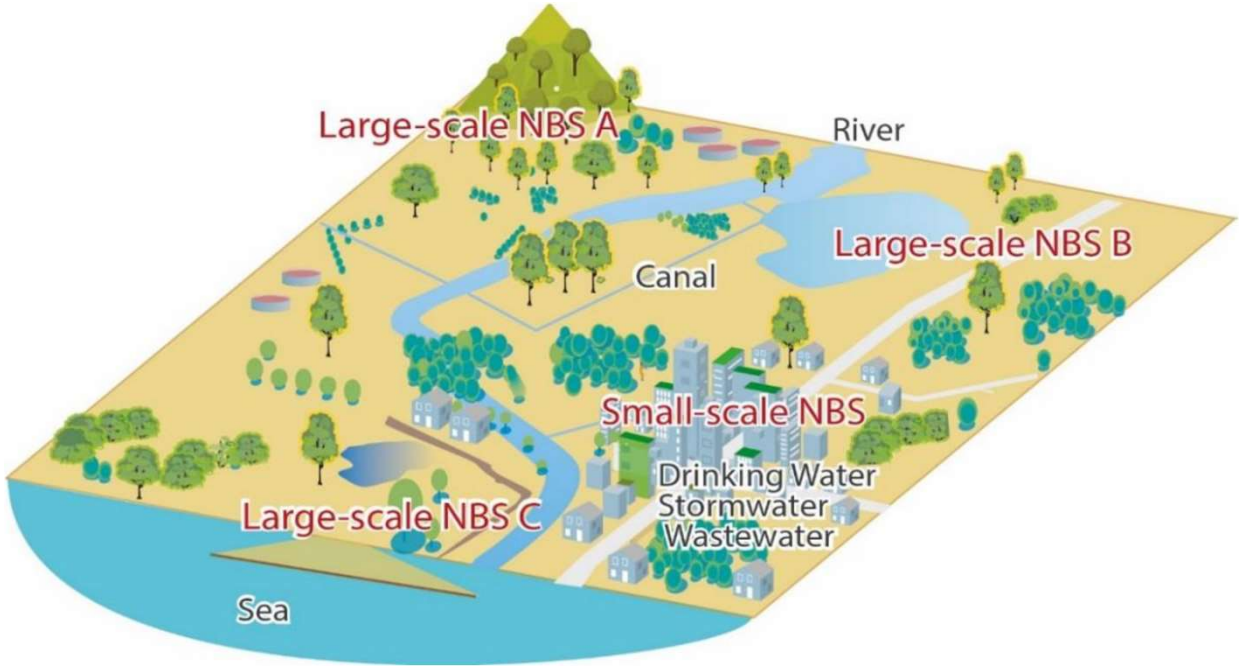
# LARGE AND SMALL SCALE NBS




**Large-scale NBS A:** NBS in mountainous regions (e.g., afforestation, reforestation, slope stabilization, etc.)

**Large-scale NBS B:** NBS along river corridors (e.g., dike relocation, retention basins, etc.)

**Large-scale NBS C:** NBS in coastal regions (e.g., sand dunes, protection dikes/walls, marshes, etc.);

**Typical examples of Small-scale NBS:** green roofs, green walls, rain gardens, permeable pavements, swales, bio-retention, etc.

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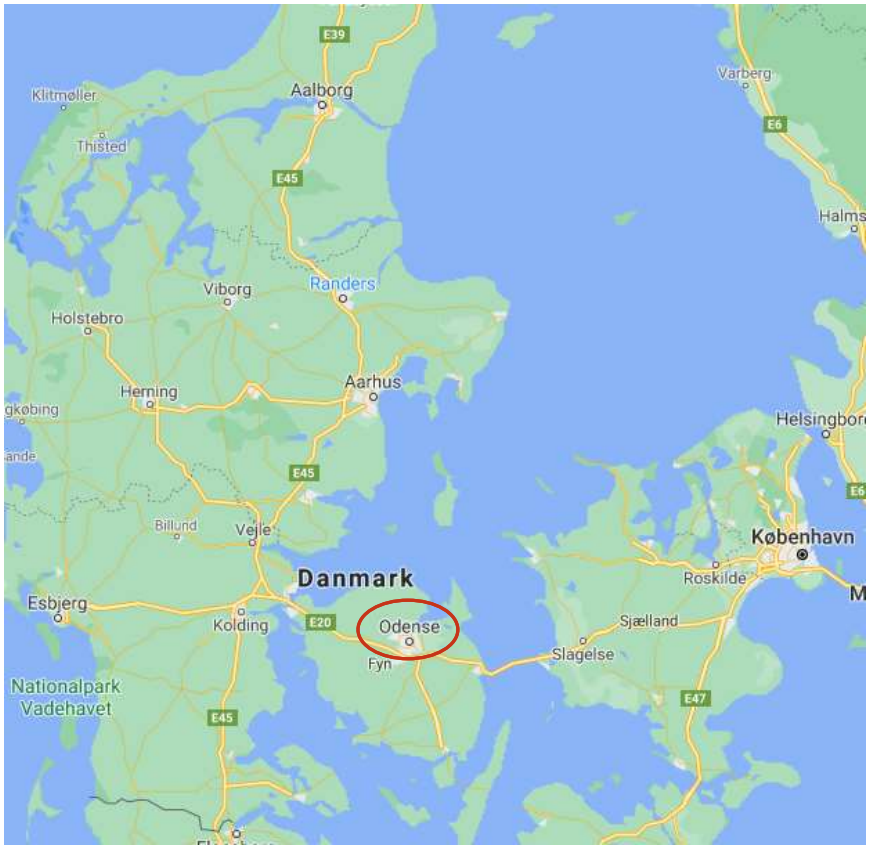
# EXAMPLE 1: ODENSE, DENMARK
# SEDEN STRAND

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## Drivers

- Promote rehabilitation of new habitats (salt meadows) outside the new dikes
- Removal of existing low coastal summer dikes and moving them inland to a higher location
- Meandering of existing streams: recreation
- Biodiversity; focus on target species like the avocet (Recurvirostra avosetta) and the natterjack toad (Epidalea calamita)

# EXAMPLE 1: ODENSE, DENMARK
# HYDROLOGICAL CONDITIONS


## Coastal systems

- Mean sea level + 0,05 m, normal high tide 0,4 m (very flat)
- Significant wave height 0,5 m at NBS site,
- Storm surge + 1,95 m (100 years return period)
- Water salinity 2,5 %.
- Water quality in Odense Fjord is affected by fertilizers being used in the catchment including one third of the area of Funen
- Bathing in the shallow water of Odense Fjord is not practiced due to better conditions at the nearby beaches at the open sea.

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# EXAMPLE 1: ODENSE, DENMARK


- The "NBS Dike" represents a change in paradigm
- Summer dikes' purpose was to protect farming lands (up to 1,5 m height)
- The "NBS Dike" is meant to primarily enhance conditions for nature to thrive
- Undertaking the "NBS Dike" has also highlight the many non-technical challenges to overcome for NBS to become mainstream

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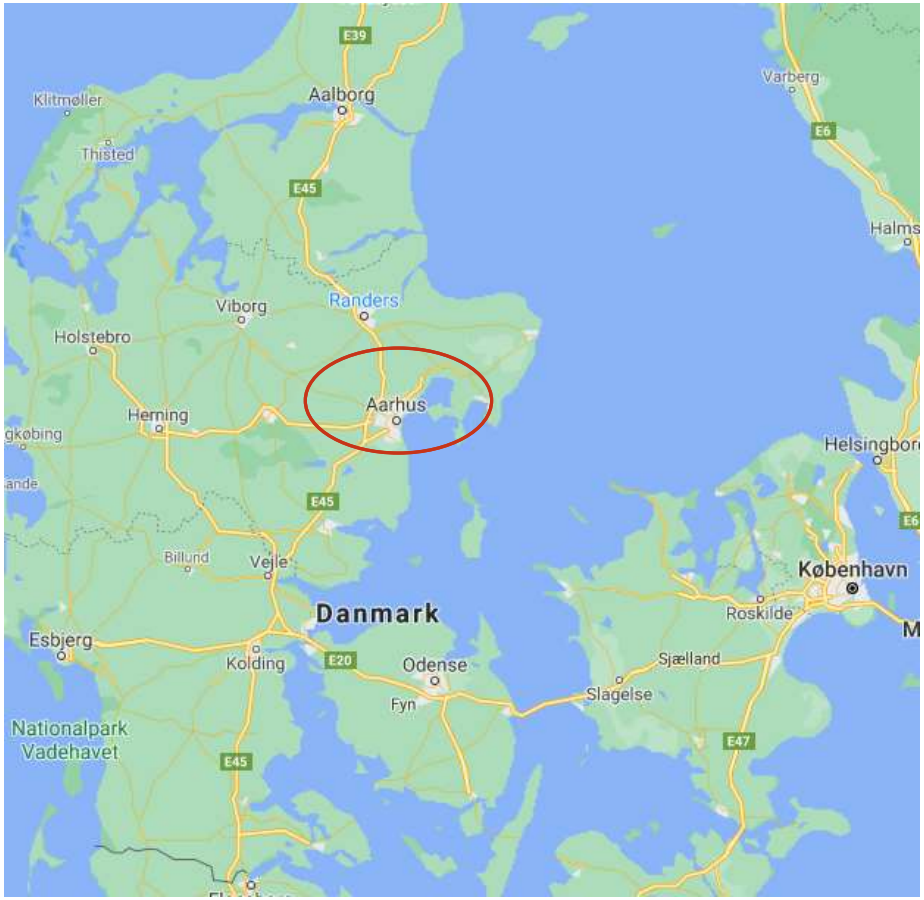
# EXAMPLE 2: AARHUS, DENMARK - LAKE EGÅ




## Primary driver

- Nutrient reduction

## Secondary drivers

- Flood risk reduction
- Nature and biodiversity enhancement in rural areas

# EXAMPLE 2: AARHUS, DENMARK - LAKE EGÅ

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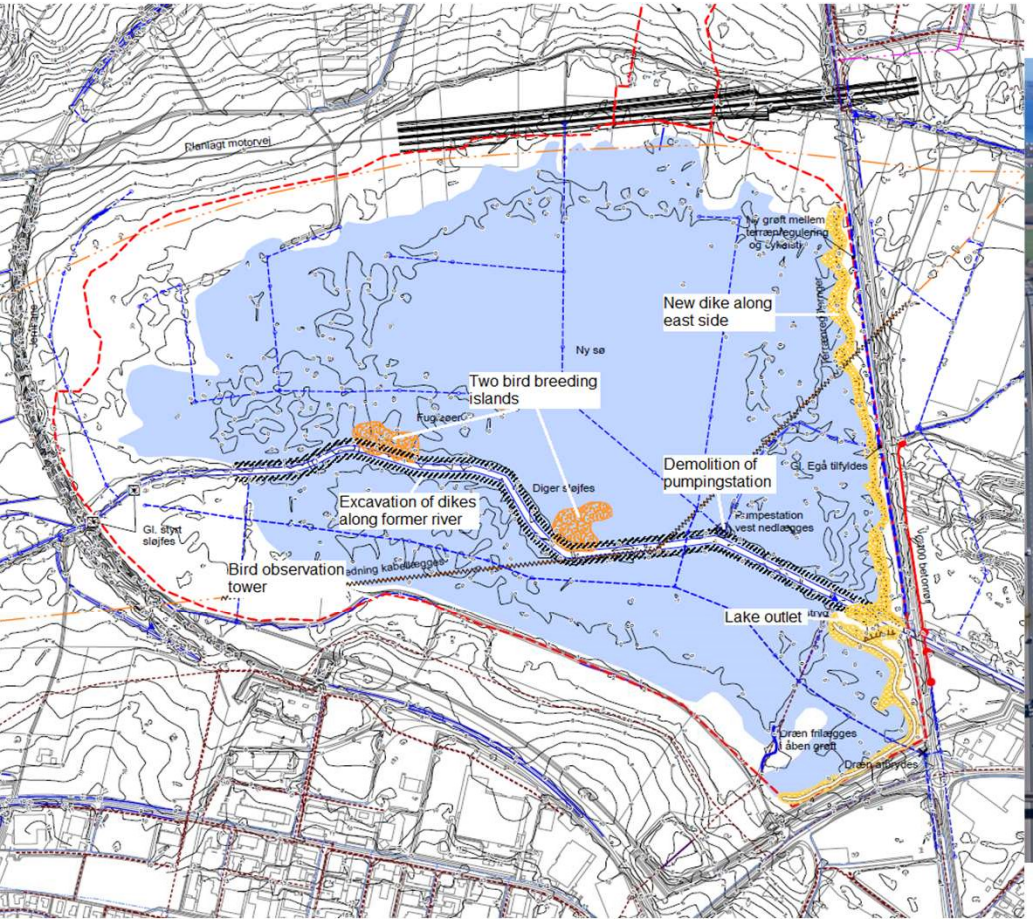


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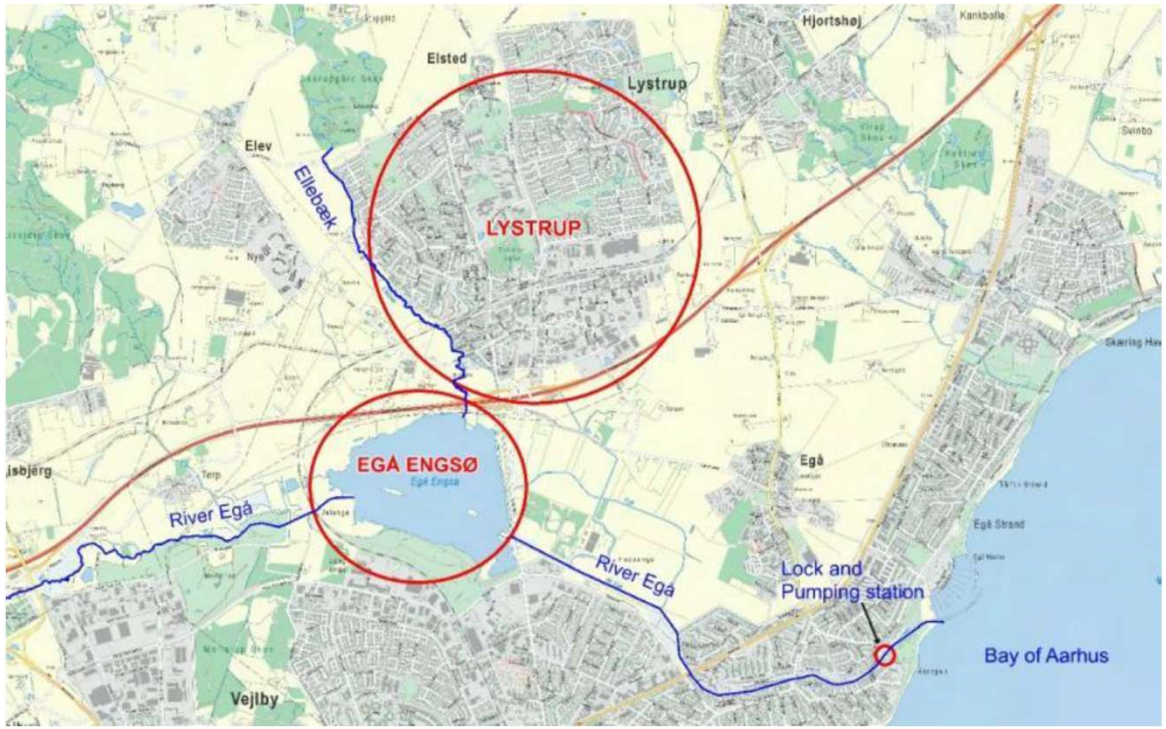
# LAKE EGÅ




## Wetland established

- Reduces the nitrogen discharge to Aarhus Bay
- Improves the natural conditions in and around Egådalen (the valley of Egå)
- Reduces the flood risk from Egå river
- Co-benefit: higher and better recreational opportunities
- The wetland becomes part of an integrated water system

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# EXAMPLE 2: AARHUS, DENMARK – LYSTRUP


## Flood Risk Protection

- 12 distributed NBS for reduction of pluvial flooding: integrated system
- A versatile pilot project
- New green areas
- Entire city secured for 30 million DKK (about 4 mill. EUR)
- Good process with active involvement from citizens and end-users
- No unaffordable barriers

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# EXAMPLE 2: AARHUS, DENMARK - LAKE EGÅ - NATURE

<u>Species richness and composition</u>

- Breeding birds
- Makrophytes
- Invertebrates (water)
- Terrestrial vegetation
- Mammals

(Replicable field survey, based om existing data/monitoring setups from year one after establishment of lake)

<u>Number and type of protected species</u>

- Crested Newt (T. Cristatus)  - amphibians

(eDNA + field survey)

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# EXAMPLE 2: AARHUS, DENMARK - LYSTRUP - WATER

## Co-creation with water utility 'Aarhus Water'

(Measuring in 1 or 2  waterponds)

<u>Quantity - Flood peak/Delay time to peak</u>

- Precipitation
- Waterlevel (Loggers)

<u>Quality -</u>

- Temp + oxygen (Loggers)

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# EXAMPLE 2: AARHUS, DENMARK - LAKE EGÅ AND LYSTRUP

## Indicators for M&E

<u>Number of people that visit or spend time in the NBS area</u>

- Number of visitors

<u>Enhancing the attractiveness…</u>

- Profile of visitors, usage, perception
- Health benefits
- Questionnaires being developed
- Change in land/property values

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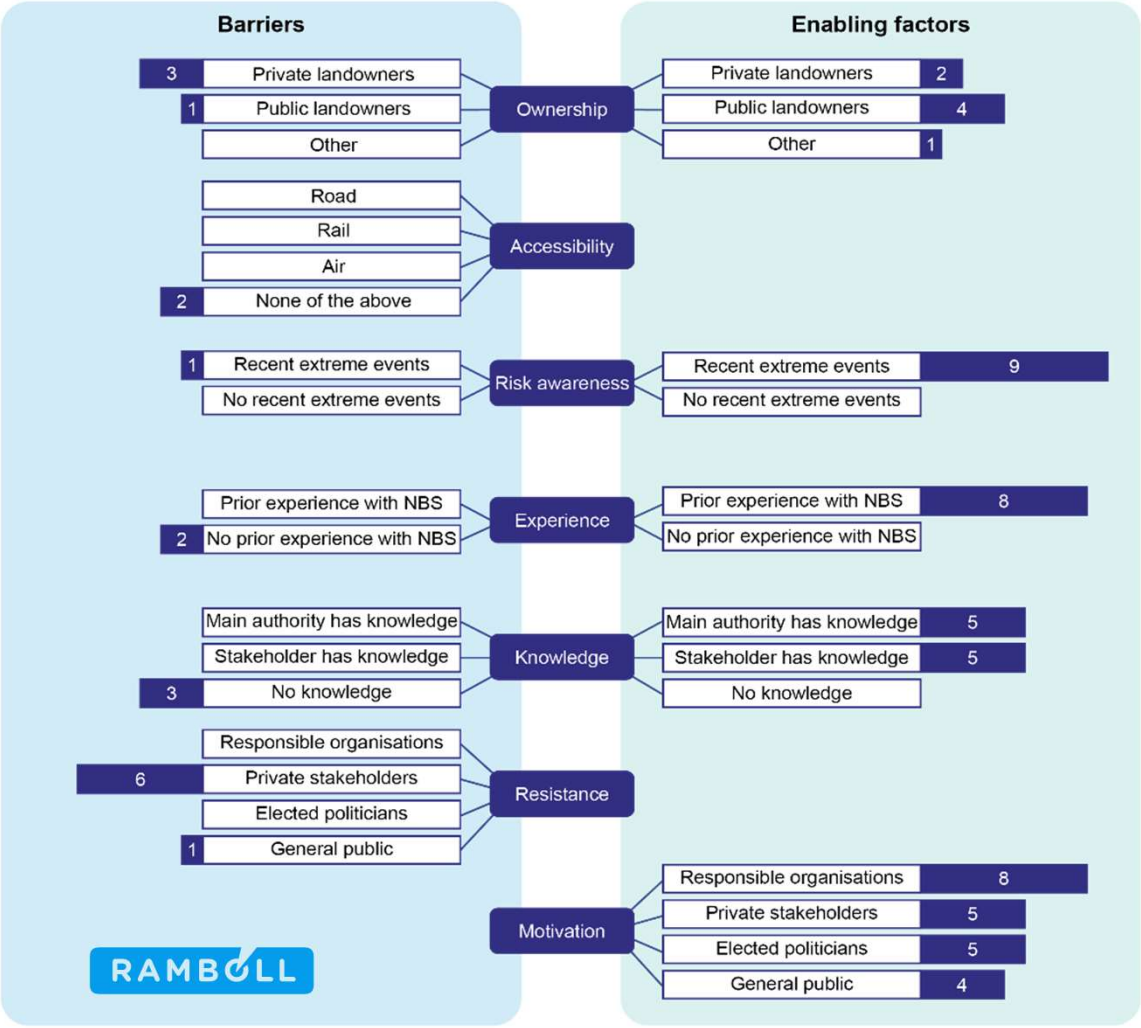
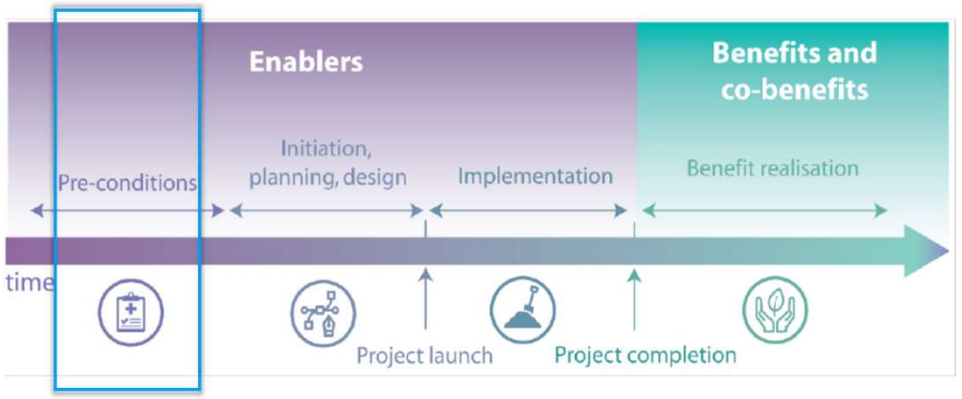
# NBS GOVERNANCE: LESSONS LEARNED SO FAR…



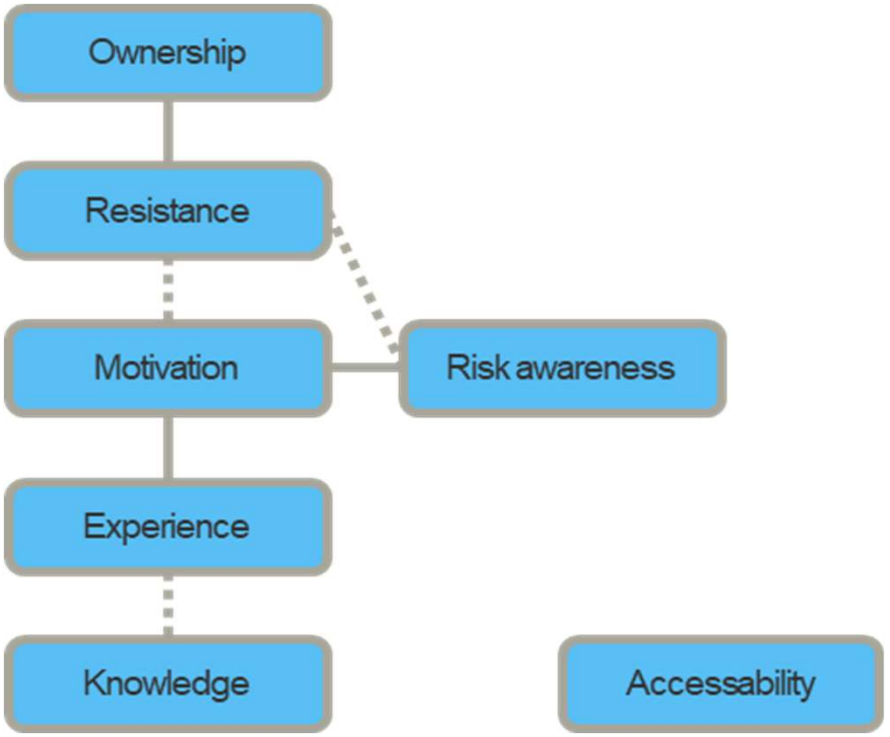




- NBS lifecycle (PHUSICOS)
- Enabling factors and barriers
- Pre-conditions

# NBS GOVERNANCE: LESSONS LEARNED SO FAR…

## Key enabling factors/barriers

- Motivation and co-benefits: what's in it for me?
- Risk awareness: prior events
- Prior experience with NBS
- Knowledge of NBS
- Ownership of land (especially relevant with coastal NBS)
- Resistance from stakeholders
- Accessibility for construction and maintenance

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# Bright ideas. Sustainable change.