Webinarserie

kl. 11.00-11.45

NATURBASERT SONE

Lær mer om blågrønne
og naturbaserte løsninger

Webinarserie åpen for alle:

- Inviterte foredragsholdere fra forskning og forvaltning m.fl.
- Vanligvis ca. en gang i måneden, **torsdager kl.11.00-11:45**
- Info, påmelding, presentasjoner og opptak: www.niva.no/nbs
- Forslag til tema eller andre innspill: nbs@niva.no

#naturbasertsone

Hvordan sikre seg mot flom og skred ved bruk av naturbaserte løsninger – erfaringer fra PHUSICOS prosjektet

Amy Oen og Bjørn Kalsnes

NGI – Norges Geotekniske Institutt

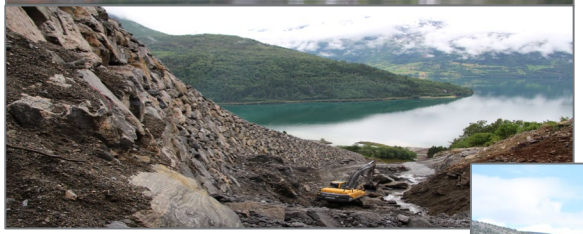
Naturbasert sone, 15. juni 2023

This project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement No 776681

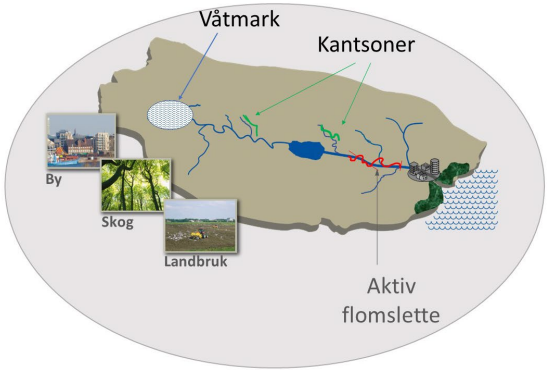
Klimatilpasning flom og skred Norge

- Eksempel Gudbrandsdalen/Kvam 2011/2013

Tradisjonelle tiltak



Naturbaserte løsninger



LaRiMiT – **L**andslide **Ri**sk **Mi**tigation **T**oolbox

1) Hvilke **muligheter** finnes?

2) Er de **gjennomførbare**?

3) Spørsmål knyttet til **økonomi** og **miljøpåvirkning** av tiltaket

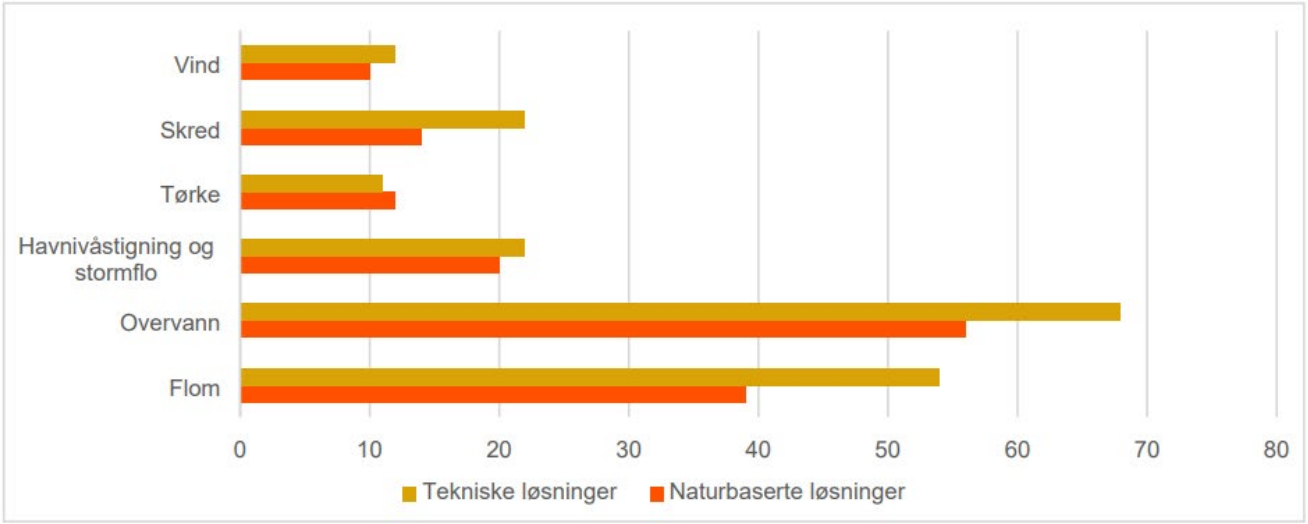
→ *Stor database med tiltak for skredsikring*

→ *Scores utarbeidet av eksperter i skredhåndtering*

KLIMA 2050

Kunnskap om naturbaserte løsninger i Norge

"Tiltak som utnytter naturens prinsipper til både å dempe de negative effektene av forventede klimaendringer, samt å utnytte mulighetene disse endringene kan innebære, på en bærekraftig måte." (Asplan Viak, 2020)



https://www.miljodirektoratet.no/publikasjoner/2021/januar-2021/losningen-er-naturbasert/

Naturbaserte løsninger i Norge

"Tiltak som utnytter naturens prinsipper til både å dempe de negative effektene av forventede klimaendringer, samt å utnytte mulighetene disse endringene kan innebære, på en bærekraftig måte." (Asplan Viak, 2020)

Oppgaver (bevisbyrde), nasjonalt/internasjonalt:

- **NBS effektivitet**
  - Må redusere usikkerhetene knyttet design, konstruksjon og vedlikehold av NBS.
  - Kost-nytte analyser.
- **Tilleggsnytte av NBS**, som tradisjonelle metoder ikke bringer
- **Erfarings database**

https://www.miljodirektoratet.no/publikasjoner/2021/januar-2021/losningen-er-naturbasert/

Flom & skredsikring - nytte av naturbaserte løsninger

- **Fysiske konsekvenser:**
  - Redusere flom- og skredrisiko;
  - Bedre kvalitet på økosystem;
  - Bedre fysiske forhold for innbyggere (friareal)
- **Samfunnsmessige konsekvenser:**
  - Bedre deltakelse i lokaldemokratiet;
  - Øke oppmerksomheten om bærekraftige løsninger;
  - Bedre kommunikasjon mellom problem-eier og brukere
- **Økonomiske konsekvenser:**
  - Kan være økonomisk fordelaktig, ikke minst på lang sikt med tanke på behov for vedlikehold;
  - Stimulere innovativ utvikling;
  - Bidra til involvering av lokalt næringsliv

Klima 2050 report No. 16: Nature-based Solutions. Landslides Safety Measures

Flom & skredsikring – mulige ulemper av naturbaserte løsninger

- **Fysiske konsekvenser:**
  - Større arealbehov
  - Egnethet for høyrisikoprosjekter (kvikkleire, storflom, …)
  - Mangler erfaringsdatabase (hvor virker, og hvor virker ikke)
- **Samfunnsmessige konsekvenser:**
  - Større usikkerhet mht effekt (frykt hos publikum)
- **Økonomiske konsekvenser:**
  - Manglende avklaring ansvarsforhold – behov for standarder
  - Vanskeligere å finne privat «risikokapital»

PHUSICOS – ‘According to nature’

EU HORIZON 2020 Innovation Action (2018-2023) to demonstrate the implementation of nature-based solutions to reduce the risk of extreme weather events in rural mountain landscapes:

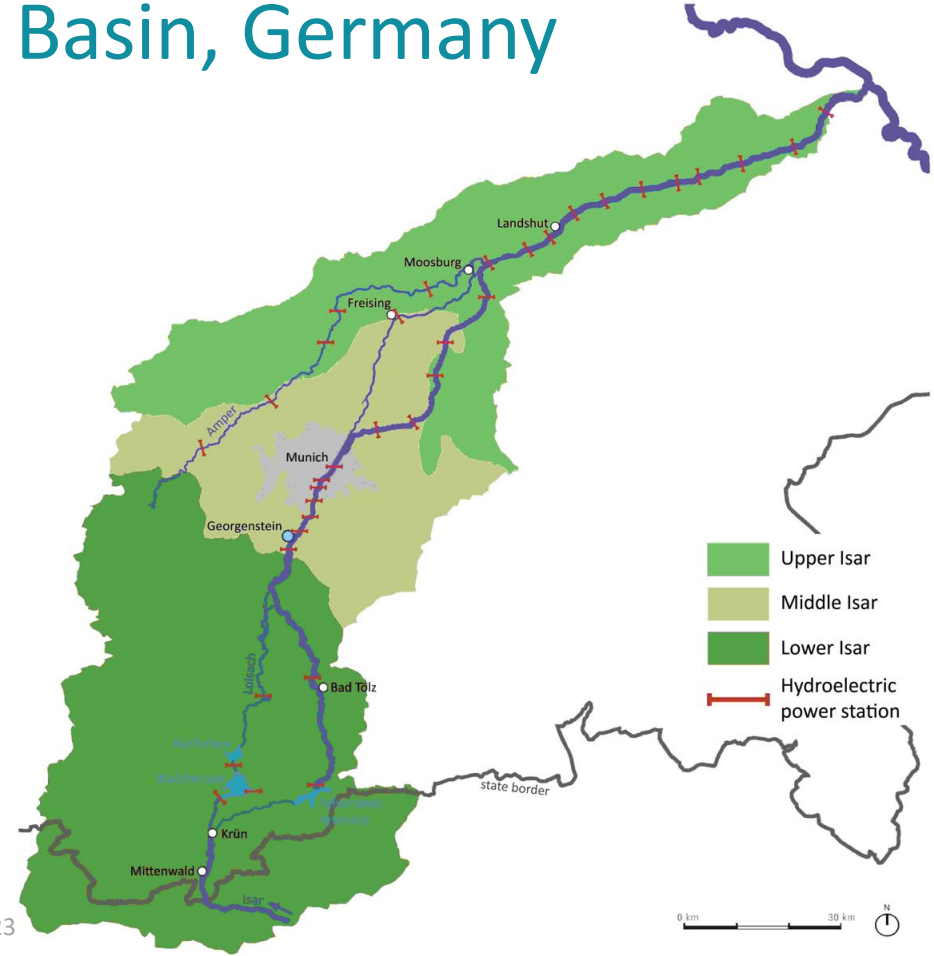
- The impacts of extreme hydro-meteorological events in mountain areas often affect entire river basins (flooding and landslides)
- Extreme weather events trigger rapid-moving mass gravity flows
- Managing water issues can help manage landslide and debris flow hazards downstream.
- Mountainous and rural regions do not receive same attention as urban areas.

Illustration: The Norwegian Water Resources & Energy Directorate

NBS implementering i PHUSICOS

Site	Hazard (NBS Intervention)
Gudbrandsdalen, Norway	Flooding (Receded green barrier – not to be implemented in project) Flooding (Retention high in catchment) Flooding, debris flow (Vegetation, check dam) Flooding, torrents (Historic water ways suggested by local stakeholders)
Isar River Basin, Germany	Flooding (Flood plain restoration already implemented)
Kaunertal, Austria	Erosion, landslides (microbe-assisted revegetation)
Serchio River Basin, Italy	Erosion, run-off, pollution, flooding (Vegetated buffer strips at two locations and education) Flooding (Vegetated retention basin) Flooding (Gentle channel maintenance)
Pyrénées, France & Spain	Erosion, rockfall (Vegetated terraces) Rockfall (Wood structures) Snow avalanche (Afforestation) Debris flow (Wooden gabions with vegetation)

Isar River Basin, Germany



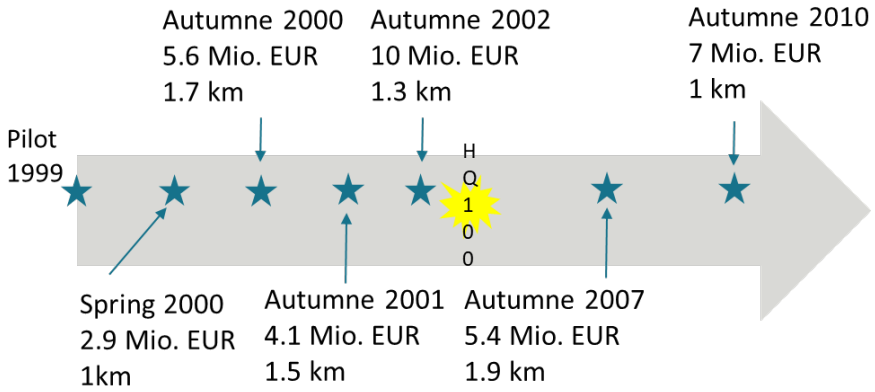
Isar River, Germany – the ‘Isar-Plan’

- 8 kilometer
- Bank flattening
- Increased flooded area
- Bed expansion and river braidening
- Removal of artificial embankment
- Honey comb structure
- Secondary Dam rehabilitation

Implemented Isar-Plan (Aude Zingraff-Hamed, May 2015)

Isar River, Germany – the ‘Isar-Plan’

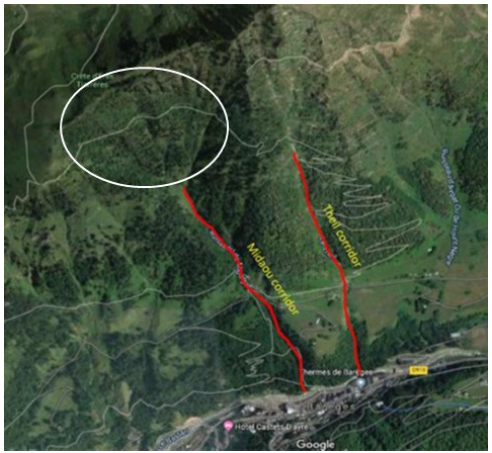
- Funding:
  - 35,000,000 Euros
  - Funded by: City government & Water agency
- Flood risk reduction:
  - Avoid good destruction and life loss (HQ100)
  - Hydro-morphological simulation
  - 3D flow Model
- Co-benefits:
  - Good Ecological Status
  - Increase of recreational uses (conflict with ecological benefits)
  - Increase of cultural value
  - More restaurants
  - Increased tourism
  - Increase of the housing value

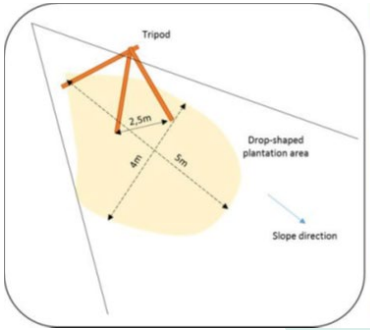


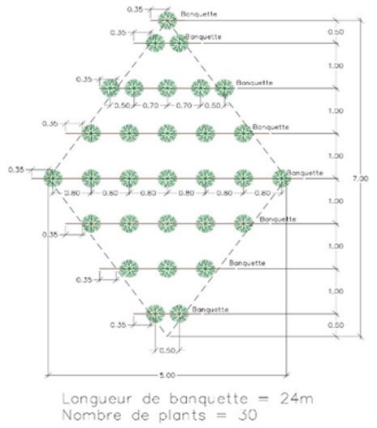
Pyreneene, skogplanting

Capet Forest, France (Baréges)

- Snow avalanches
- Various ‘grey’ measures since 1860 (‘Museum of measures’)
- Afforestation in the release area; 6800 plants of local tree species
- Planted in polygons of 16 and 30. and protected by 88 wooden tripods, existing measures or existing vegetation
- Will need 20-30 years to reach its full potential



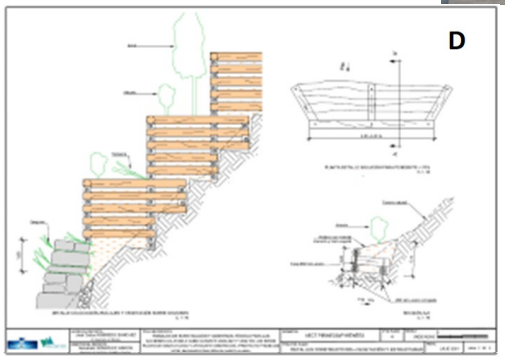




Pyreneene, terrasering/revegetering

Santa Elena, Spain

- Erosion & rock fall
- Glacial till
- Dry masonry wall & timber gabions
- Local bushes / trees with deep roots



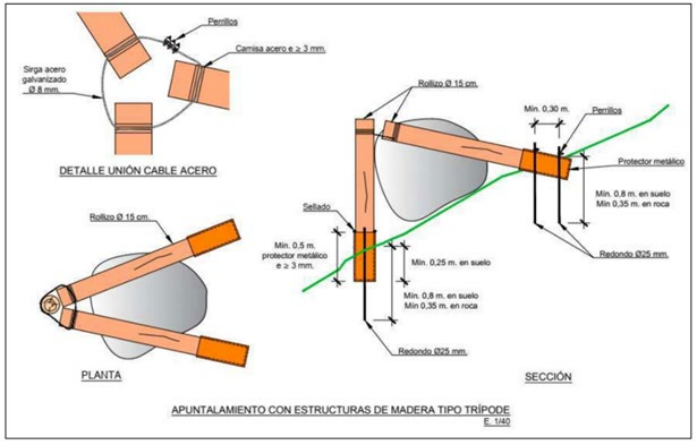
Erill-la-Vall, Spain

- Shallow and deep-seated instability – debris flows.
- Thick glacial till
- Terracing main gullies w/ rocks and timber gabions, local soil, bushes and trees.
- Monitored since 2007

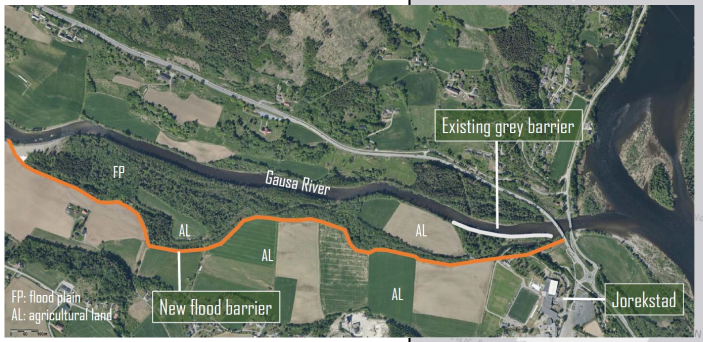
Pyreneene, ‘andre konstruksjoner’

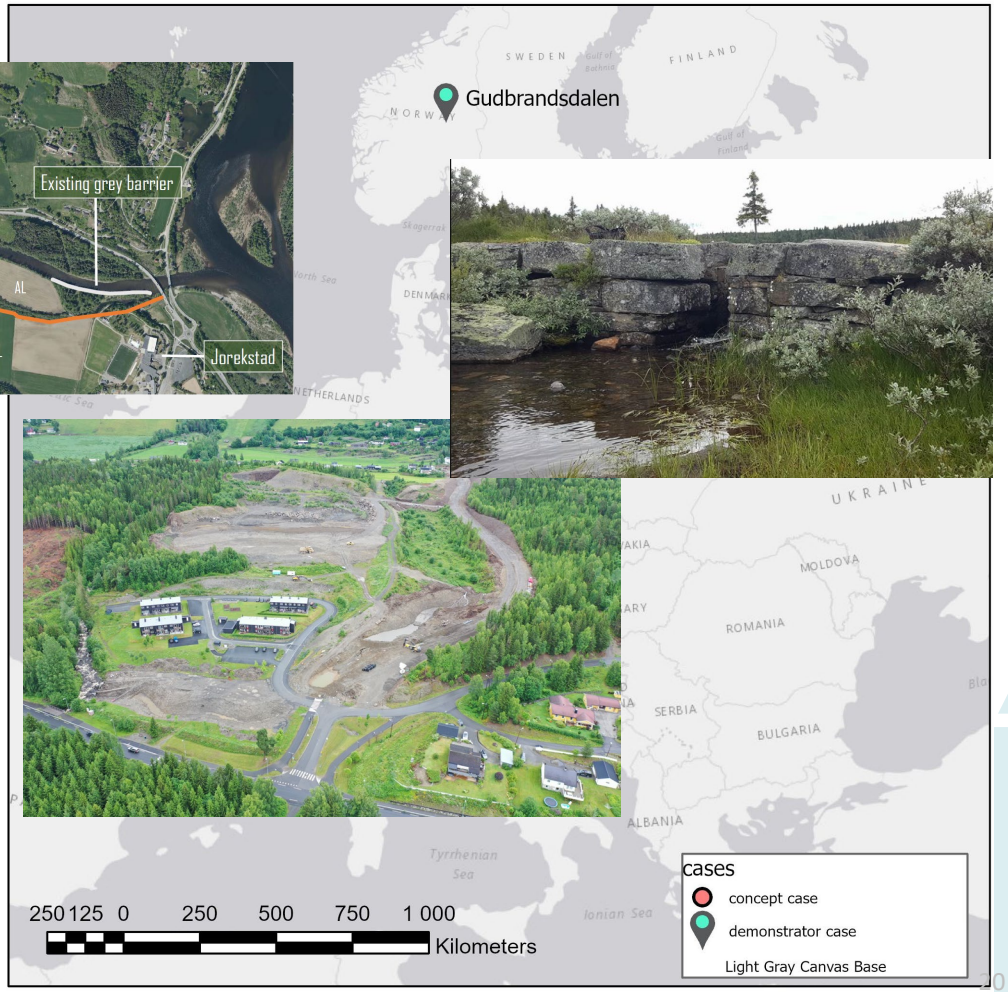
Artouste, France

- Rockfall from ledges and blocks on the till surface threaten road.
- Fixing individual rock fall sources by wood- and rock constructions.
- NBS?? - work done by hand. i.e. avoiding access roads, heavy machinery, etc.

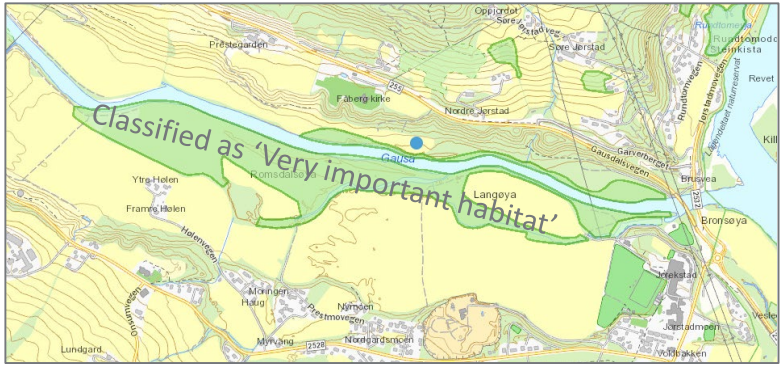


Gudbrandsdalen





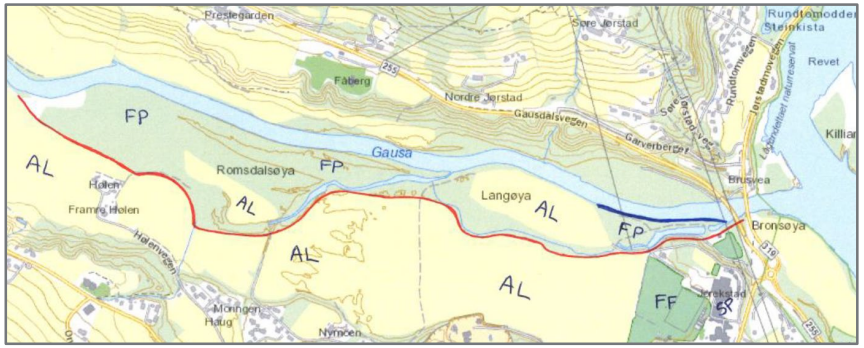
Jorekstad ‘grønn’ tilbaketrukket flomvoll

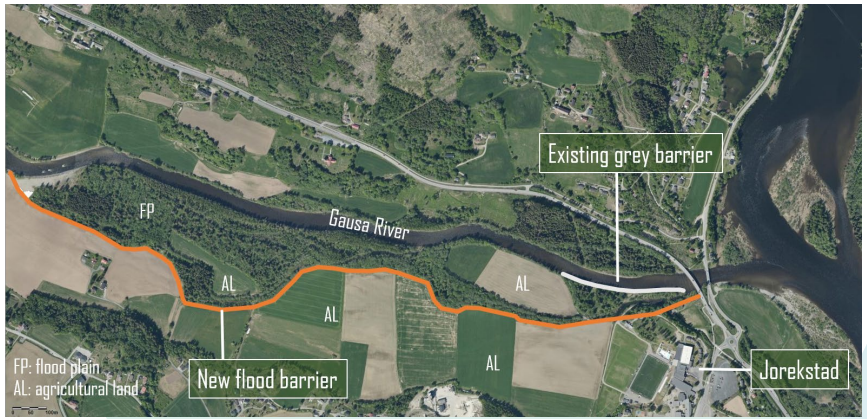


Aerial photographs: 2019 (after) versus 1967 (before) existing flood barrier. The flood barrier changed the riparian sone and some important species disappeared.

Jorekstad ‘grønn’ tilbaketrukket flomvoll

- Receded flood barrier to allow more space for flooding.
- Protects sport facilities and housing, as well as farmland.
- Avoid problems with sediment deposition and shallowing of main river Gudbrandsdalslågen
- Restore flood plane (FP) riparian vegetation, with several red-list species.
- Agricultural land (AL) inside the receded barrier is also flooded during extreme events today





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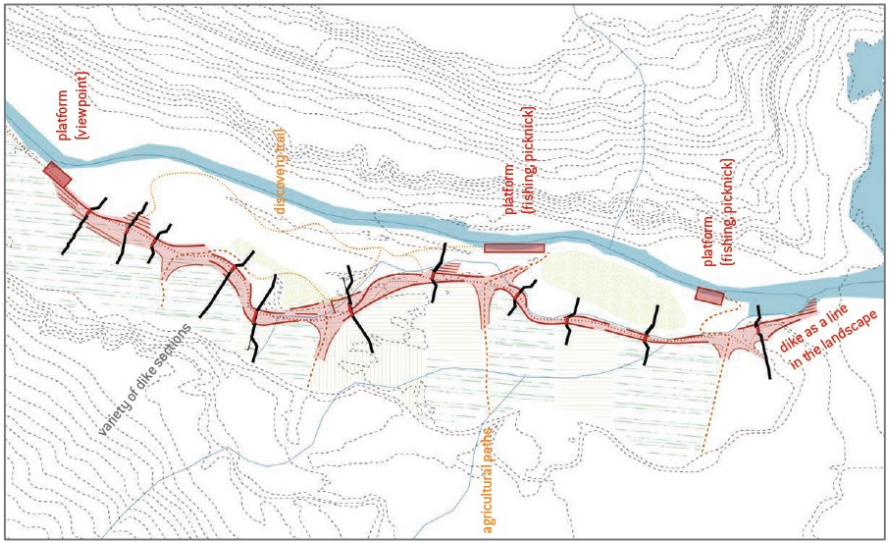
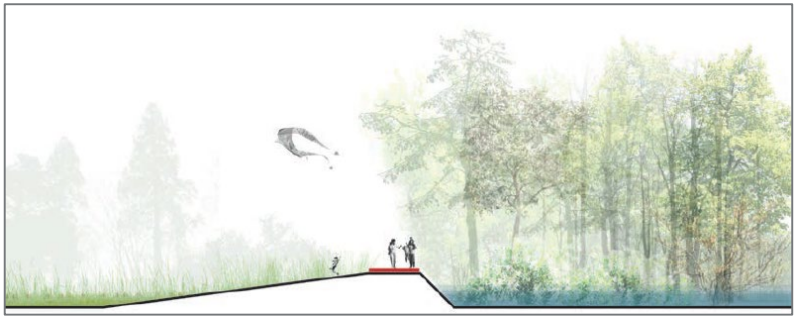
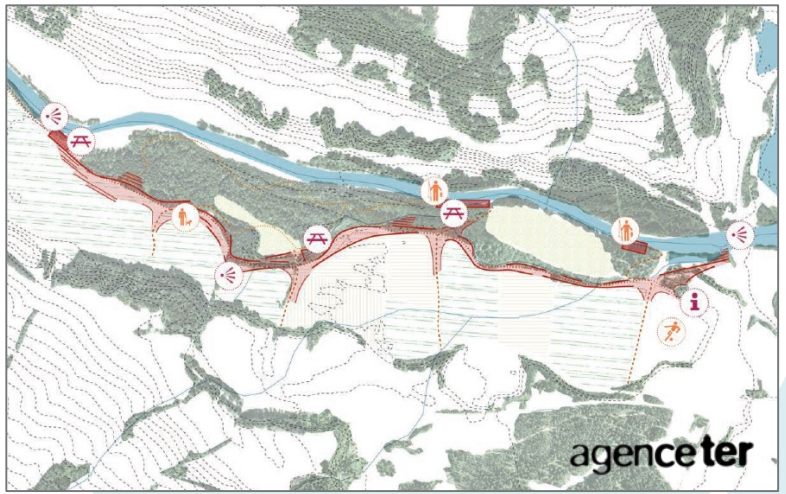
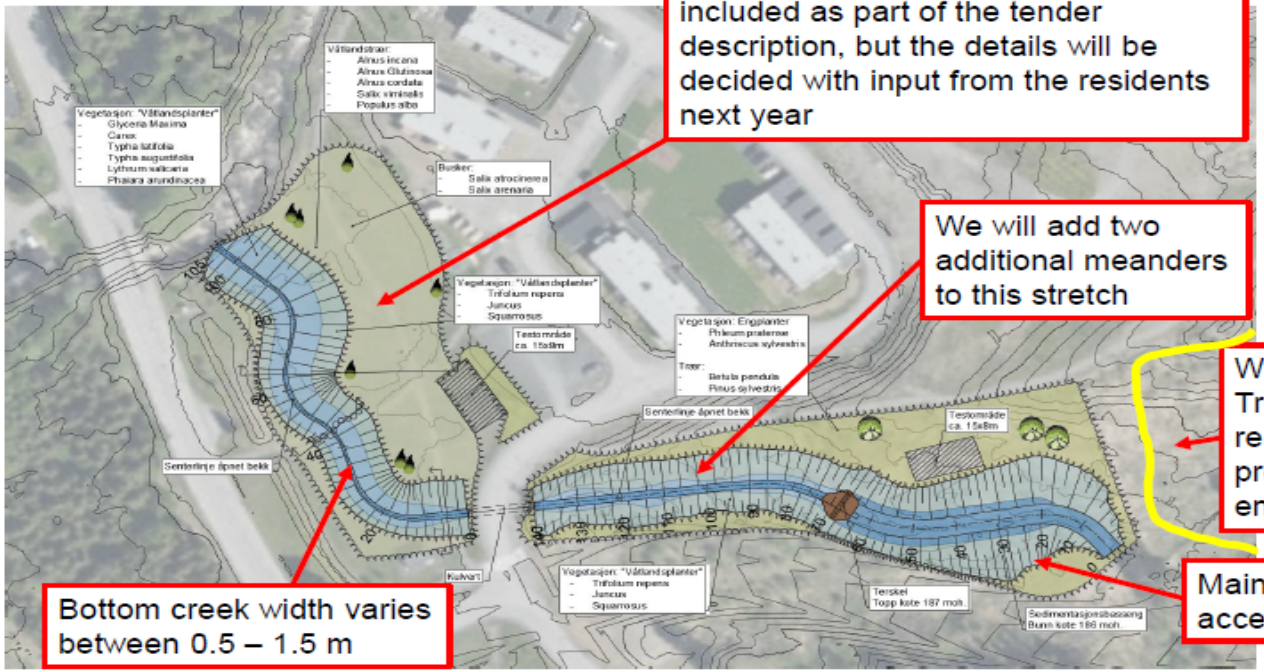






Trodalen, Øyer - planer

Overview



Trodalen, Øyer - gjennomføring

Barrierer – erfaring fra Jorekstad

1.	Lack of political will and long-term commitment	
2.	**Lack of sense of urgency among policymakers**	**General skepticism to NBS, lack of knowledge**
3.	**Lack of public awareness and support**	
4.	Risk aversion and resistance to change	
5.	Silo mentality	
6.	**Misalignments between short-term plans and long-term goals**	**Merging of two counties**
7.	Lack of supportive policy and legal frameworks	
8.	Lack of design standards and guidelines for maintenance and monitoring	
9.	Lack of skilled knowledge brokers and training programs	
10.	**Functionality and performance uncertainties**	**General skepticism to NBS, lack of knowledge**
11.	**Perceived high cost**	
12.	**Lack of available financial resources**	**Too little funding available**
13.	**Lack of financial incentives**	
14.	**Property ownership complexities**	**Loss of agricultural land**
15.	Space constraints	
16.	**Procurement challenges**	**Complex, formal objections**
17.	**Other factors**	**Loss of income from gravel removal**

Solheim et al. 2021 *Sustainability*, 13, 1461.

Guide book

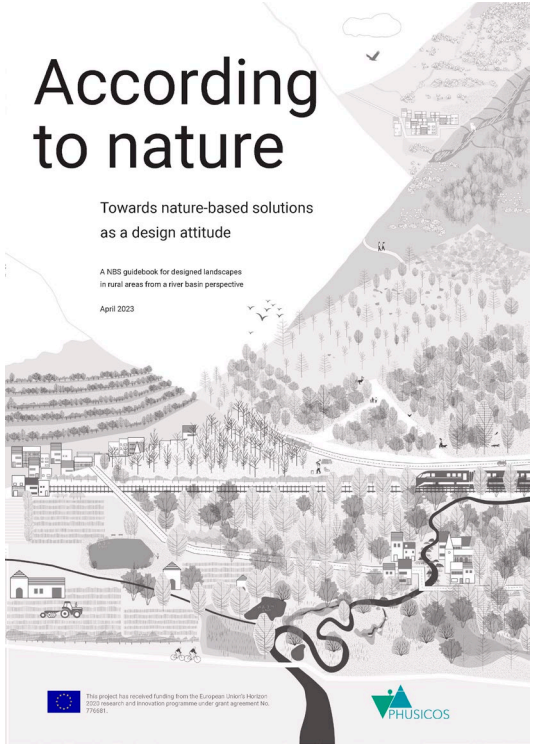


Table of contents

Guide book – rivers and lakes (example)

C1.RIVERS AND LAKES

Making room for the floodable river

Rivers and lakes, including ponds and streams, belong to the big family of the so-called freshwater habitats. Rivers are natural watercourses flowing gravimetrically from high elevations (mountain springs) towards another waterbody at a lower elevation, such as an ocean, sea, bay, lake, wetland or another river. Lakes are strictly connected to rivers, being naturally occurring, relatively large body of water localized in a basin completely surrounded by dry land, with much slower-moving flow than any inflow or outflow streams that serve to feed or drain it. A river system comprises both the main course of the river and all the tributaries that flow into it. In addition to the river channels, riverine ecosystems include riparian zones, floodplains, and wetlands, contributing significantly to the overall riverine biodiversity, renewable resources, and ecosystem goods per unit area. The area that the river system drains is known as the catchment, including both land and water. Rivers are dynamic and may change form several times throughout their course. For example, a fast-flowing mountain stream may develop into a wide, deep and slow-flowing lowland river. River systems are among the zones of the earth with the highest biological diversity, as well as the most intense human activity. Therefore, freshwater biodiversity is endangered in many areas, as a consequence of decades of humans exploiting rivers with large dams, water diversions and pollution.

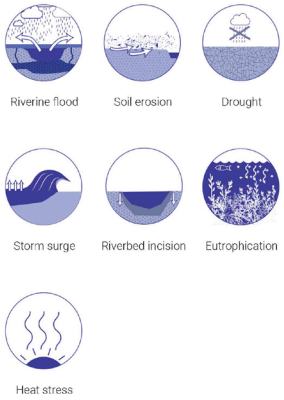
Rivers and lakes, including riparian areas, cover about 7.5% of the EU land area. Joint Research Centre (JRC, 2020) reports that large parts of rivers and lakes are in a state of crisis due to land take. They harbour a high amount of biodiversity, and this makes them extremely sensitive to environmental impacts, as they integrate disturbances from their entire catchments. These types of external stresses affect not only water quality and quantity, but also the biodiversity of both flora and fauna, and both freshwater ecosystems and riparian ecosystems.

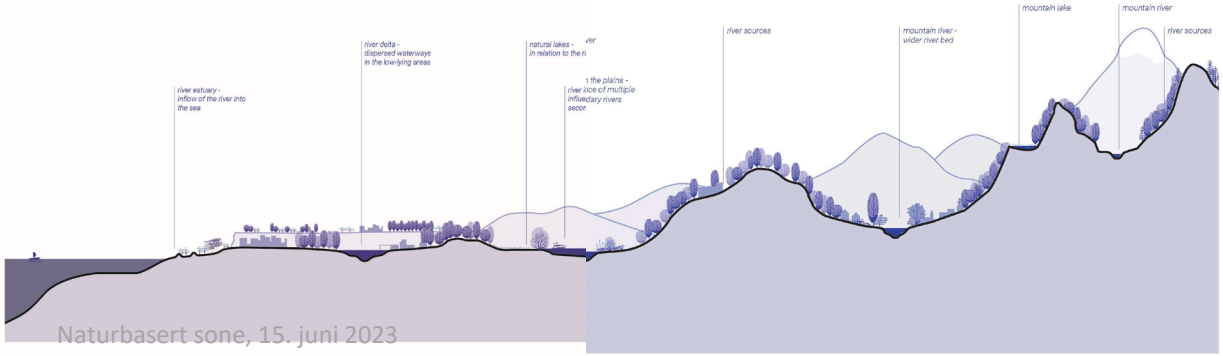
River systems and lakes have critical roles for various ecosystem services, such as biodiversity, erosion protection, water availability and flood attenuation. According to JRC (2020) expansion of artificial land in riparian areas in 2000-2018 has occurred at a rate of 7% per decade, especially at the expense of agricultural land. In addition, climate change causes a significant and increasing pressure on the river and lake ecosystems.

Main legal instruments that share the objective to maintain or enhance the sustainable use or ecosystems include the Water Framework Directive, Nitrates Directive, Bathing Water Directive, Urban Waste Water Treatment Directive, Birds and Habitats Directives, Groundwater Directive, Floods Directive, Directive on Environmental Quality, EU Biodiversity Strategies to 2020 and to 2030; Invasive Alien Species Regulation.

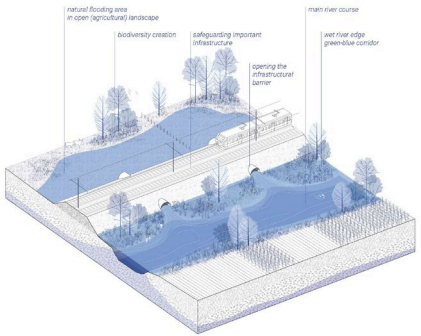
HAZARDS

Most hazards for rivers and lakes are related to extreme weather events, most often linked to precipitation. Extreme weather events in rivers and lakes not only affect people and properties directly exposed, but impact also the ecological health of our freshwater systems. Many of our rivers and lakes have been dramatically modified in the past by human activities, for example by "narrowing" or paving the channels with concrete, thus reducing the natural ability of freshwater ecosystems to withstand or recover from these events. Land use changes have also affected the possibility of letting the river system naturally handle flood situations (flood plains, wetlands). Vegetation clearcutting and change in natural river shape can favour soil riverbed Riverbed incision, which consequently re-shapes river channels, compromising the stability of riverbanks. Erosion due to water runoff leads to shallow riverbank instabilities that obstruct the natural water flow. Major floods can increase domestic, agricultural, and industrial pollution to rivers and lakes and reduce water quality. Drought events increase levels of pollution, hinder fish movement, expose water plants to damage, heat stress or frost, and increase the risk of eutrophication. In tropical coastal areas, storm surges caused by strong winds, tsunamis or hurricanes can affect flooding regimes and freshwater inputs over the short and medium term.





Guide book rivers and lakes (NBS)



RE-ENABLING NATURAL FLOODING AREAS

TYPE OF INTERVENTION

C Creation

M Management

HAZARDS

(Riverine) flood · Flash flood · Drought · Heat stress

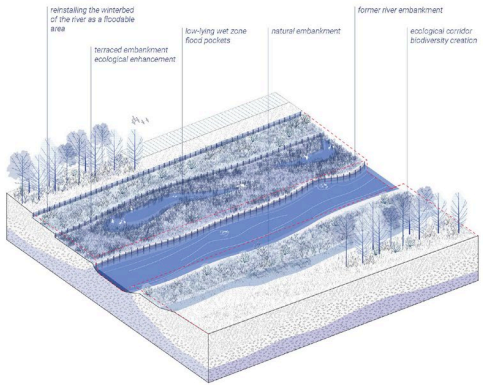
DESCRIPTION

Flooding areas along rivers are natural retention spaces for water from riverine flood caused by heavy rainfall and/or snow-melt. They play an important role for flood risk reduction. These wet landscapes bring many opportunities for specific nature and habitat development, while allowing the reduction of drought problems. Often former natural floodplains were cut off from the river by extensive urban and infrastructural development over time. The restoration of the flooding areas as an intrinsic part of the river logic is fundamental to recover natural processes and to guarantee future flood protection. This goes hand in hand with a strong management on the scale of the river basin and cooperation between sectors and regions.

MAIN FUNCTIONS AND BENEFITS

Riverine flood regulation · Pluvial flood regulation · Drought mitigation · Water pollution regulation

Education · Climate resilient landscape · Biodiversity creation · Integrated water management



RIVERBANK ADAPTATION & SETTING BACK LEVEES

TYPE OF INTERVENTION

P Protection

R Restoration

HAZARDS

(Riverine) flood · Flash flood · Drought · Riverbed incision

DESCRIPTION

When levees are built (too) close to the river, they prevent water from flowing across the natural floodplains during (riverine) floods, which increases the water velocity and thereby the erosional power. Moreover, levees can complicate the ecological and biological dynamics of the river basin by interrupting lateral connections between streams.

Widening the riverbed creates more room for the water in case of a riverine flood or heavy rainfall. By setting levees back, a natural flooding regime is reinstalled, which results in lower flood levels and more diverse habitats in the floodplain. At the same time an adapted riverbank also decreases the risk of erosion.

MAIN FUNCTIONS AND BENEFITS

Flood regulation · Drought mitigation · Biodiversity stimulation · Riverbank erosion mitigation

Natural corridors · Tourism and recreation · Climate resilient landscape · Integrated water management

Lærdom fra PHUSICOS (forskning)

- Planlegg i god tid. Å få planene gjennomført tar mer tid enn man kanskje tror.
- Innkjøp kan være tidkrevende. Vær så detaljert som mulig i konkurransegrunnlaget. Formelle innsigelser vil føre til alvorlige forsinkelser.
- Ta med interessenter inn i prosessen så tidlig som mulig, helst fra begynnelsen av;
  - Samskaping av tiltakene etablerer 'eierskap' og øker entusiasmen.
  - Bruk deres lokalkunnskap der det er mulig og vis takknemlighet.
  - Identifiser ambassadører for prosjektet og samarbeid tett med dem.
  - Identifiser potensielt "problematiske" interessenter og planlegg strategier for å håndtere dem.
- Velg offentlig eid landområde (hvis mulig).
- Naturbaserte løsninger tar tid å etablere og bli effektive, så planlegg og implementer langsiktige overvåkingsprogrammer for å dokumentere effekt og forbedre kunnskapen om usikkerheter.
- Vurder hybride løsninger.

This project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement No 776681

Takk for oppmerksomheten!

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https://phusicos.eu/
@phusicos

Takk for i dag!

Velkommen til neste #naturbasertsone

24. august

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Kontakt: nbs@niva.no