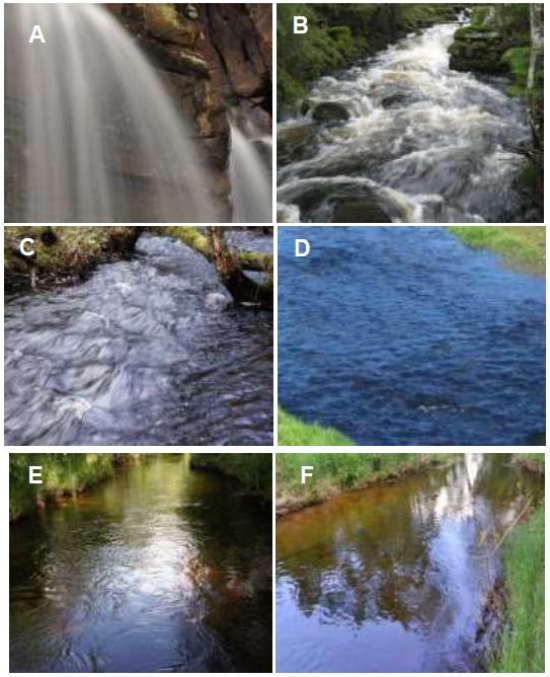
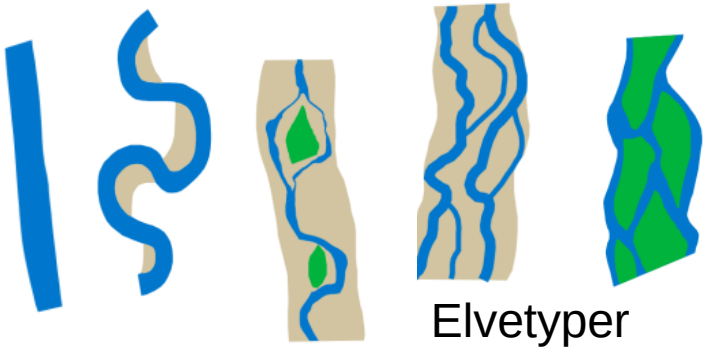
# SusWater WP6
## Status desember 2017


Mesohabitater / strømningstyper

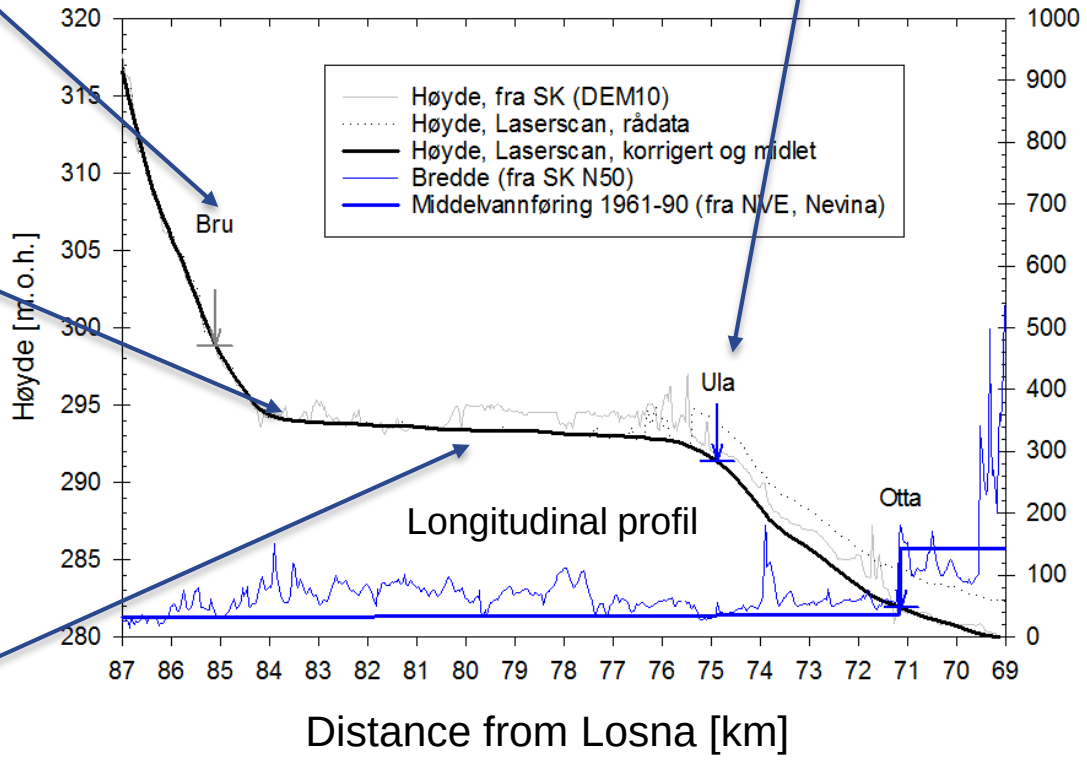
Elvetyper


| Class | Code | Description |
|---|---|---|
| 1 | | Near-natural |
| 2 | | Slightly modified |
| 3 | | Moderately modified |
| 4 | | Extensively modified |
| 5 | | Severely modified |

# Leveranser WP6

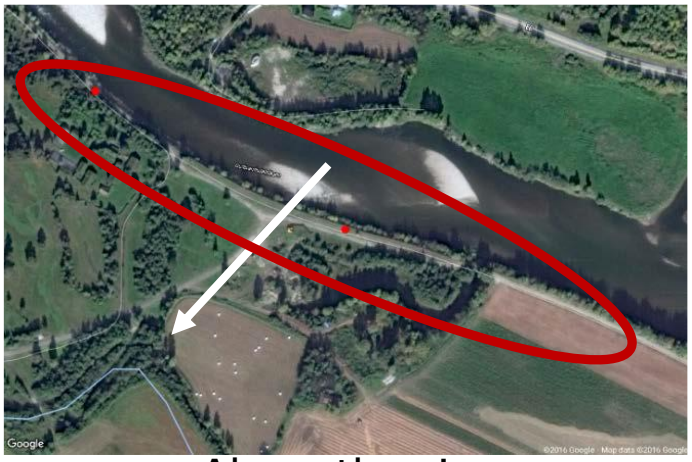
- Workshops
  - Forsker-workshops
  - Nordisk vannforvaltning
  - EU WFD Ad-hoc task force HyMo
- Notater og rapporter
  - Test av metoder i Lågen og Surna
  - Tilpasning av CEDREN-metodikk
  - Oversikt over internasjonale metoder
- Best practise håndbok:
  Tiltak for miljødesign
- Anbefalt metodikk for karakterisering og klassifisering av HyMo

# Test of methods in Gudbransdalslågen




*from Peggy Zinke, NTNU/SINTEF*

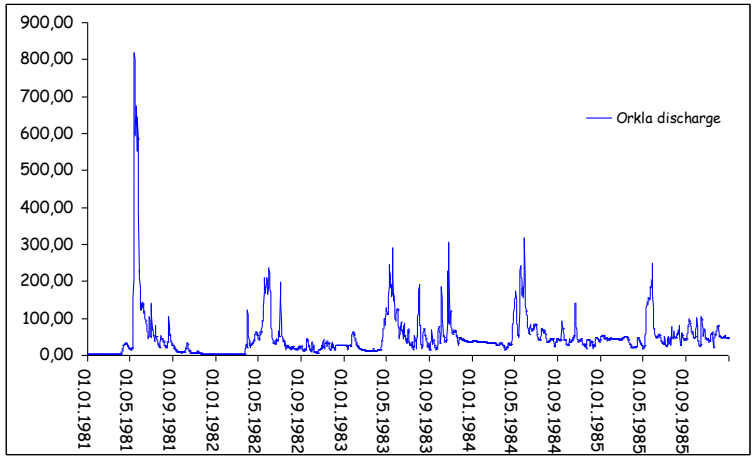
# Four categories of HyMo




Along the river
- impacting lateral connectivity

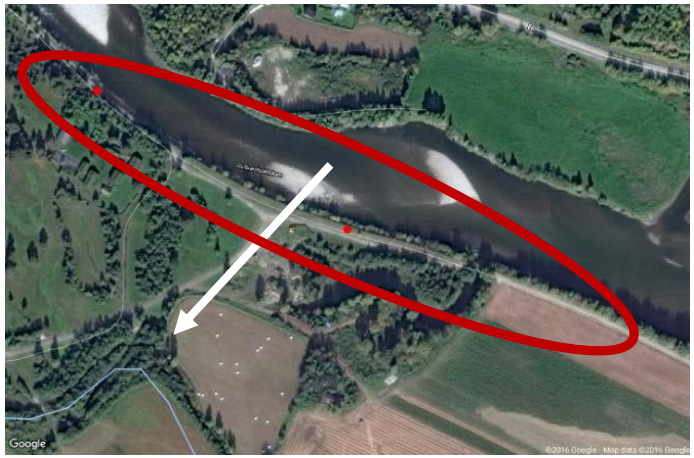
Inside the river
- impacting in-channel habitats

Across the river
- impacting longitudinal connectivity

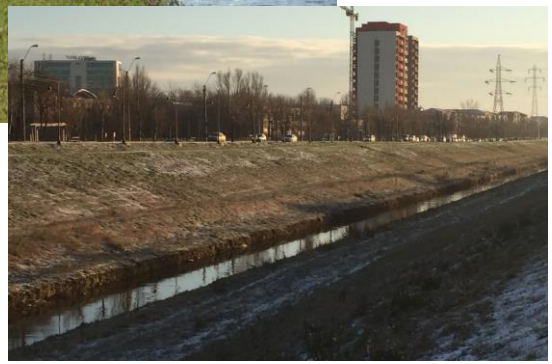



Hydrology
- impacting all factors

# Lateral connectivity and embankment




Along the river



- Access to floodplain, side arms and oxbow lakes
- Possibility to move laterally
- Erosion and sediment balance impacts
- Riparian zone
- Channelization
- Incision

Indicators:

- % of river length with levees (above land surface)
- % of river length with embankment
- % of river length without trees along bank (only below tree-line)
- Incision – need to measure in field

# Changes across the river

Across the river

- Barriers for fish migration
- Barriers for sediments, ditrius and nutrients
- Fragmentation of habitats
- Have to include barrier in upstream water body

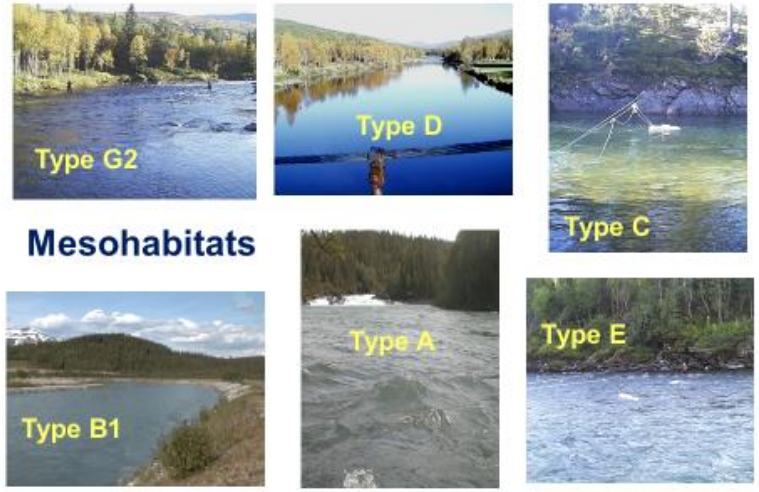
Indicators:

- Degree of fragmentation
- Barrier effect
- How much of the water body is backed up by weirs?
- Degree of regulation in catchment

# Changes inside the river

Inside the river

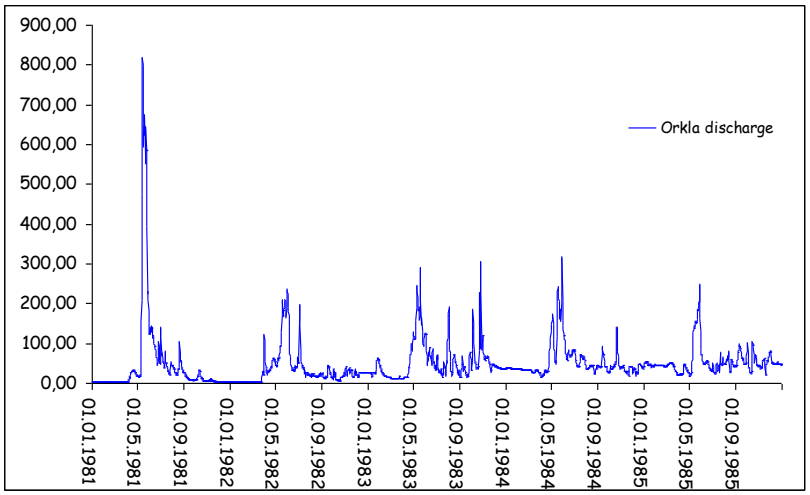
- Wetted area, surface pattern, water velocity, depth (mesohabitats/geomorphic units, i.e. river type in handbook)
- Substrate and shelter
- Structures in the river
- Removal of sand and gravel




Indicators:

- % of river length impacted by structures (aerial photos, maps, etc)
- % of river length of removed gravel/sand (recorded by local authorities)
- Substrate and shelter: Measure in situ
- Changes in river types: only possible if pre-impact studies exist

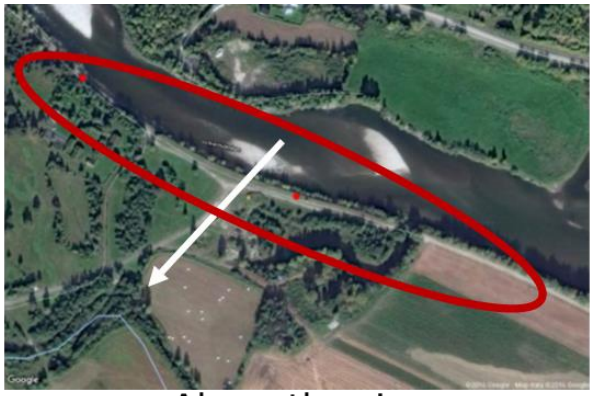
# Changes in hydrology




- Total amount of flow
- Lowest weekly flow
- Floods of 1 and 10 years return period
- Peaking: Ratio, ramping rate and dewatered area
- Water temperature and ice

Calculate changes based on 30 years of flow data, with and without pressure

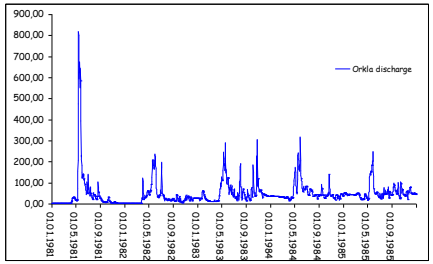
# Comparing to reference



Along the river
- impacting lateral connectivity

Across the river
- impacting longitudinal connectivity

- Absence of levees, embankments, incision, impacting lateral connectivity
- Absence of dams, weirs and constructions across the river
- Hydrological analysis before – after by models



# Comparing to reference - inside the river

Inside the river
- impacting in-channel habitats

- Data from reference existing
  - Measurements
  - Photos, databases
  - Assessments, investigations

- Data from reference absent
  - Typology for reference
  - Altitude
  - Gradient
  - Expected class

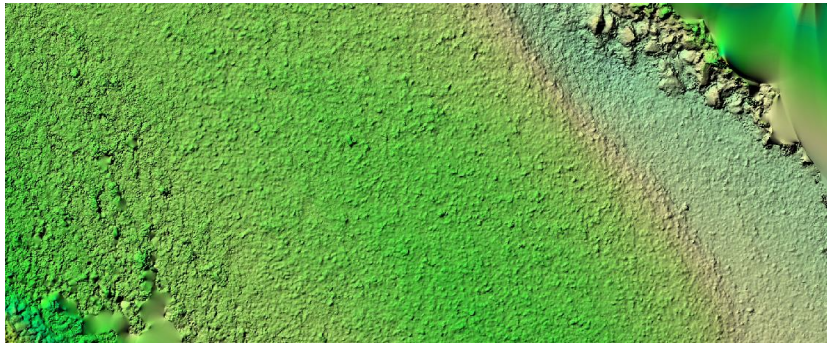
*Table 20. Classification of river classes based on physical criteria and obtained by the pooling of mesohabitats (**table 19**).*

| River class | Mesohabitat | River surface | Gradient | Water velocity | Water depth |
|---|---|---|---|---|---|
| Glide | A+B1+B2 | Smooth | Moderate | Fast | Shallow/Deep |
| Pools | C | Smooth | Moderate | Slow | Deep |
| Shallows | D | Smooth | Moderate | Slow | Shallow |
| Whitewater | E+F | Turbulent | Steep | Fast | Deep/Shallow |
| Rapids | H+G1+G2 | Turbulent | Moderate | Fast | Shallow/Deep |

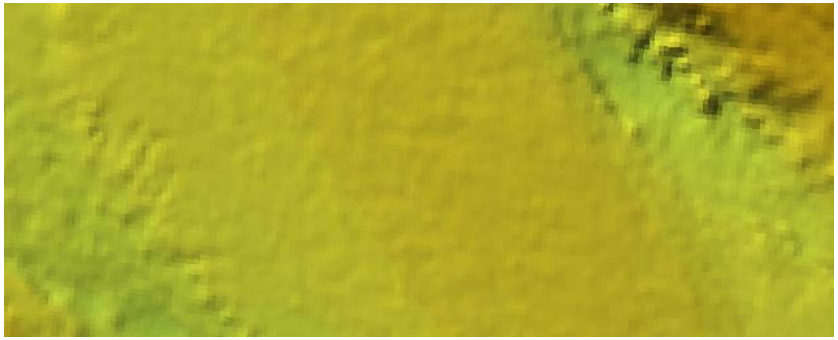
# New technologies

Picture from drone

Picture from airplane



Terrain model from drone picture



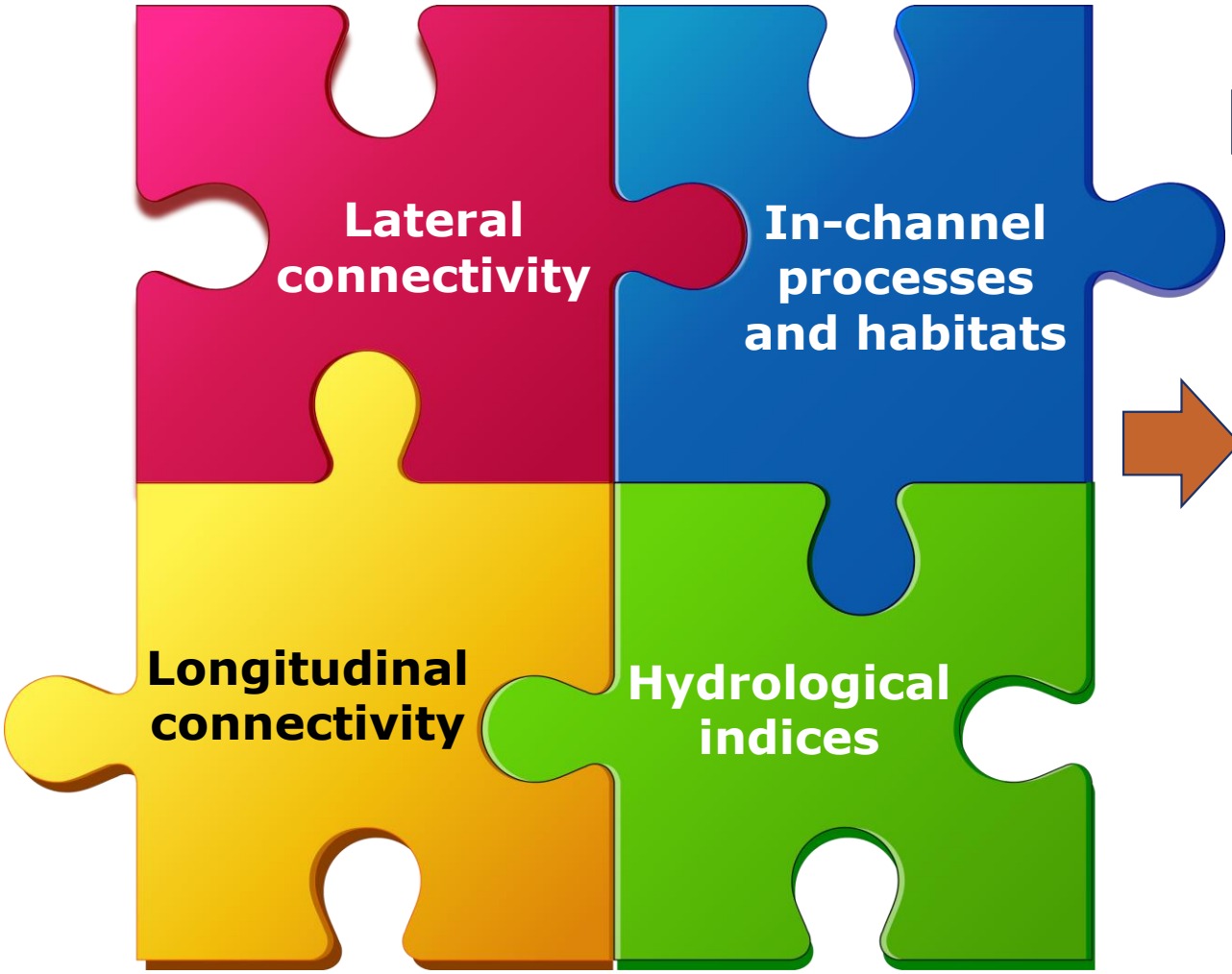
Green LiDAR image

*from Agnès Moquet-Stenback, NVE*

# Indicators for HyMo

| | Theme: | Importance | Why important | Metrics for change |
|---|---|---|---|---|
| Processes along and on the side of | Lateral connectivity (levees) | High | Access to floodplain | % impacted river (max 50% each side) |
| | Embankments, channelisation | High | Lateral erosion | % impacted river (max 50% each side) |
| | Riparian zone | Low | Link terrestrial-aquatic zones | % river with higher vegetation (below treeline) |
| | Incision | Medium | | average incised river [m] |
| Inside river (substrate, flow) | Removed or added gravel, rocks, sand | Low | | % impacted river (local authorities) |
| | Structures in the river | Low | Hydraulic variation | % impacted river |
| | River types according to environmental design | Medium | Distribution and variation in habitat | change according to expected |
| | Porostiy of substrate | High | Shelter and habitat important for biota | Change in shelter class according to environmental design |
| Barriers | Fragmentation and barriers within the Water Body | High | Fish migration, sediment transport | Barrier effect after Sandlund et al |
| | | Medium | Fish migration, sediment transport | Degree of fragmentation after Sandlund et al |
| | | Low | Fish migration, sediment transport | % of water body with backwater from barriers |
| | Fragmentation and barriers in upstream Water | Low | Fish migration, sediment transport | Degree of regulation (reservoir capacity/annual inflow) |
| Chemistry, temp. | Water temperatur | High | Growth of organisms | Change in growth season (when temp > 8°) |
| | Ice condition (surface, frazil and bottom ice) | Medium | Habitat | Change in surface and frazil ice |
| | Supersaturation | Medium | Habitat | |
| Flow | Total flow | High | Total amount of flow important for all topi | Change in total flow % |
| | Low flow summer | Medium | Fish survival | Change in 7-day low flow for June-September in % |
| | Low flow winter | Medium | Fish survival | Change in 7-day low flow for November-March in % |
| | Annual flood | Low | Ecosystem services | % change in max annual flood |
| | Dynamic flood | High | Maintaining geomorphic processes | % change in frequency for reference 10-year flood |
| | Short term flow variation: Ratio | Medium | Response for ecosystem | Ratio QHigh/QLow |
| | Short term flow variation: Rate of change | High | Response for ecosystem | cm/hour |
| | Short term flow variation: Dewaterd area | High | Stranding risk | % change in wetted area from QHigh to QLow |

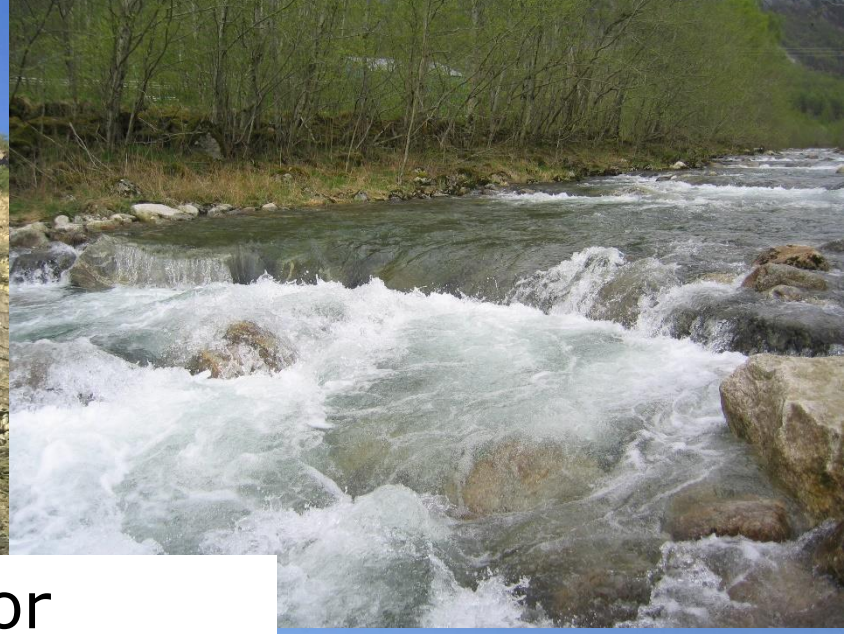
# Weighing and combining




**Combine to overall index for status**

Breakdown for each indicator

Mitigation measures



Takk for oppmerksomheten