

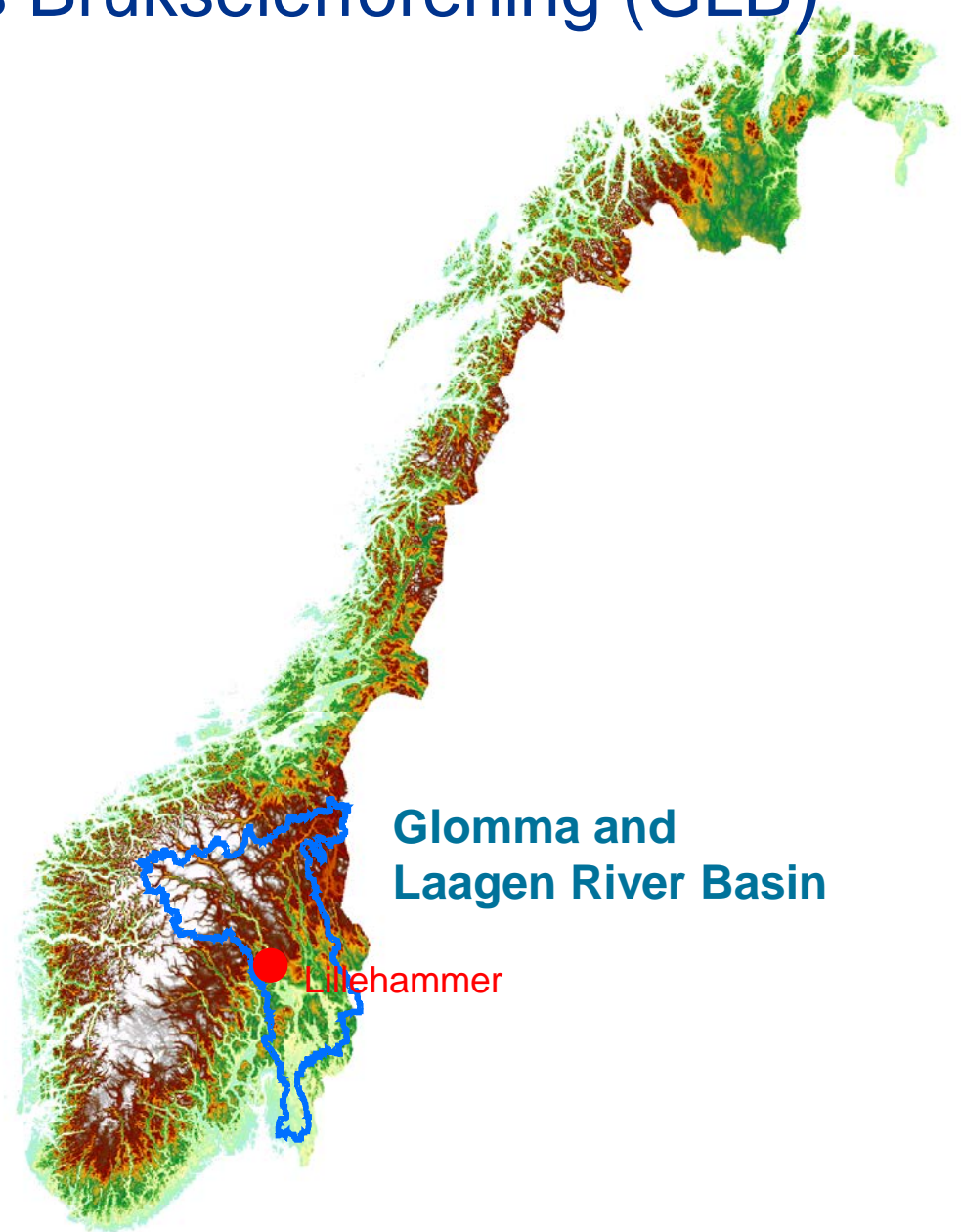


# **Glomma and Laagen Water Management Association**

Ingjerd Haddeland  
Hydrologist, Eidsiva

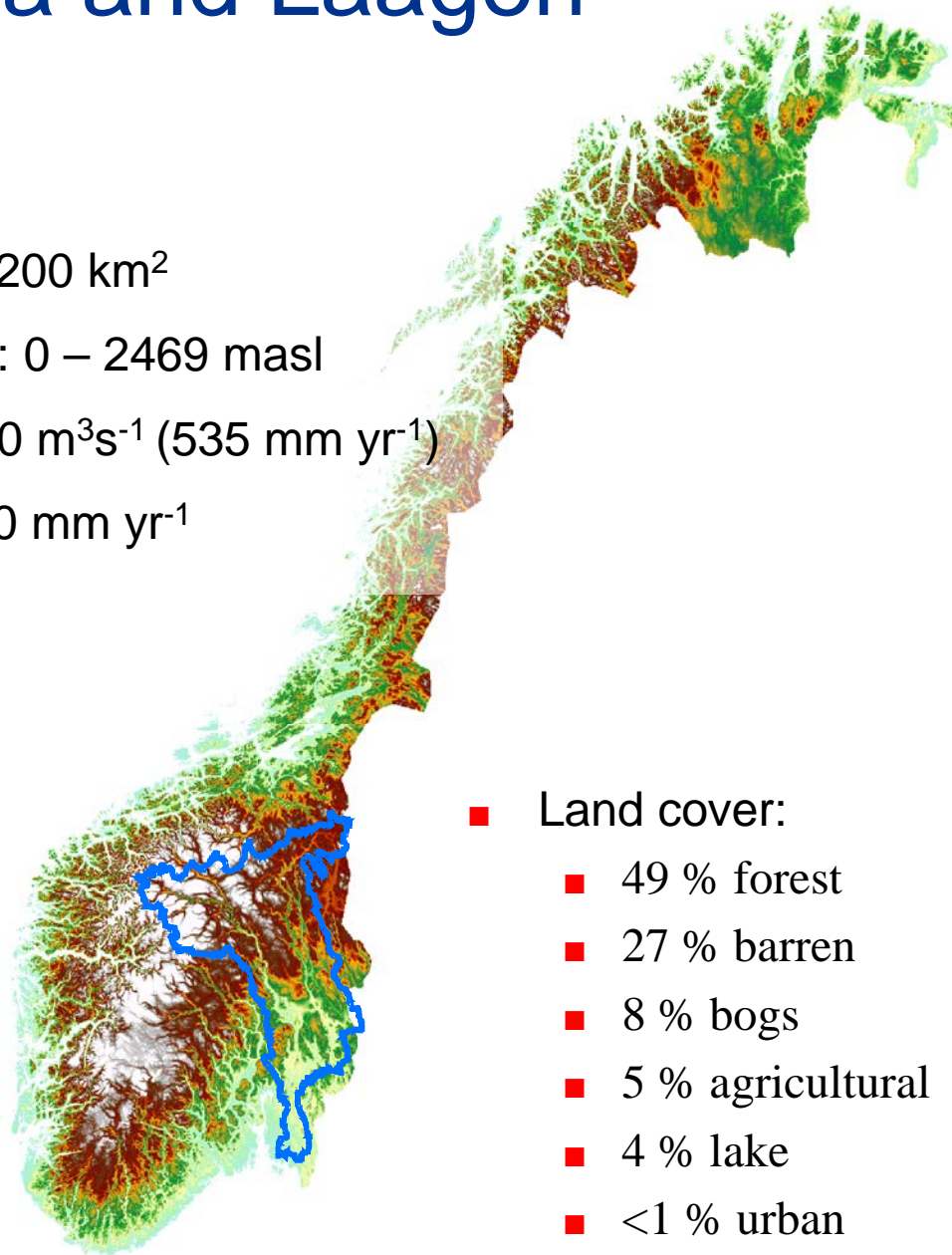
# Glommens og Laagens Brukseierforening (GLB)

Water Management  
Association for the largest  
river basin in Norway



# Glomma and Laagen

- Area: 41 200 km<sup>2</sup>
- Elevation: 0 – 2469 masl
- $Q_{\text{mean}}$ : 700 m<sup>3</sup>s<sup>-1</sup> (535 mm yr<sup>-1</sup>)
- $P_{\text{mean}}$ : 800 mm yr<sup>-1</sup>

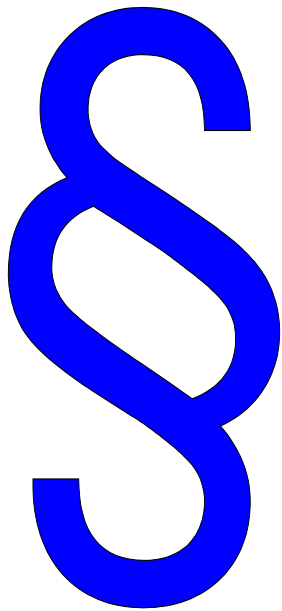


- Land cover:
  - 49 % forest
  - 27 % barren
  - 8 % bogs
  - 5 % agricultural
  - 4 % lake
  - <1 % urban



# Why Water Management Association?

The Law: The Watercourse Regulation Act, issued by the Ministry of Petroleum and Energy in 1917.

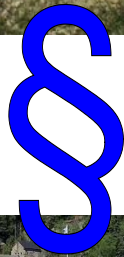


- §1 «Regulations of watercourses are understood to be measures for regulating a watercourse's rate of flow (including diversions, pumping).»
  
- §9 «No license for a regulation should be granted ... until all interested owners of waterfalls or works in the watercourse have had the opportunity to form a water management association.»

# Water Management Associations (WMA)



Photo: Tore Sollibråten/Eidsiva



When two or more owners of waterfall rights have hydroelectric power stations along the same watercourse, and utilise water from the same upstream reservoirs, these companies must join to form a co-operative body:

## **Water Management Association**

- \* The WMA is granted licenses for reservoirs.
- \* The power companies are granted licenses for utilising the water for hydropower.

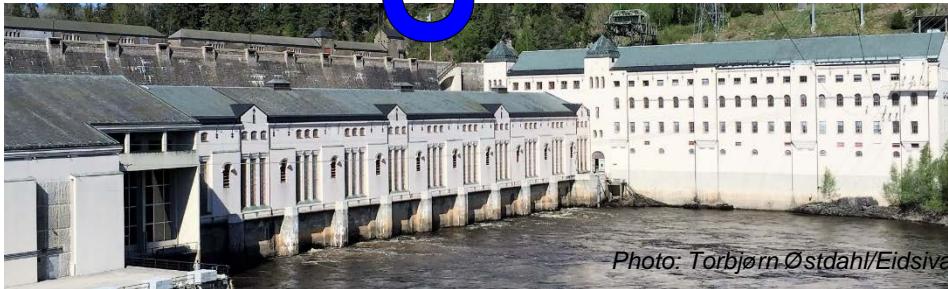
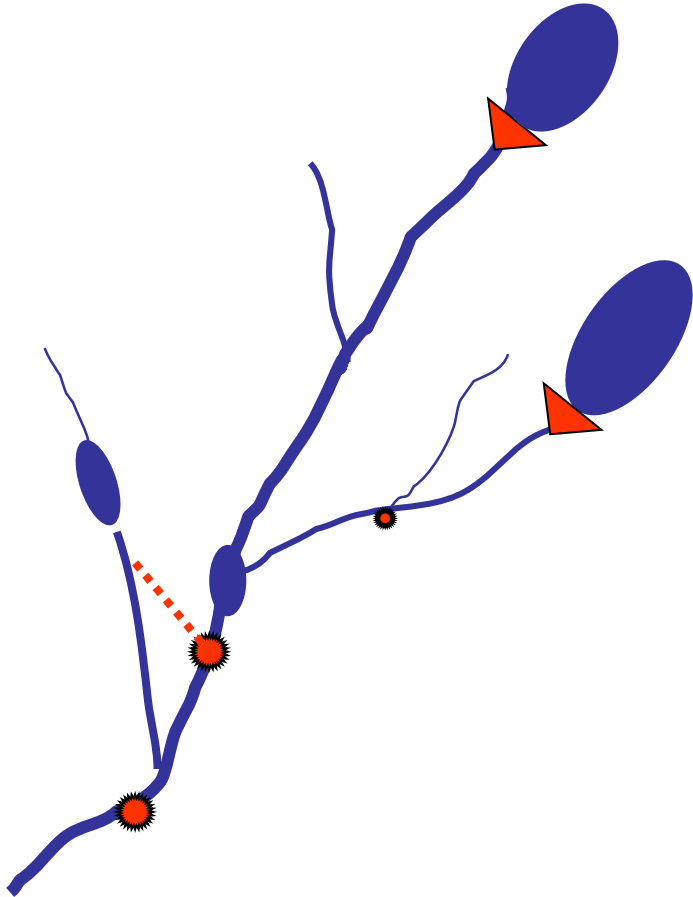


Photo: Torbjørn Østdahl/Eidsiva

# WMA objectives

- Water resources management:
  - For the benefit of the public (nation)
  - For the benefit of the companies involved
- Coordinate and create harmony between different owners of water works
- Coordinate and create harmony between different users of water
- Public safety

# WMA principles



- All downstream plants share expenses for upstream reservoirs
- The management is coordinated in the same river basin (or river branch)
- Disputes are solved according to regulations or agreements, ...
- ...or in court

# Norwegian WMAs

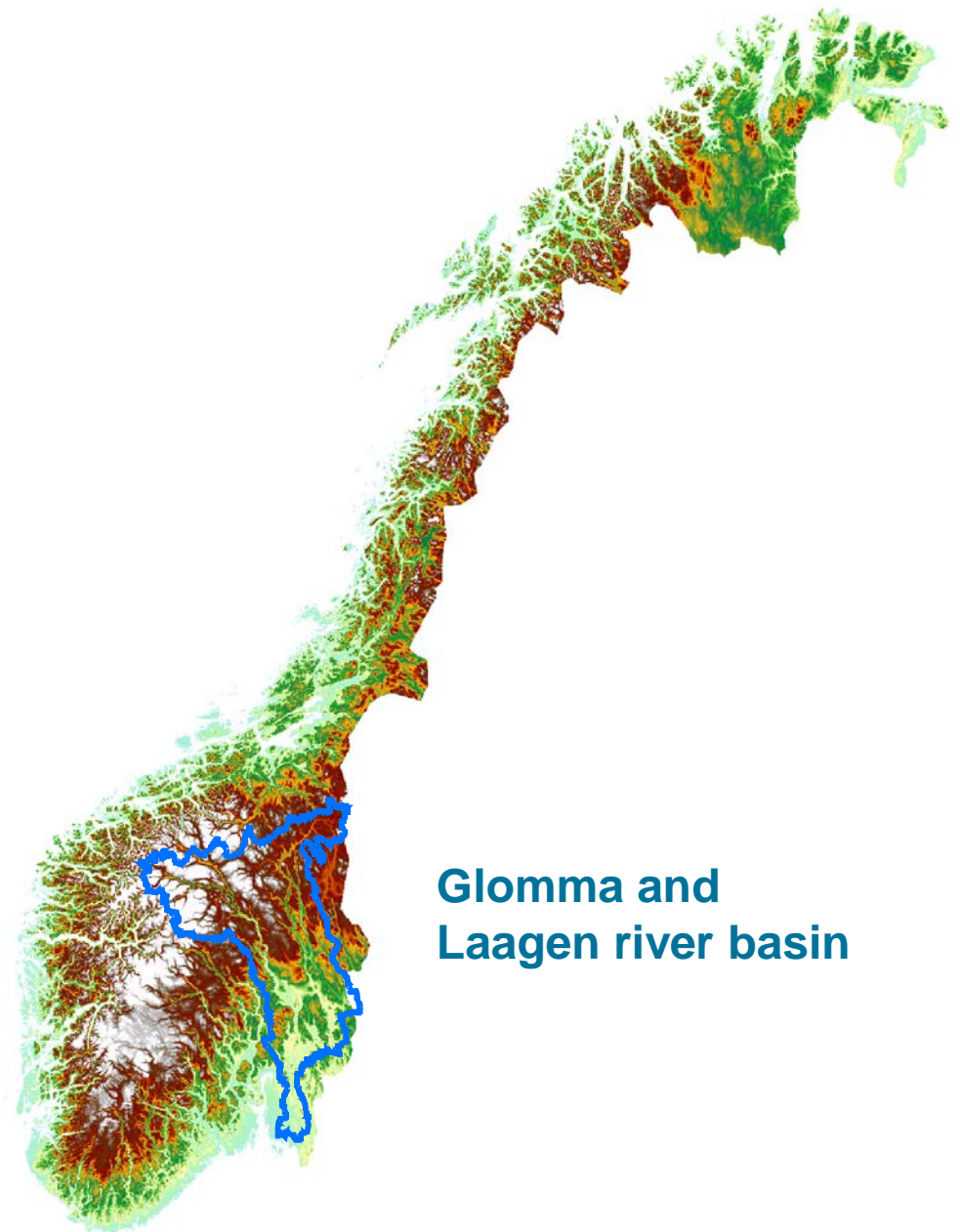
- Glomma
- Drammen
- Numedal
- Skien





# GLB

- Water management association for the largest river basin in Norway
- Established in 1918
- Owned by 16 hydropower companies
- Daily tasks performed by Eidsiva on behalf of GLB (15 man-years)
- CEO: 0.5 man-years



**Glomma and  
Laagen river basin**

# GLB: Main objective

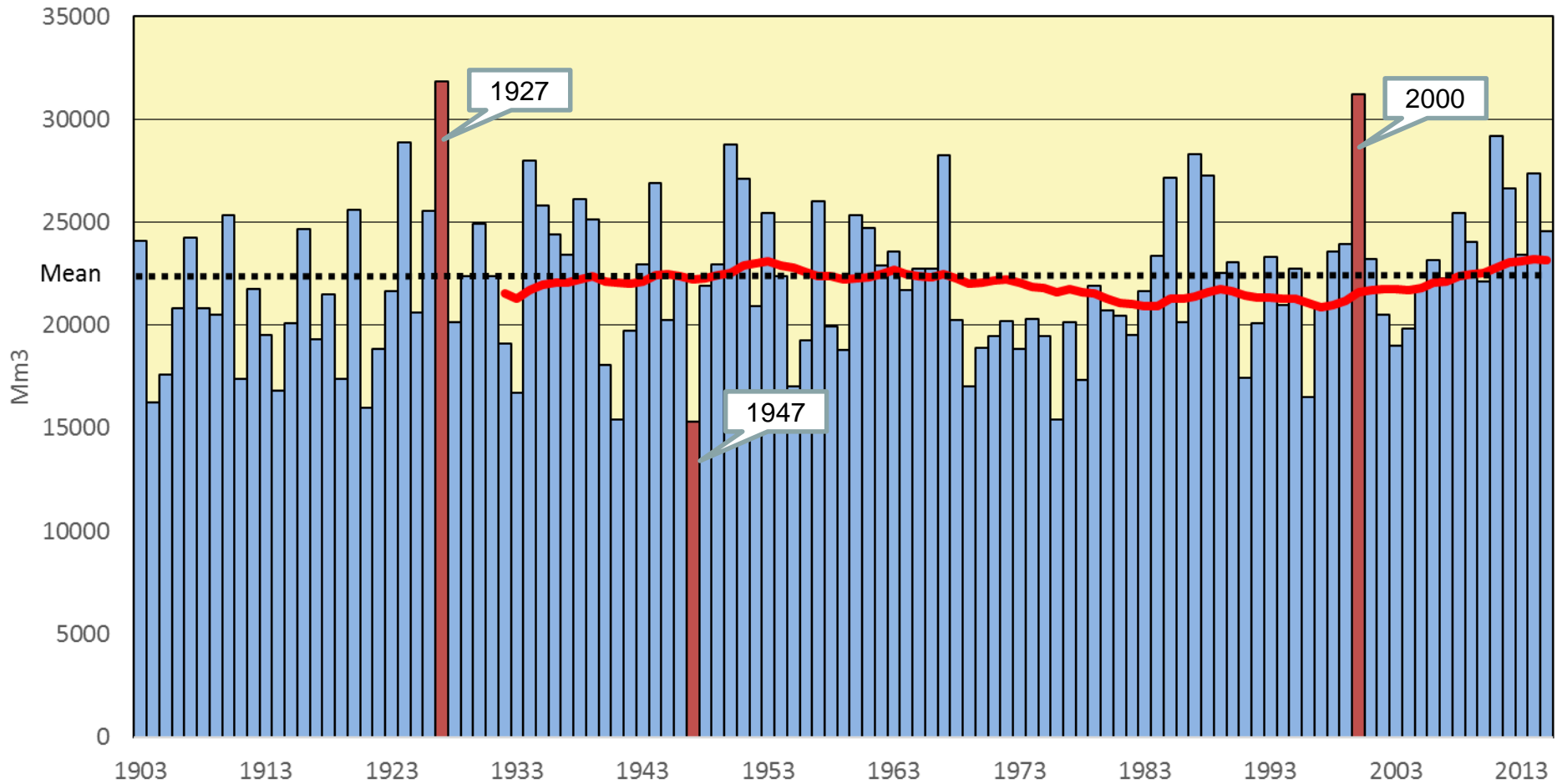
“Regulate water flow in the Glomma and Laagen river basin, within licensed conditions, in order to maximize energy production (economic outcome).”

# Hydropower in the Glomma & Laagen river basin

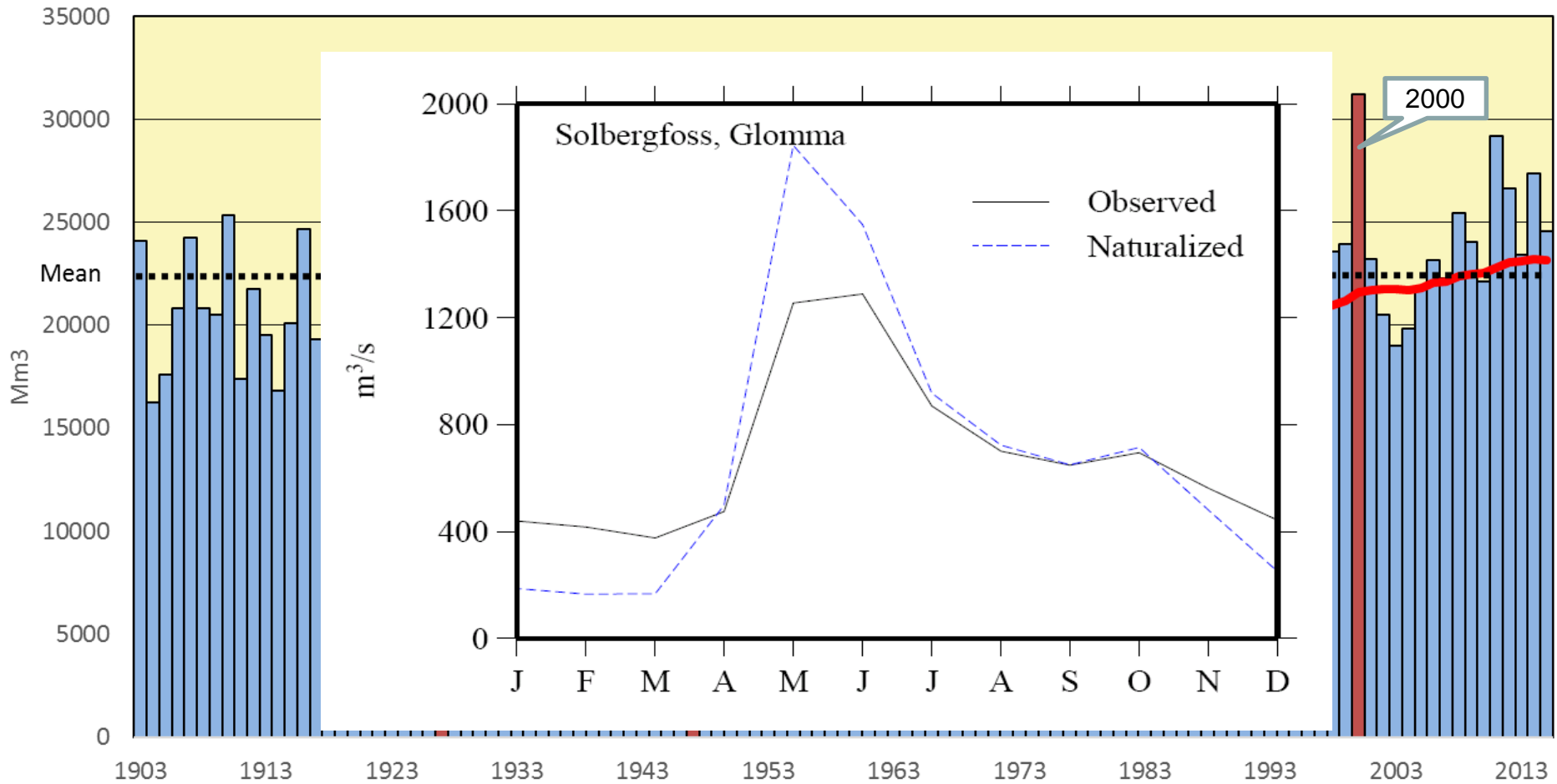
- 27 reservoirs and 7 diversions
  - storage capacity: 3500 Mm<sup>3</sup>  
(16% of mean annual runoff)
- 50 power stations
- Installed capacity: 2 500 MW
- Production: 12 TWh/year
  - appr. 9 % of Norway's
- 16 hydropower companies



# Annual runoff



# Annual runoff



Solbergfoss



# GLB's activities (1): Hydrology

- Hydrometeorological data
- Short term discharge forecasts
- Long term discharge scenarios / projections
- Reservoir operations
  - Water levels, environmental flow
- Dam safety
- Investments



*Photo: Geir Gautun/HydraTeam*

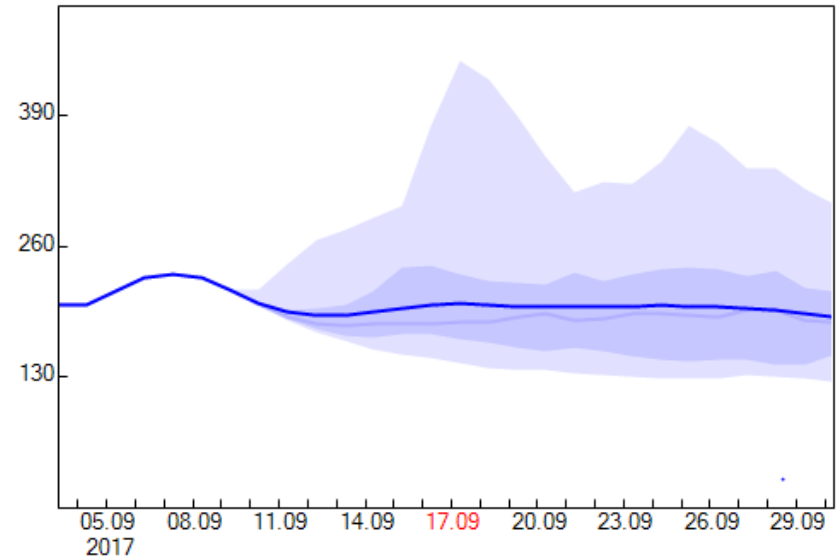


*Photo: Jens Kristian Tingvold/Eidsiva*

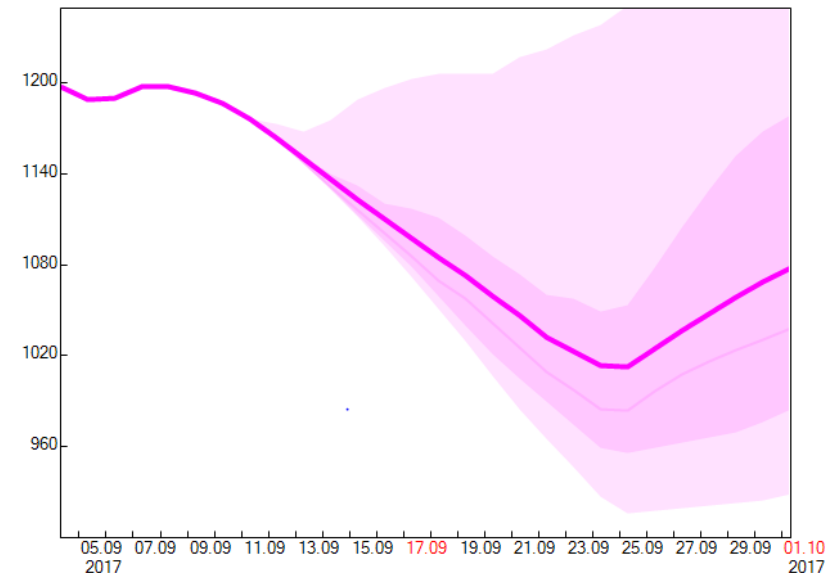
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private : SIMFLOW - Losna

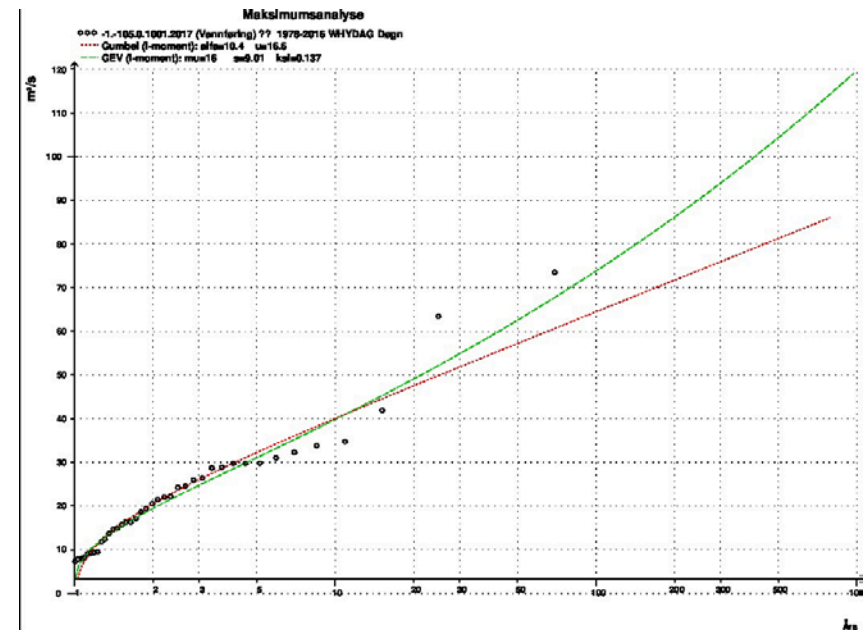


private : SIMRESERV - Mjøsa



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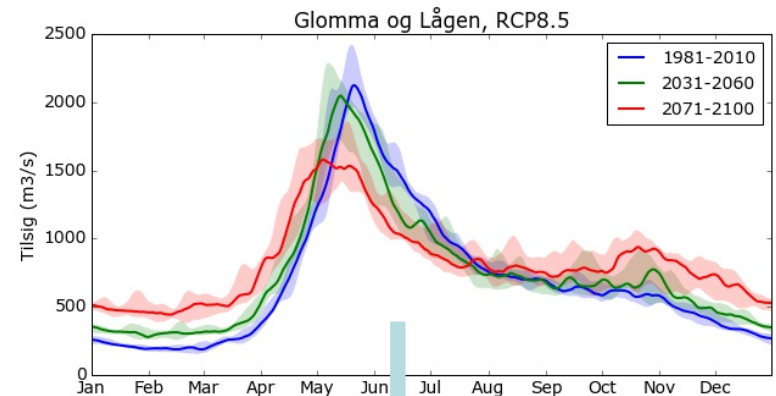


Flood frequency curve, Fundin (NVE's software).



# GLB's activities (1): Hydrology

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Increase in annual production:  
900 GWh

# GLB's activities (2): Civil Engineering

- Build, operate and maintain dams, gates, diversions
- Dam safety



Photo: Fredrik Staff Edin/Eidsiva



Photo: Fredrik Staff Edin/Eidsiva

# GLB's activities (3): Environment

- Fish

- Fish ladders
- Fish stocking
- Habitat improvements
- Follow-up studies (actual project consequences)



Photo: TrondTaugbøl/Eidsiva

- Vegetation and soil

- Erosion protection measures
- Establishing soil and vegetation cover
- Follow-up studies (actual project consequences)



Photo: TrondTaugbøl/Eidsiva



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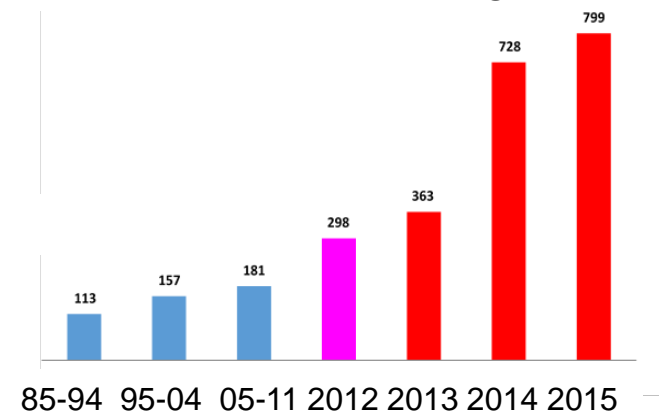
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- Vegetation and soil

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Number of fish passing:



# GLB's activities (3): Environment

- Fish
  - Fish ladders
  - Fish stocking
  - Habitat improvements
  - Follow-up studies (actual project consequences)
- Vegetation and soil
  - Erosion protection measures
  - Establishing soil and vegetation cover
  - Follow-up studies (actual project consequences)



# GLB's activities (4): Licensing

- Compensatory bridges and roads
- Compensate landowners and others
- New licenses (applications)
- Revisions



# Water issues



- Hydropower production
- Water supply
- Agriculture
- Forestry
- Fishing
- Recreation
  
- Water quality
- Ice conditions
- Floods / droughts

# Different needs

- Timber rafting
- Agriculture, forestry
- Recreation





# Reservoir operations during floods

- The national authority (Norwegian Water Resources and Energy Directorate) has the final word.
- The WMA is in close contact with the national authority that issues flood warnings to the public.
- The river basin is for most practical purposes "run" by the WMA.
- Need permission from national authorities if regulation rules are to be set aside.



# Laagen at Hunderfossen



Source: dagbladet.no