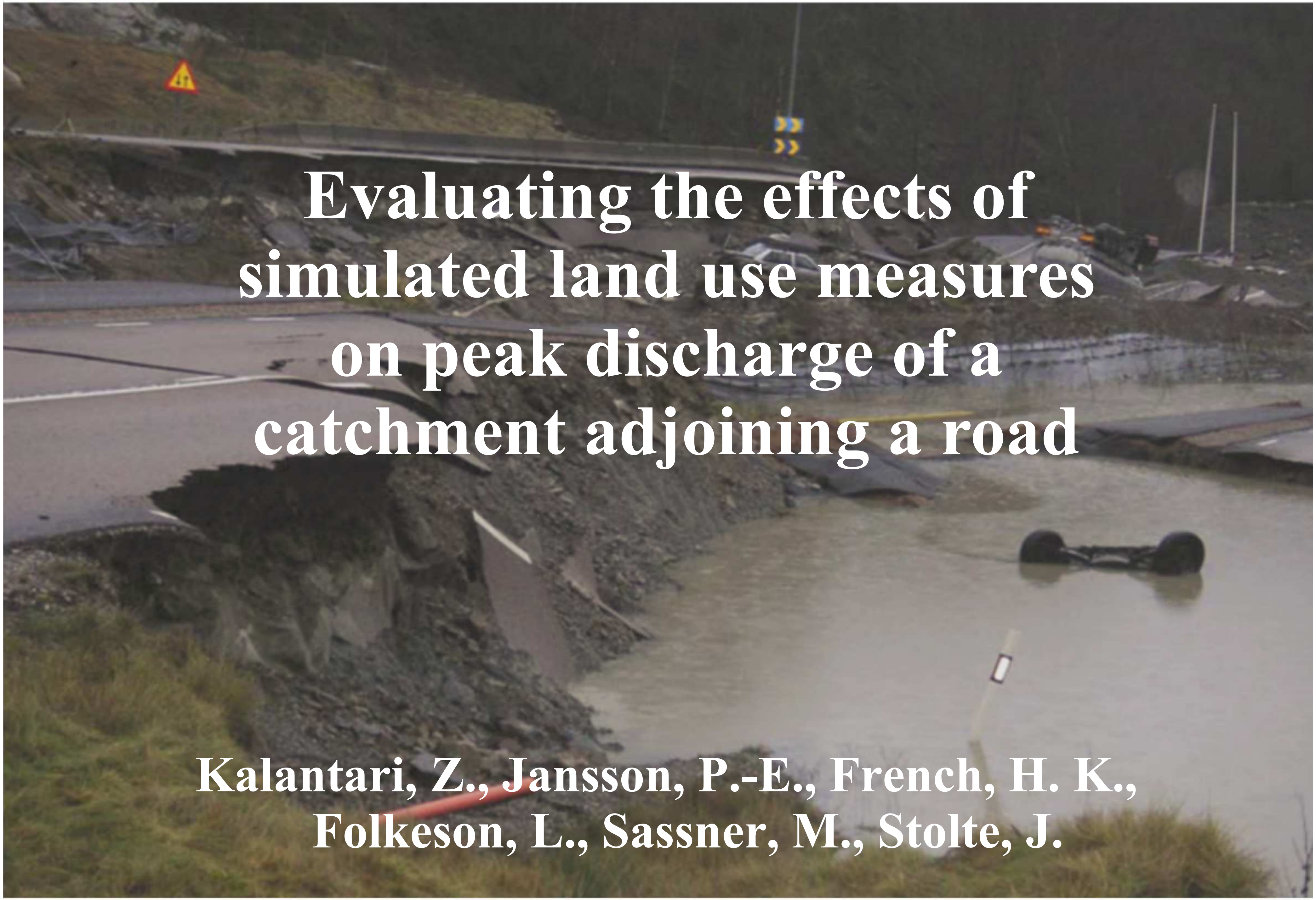


Evaluating the effects of simulated land use measures on peak discharge of a catchment adjoining a road

Kalantari, Z., Jansson, P.-E., French, H. K., Folkeson, L., Sassner, M., Stolte, J.

- “Adaptation of road drainage structures to climate change”
- Funded by The Swedish Transport Administration (Trafikverket) through the Centre for Operation and Maintenance (CDU)
- Operated by the Royal Institute of Technology, KTH, Sweden.

KTH VETENSKAP OCH KONST
ROYAL INSTITUTE OF TECHNOLOGY

CDU
Centrum för forskning och utbildning i drift och underhåll av infrastruktur

Motivations

The climate change will lead to more frequent

- extreme precipitation events
- snow melt periods
- flooding on the roads

- Already today, many road-drainage facilities lack the capacity to deal with extreme flows.

Flooding, Road 918, Stava

Erosion, Road 240, Hagfors

Hence, due to the climate change and landuse change, the number of incidences on roads will increase.

Debris flow, Fulufjället, 1997

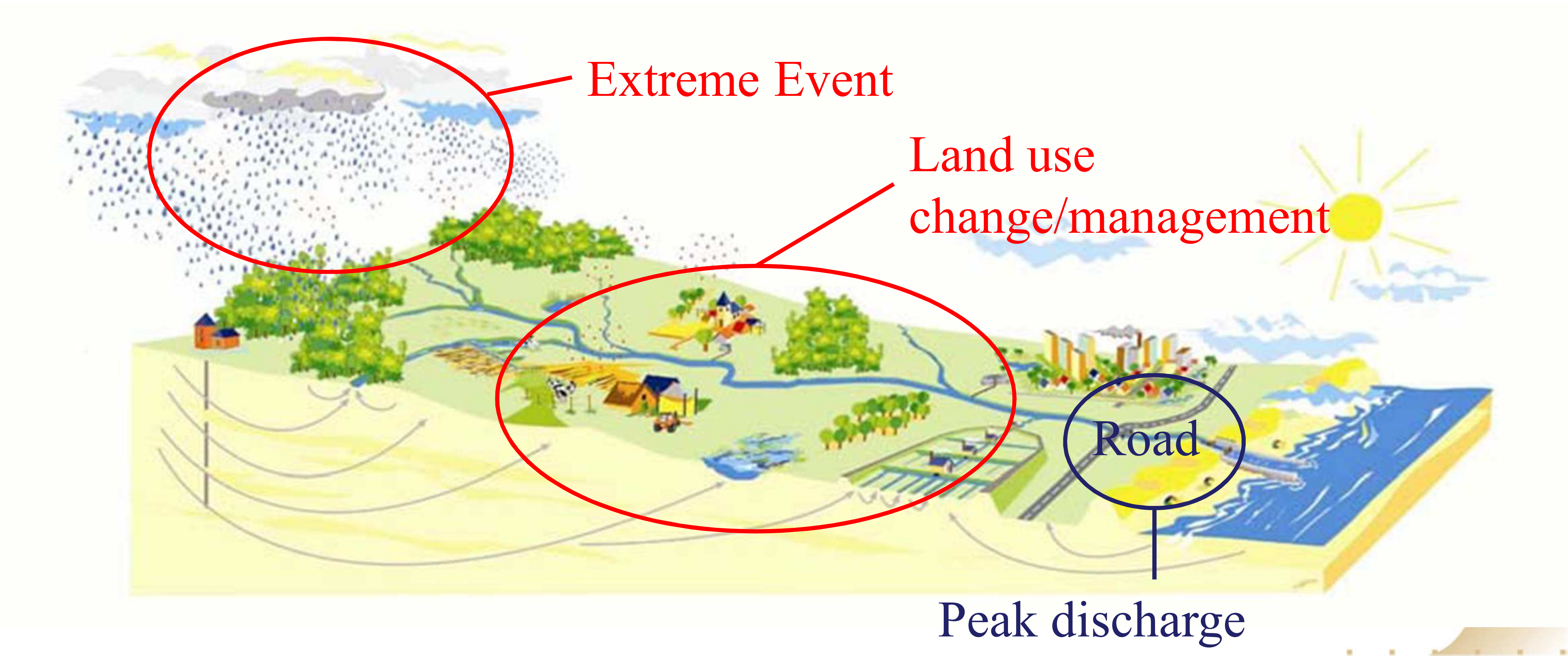
Landslide, Småröd, 2006

Main Objective

To develop scientifically well-founded recommendations and suggestions on a cost-efficient adaptation of road drainage systems to climate change and land use change

Specific Objectives

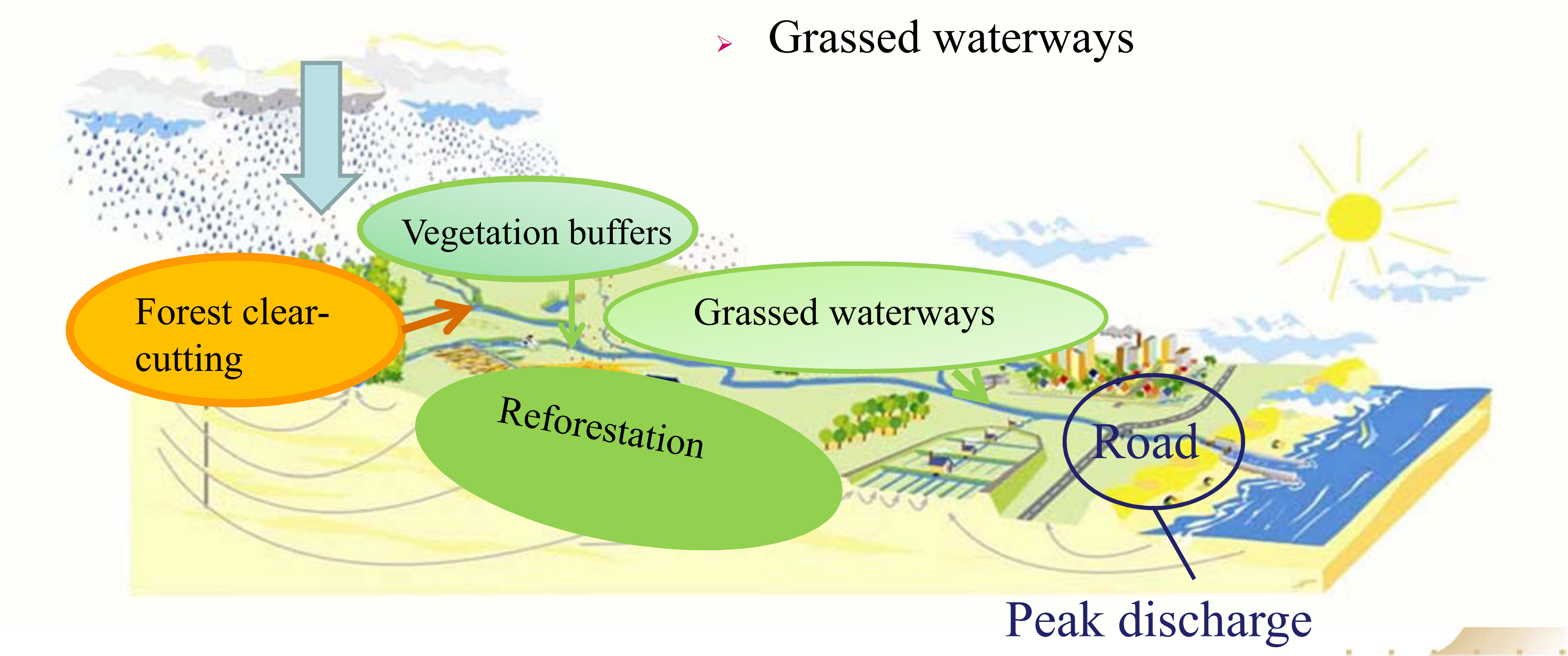
- Study the effect of different measures to combat negative impact of extreme events on discharge meeting the road
- Study the effect of land use change by creating and modelling land use scenarios



Methods

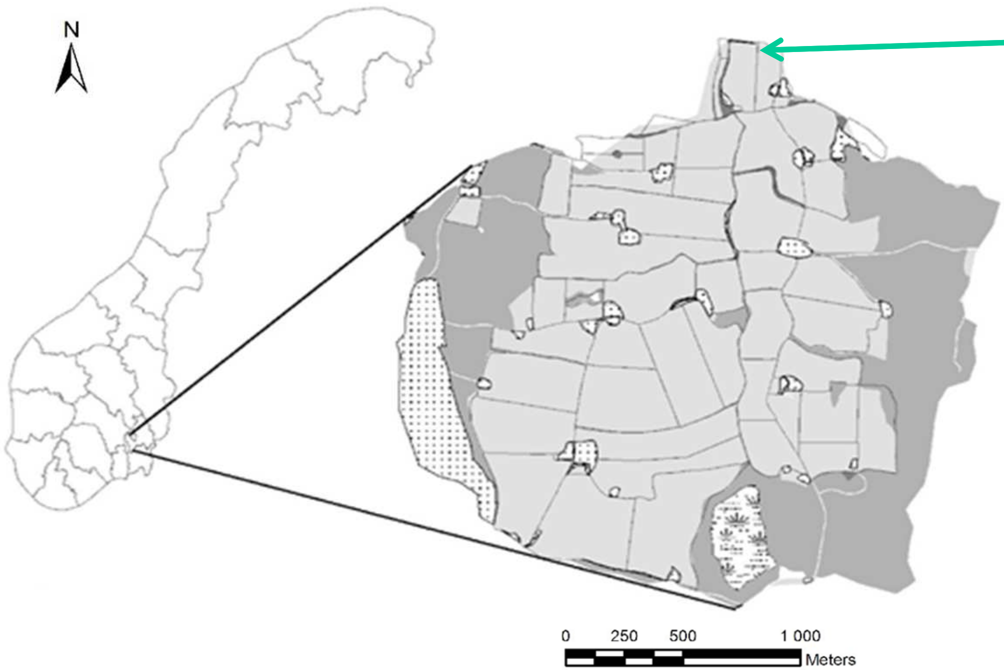
A Physically distributed hydrological model (MIKE SHE)
Four historical storm events with return periods of 2, 5, 10 and 50 years
Four different land use scenarios:

- Clear-cutting
- Reforestation
- Vegetation buffers along creeks
- Grassed waterways



Study area: Skuterud, Norway

Monitoring station



Total area: 4.5 km^2
Arable land: 60 %
Forest: 30 %
Urban: 10 %

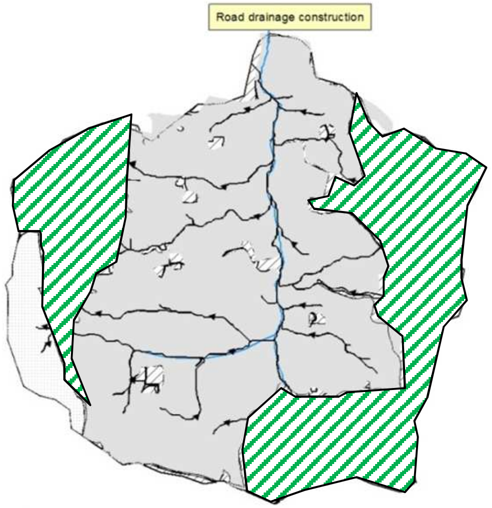
Event pictures

Runoff generation caused by freeze/thaw cycles in combination with snowmelt/precipitation

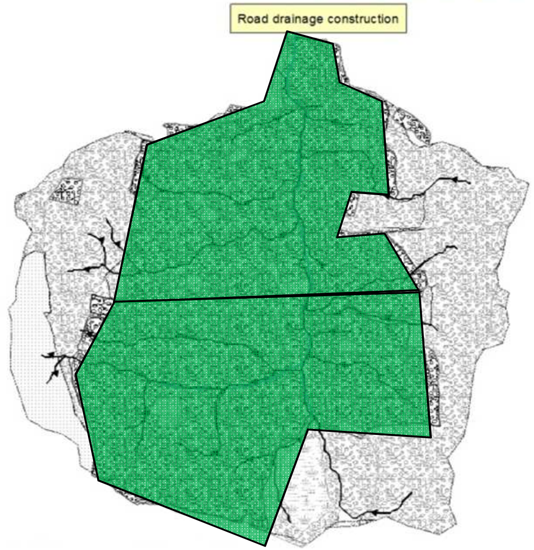
Simulated land use scenarios

Current

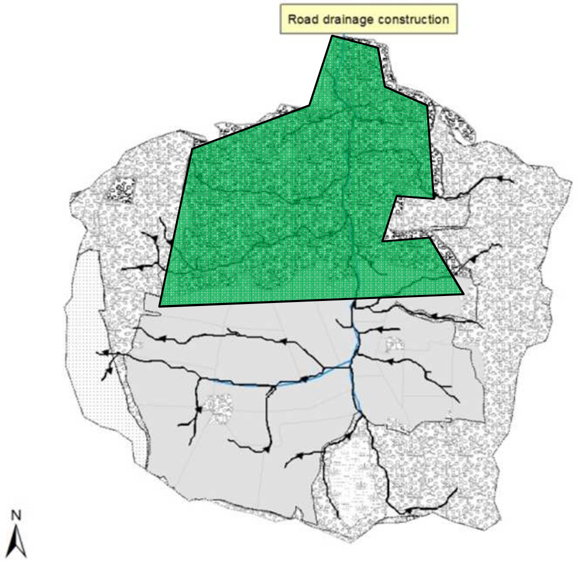
30% forest clear-cutting



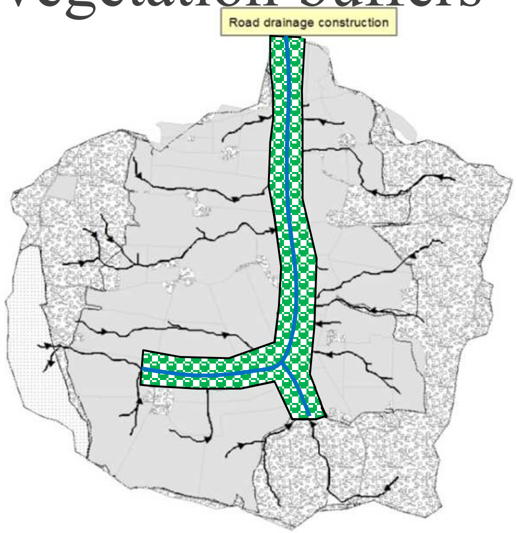
+60% forest



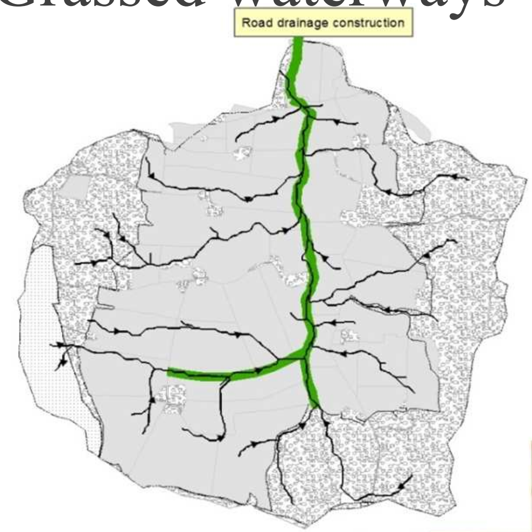
+30% forest

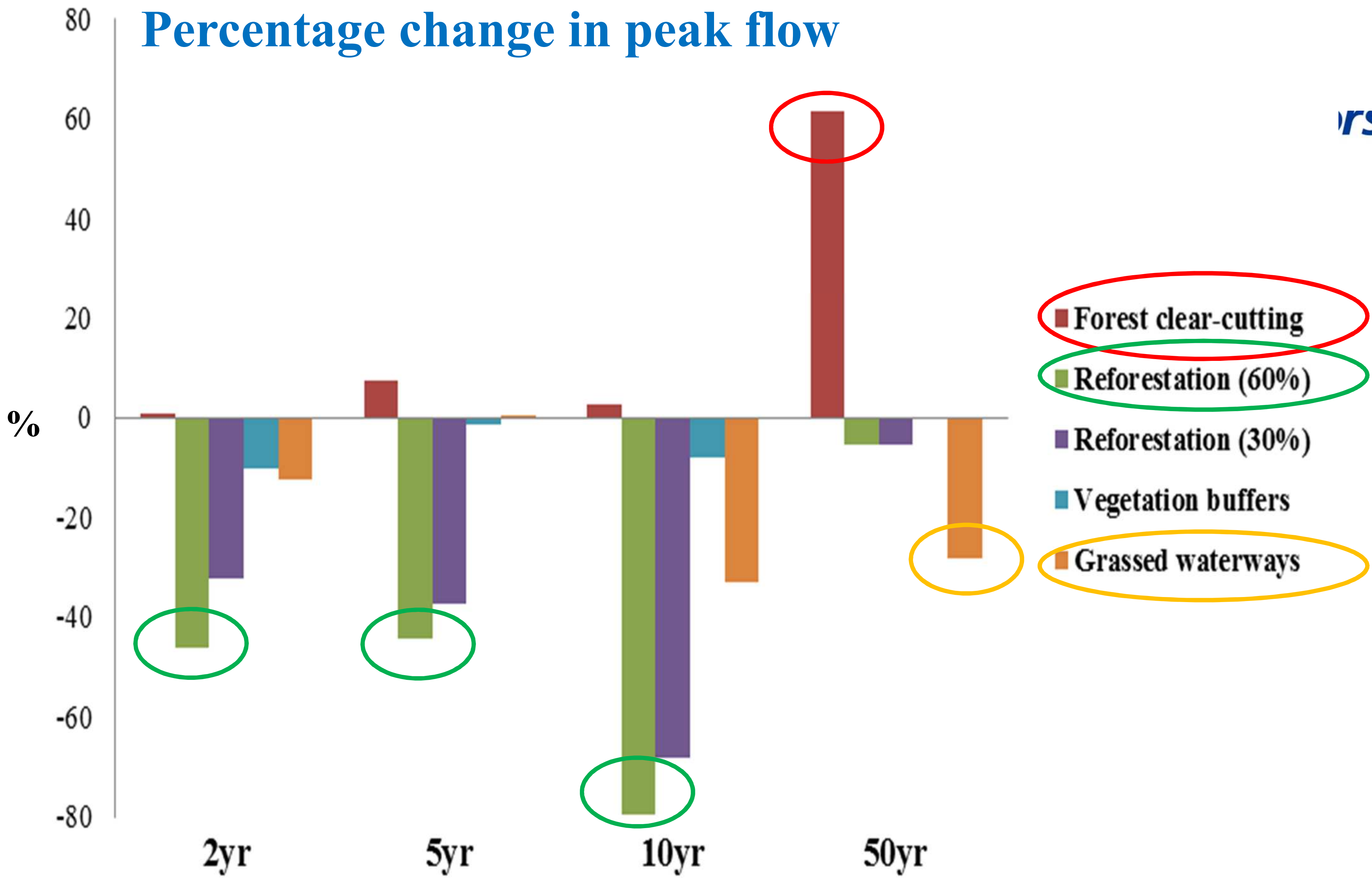


Vegetation buffers



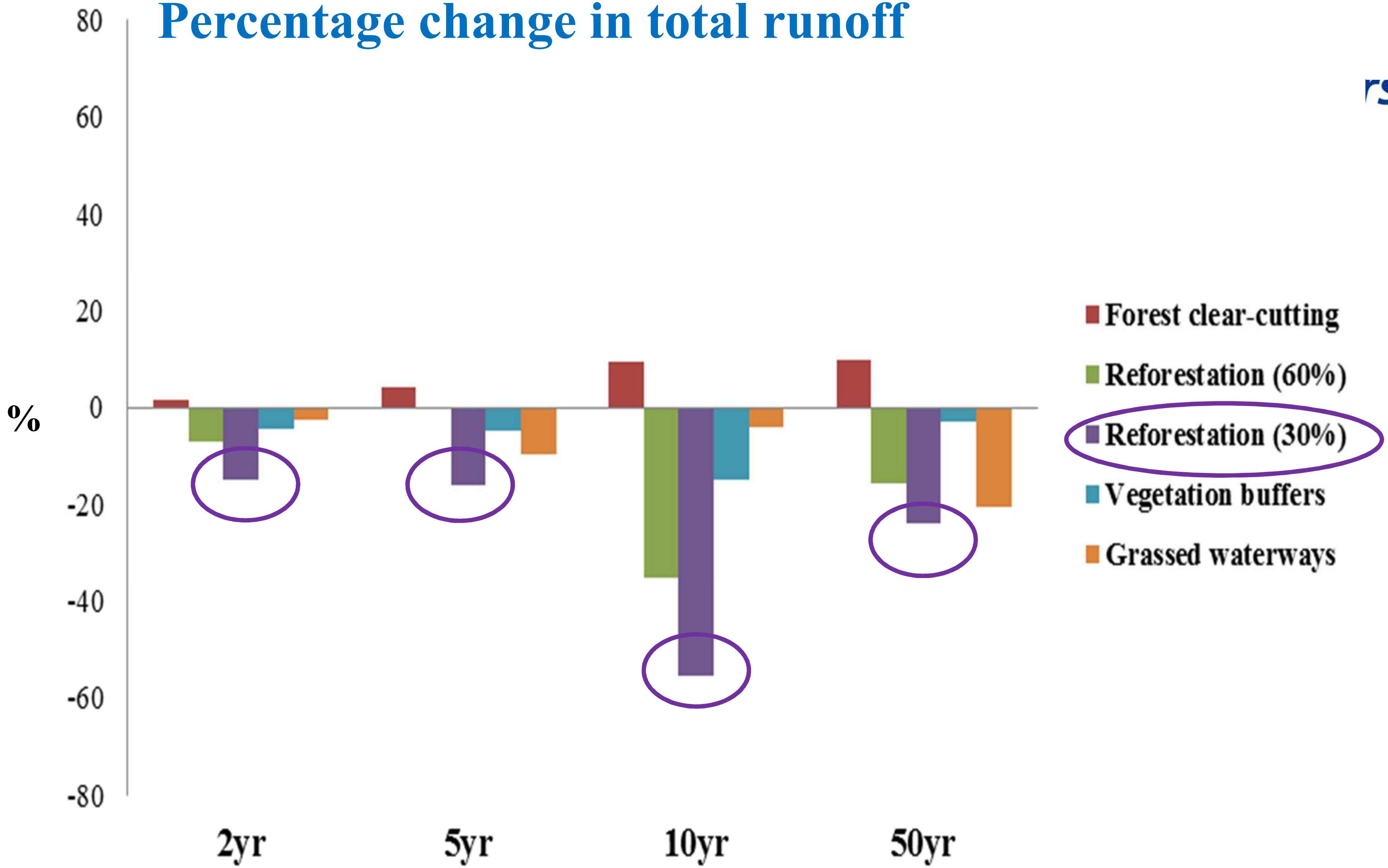
Grassed waterways





Percentage change in peak flow
%
80
60
40
20
0
-20
-40
-60
-80
2yr
5yr
10yr
50yr
Forest clear-cutting
Reforestation (60%)
Reforestation (30%)
Vegetation buffers
Grassed waterways

Percentage change in total runoff



Main lessons learned:

- Land use composition and configuration **affect discharge** (peak flow and total runoff)
- The specific effect of land use measures on discharge depends on their **spatial distribution** and on the **size** and **time** of storm events.
- For example, doubling the forest area does **not** give a **doubling** in runoff volume **reduction**
- The **location** of any land use change is of high **importance**

Conclusions so far…

- **Forestation /reforestation** important in **controlling** peak flow and total runoff.

- Need for strategies that improve **communication** between **road managers** and the **forestry** and **agriculture** sectors.


THANK
YOU

Effect of land use change scenarios, MIKE-SHE , Skuterud