



SKOGFORSK

Soft Logging: Avoiding Damage to the Soil and Water

Staffan Berg, Sima Mohtashami,
Isabelle Bergkvist, Björn Löfgren

What is the problem?

- ❑ Mechanized forestry began about 1960, winter season.
- ❑ Today: high demand from pulp and paper industry, all year round.

Environmental/Societal significance

Soil

- Rutting
- Compaction
- Disturbing C and N fluxes in the soil.

- EU soil directive (2004/35/EC).
- FSC/PEFC.

Environmental/Societal significance

Water

- Higher sediment load to the Surface waters.
- Increased nitrate leaching .
- Higher risk for Hg accumulation in fish.

- EU Water Framework Directive (2000/60/EG).
- The Swedish Environmental objectives.

Means of mitigation

- ❑ Design of machine: adjusting tyre pressure, using wider tyres, tracks.
- ❑ Fixed or temporary bridges .
- ❑ Ground cover rigs, made of timber, mats of tires, harvest residues or downgraded wood logs.
- ❑ Planning :
utilizing DSS created in GIS , case study:
Aim: designing optimal off-road routes
with minimum impacts on soil and water

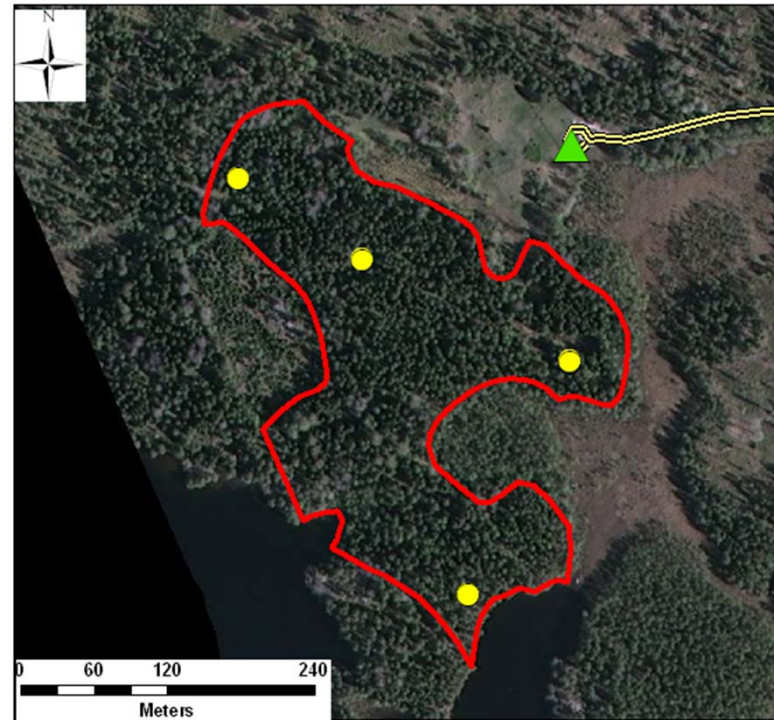


Photo: Martinsons



Photo: Eva Ring

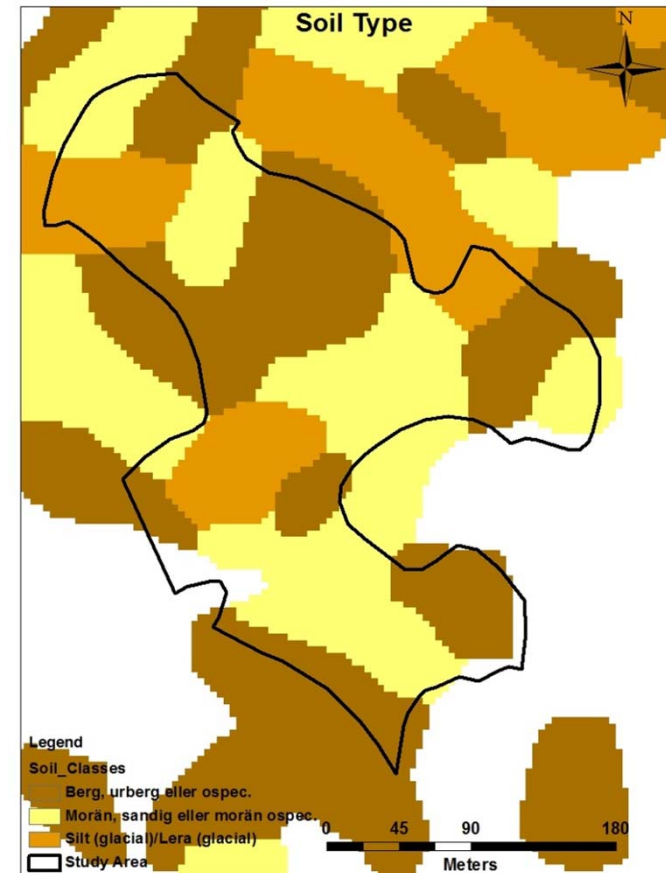
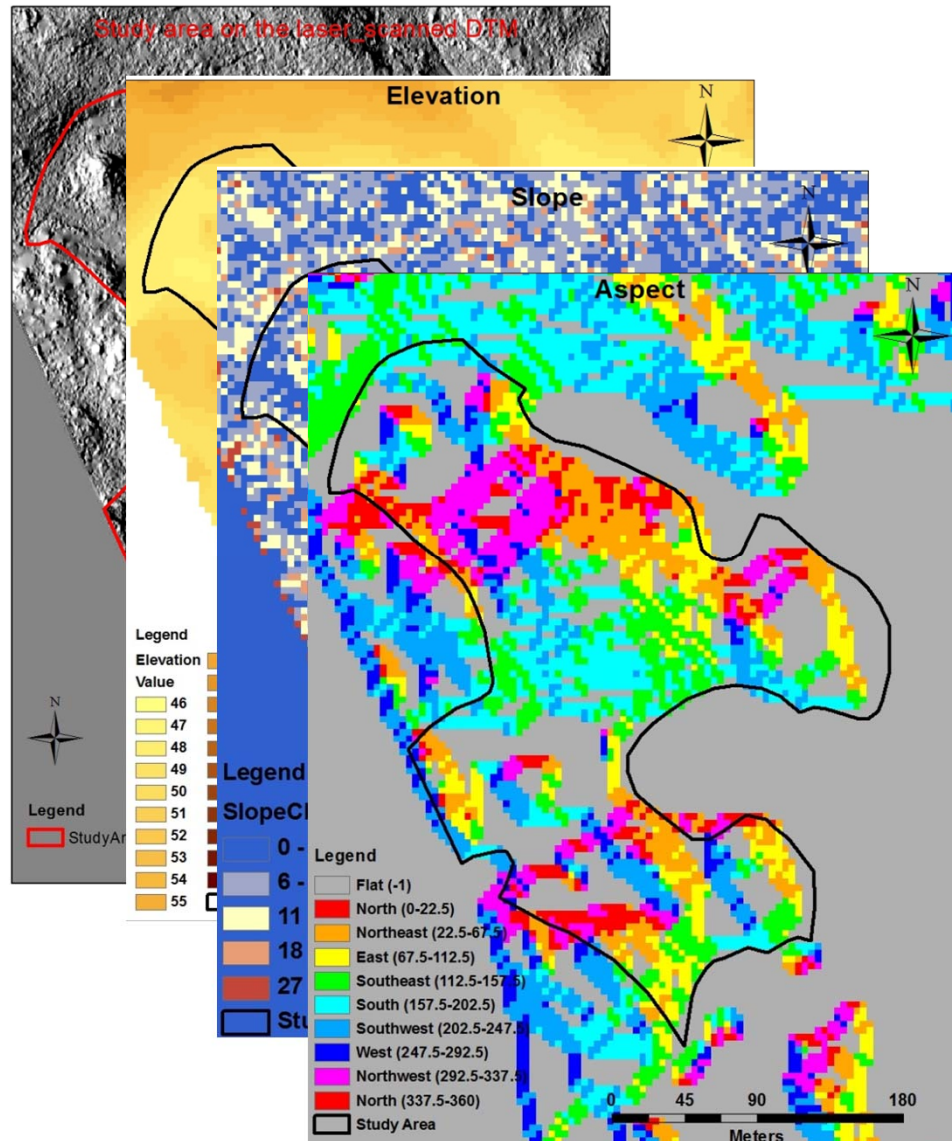
Study Area



Legend

-  source(Landing Point)
-  Destinations
-  Study Area
-  Main Roads

Input Data



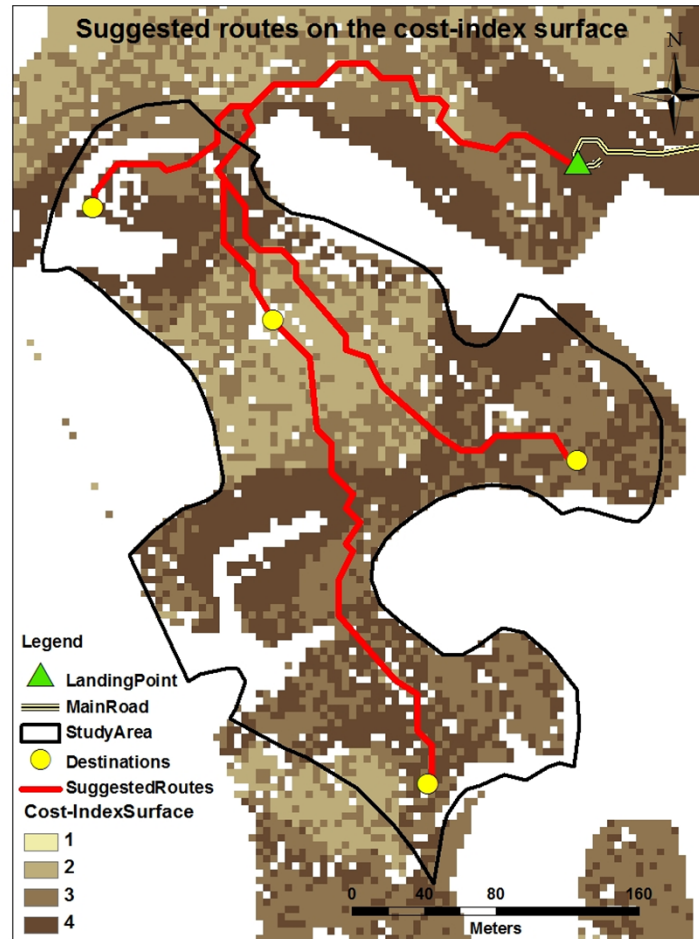
Multi Criteria Decision Analysis (MCDA)

Factors	% of influence	Factor classification	
		Original values	Cost-index values
Elevation	50%	65 – 60	1
		60 - 55	2
		55 - 50	3
		50 - 46	5
Slope	30%	0 – 6	1
		6 – 11	2
		11 - 18	3
		18 - 27	4
		27 - 90	5
Soil classes	20%	Rocks	1
		Sediments	3
		Silt	5
Sum	100		

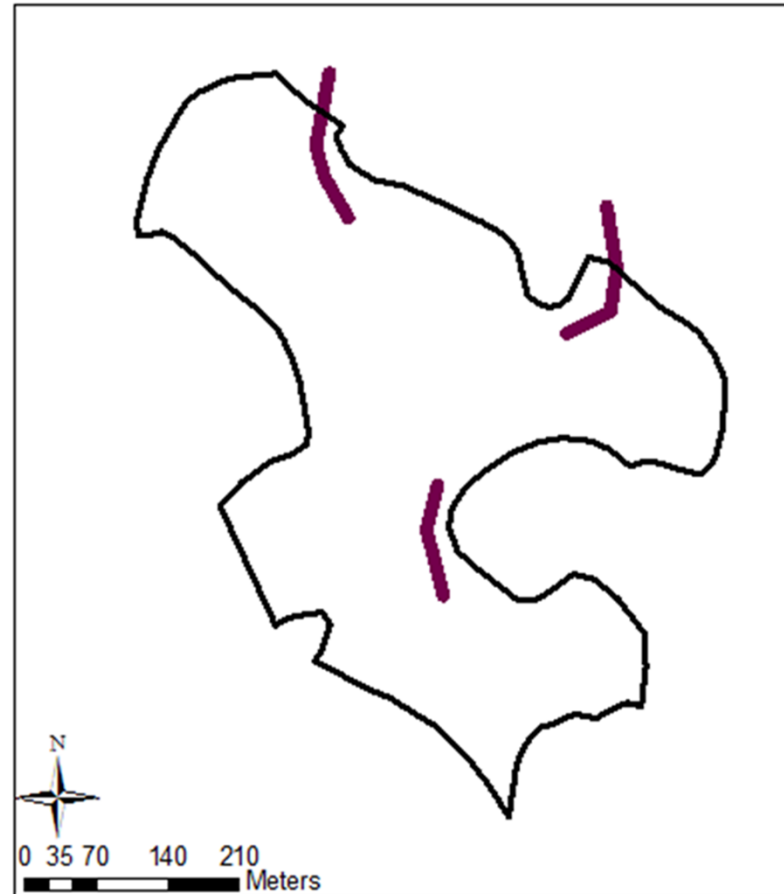
No go areas
Ditches
Steep Slope (Slope>18 degree)
Nature Reserves
peat land, clayey parts, water

✓ Aspect was used to find proper orientation.

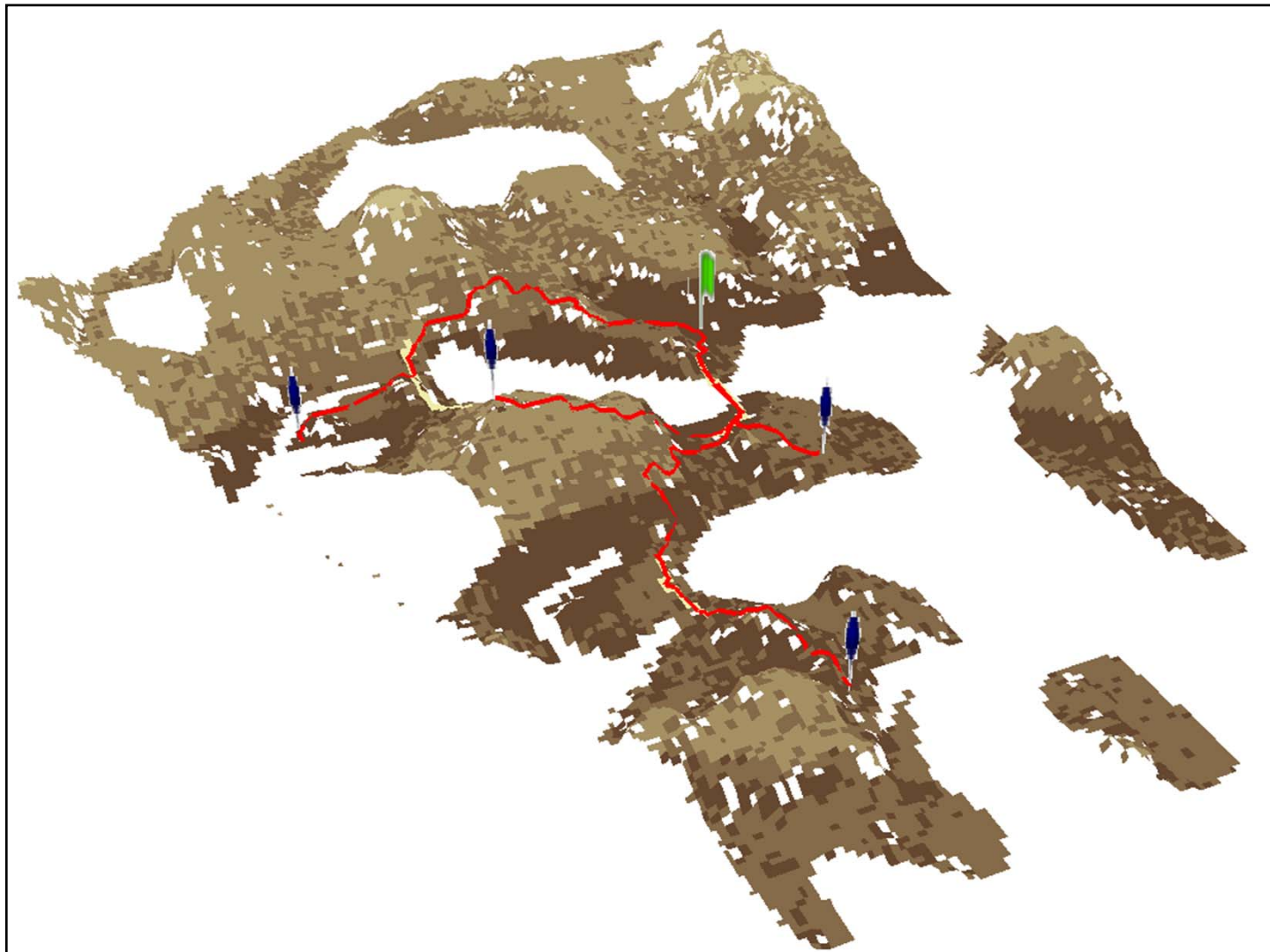
Designed route layout, scenario 1



Another alternative: making bridge!

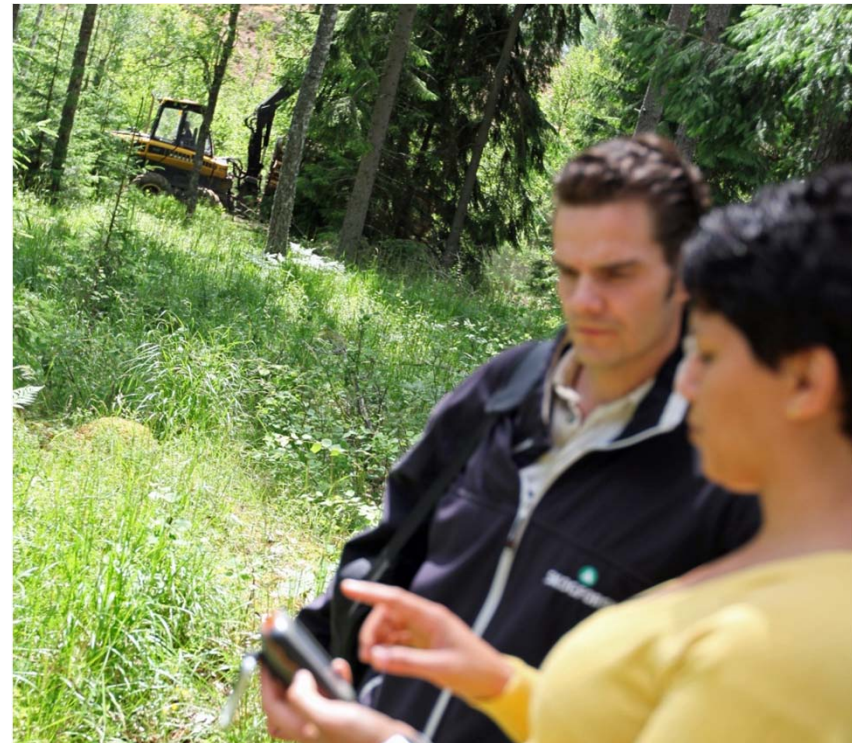


Designed route layout, scenario 2



Achievements:

- ❑ Results were validated using a GPS device.
- ❑ Save in length of the route= 687 m/round
- ❑ Save in time = 0.24 h/round
- ❑ Volume of the wood = 1573 tonnes
- ❑ Assuming the cost of forwarder as 85 EUR/h:
More than 3200 EUR save in money.
- ❑ Less damage, less fuel consumption, less emission



Discussion

- ❑ Forestry operations cause physical, chemical, biological impacts on soil and water.

- ❑ Sustainable forest management could be achieved if we use already existing tools and knowledge:
 1. Auxiliary Equipments
 2. Planning in advance using GIS (application of laser scanned data, soil type,...)

Thank You !