Strategic planning of investments in forest roads

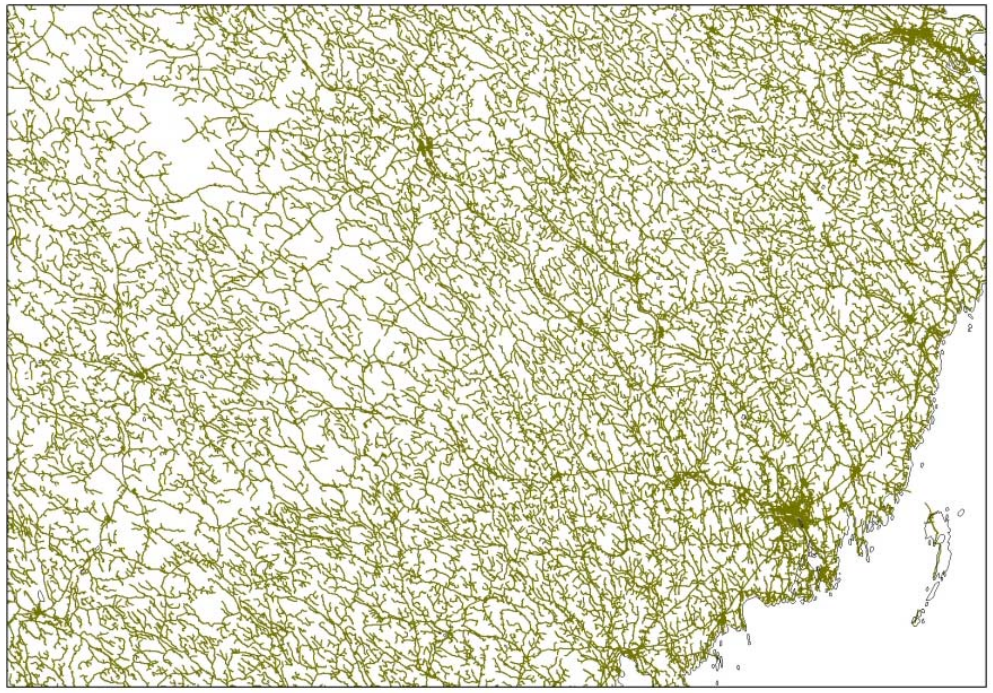
Victor Asmoarp. The Forestry Research Institute of Sweden
Patrik Flisberg. The Forestry Research Institute of Sweden
Mikael Frisk. The Forestry Research Institute of Sweden
Mikael Rönnqvist. Universite Laval. Canada

Seasonal climate variation

- Insufficient bearing capacity
  - Large stocks to secure continues supply
  - High costs due to quality losses
  - Higher transport costs due to road blockings

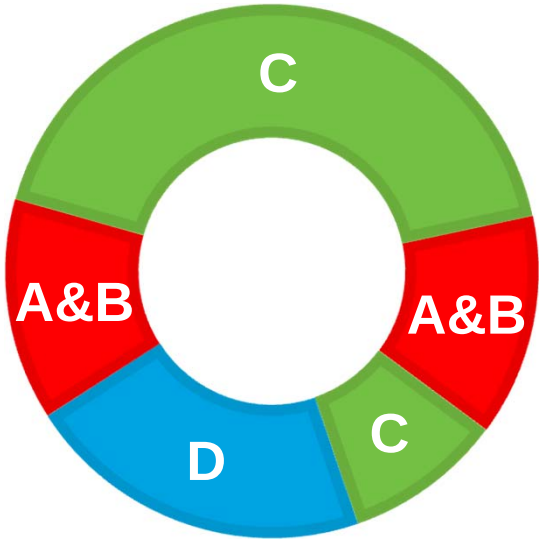
High density forest road network

- High density forest road network
  - 210.000 km forest roads
  - Varying standard (accessibility)
- Detailed road information
  - The National Road Database



Seasons and forest roads

July - **Summer**



April - **Spring thaw**

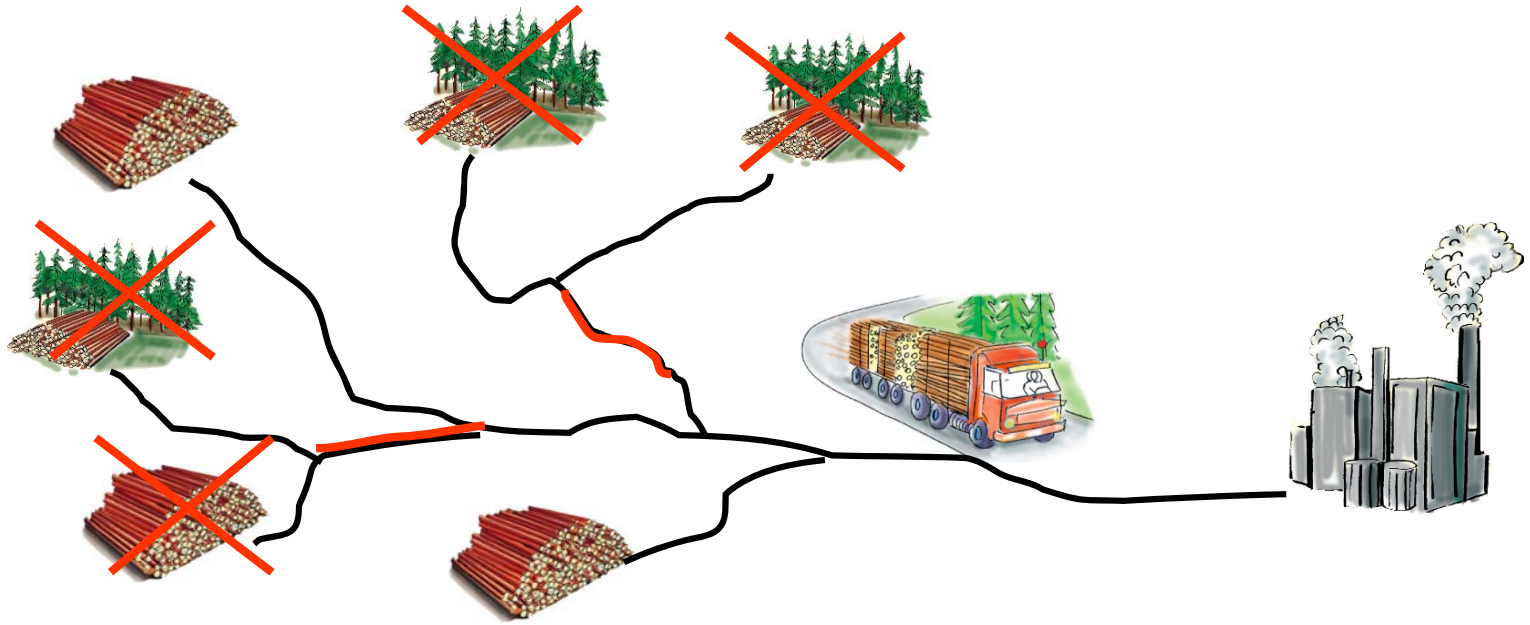
October - **Heavy rain**

January - **Winter**

Forest roads classification

- A&B – All year around
- C – All year around, not spring thaw and heavy rain
- D – Only frozen roads

Road investment problem



- Which links should be upgraded to secure the flow of round wood while minimizing costs?

RoadOpt

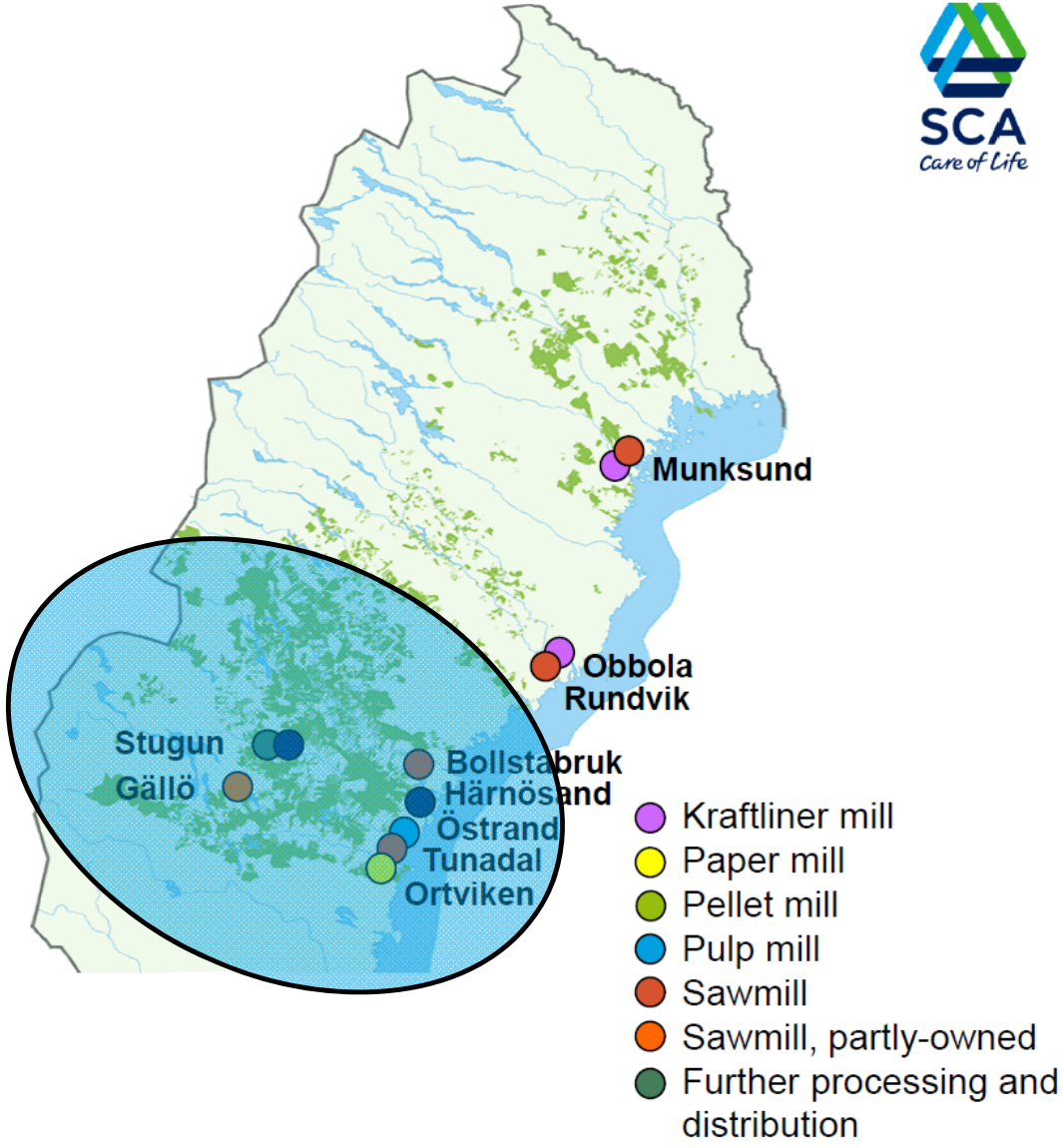
- Objective
  - Minimize cost for road upgrading. transportation and harvest
- Decisions
  - Upgrading decisions for the road links
  - Estimate the overall wood flow
  - Harvest areas to cut
- Constraints
  - Limited supply
  - Demand must be fulfilled
  - Road link accessibility classes

Input data

- Estimation of future cuttings
  - Volume per assortment and stand in each time period
  - Connection to the closest road link
- Road information
  - Accessibility classes
- Prognosis of future industrial demands
  - Volume per assortment for each time period and season
- Cost parameters
  - Transportation
  - Harvest
  - Inventory
  - Road upgrading

Case study SCA

- 2.6 million hectares of forest land, of which 2.0 million is used for timber production
- Annual harvest 4.0 million m3
- Wood supply areas
  - Jämtland – 600.000 ha
  - Medelpad – 350.000 ha
  - Ångermanland – 350.000 ha



Objective of case study

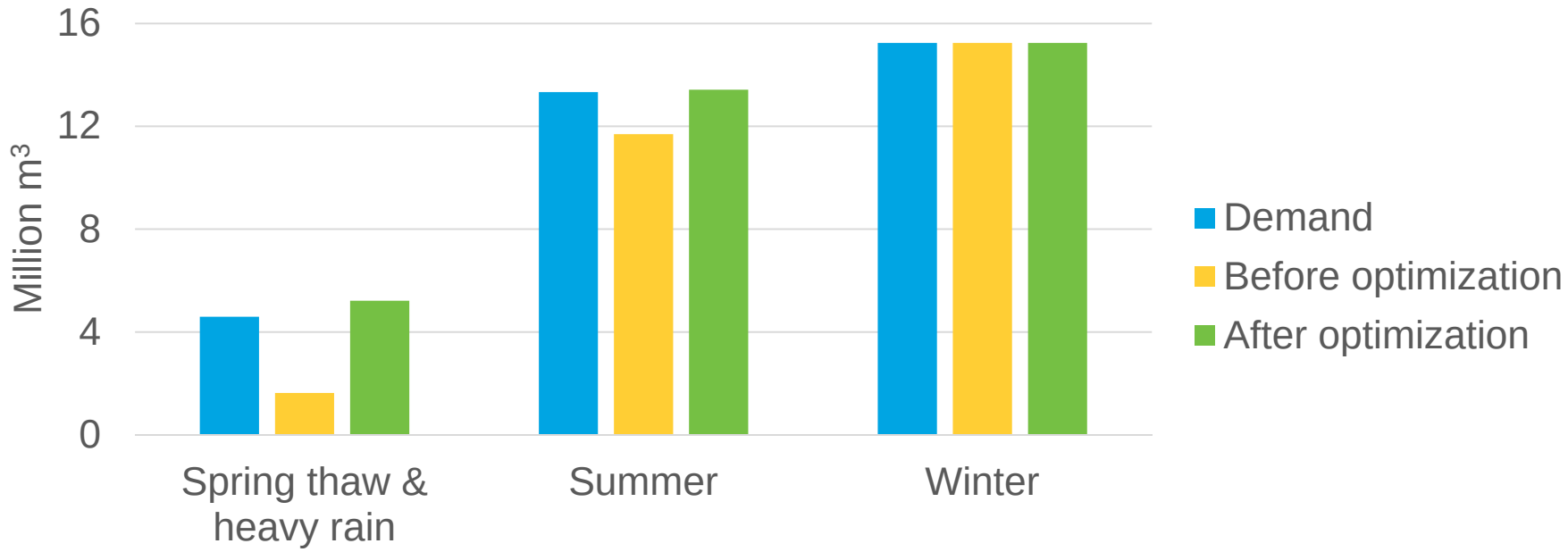
- Find the optimal investment level of road upgrading at each wood supply area

- Investigate the potential savings of planning road upgrading, harvest and transport together

  Scenarios

  - Fixed – using manual harvest plan from SCA
  - Free – harvest plan decided by the model

Accessible volumes

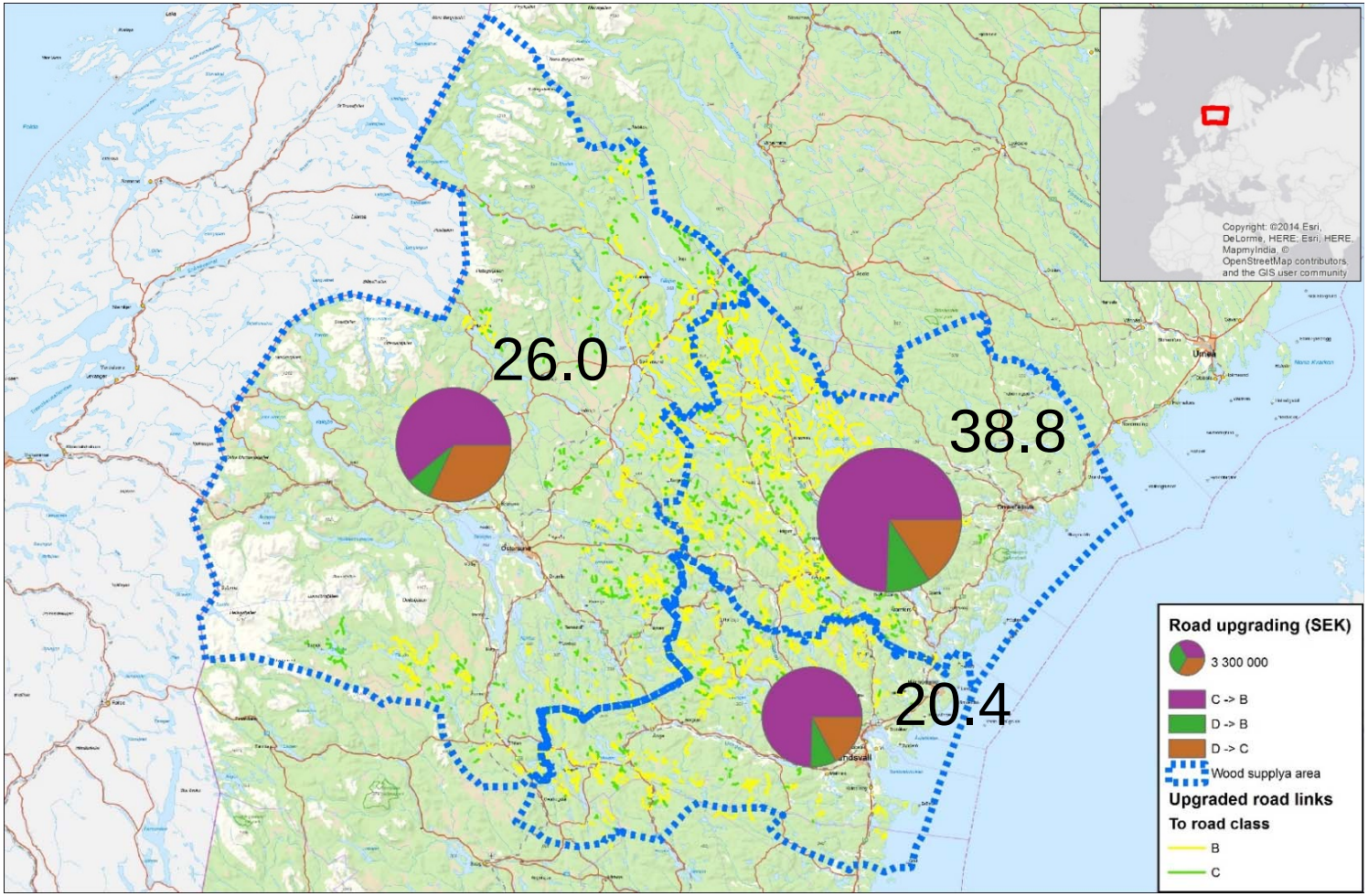


- Road upgrading 33 million EUR
  - From class C to B 3 023 km
  - From class D to B 372 km
  - From class D to C 908 km

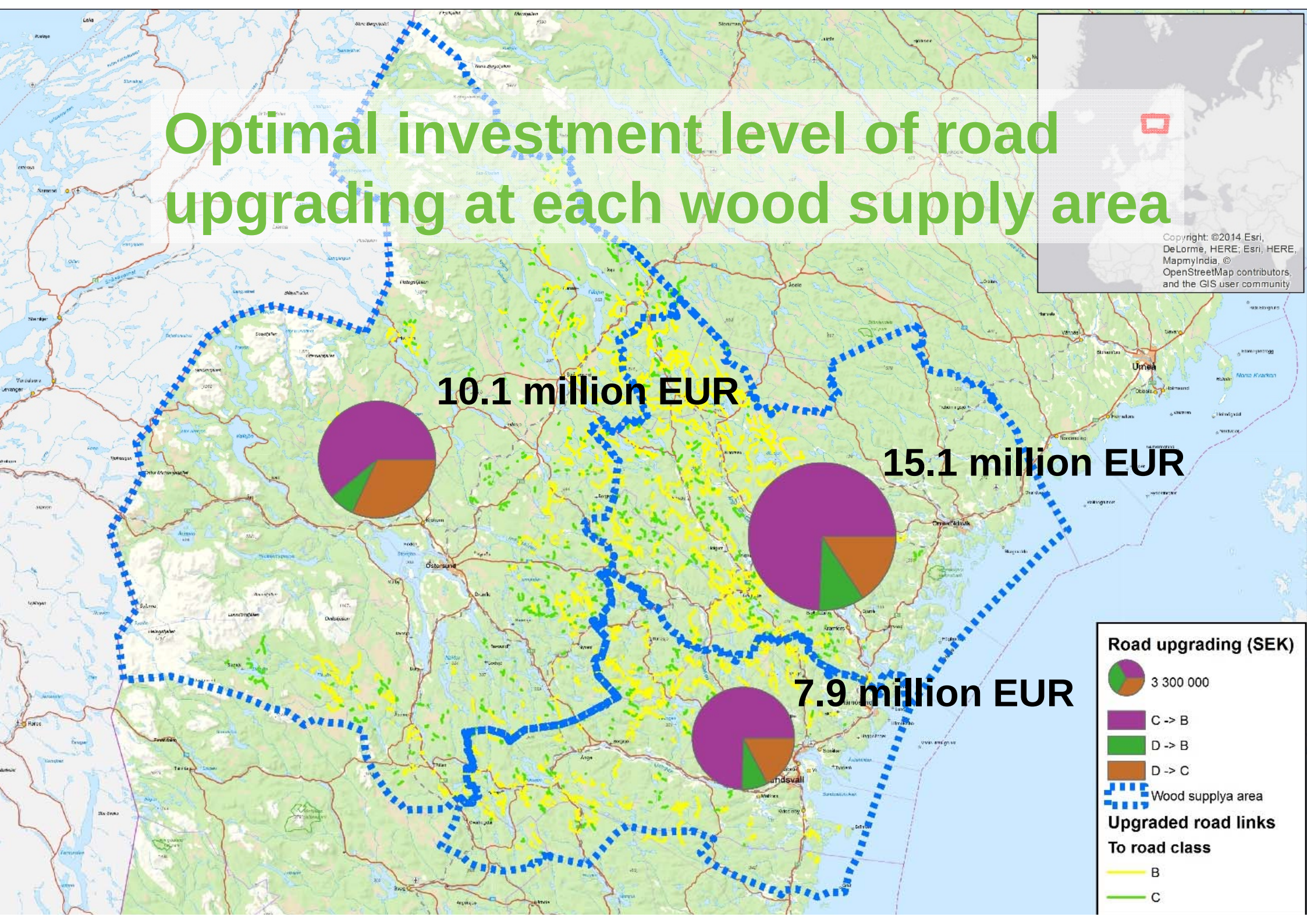
Results

- Transport cost 1.331 million SEK (192 million CAD)
- Road upgrading 86 million SEK (12.4 CAD)
- Road upgrading
  - From class C to B 3.023 meters
  - From class D to B 372 meters
  - From class D to C 908 meters

Optimal investment level of road upgrading at each wood supply area



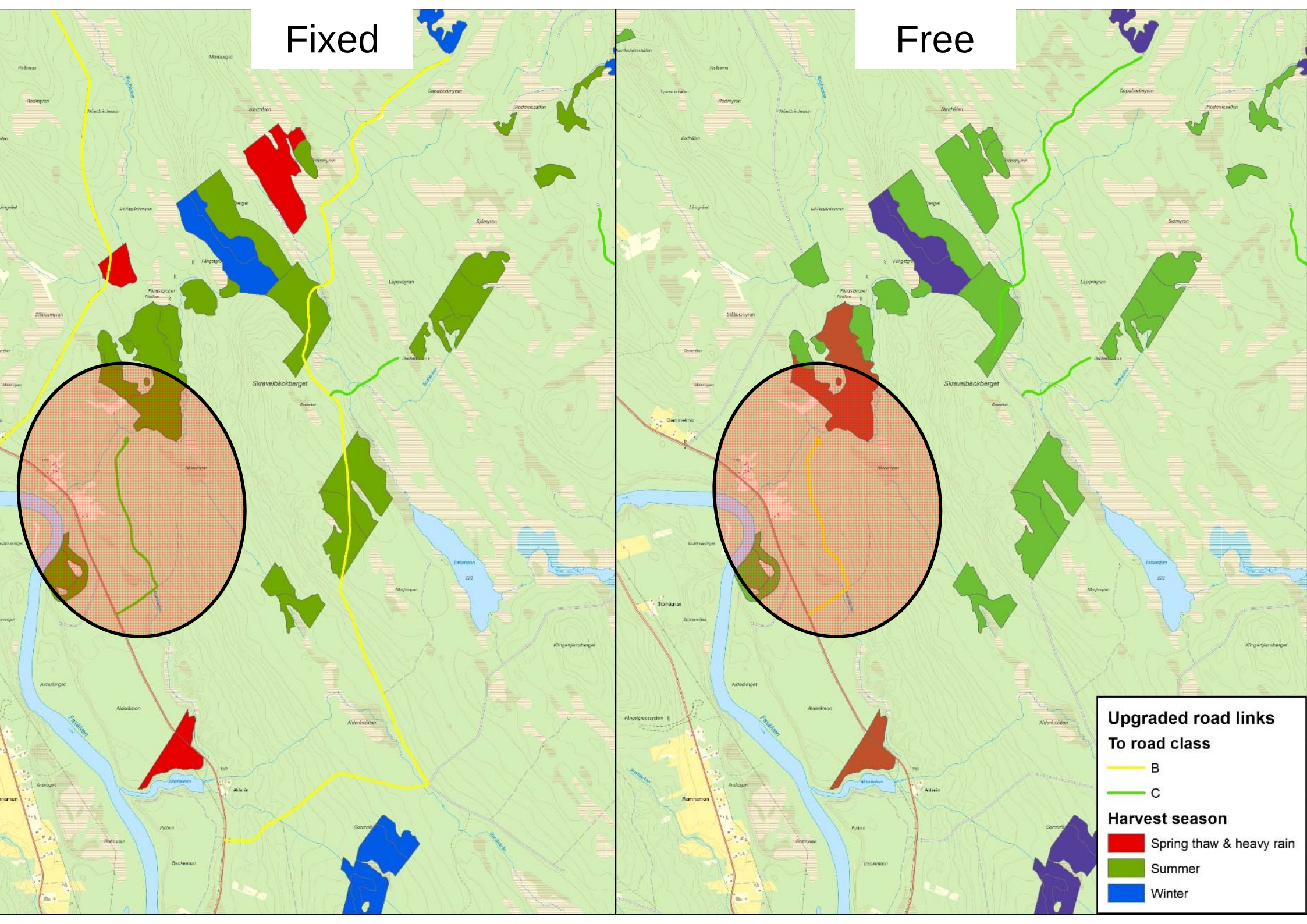
Optimal investment level of road upgrading at each wood supply area



Coordinated planning

Harvestingplan	Road upgrading	Transportation	Total
Fixed (million EUR)	33.0	166.4	199.4
Free (million EUR)	13.3	162.0	175.3
Savings (million EUR)	**-19.7**	**-4.4**	**-24.1**
Diff cost (%)	-60%	-3%	-12%

Potential savings 24.1 million EUR


Fixed
Free
Skravelbäckberget
Upgraded road links
To road class
B
C
Harvest season
Spring thaw & heavy rain
Summer
Winter

Conclusions

- Important with good input data
- Big difference in investments between the wood supply area
- Impossible to do this calculation by hand

- Important results for SCA:

  “Big savings by planning harvest, road upgrading and transport together”

Further investigation

- Sensitivity analysis
  - Placement on gravel pit
  - Length on depreciation period at investments
- Scenario analysis
  - Central Tire Inflation
  - Storage

Thanks for listening

Victor.Asmoarp@Skogforsk.se

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