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Ecosystem services and climate change

A decision support process for a community forest in the Austrian Alps

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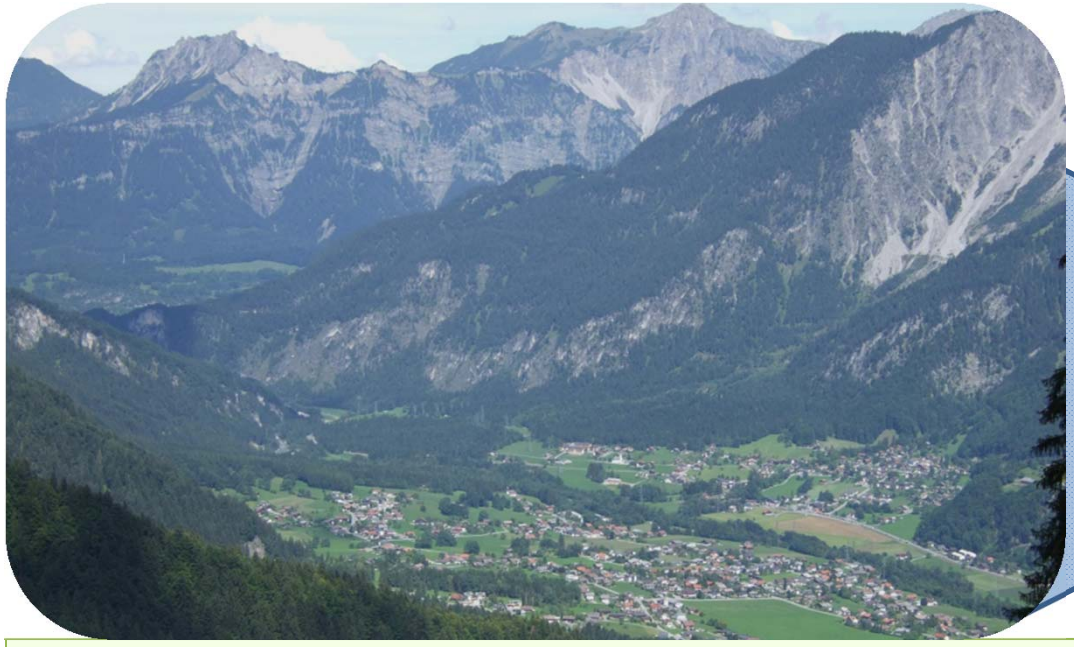
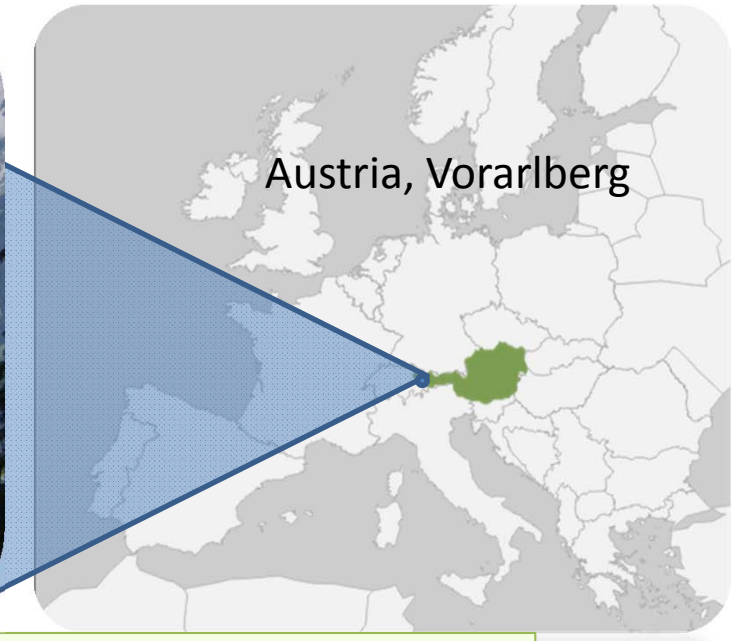
Case study

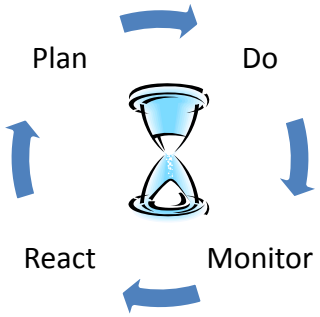




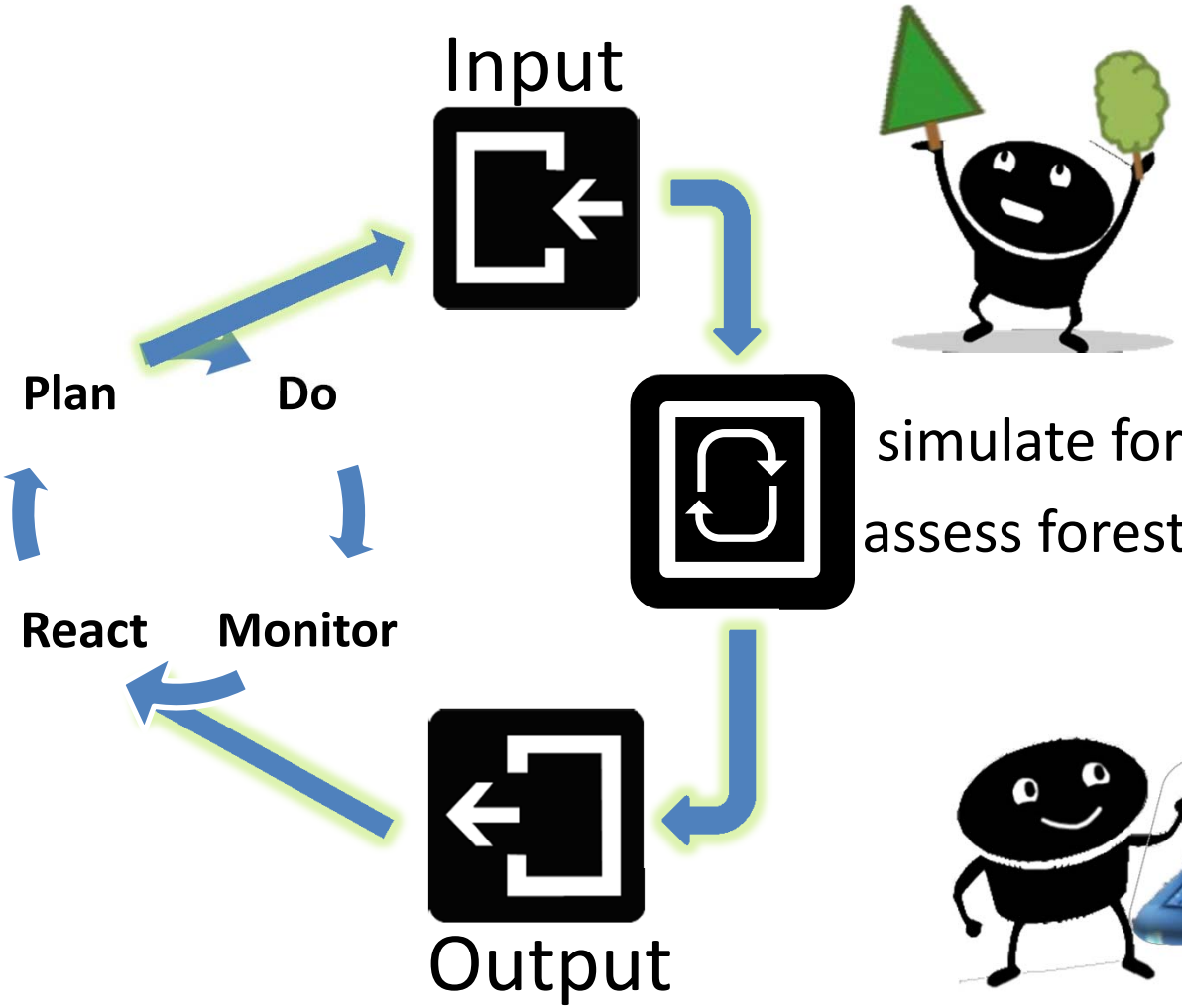
- spruce (picea abies) 90%, fir (abies alba) 8 %, broadleafed 2%
- Elevation 1100-1800m a.s.l
- MAT: 6°C, MAP: 1500mm/a
- Multifunctionality:
  - Protection (gravitational hazards)
  - Production (high value timber)
  - Conservation (partly Natura 2000 area)

Management problems

- Multiple forest functions
- Changing environment
- Limited accessibility
- Long turnover rates – time lag in mgmt circle



Decision support requirements

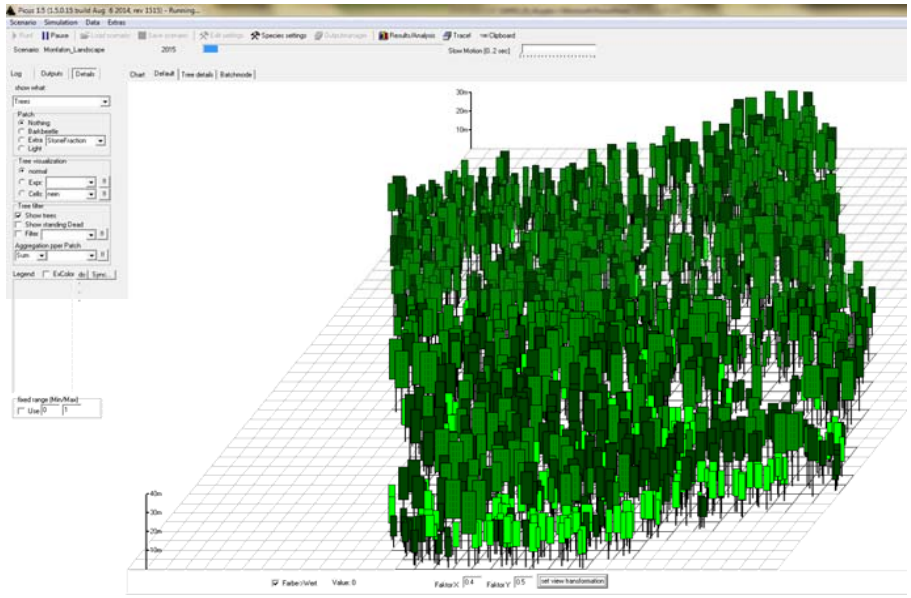


simulate forest structures

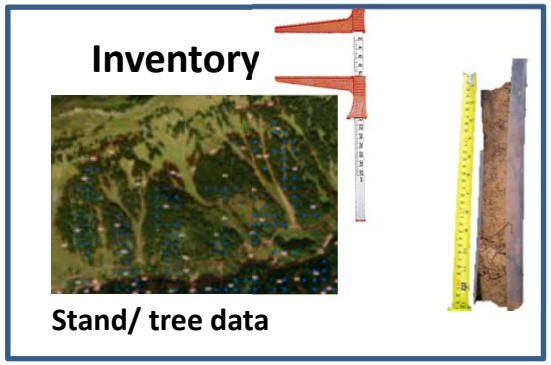
assess forest functionality

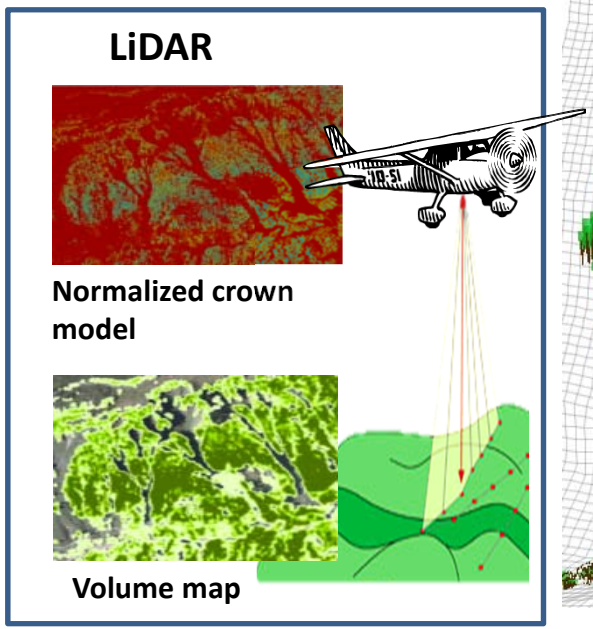
support by modelling

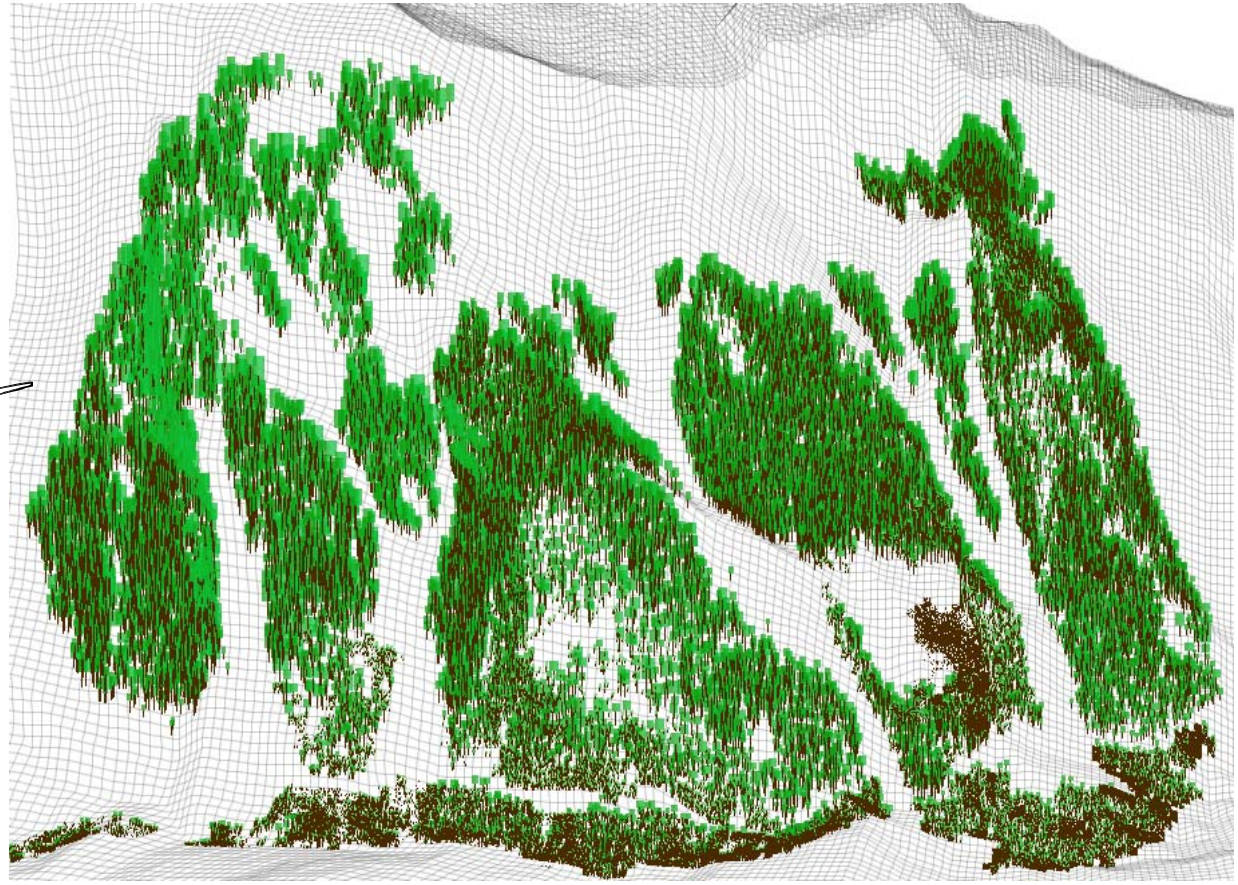
- Hybrid forest gap model PICUS v1.5 (Lexer et al,2005)
  - gap model (individual trees on 10x10m patches)
  - production model (3PG, Landsberg and Waring 1997)
- single tree coordinates
- Disturbance submodules:
  - Bark beetle
  - Browsing by ungulates



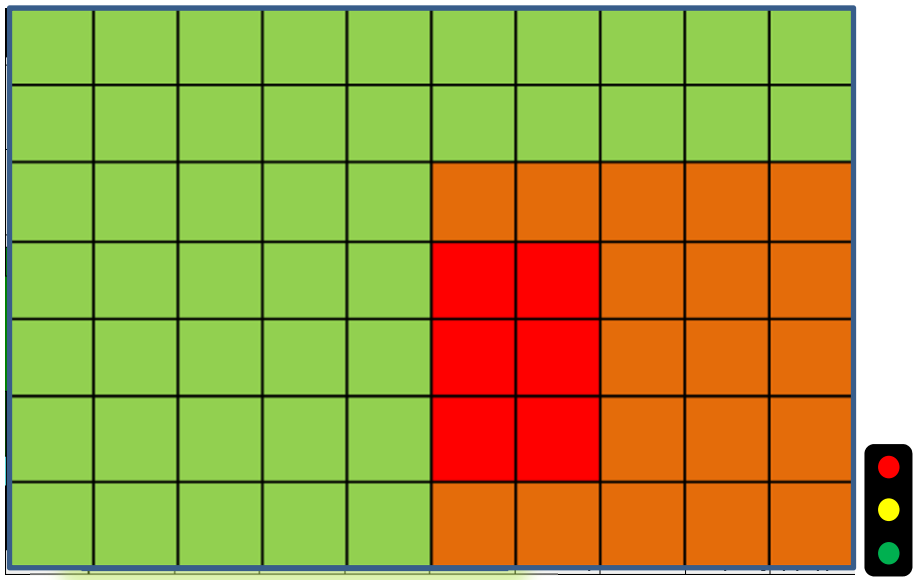
Input: tree attributes







Assess forest functionality

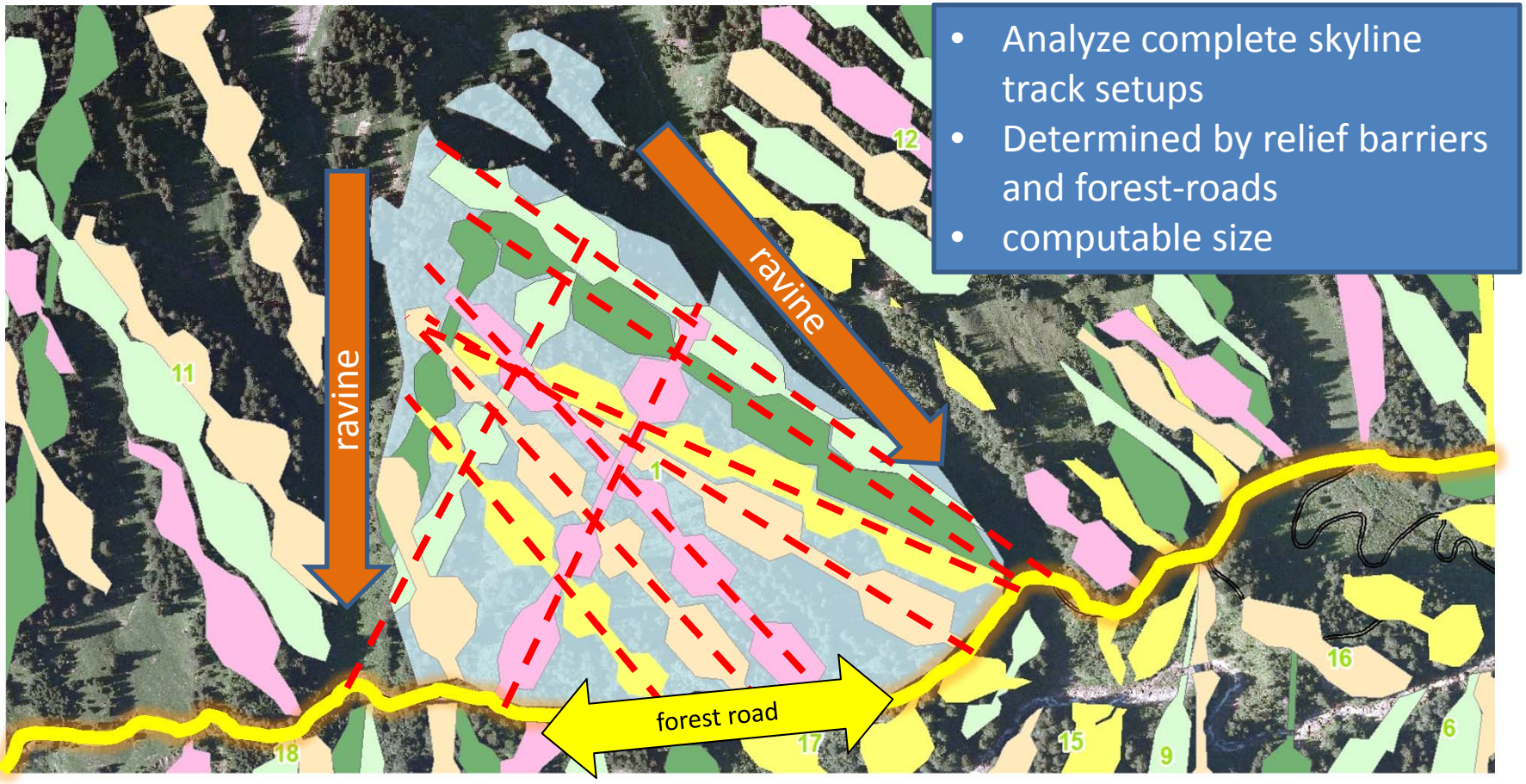


- capture attributes of forest structure in moving window
- Include DTM data

Applications:

- Protection against gravitational hazards (Frehner et al., 2005)
- Habitat suitability testing

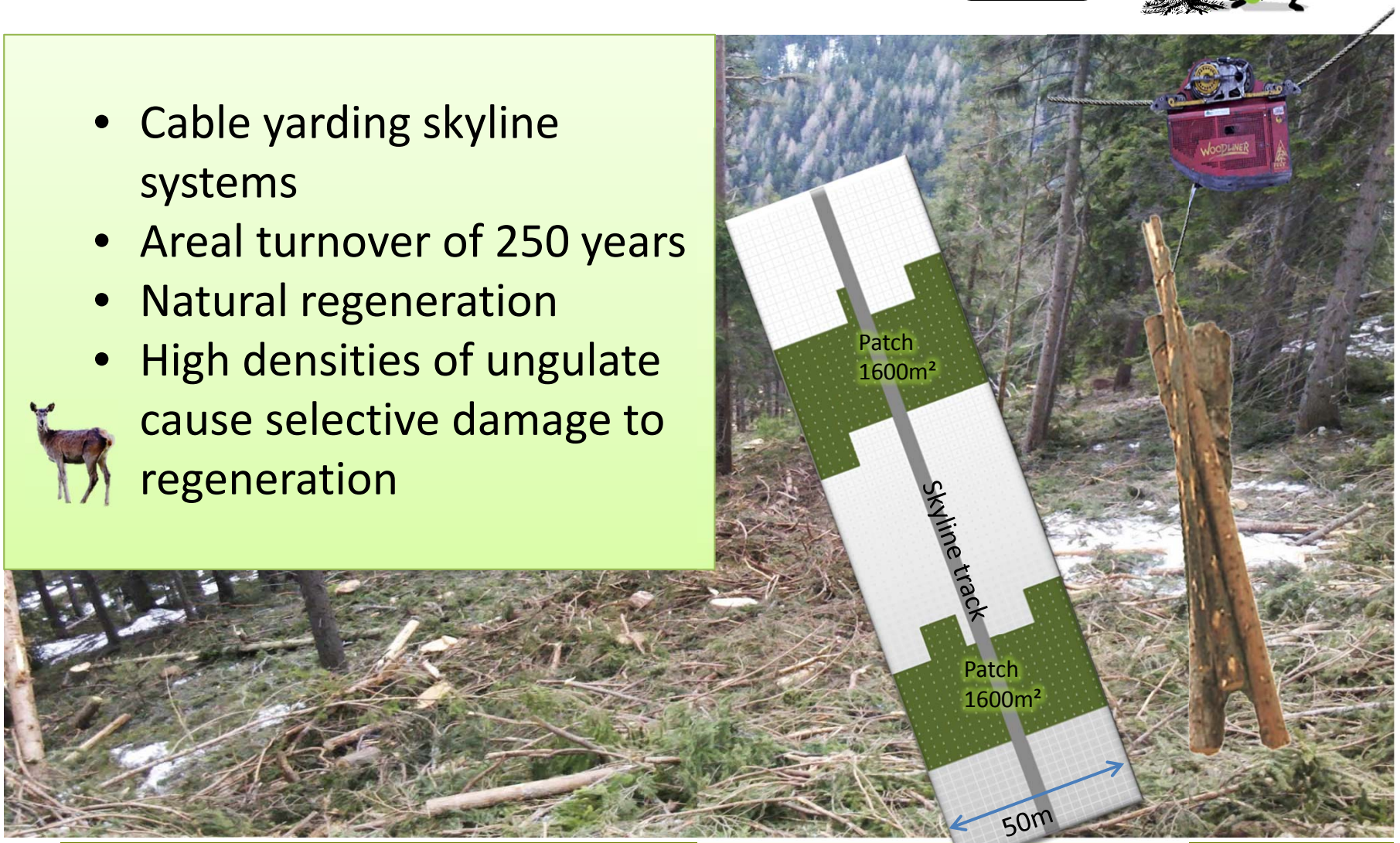
Output: Harvesting units



- Analyze complete skyline track setups
- Determined by relief barriers and forest-roads
- computable size

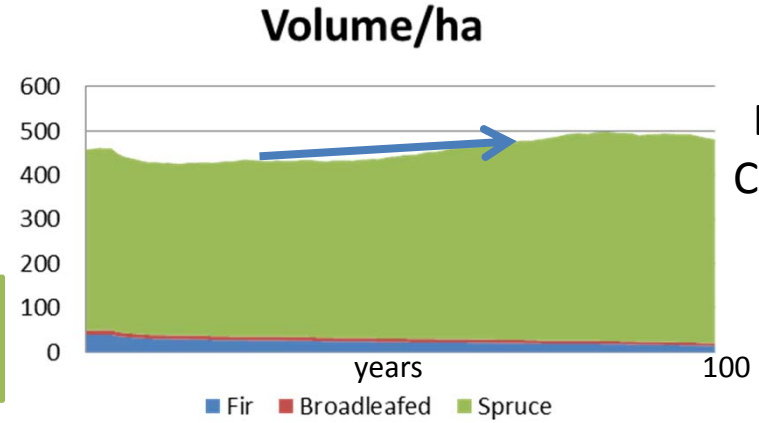
Simulate BAU

- Cable yarding skyline systems
- Areal turnover of 250 years
- Natural regeneration
- High densities of ungulate cause selective damage to regeneration



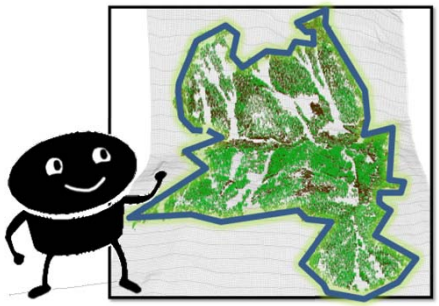
Results: Business as usual

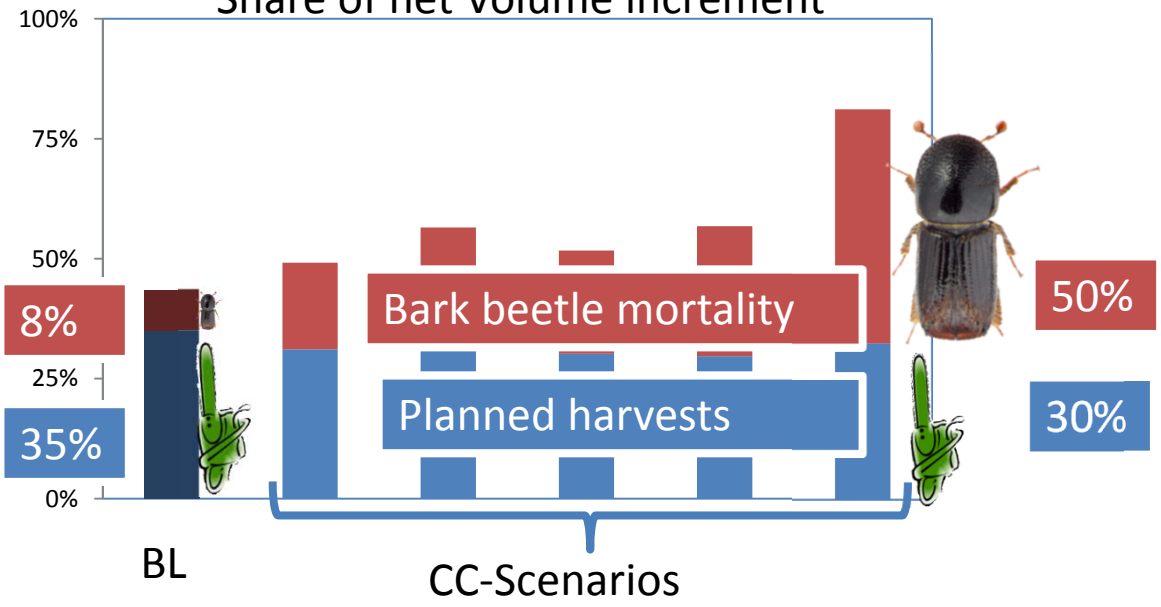
Decrease of fir share :
8% -> 3% [CC4%]



BL: +5%
CC: +-0%

Landscape

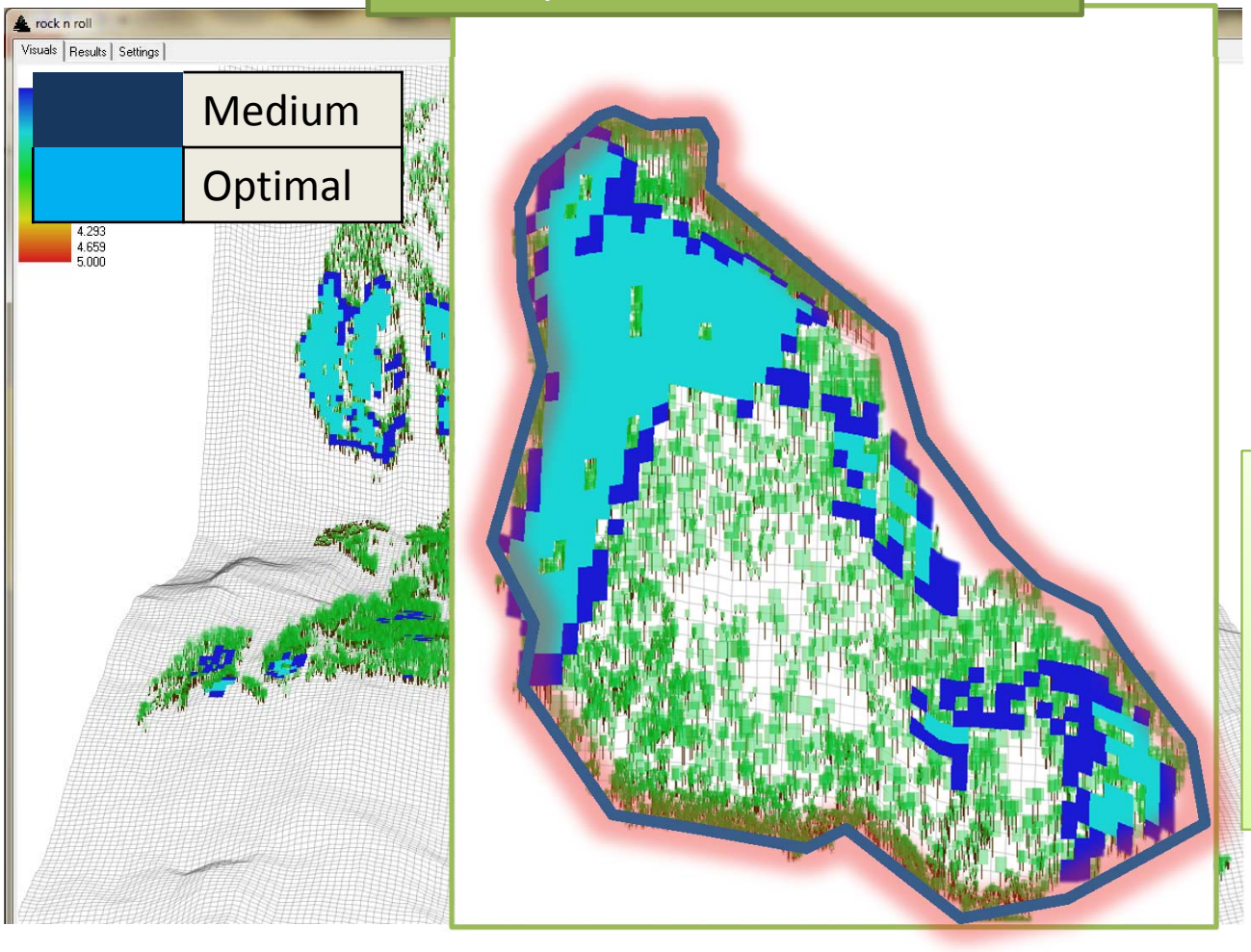




Mean values for
Period (2080-2110)

Analyse: Business as usual

Rockfall protection



Harvesting unit

Rockfall indikator:

for rocks ≥ 0.2 m³ - 5 m³

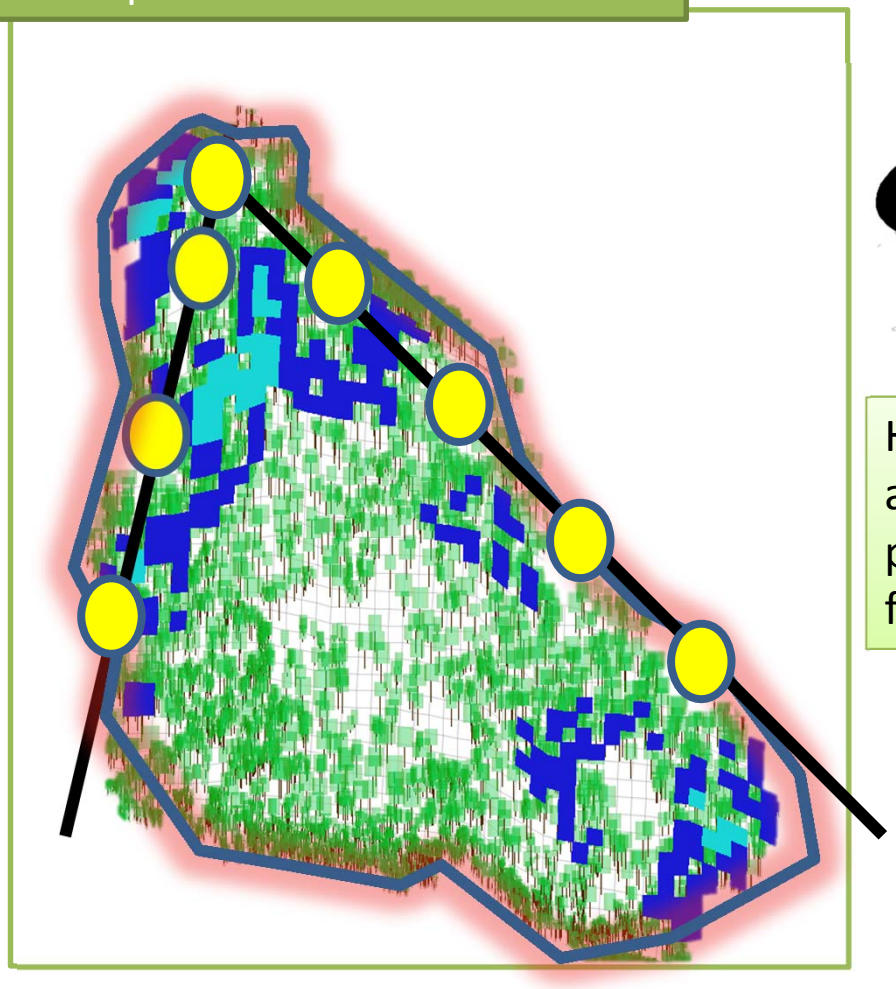
For medium:

- N > 150 (DBH>36cm)
- No gap of (6x20m)

Analyse: Business as usual

Rockfall protection

	Medium
	Optimal



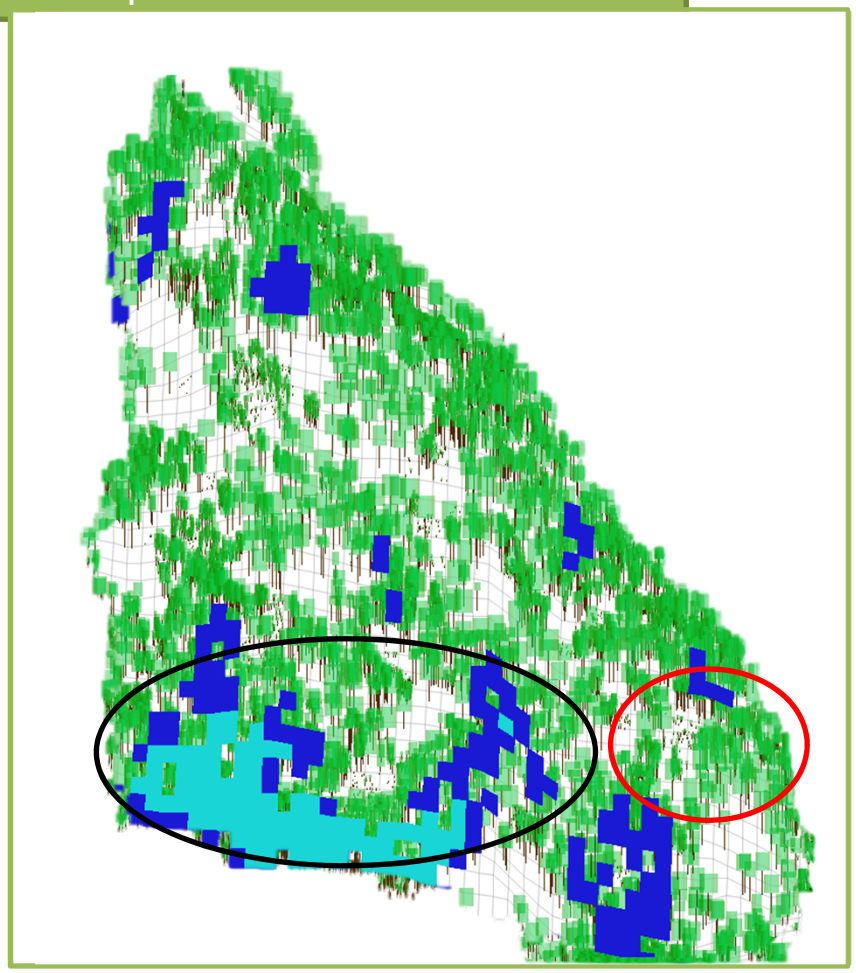
Harvesting unit

Harvesting activities reduce protective functionality

Analyse: Business as usual

Rockfall protection

	Medium
	Optimal

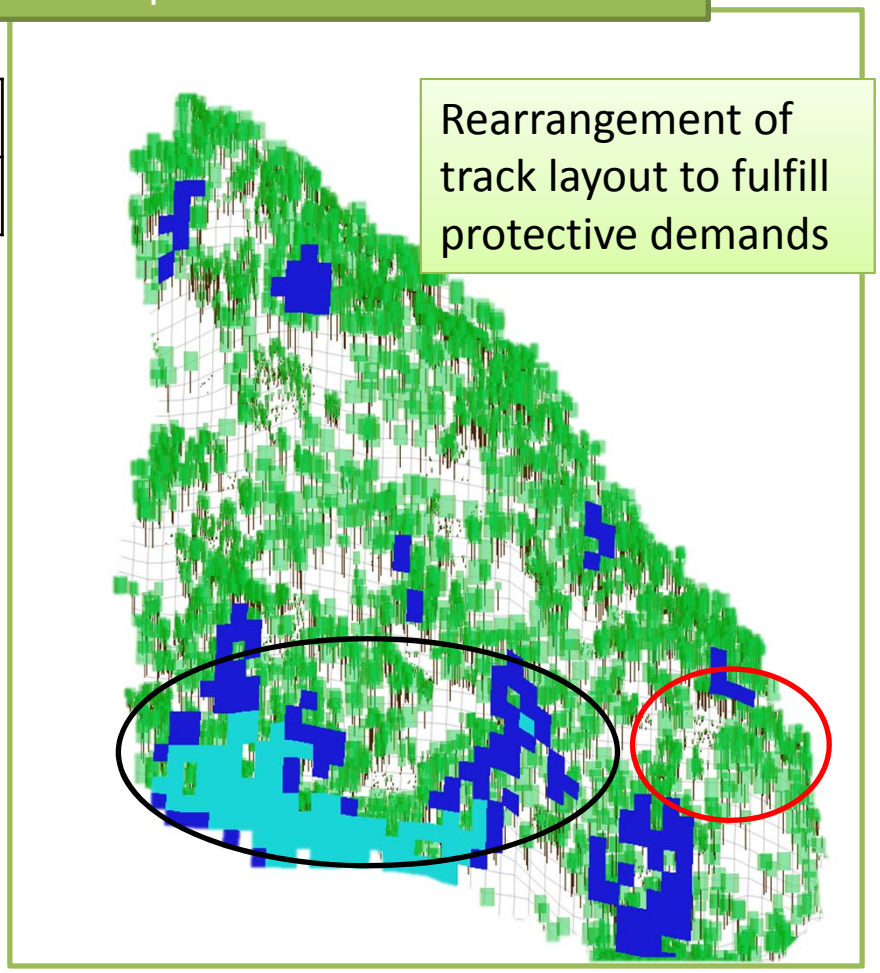


Harvesting unit

Analyse: Business as usual

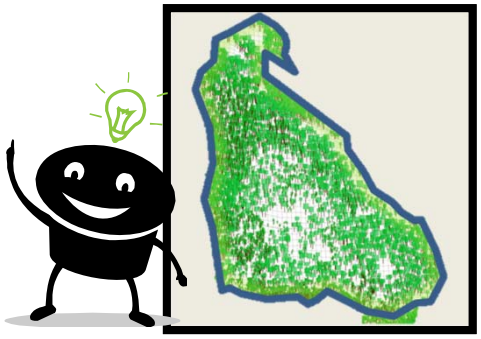
Rockfall protection

	Medium
	Optimal

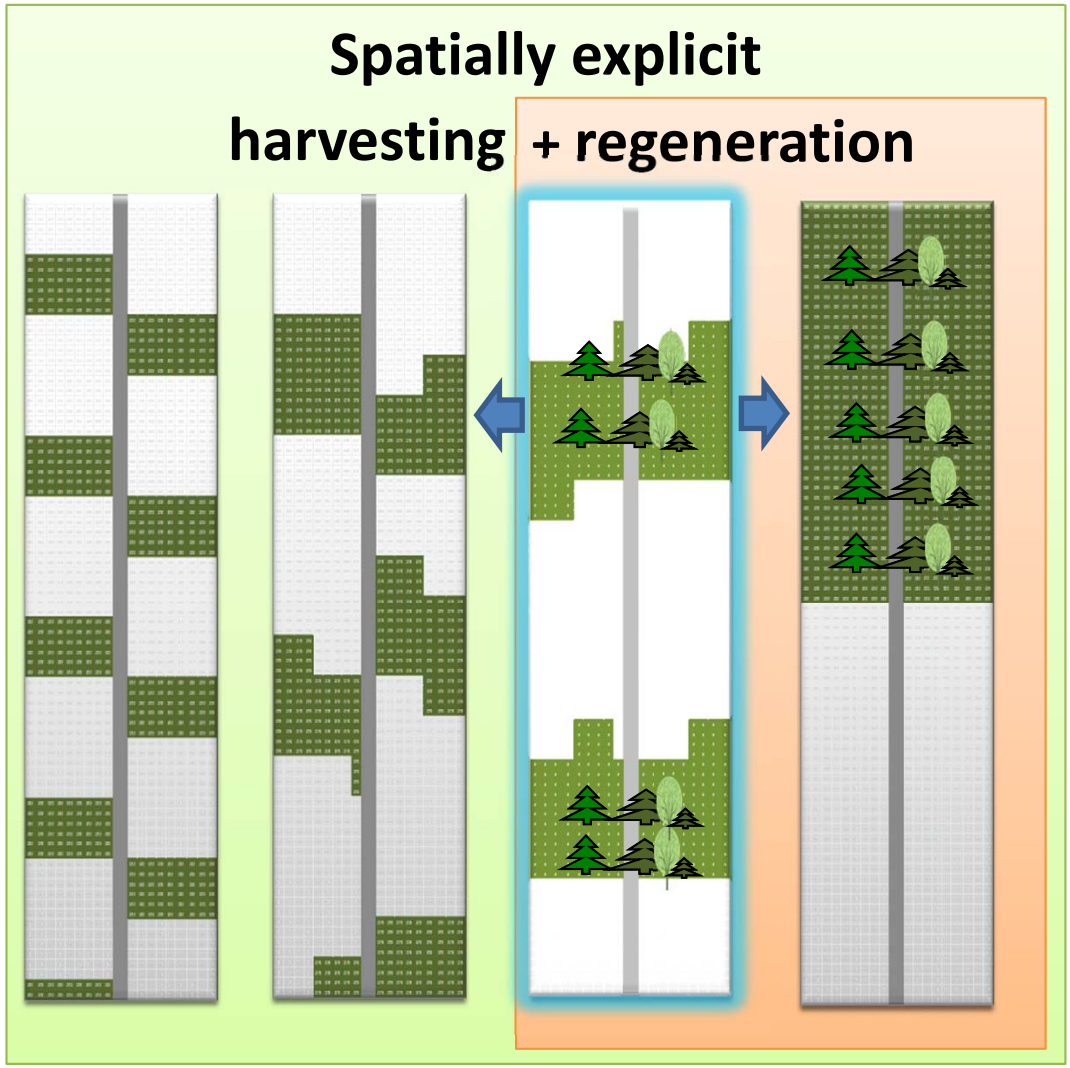


Rearrangement of track layout to fulfill protective demands

Harvesting unit



Adaptive Scenarios

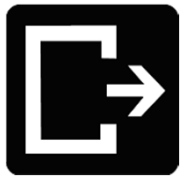


intensity

- Rotation original 250 years
- Rotation reduced 150 years

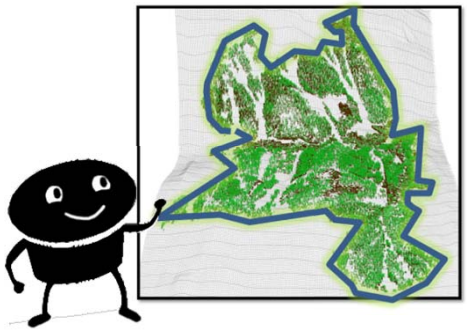
- No management
- Only sanitary management + reduced browsing rate

Results: Rockfall protection



scenario ranking

Landscape



No mgmt

artificial regeneration

Current mgmt
micro patches
smaller patches

strip cut

shorter
rotation

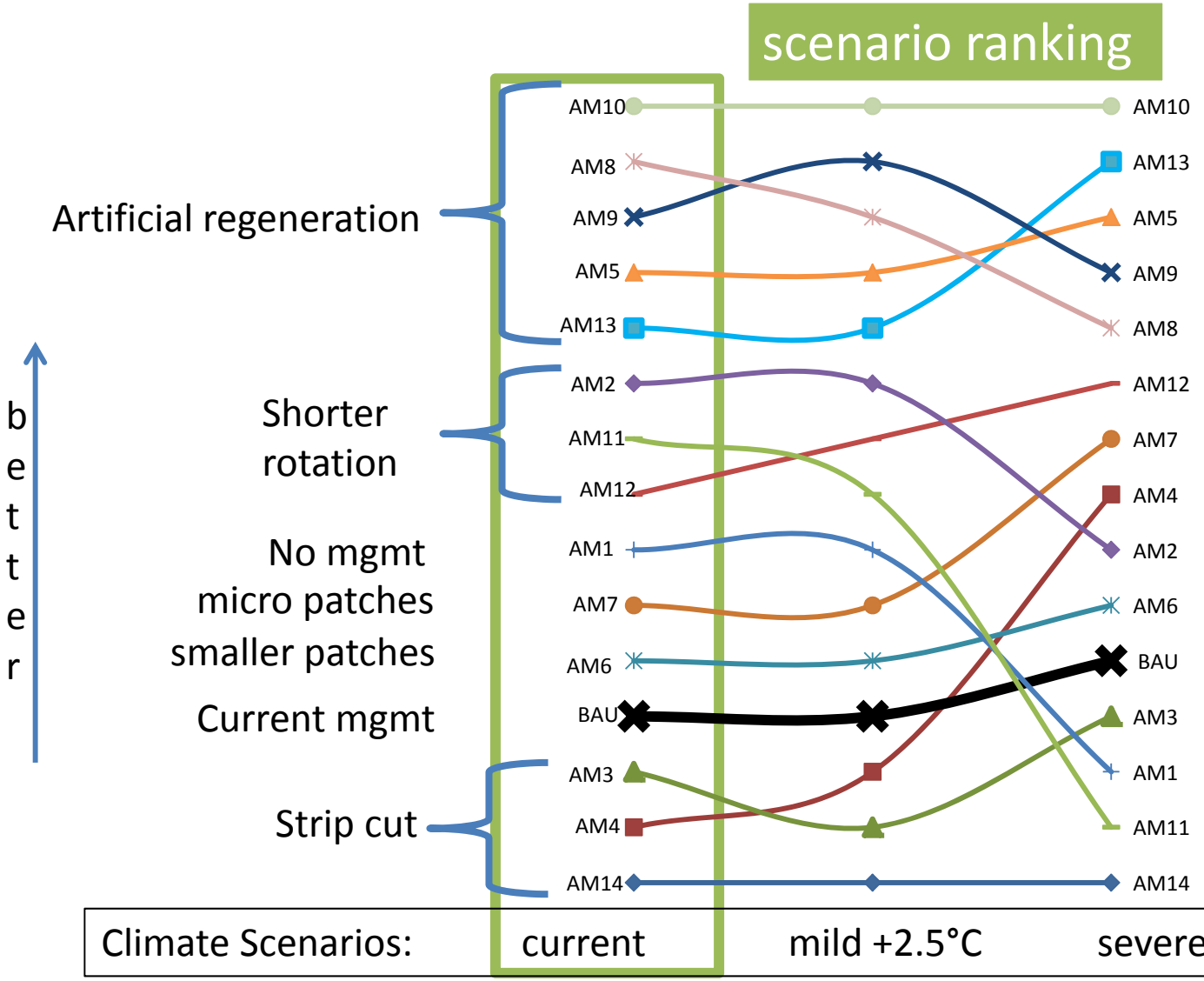
better

AM13	AM13		
AM1	AM1		
AM5	AM5		
AM4	AM4		
BAU	AM3		
AM7	BAU		
AM6	AM6		
AM3	AM7		
AM10	AM14		
AM9	AM9		
AM14	AM10		
AM8	AM8		
AM2	AM2		
AM12	AM11		
AM11	AM12		

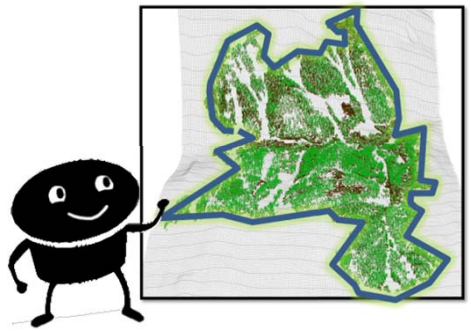
Bolder volume 1m³
Density 2400kg/m³

Climate Scenarios:	current	mild +2.5°C	severe +6°

Results: Landslide protection



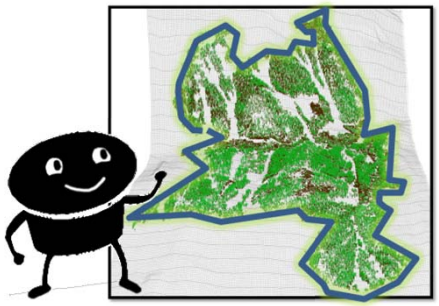
Landscape



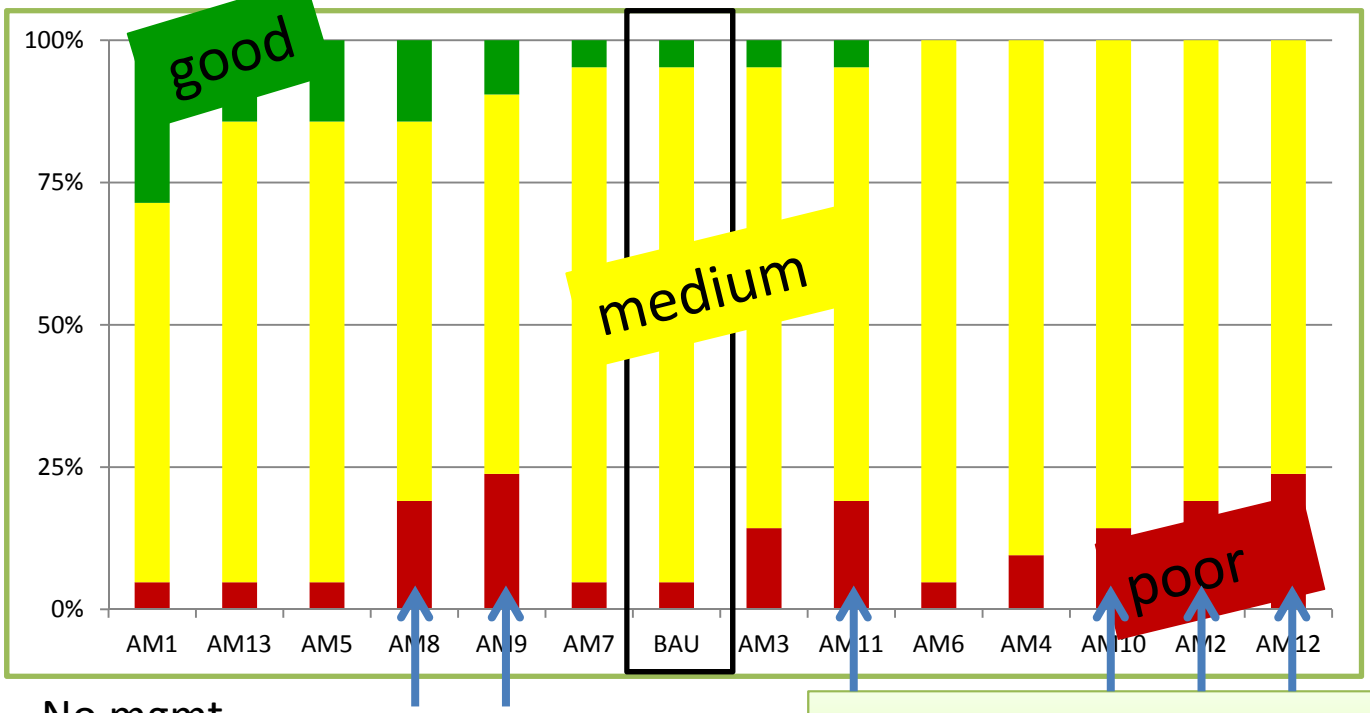
Shorter rotation + no mgmt looses positions in severe CC

Results: Bird habitat quality

Landscape



Share of harvesting units fulfilling criteria (mode for last 30 year period)



No mgmt

Shorter rotation increases poor quality sites

Climate Scenario: mild +2.5°C

Results summary

- Bark beetle damage will increase from 8% up to 50% of V_increment
- Size of current patches (1600m²) good for rockfall protection
- Artificial regeneration can increase protective functionality and counteract browsing effects

Landscape

Lets react!

>> Decision support process gives valuable input for management on **landscape** – **harvesting unit** – and **skyline track setup** – level

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