

LiDAR, habitat structure and the ecology of ungulates in a landscape of fear

Leif Egil Loe

INA/UMB

23 June 2011

Outline

- Theoretical motivation
- Hypotheses
- Biological data
- What do we want from Lidar?
- Technical challenges (with feedback from you)

Short theoretical motivation

- Predation is a main driver of population dynamics in many systems
- Additional effect to consumption: Predators create a "landscape of fear"
- Prey avoid areas with high predation risk
- Redistribution of herbivores → large ecosystem effects

Example of landscape of fear

- Wolf and elk in Yellowstone national park
- Wolves were reintroduced
 - elk moved from aspen stands to coniferous stands
 - aspen recovered from heavy browsing pressure

= Trophic cascade



Our hypotheses

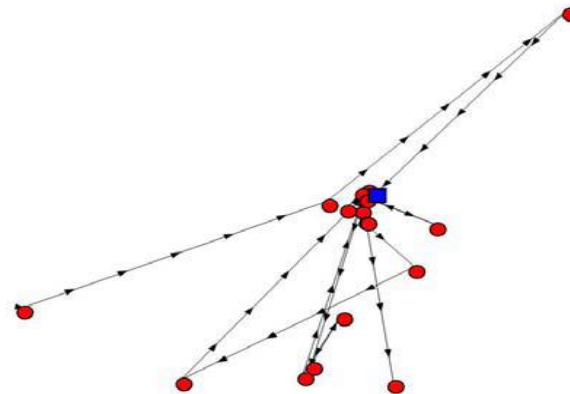
- Predators (including humans) efficiency depends on habitat characteristics
 - Hunters more efficient in open habitat
 - Ambush predators (lynx) most efficient in closed habitat
- Hunters and natural predators create contrasting landscapes of fear
- Deer respond most to the predator with highest overall kill rate

Data: where are deer killed by lynx?

- GPS collars on lynx



- Detect kills with the “cluster method”
- Field validation
 - Prey species
 - Habitat



Data: where are they killed by hunters

- GPS coordinates of hunter kills
- Visit locations where hunters killed roe deer in field



Roe deer

Data: Where are deer NOT killed

- GPS collars on deer species



Roe deer

- Detect proportion of time spent in each habitat type
- GPS-collars on many 100 individuals
- Record a location every hour
- Spatial locations on animals not limiting factor

Possible tests with these data

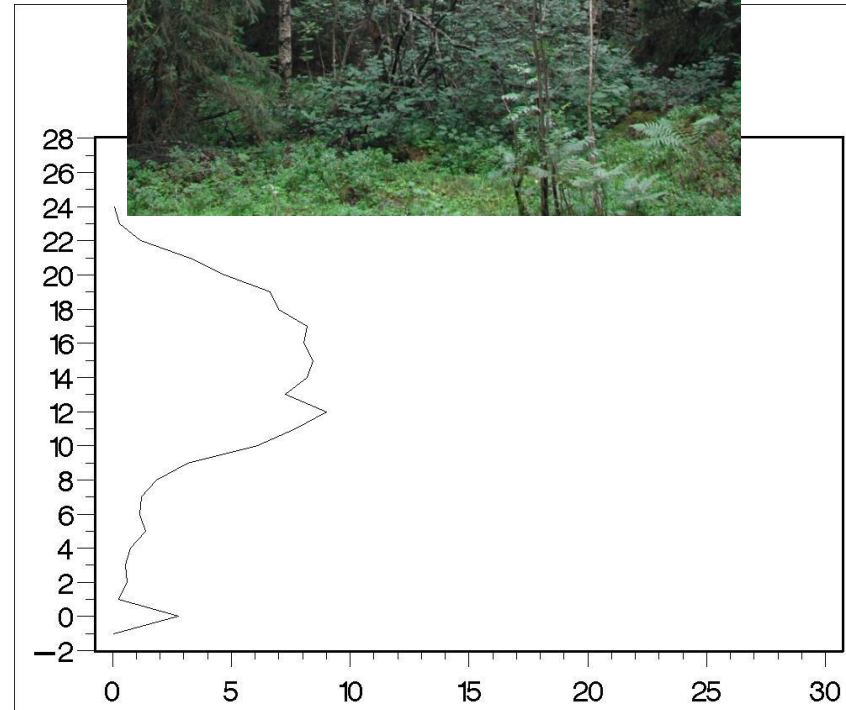
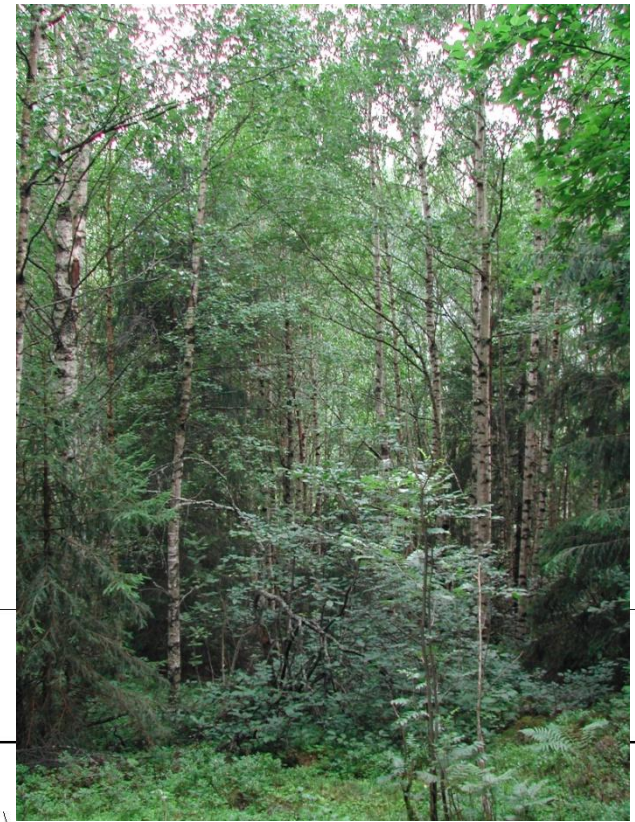
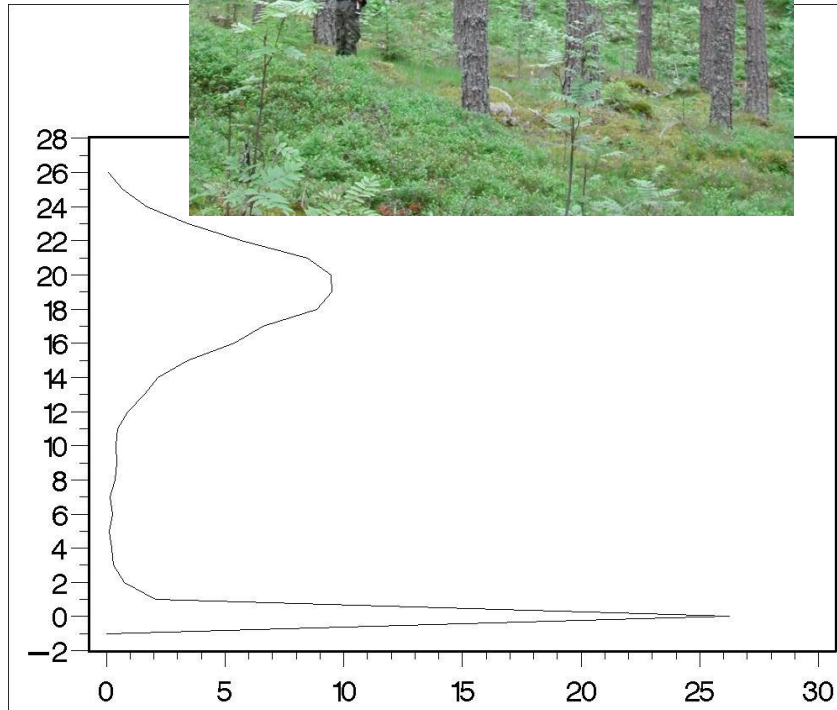
- Do high risk habitats exist?
 - Compare habitat at kill sites versus “live sites”
 - Higher risk of lynx predation in closed habitat?
 - Higher risk of being shot in open habitat?
- Do deer respond behaviourally to landscapes of fear?
 - Avoidance of habitat with highest risk
 - Seasonal effect of hunting

What do we want from Lidar?

- Get a measure of habitat density
- More specifically: A predicted value for visibility from 0-2 meter above ground

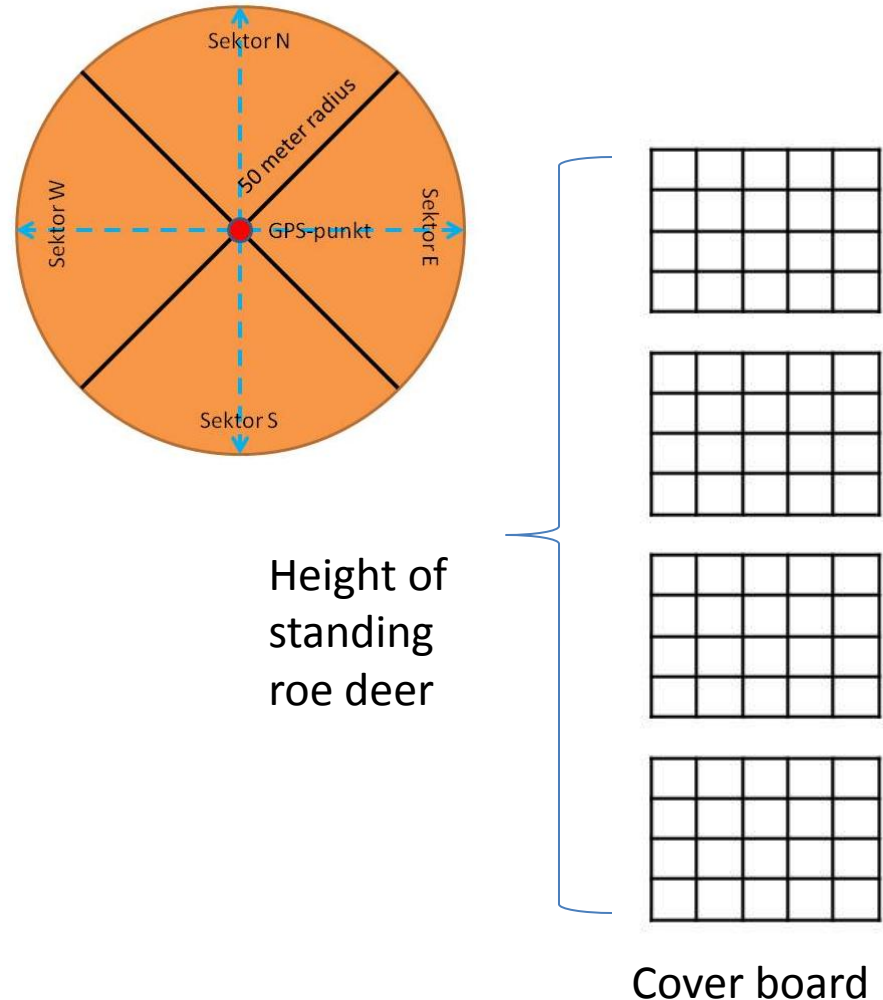
Technical challenges

- Few signals reach 0-2 meter above ground when the canopy is dense
- Data from this segment is often not used (too noisy)



Parameterisation of a visibility model

- Field validation of kill sites and live sites with DGPS
- Record in 50 m circle with 4 replicates:
 - Horizontal visibility (cover board)
 - Tree density (relascope)
 - Height of mean tree
 - Height of field layer
 - Canopy cover (%; concave densiometer)



Additional measures to improve a model for visibility?

- Any comments?