Spatial distribution of heather defoliation by sheep across natural heather-grass mosaics

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Study object

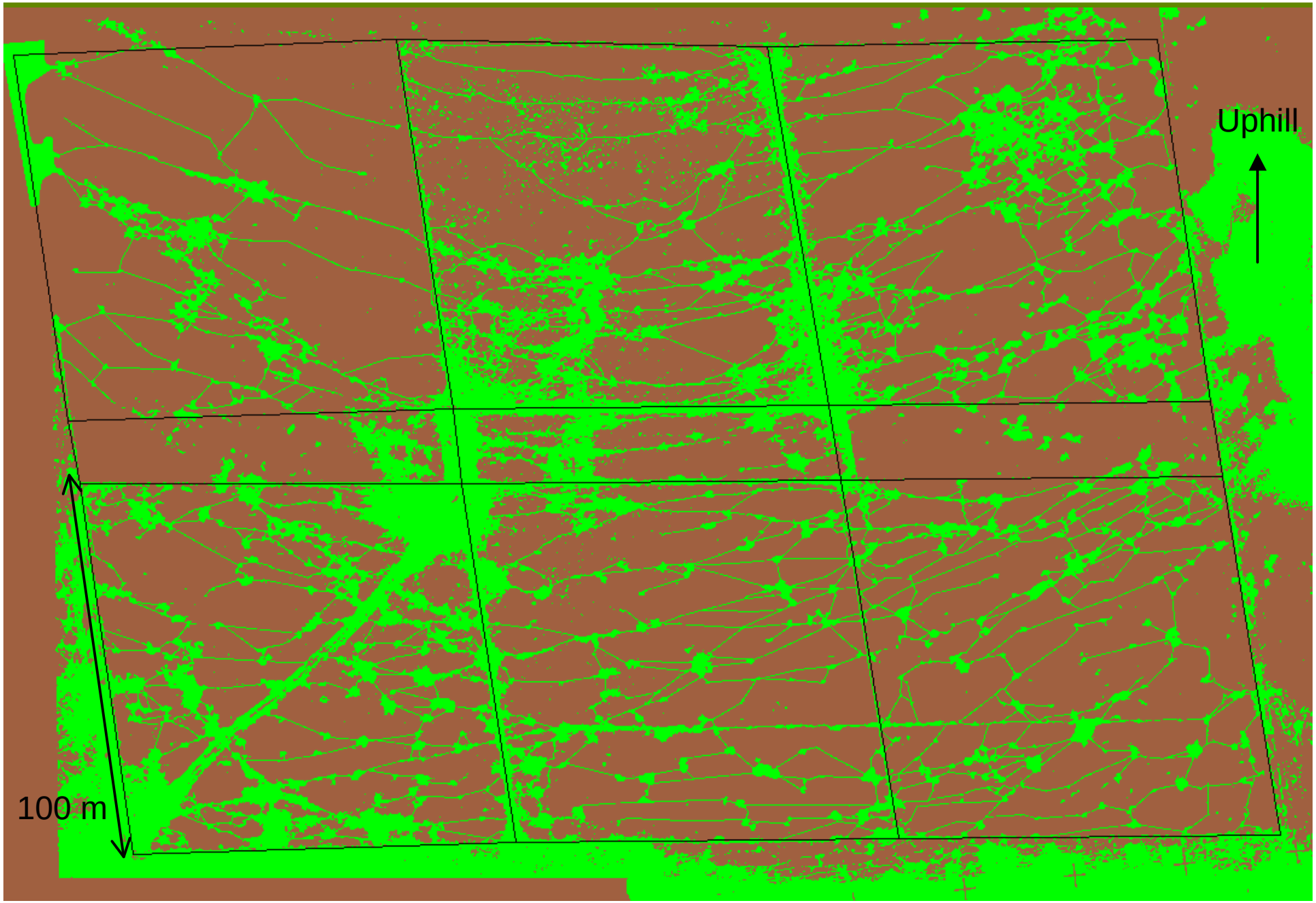
Heather moorland

- internationally important natural resource
- management aimed at:
  - → maintaining heather cover
  - → protecting insect diversity
  - → protecting bird populations
  - → facilitating tree regeneration
  - → ... etceteras
- grazing is important part of ecosystem
- different objectives might require different grazing regimes

Grazing management

- grazing impact rule of thumb: '40% rule'
- overall grazing intensity expressed as the stocking density: number of sheep / hectare
- but: - sheep only use part of the landscape intensively
  - high defoliation of heather could occur locally even at low stocking densities
- so: - where do animals graze the heather ?

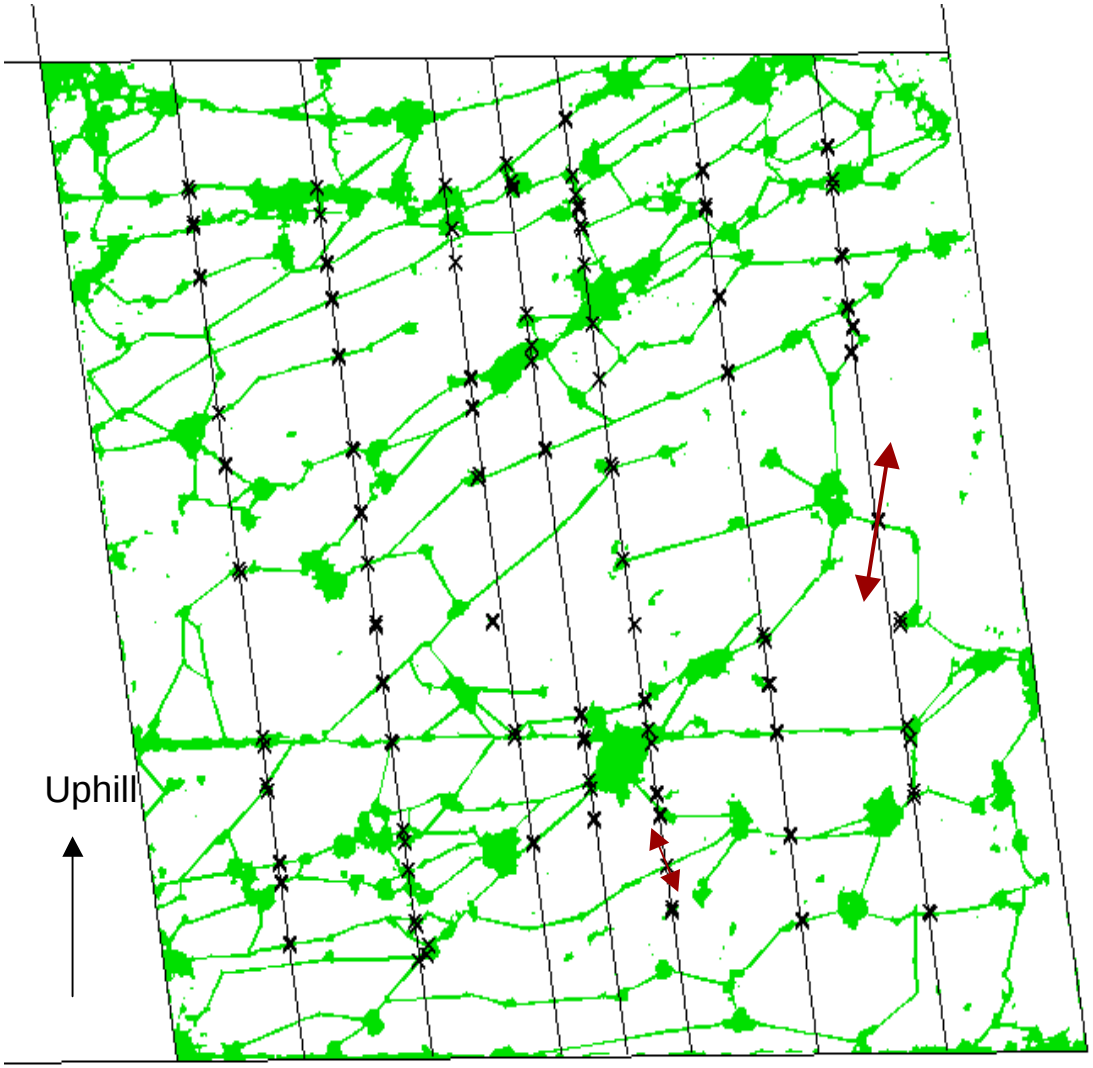
Experimental site



Field experiment - Design

Study site	6 plots of 100 x 100 m
Duration	3 years
Treatments	Scottish Blackface sheep 2, 3 and 4 sheep per hectare (groups of six, different frequency) year round grazing
Measurements	heather defoliation (spring and autumn)

Field experiment - Heather measurements



Transect

- perpendicular to grass/heather edge
- measurement locations: 0,25,50,75,100,125,150,200,… ,500 (cm)

Location

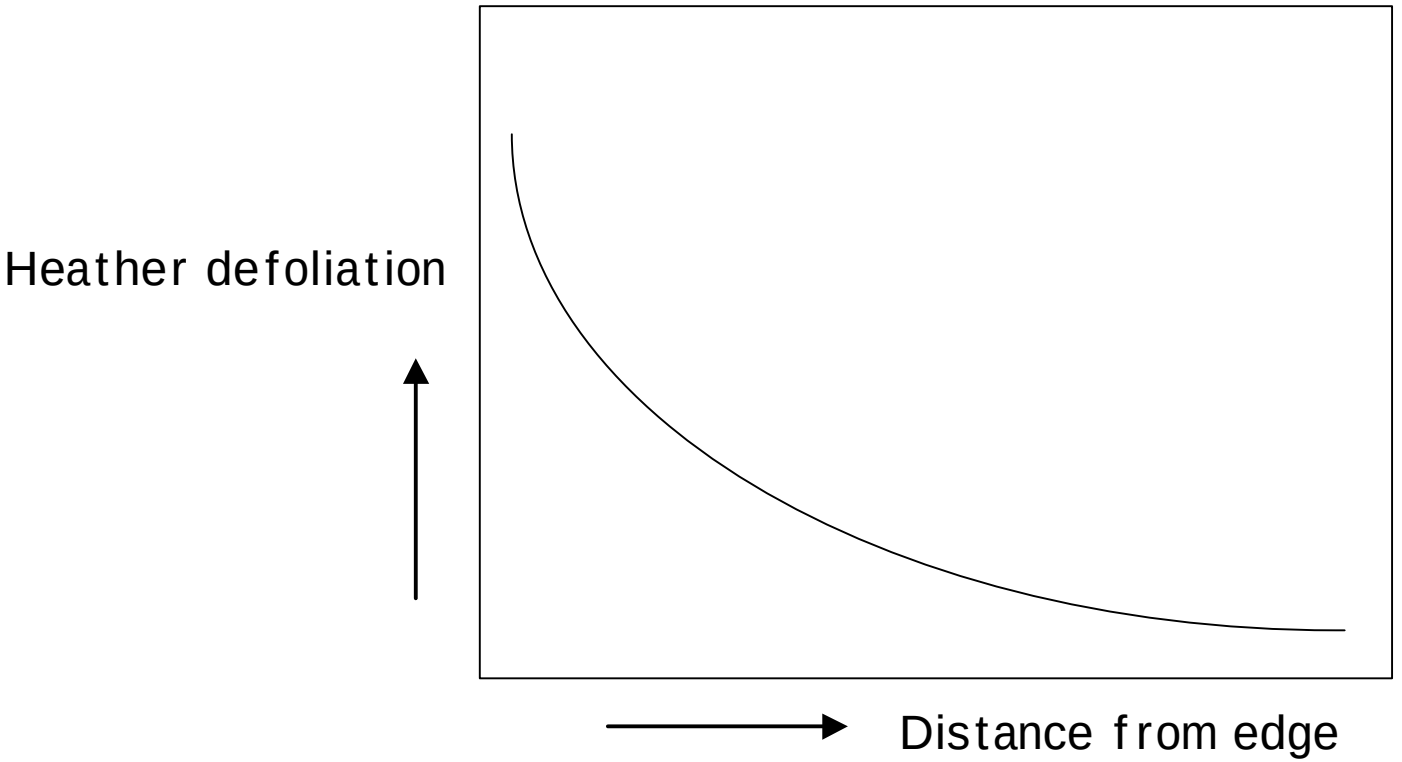
- 10 shoots
- current years growth
- biomass removed:
- <50% , >50%, >100%
- mean % for 10 shoots

Foraging behaviour

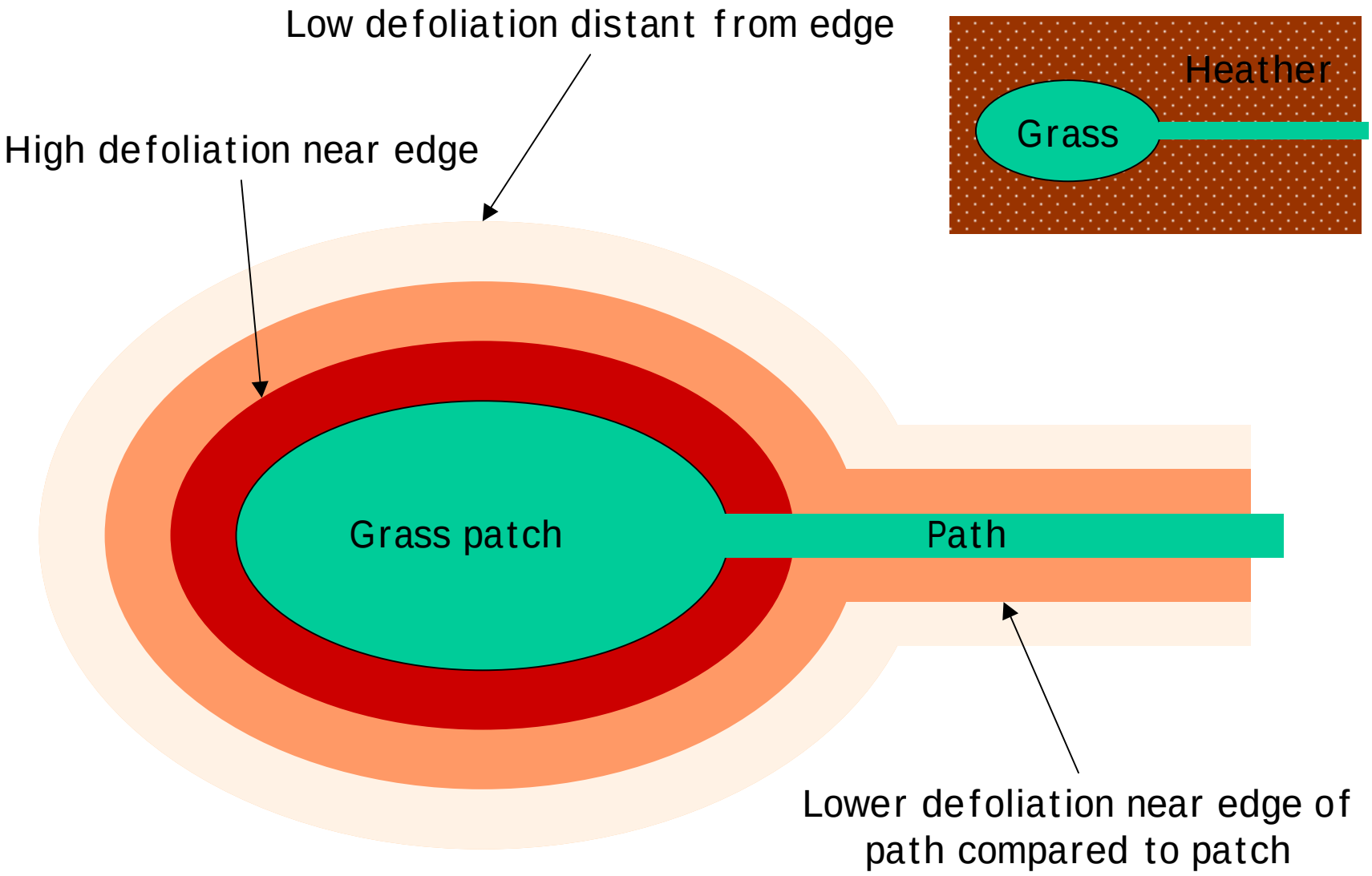
- observations show mixed diet of grass and heather
- sheep prefer eating grass over heather
- therefore grass is the 'nutritional attraction'
- pattern of heather defoliation is influenced by grass patches and paths

Heather defoliation away from the edge

- heather defoliation is higher near the edge of grass patches and paths than further away

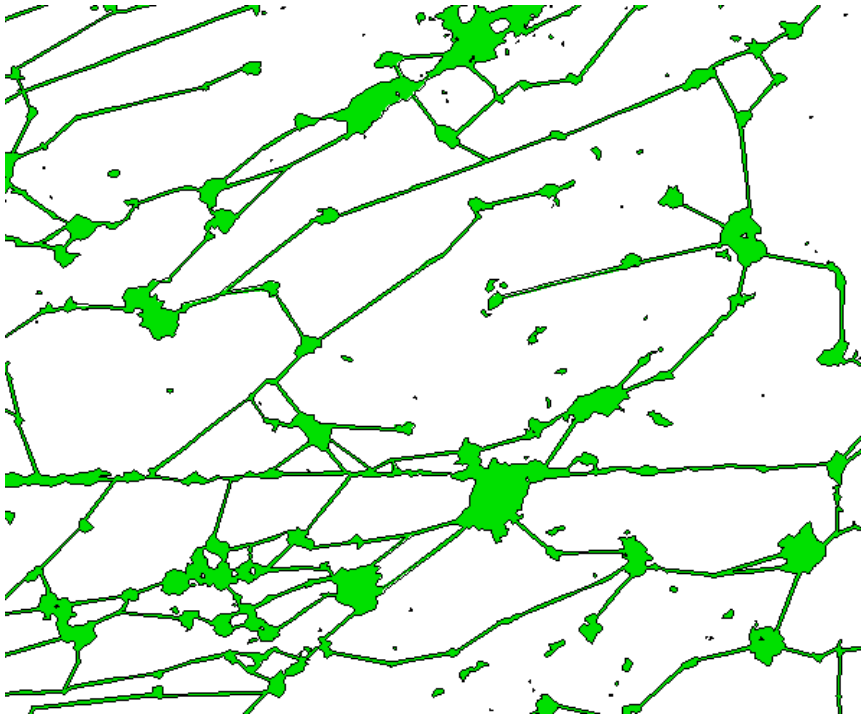


Heather defoliation away from the edge

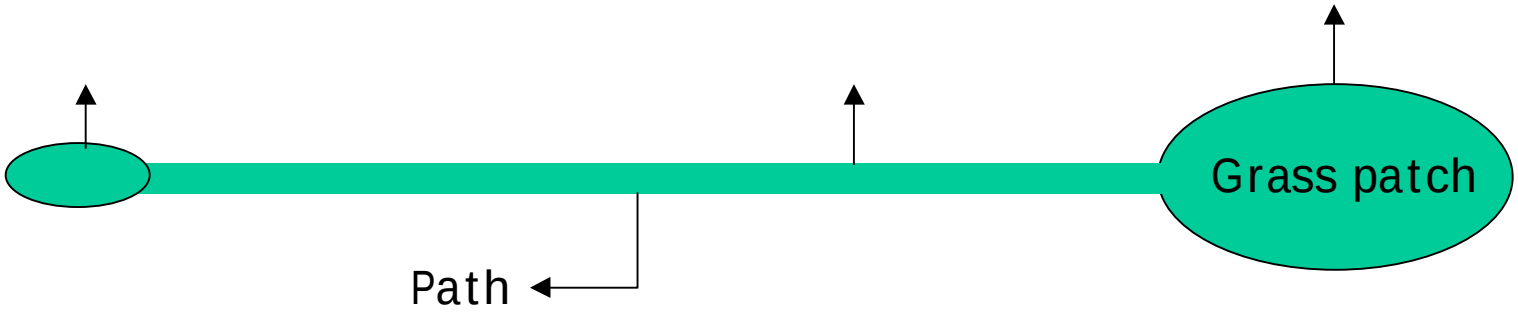


Heather defoliation at the edge

- heather defoliation declines away from the grass-heather edge
- but what is the defoliation at the edge of a grass patch or a path?



Heather defoliation at the edge

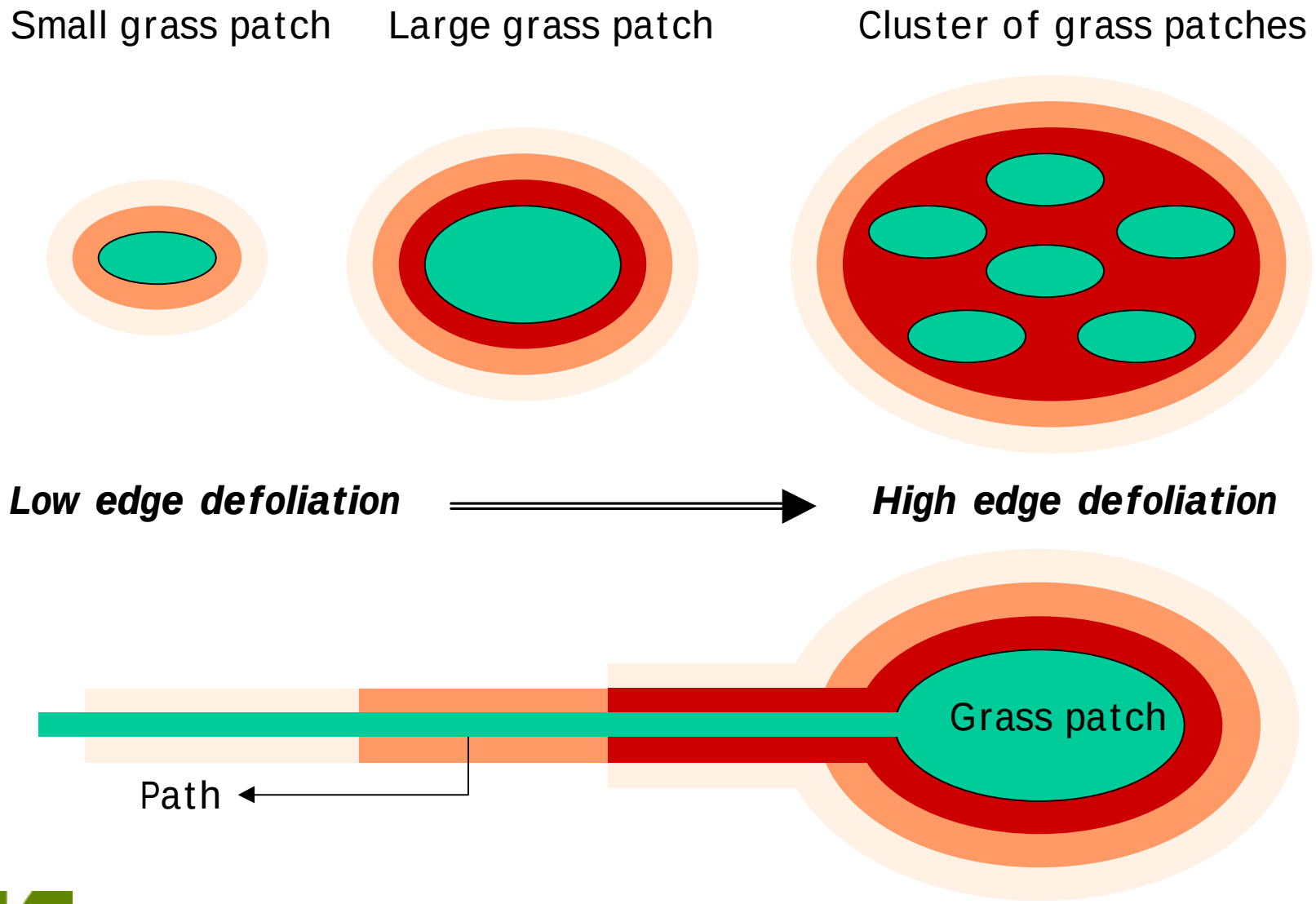


- heather defoliation at the edge predicted by *attraction* of nearest grass patch:

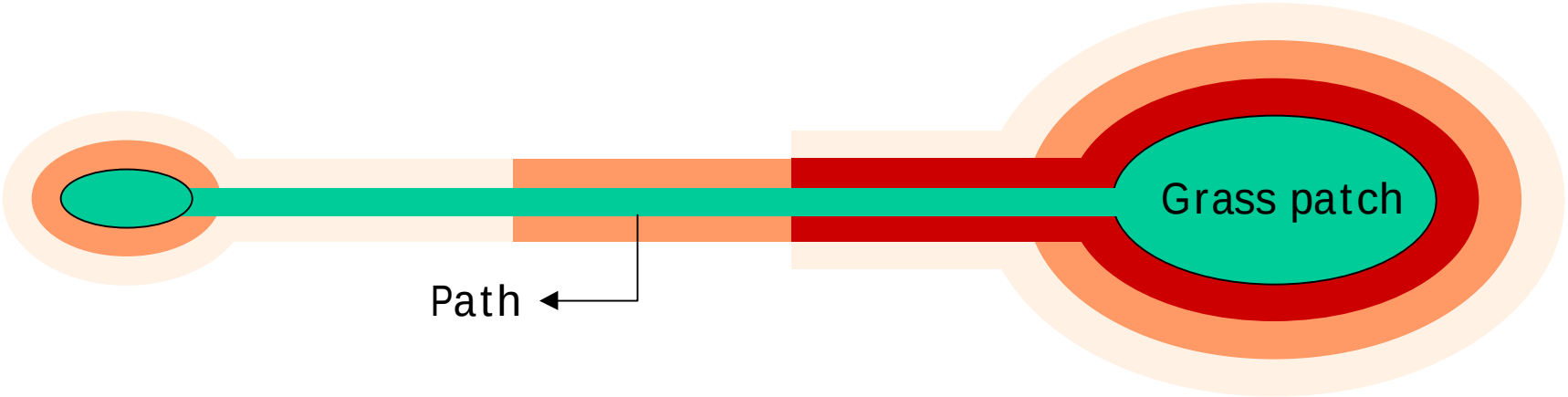
$$\text{Attraction} \approx \frac{\text{Grass Patch Area}}{\text{Distance}^2}$$

- positive correlation between attraction and heather defoliation at the edge

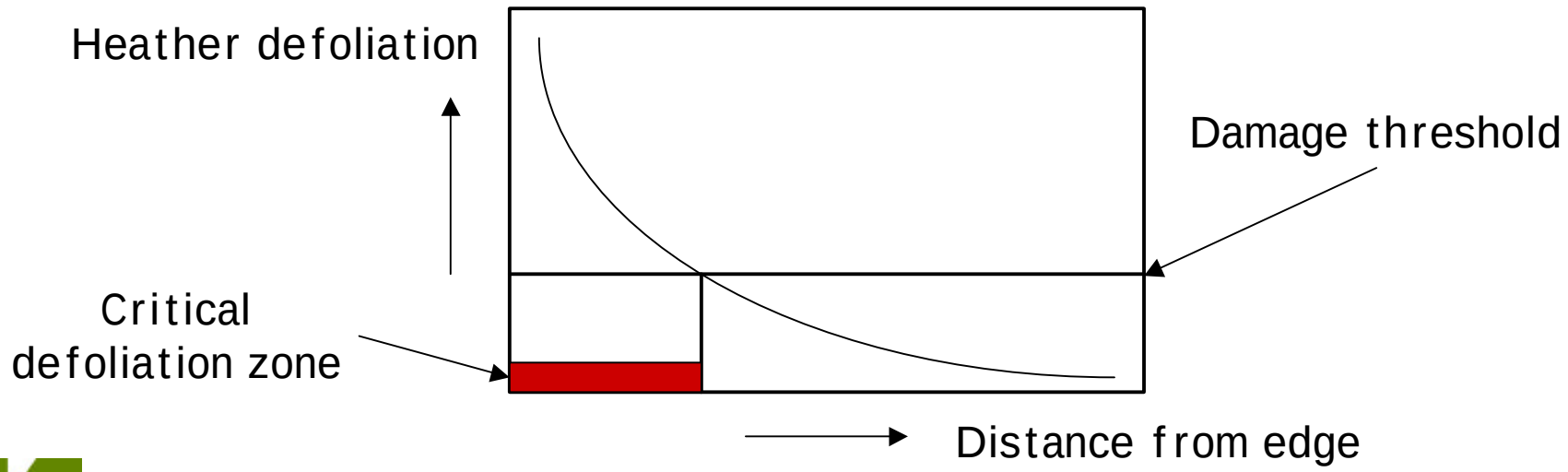
Heather defoliation at the edge



Critical defoliation zone



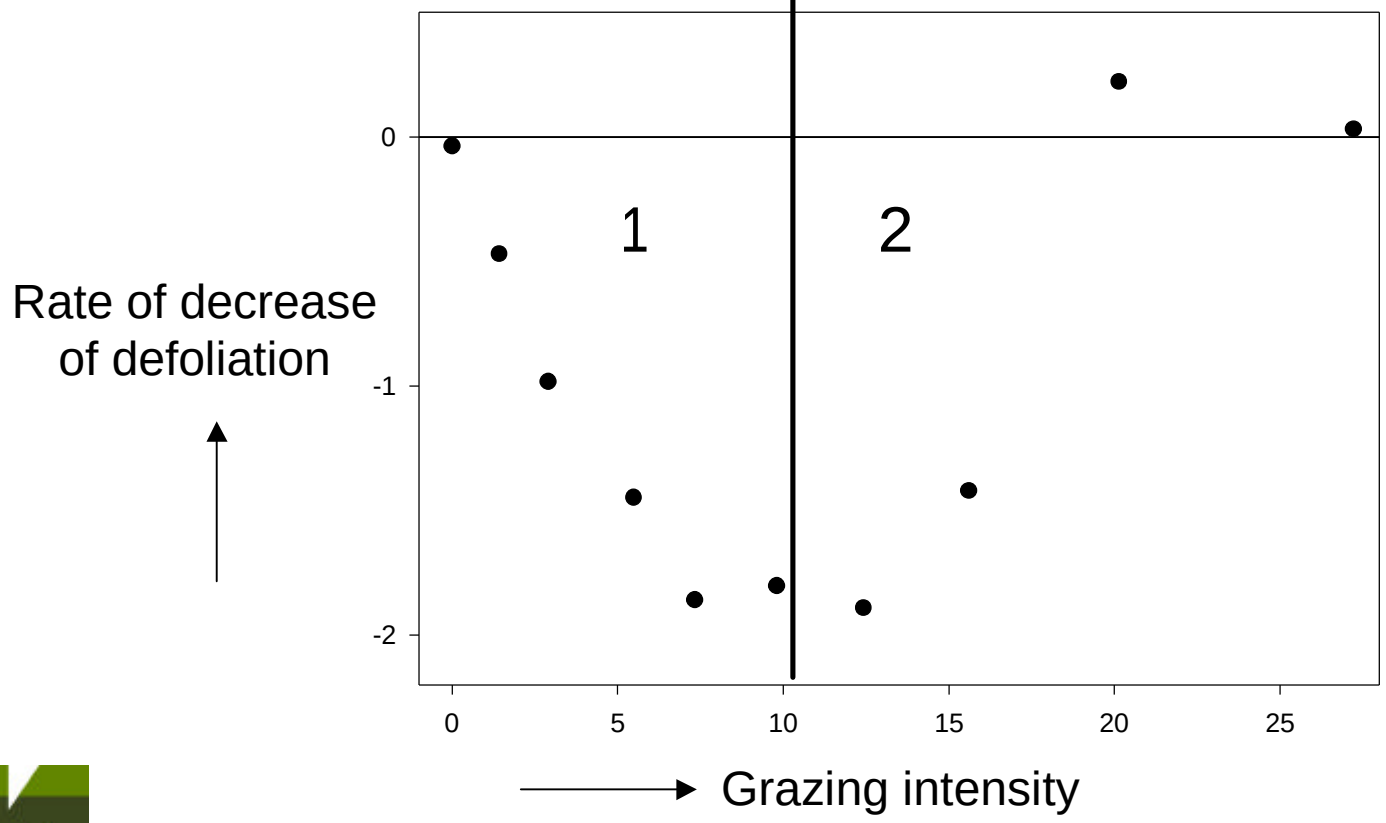
- how does this affect the zone where defoliation is critical ?



Critical defoliation zone

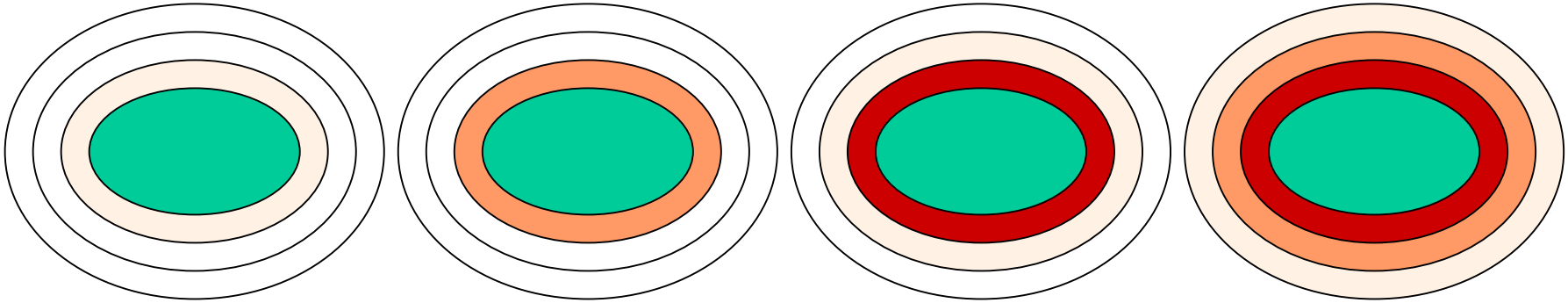
- effect of increasing grazing intensity on critical defoliation zone

- increase of edge defoliation	- constant edge defoliation
- defoliation zone constant	- increasing defoliation zone



Zone of defoliation impact

Low grazing intensity → ***High grazing intensity***



Increase - edge defoliation

Increase - defoliation zone

Conclusions

- heather defoliation is concentrated :
  - on part of the landscape
  - around large grass patches
  - near the edge of grass patches or paths

- critical defoliation zone increases only at high grazing intensity

- þ heather defoliation can locally be high, even at low grazing intensity

Management implications

- specific management objectives require specific grazing regimes
- to maintain overall heather cover, grazing intensity has to be lower than predicted by overall stocking density
- grazing intensity might have to be higher, to maintain flora and fauna diversity over larger areas
- understanding of the spatial impact of grazing is crucial to determine appropriate management