



*Quantifying the total impact of linear infrastructures on wildlife:*

## **a new Habitat Functionality metric to quantify simultaneously Habitat Loss & Habitat Fragmentation**



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# Assessing the impact of linear infrastructures: *Habitat Loss*

## Traditional focus of EIA: **Habitat Loss**



**Species occurrence**

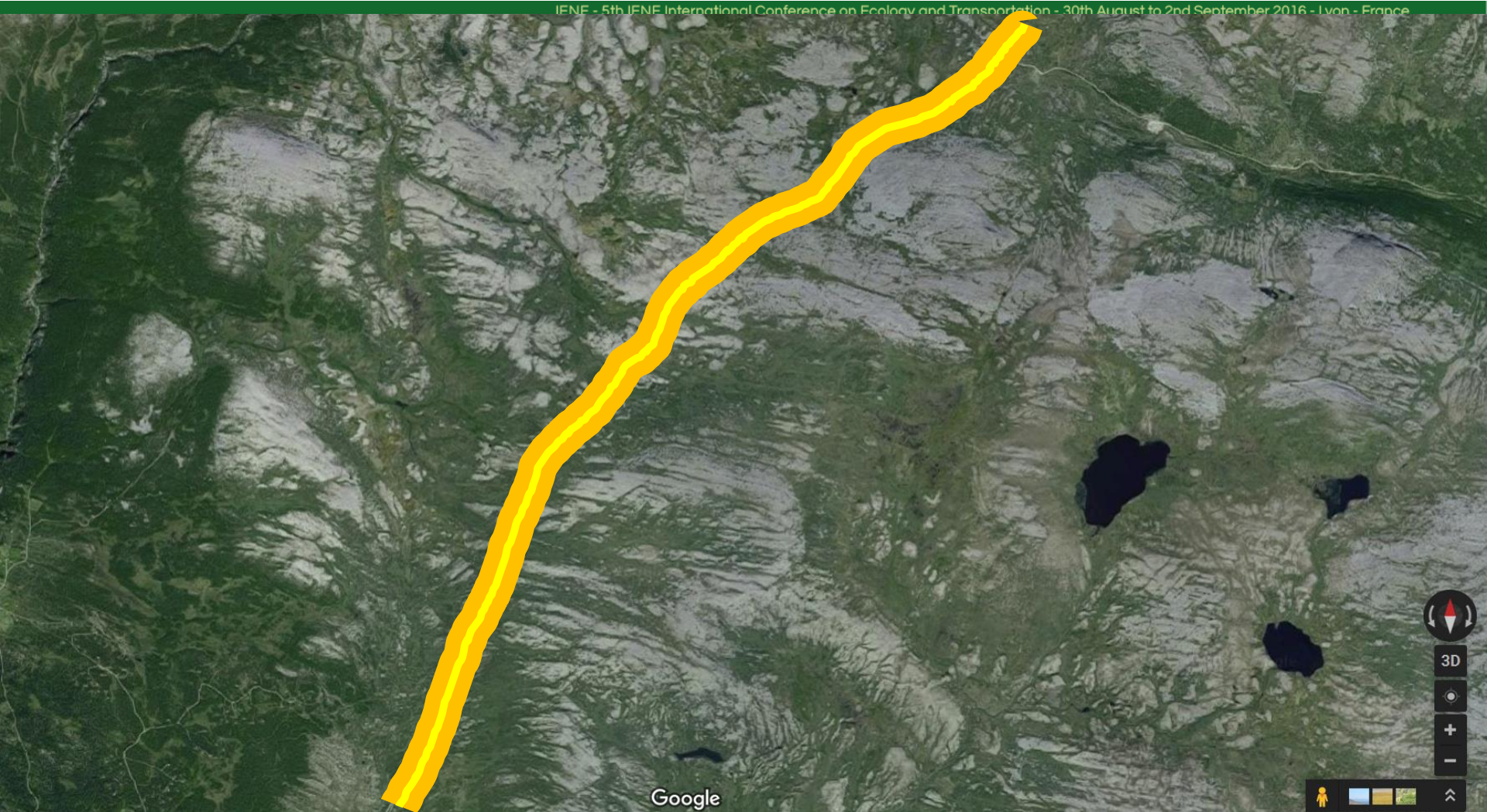


**Wildlife-vehicle collisions:  
lethal effects & road safety**



# Assessing the impact of linear infrastructures: *Habitat Loss*

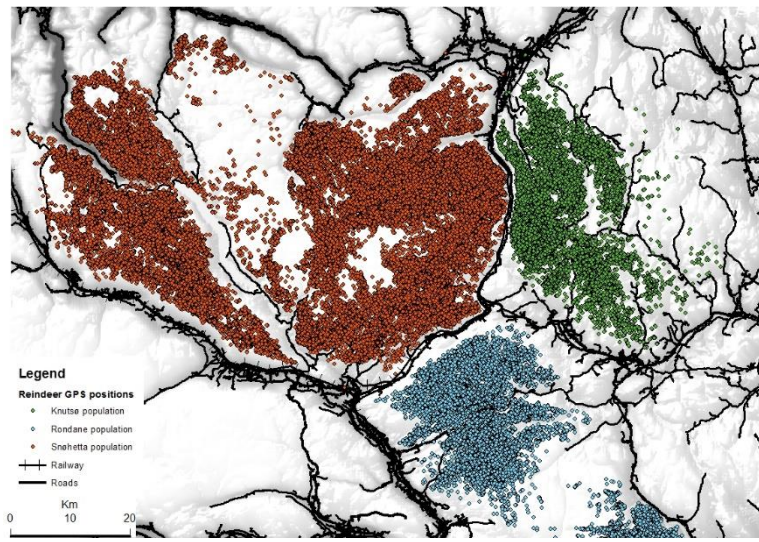
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Landscape scale: the footprint can be relatively limited even when there is a larger zone of influence

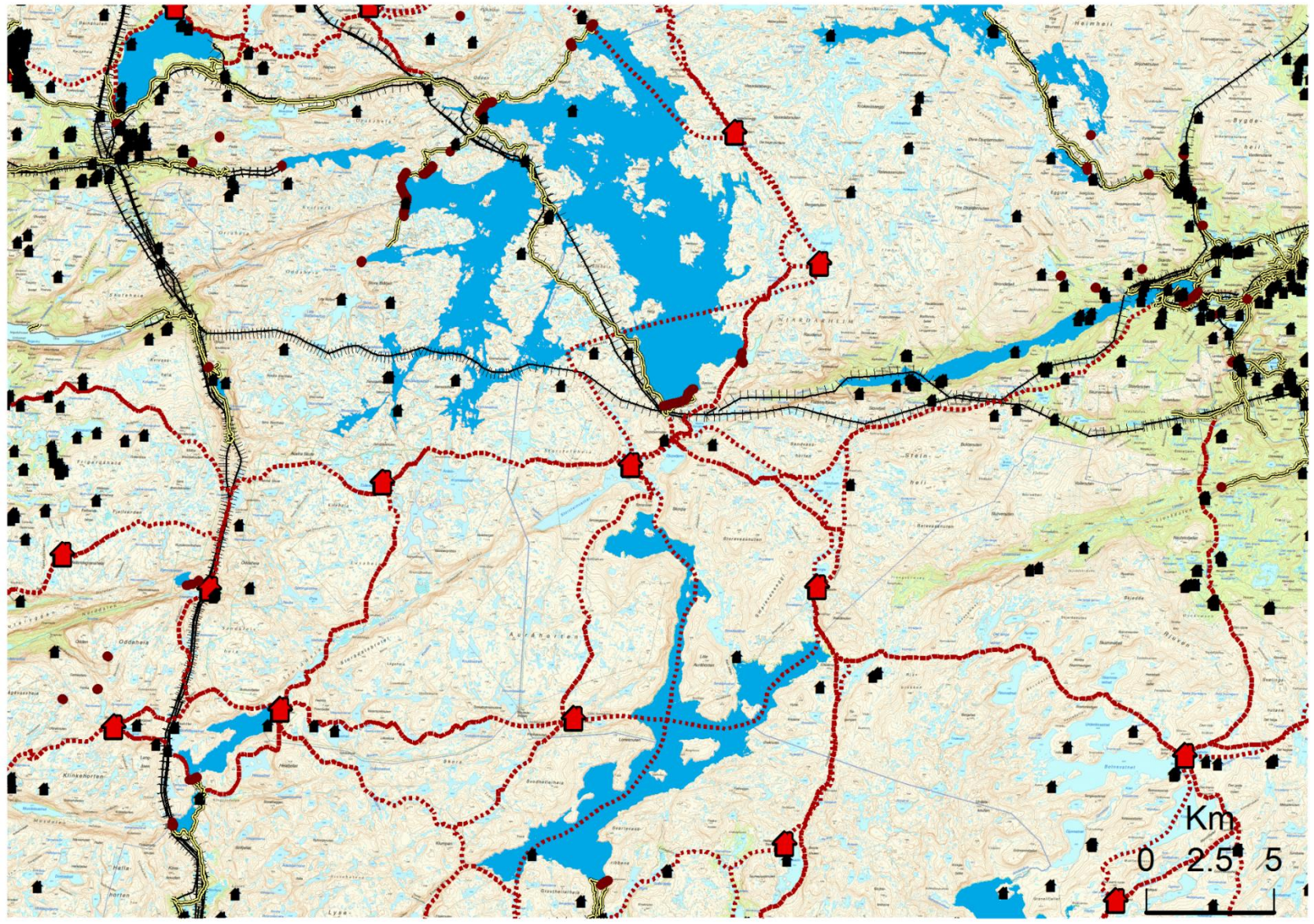
# Assessing the impact of linear infrastructures: *Hab. Fragmentation*

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# Assessing the impact of linear infrastructures: *Hab. Fragmentation*

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# What are the best tools available to animal ecologists infer the “total” impact of infrastructures - habitat loss and fragmentation?

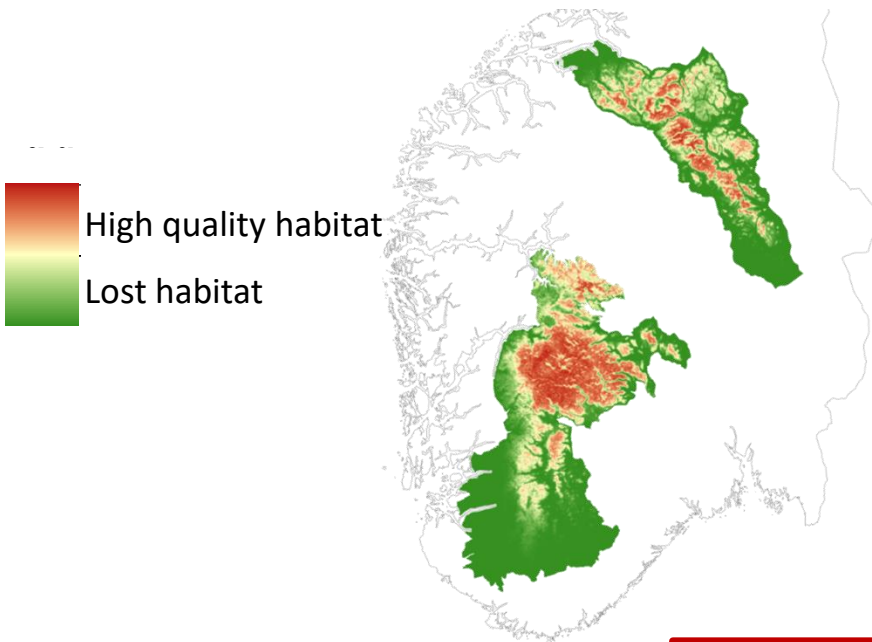
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## HABITAT LOSS



### Models of Habitat Quality

(e.g. Habitat Selection Mod., Species Distribution Mod..)

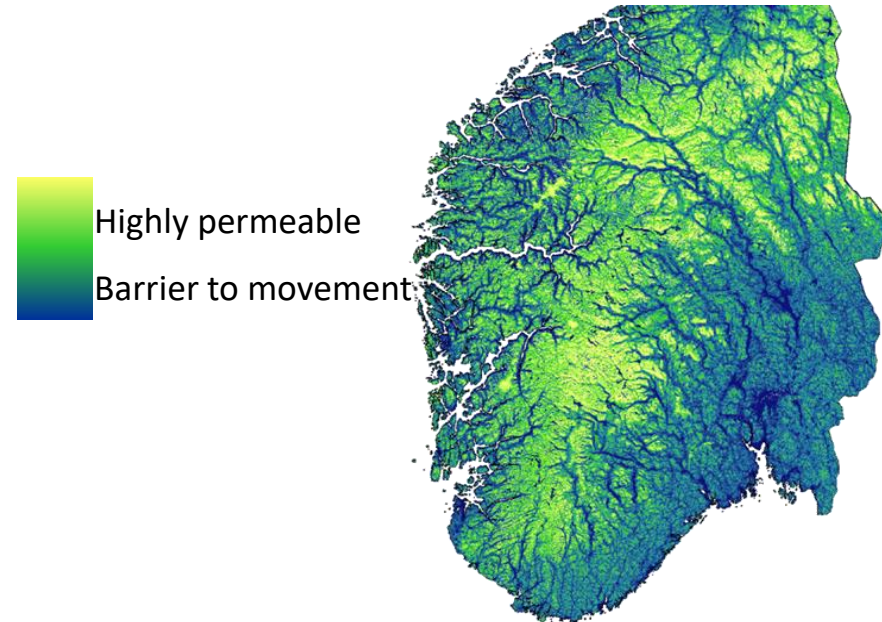


## HABITAT FRAGMENTATION



### Models of Habitat Permeability

(e.g. Step Selection Function, Graph Theory)



SEPARATE APPROACHES,  
SEPARATE METRICS,  
SEPARATE INFORMATION

Panzacchi et al. J. Anim Ecol, 2015

# Need to quantify together habitat loss & fragmentation

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important to quantify **good-quality habitat**



important to identify **barriers**



Crucial to identify habitat that is at the same time good and accessible:  
good but non-accessible habitat is lost to the species



We present a new **metric** quantifying «**Functional Habitat**»,  
*i.e.* good and accessible  
(under development)

# Habitat Functionality can aid EIA and sustainable land-planning:

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1. Quantify the “total” impact of infrastructures (Hab. Loss & Fragmentation)
2. Model and compare the loss in habitat functionality of a set of future land-development options, to identify those with the least impact (scenario-approach)
3. Forecast the gain in habitat functionality from a set of mitigation actions, to identify the most effective ones



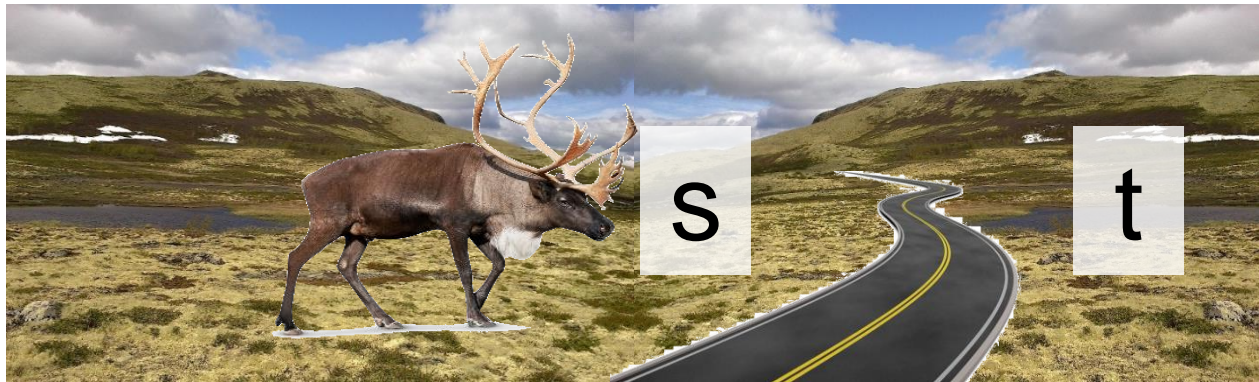
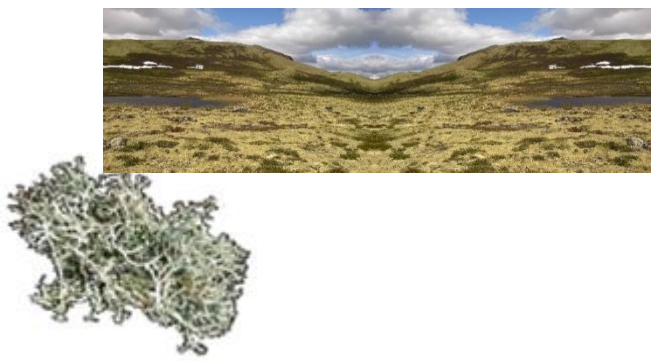
Stakeholder participation



# Computing Habitat Functionality

Habitat quality

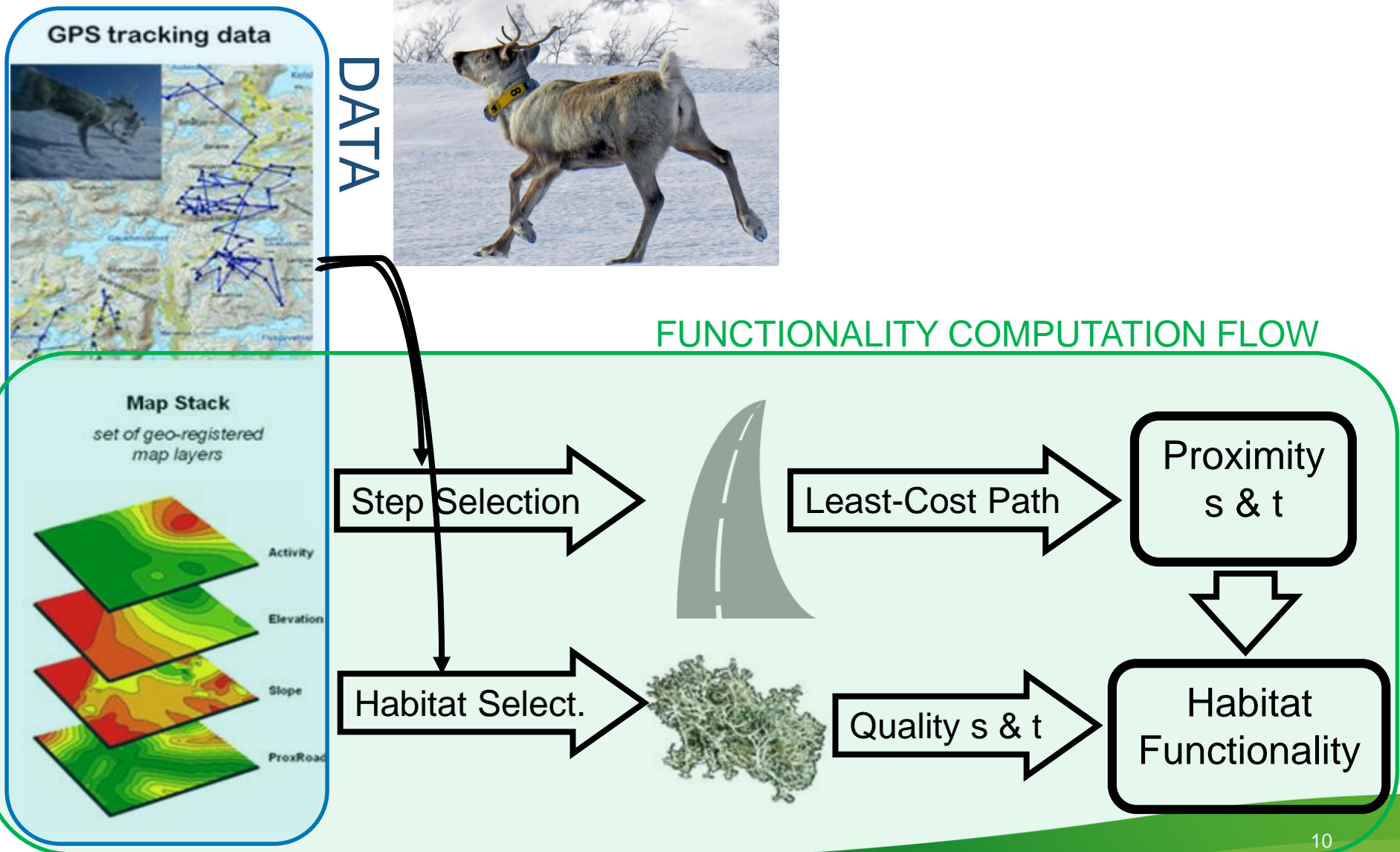
barriers



$$HF_s = Q_s \times P_{s,t} \times Q_t$$

Saura, S., & Pascual-Hortal, L. (2007). A new habitat availability index to integrate connectivity in landscape conservation planning. *Landscape and Urban Planning*, 83(2), 91-103.

# Computing Habitat Functionality: work flow

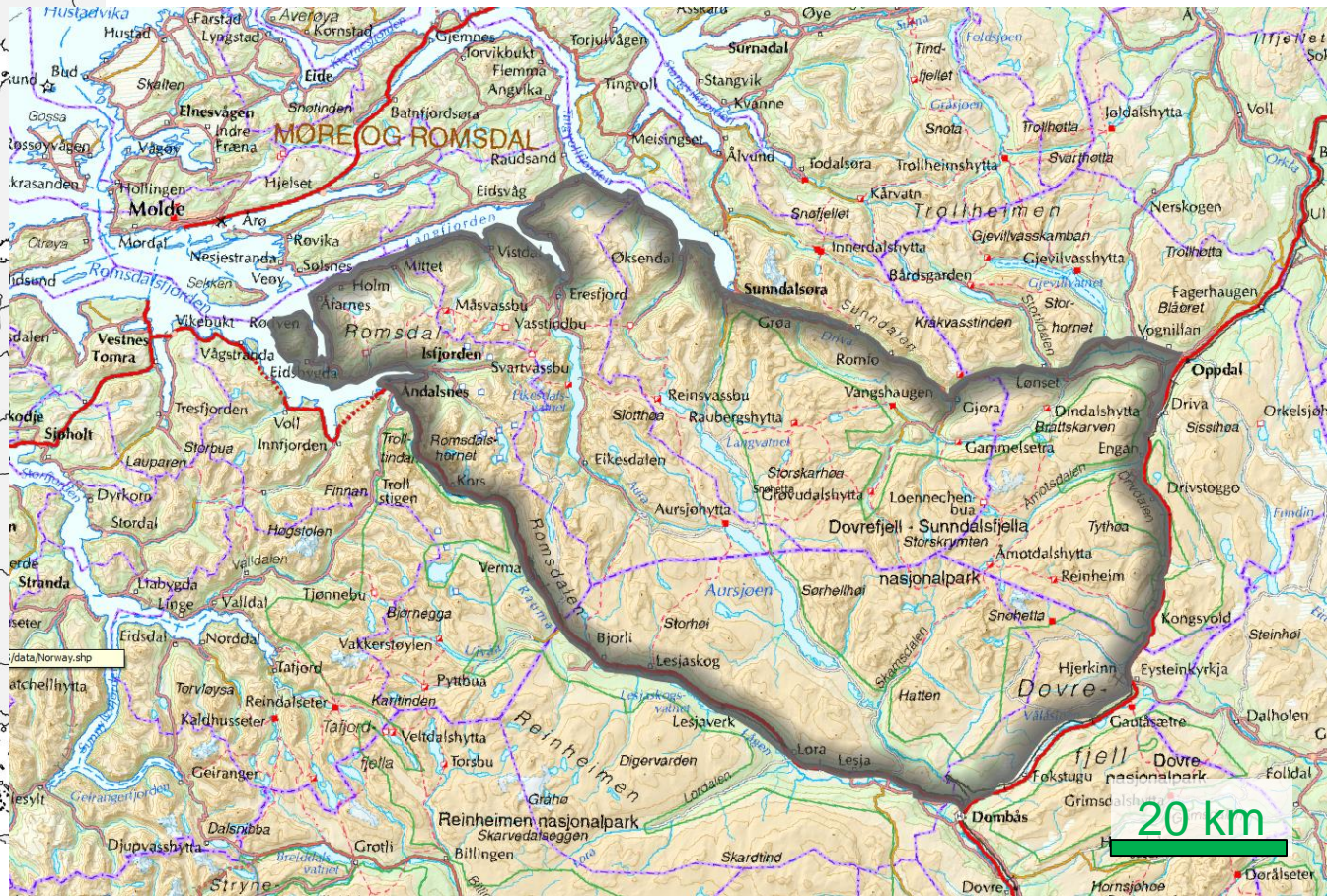


# A demonstration for reindeer in the Snøhetta area - Norway

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~ 100 x 60 km

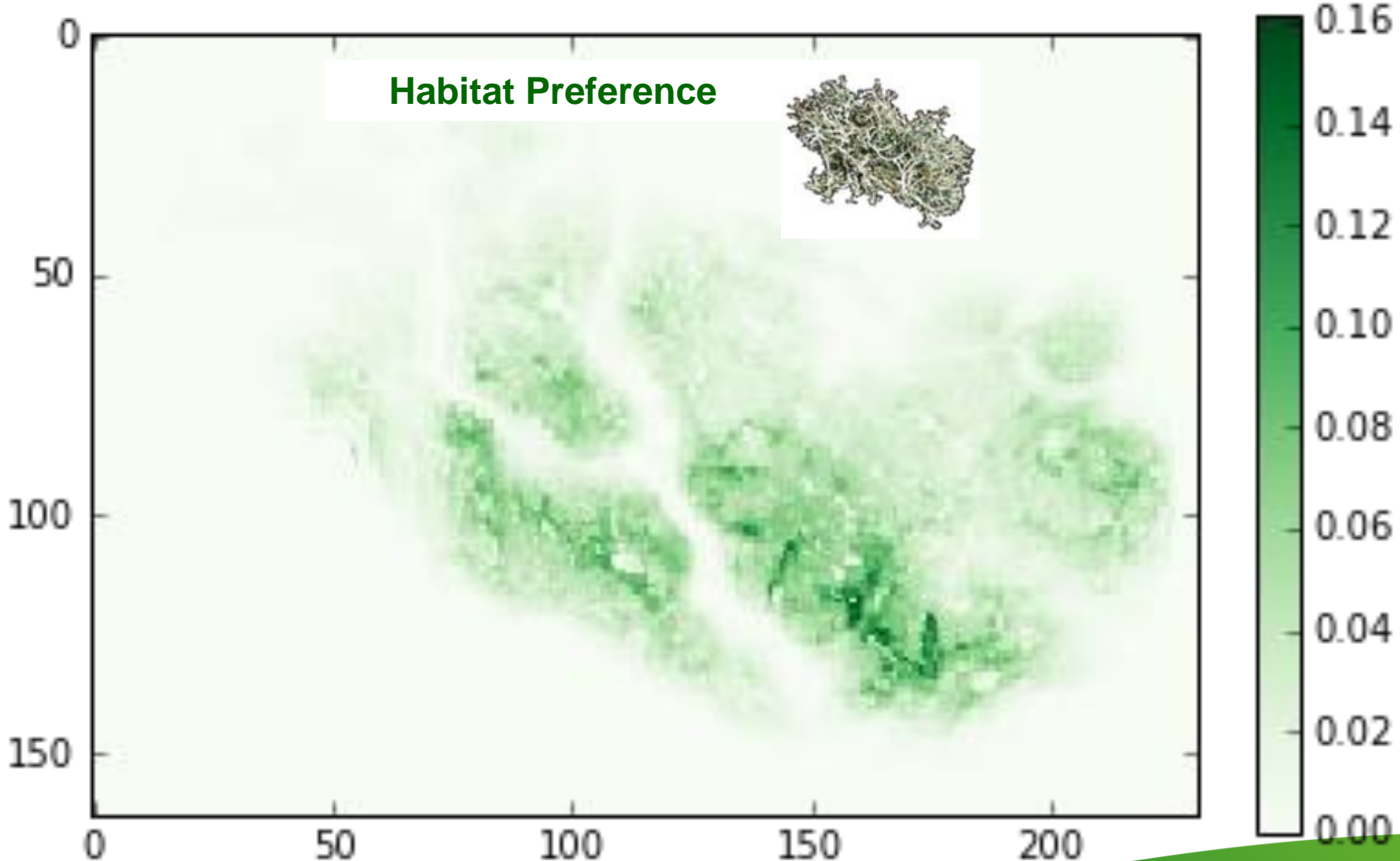


Lyon



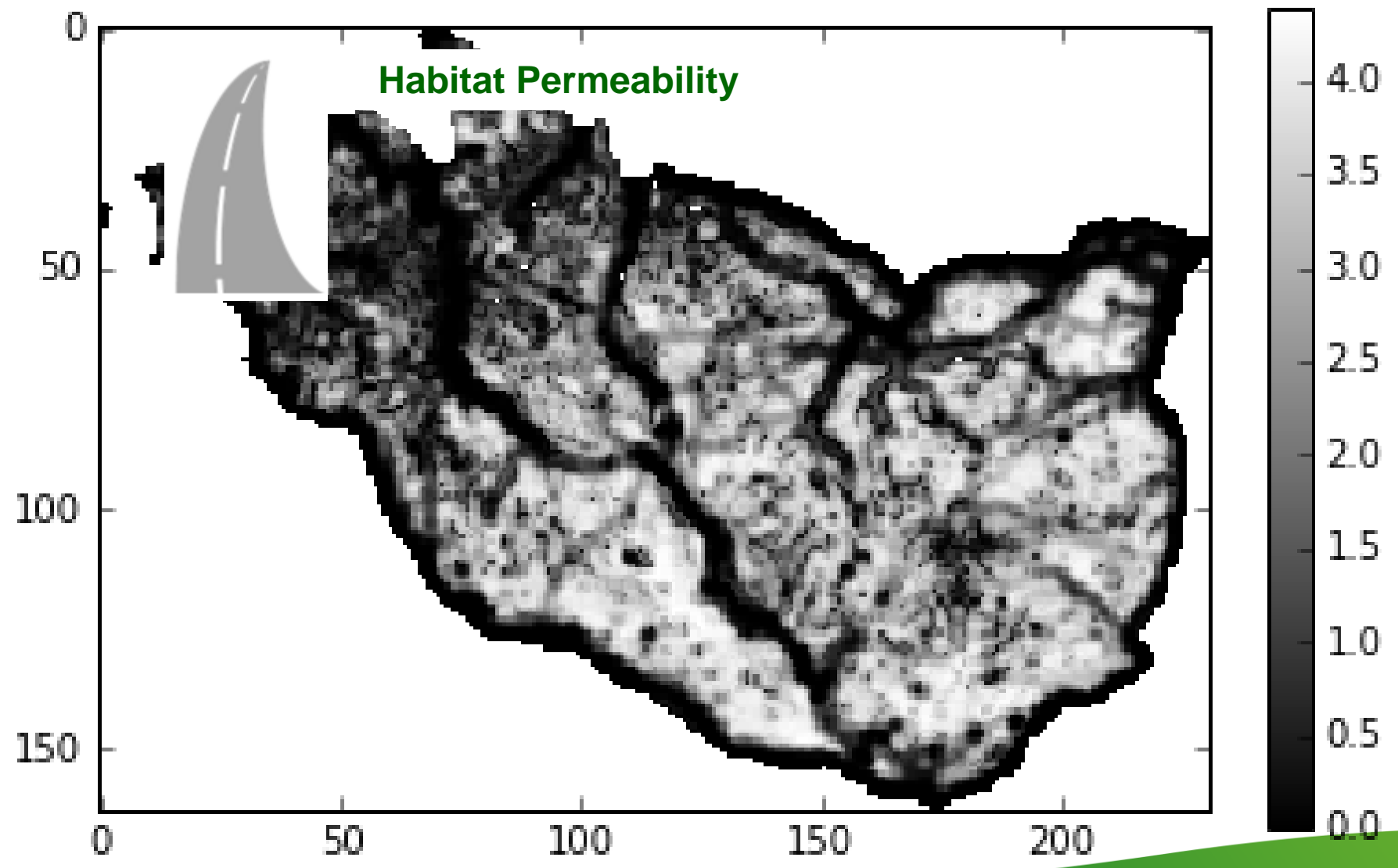
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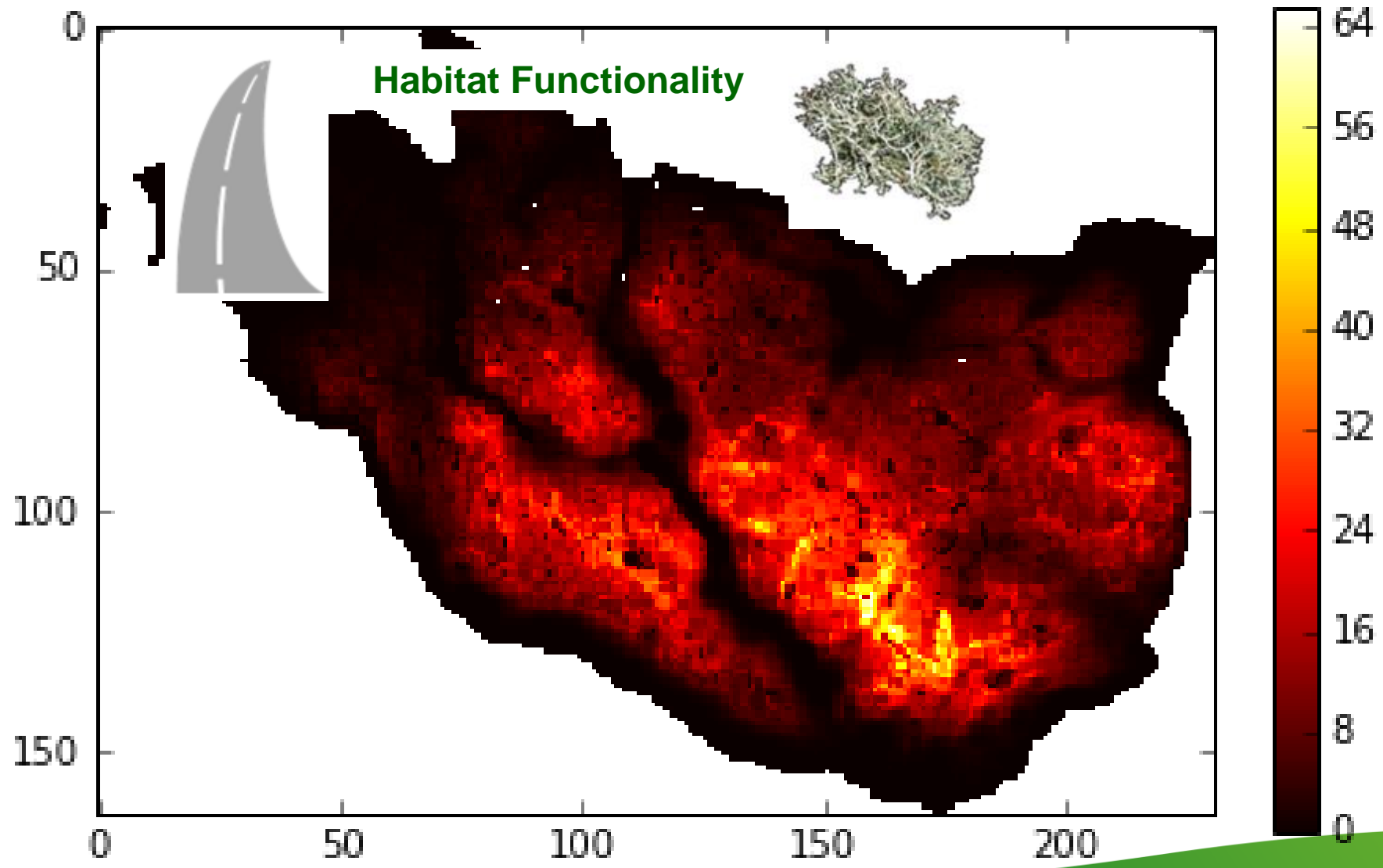


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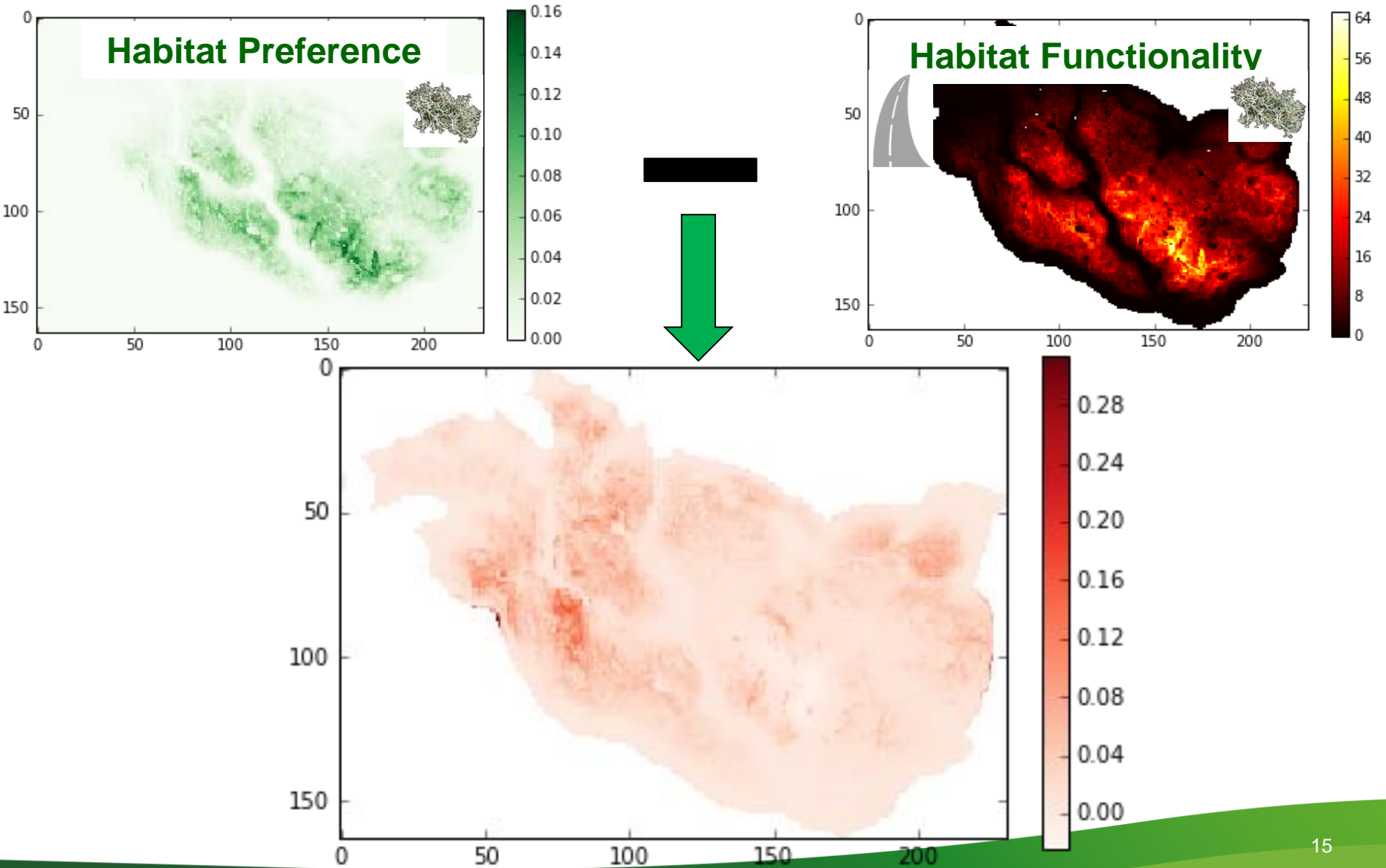
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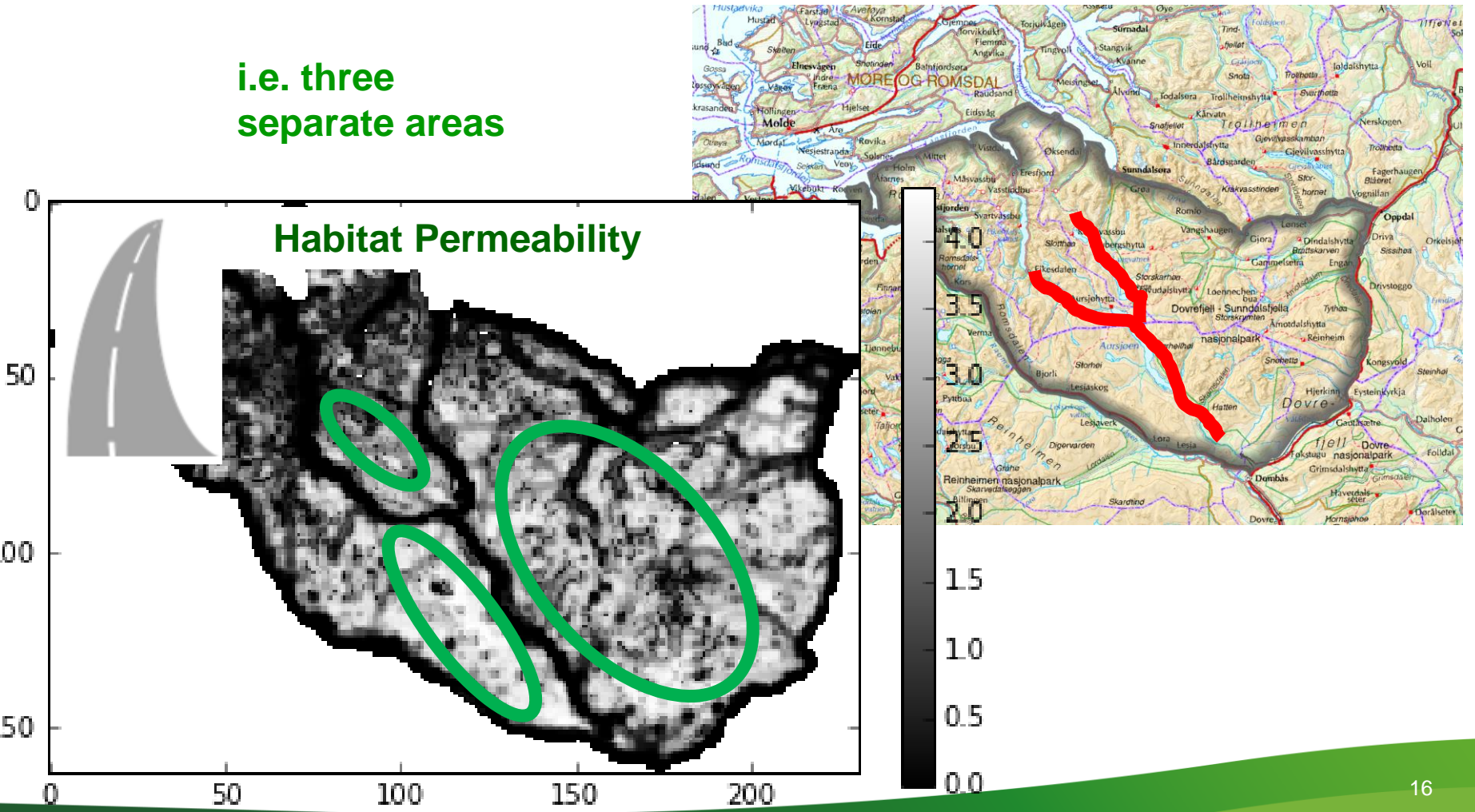
# A demonstration for reindeer in the Snøhetta area - Norway



# A demonstration for reindeer in the Snøhetta area - Norway

## Scenario 1: increase the disturbance on some access roads

i.e. three separate areas

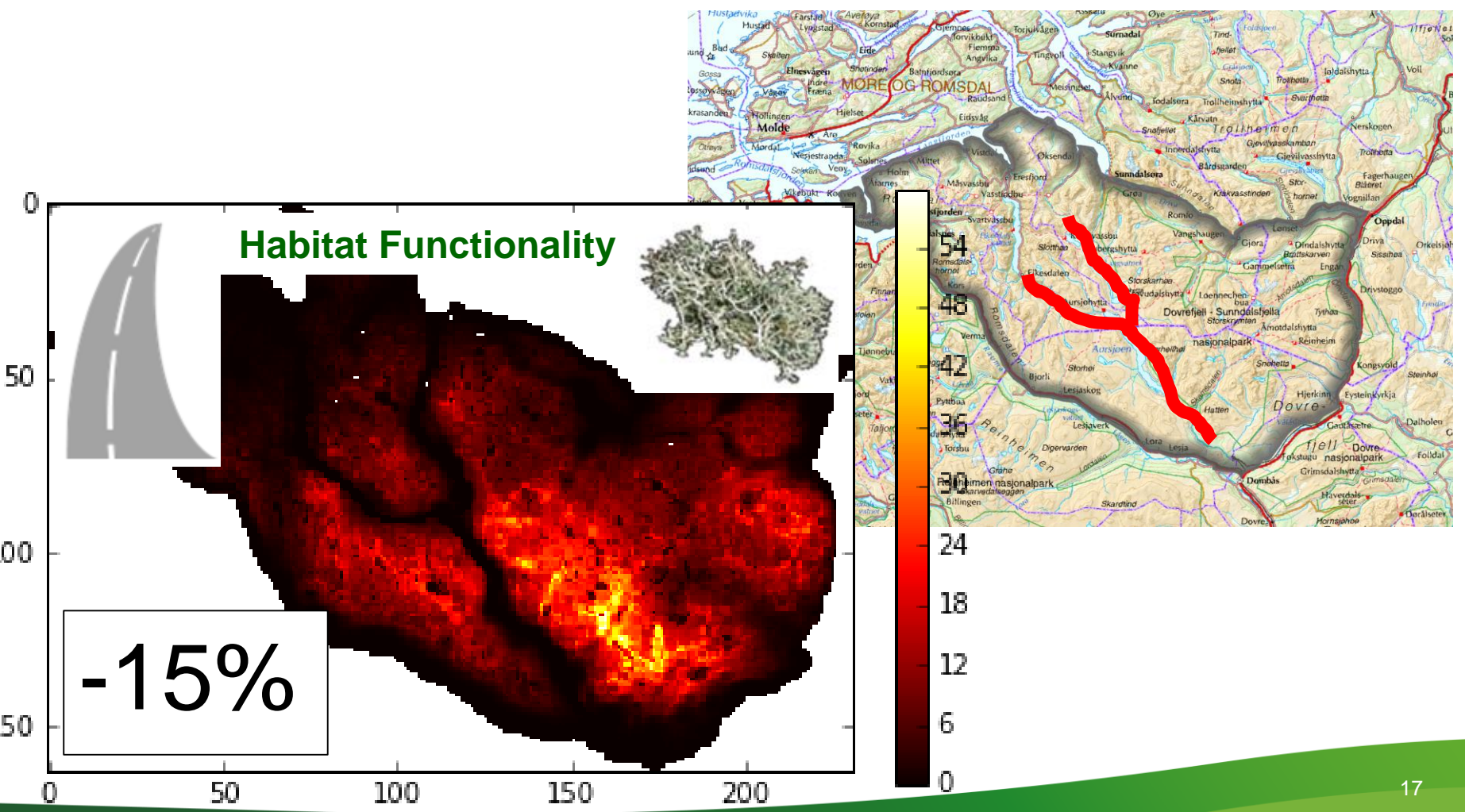




# A demonstration for reindeer in the Snøhetta area - Norway

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## Scenario 1: increase the disturbance on some access roads

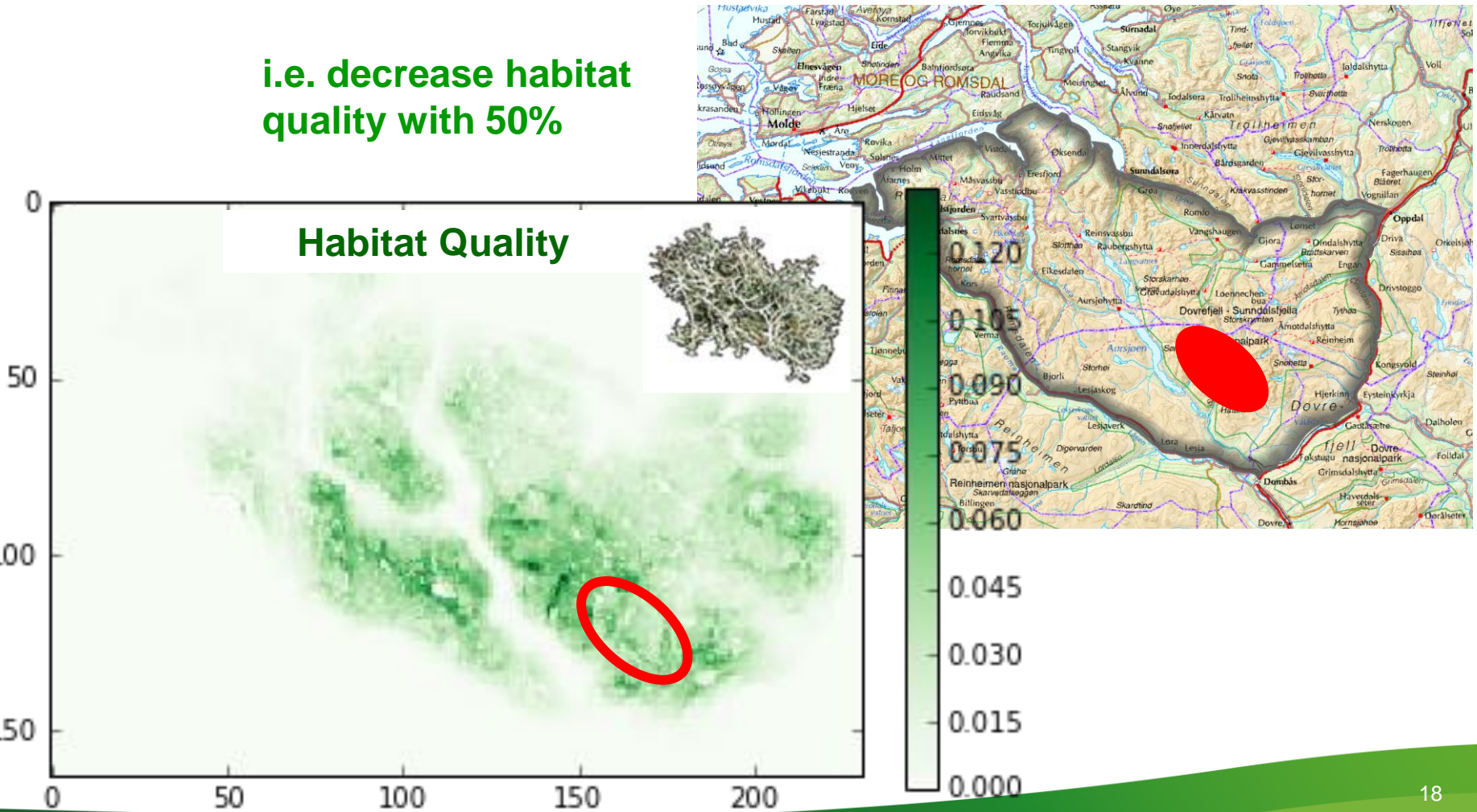


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## Scenario 2: establish a new cabin park

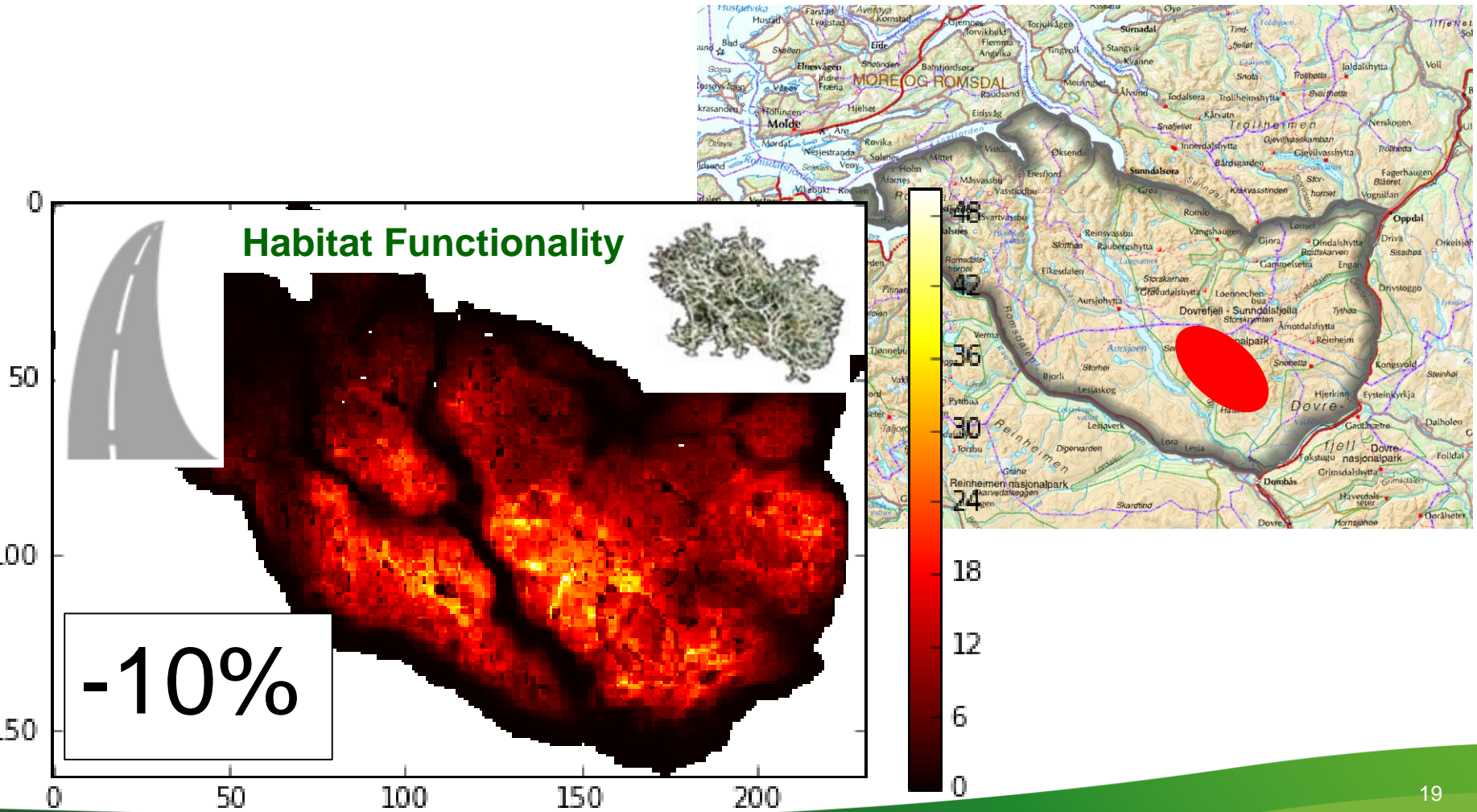
i.e. decrease habitat quality with 50%



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## Scenario 2: establish a new cabin park





## the Good:

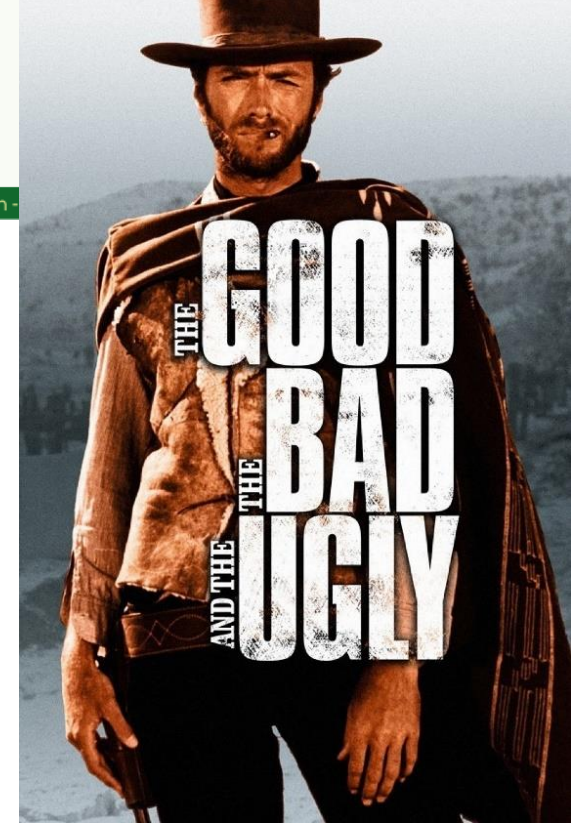
- Integration of Habitat Loss & Fragmentation  
= Habitat Functionality
- Quantitative framework for ranking scenarios
- Strong theoretical foundation in graph theory & spatial ecology

## the Bad:

- Not yet explicitly linked to population viability/abundance,  
only assumed

## the Ugly:

- Single species perspective -> habitat perspective?





# Acknowledgements

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