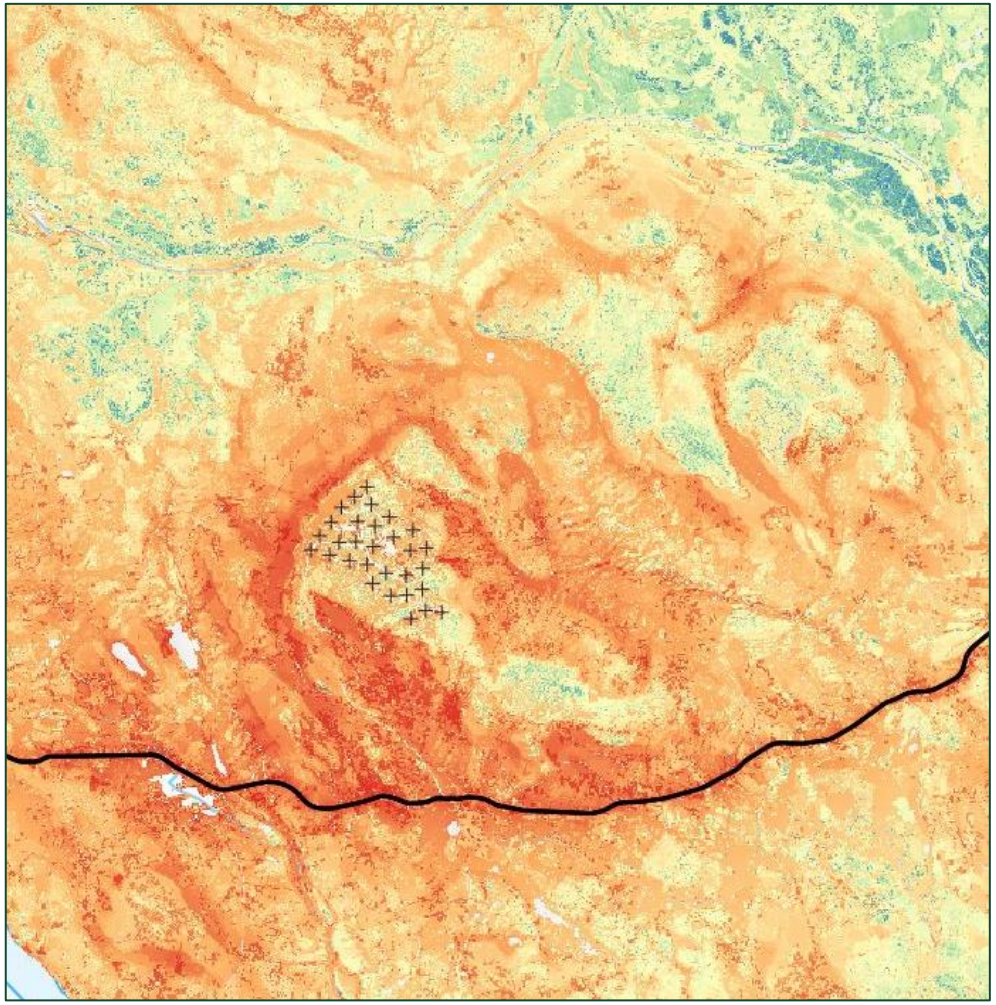
What is habitat selection?

Day 2 - Outdoor data

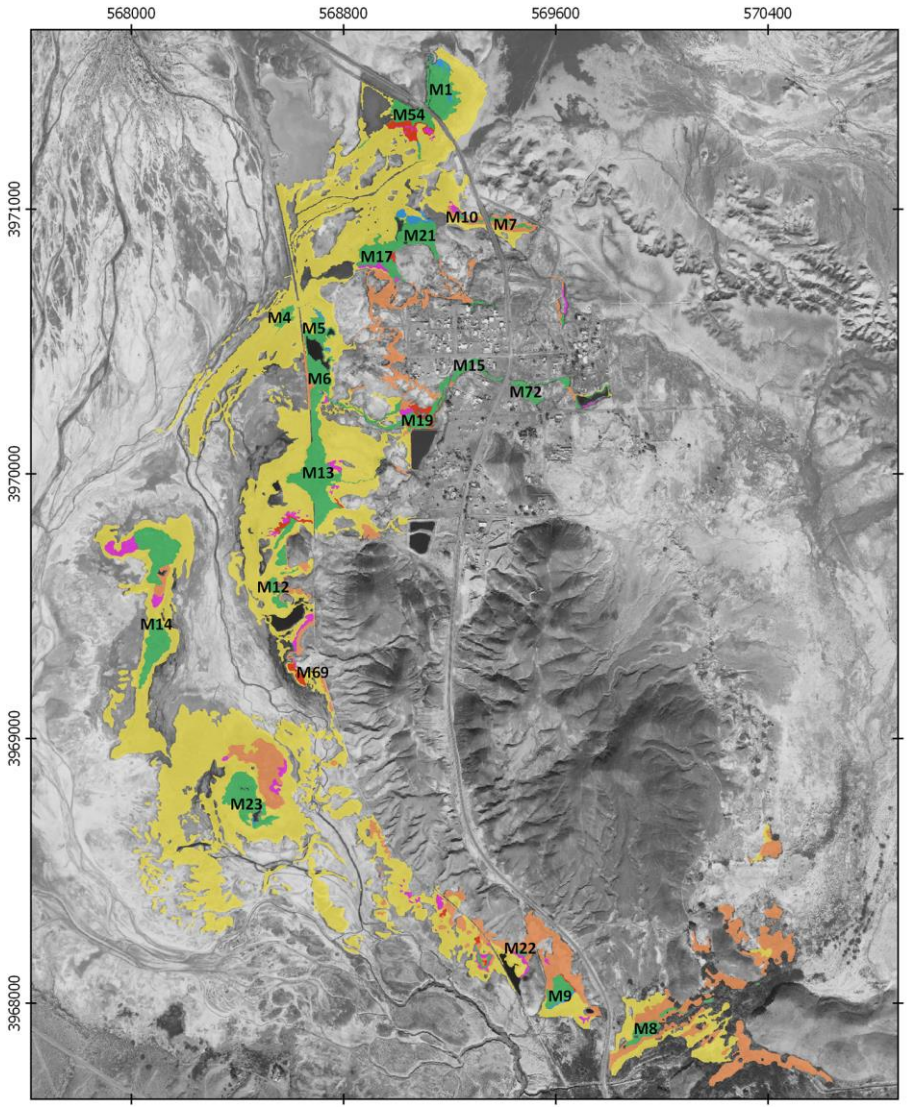
Habitat selection

- Where did the animal prefer to go?
- Resources
- Environmental pre-conditions
- Social interaction



Prediction of habitat selection

Manly's resource selection ratio



	A	B	C	D	E
1	**Habitat**	**Proportion of habitat used**	**Proportion of habitat available**	**Wi + SE**	**Bi**
2	Bulrush	0.613	0.149	4.12 ± 0.17*	0.139
3	Salt grass	0.029	0.720	0.04 + 0.01*	0.000
4	Rushes	0.016	0.020	0.80 +0.33	0.027
5	Bulrush-Rushes	0.241	0.010	23.61 + 2.15*	0.797
6	Bulrush-Salt grass	0.000	0.005	0.00 + 0.00*	0.000
7	Mix Herb	0.102	0.097	1.05 + 0.16	0.036

Vegetation Cover

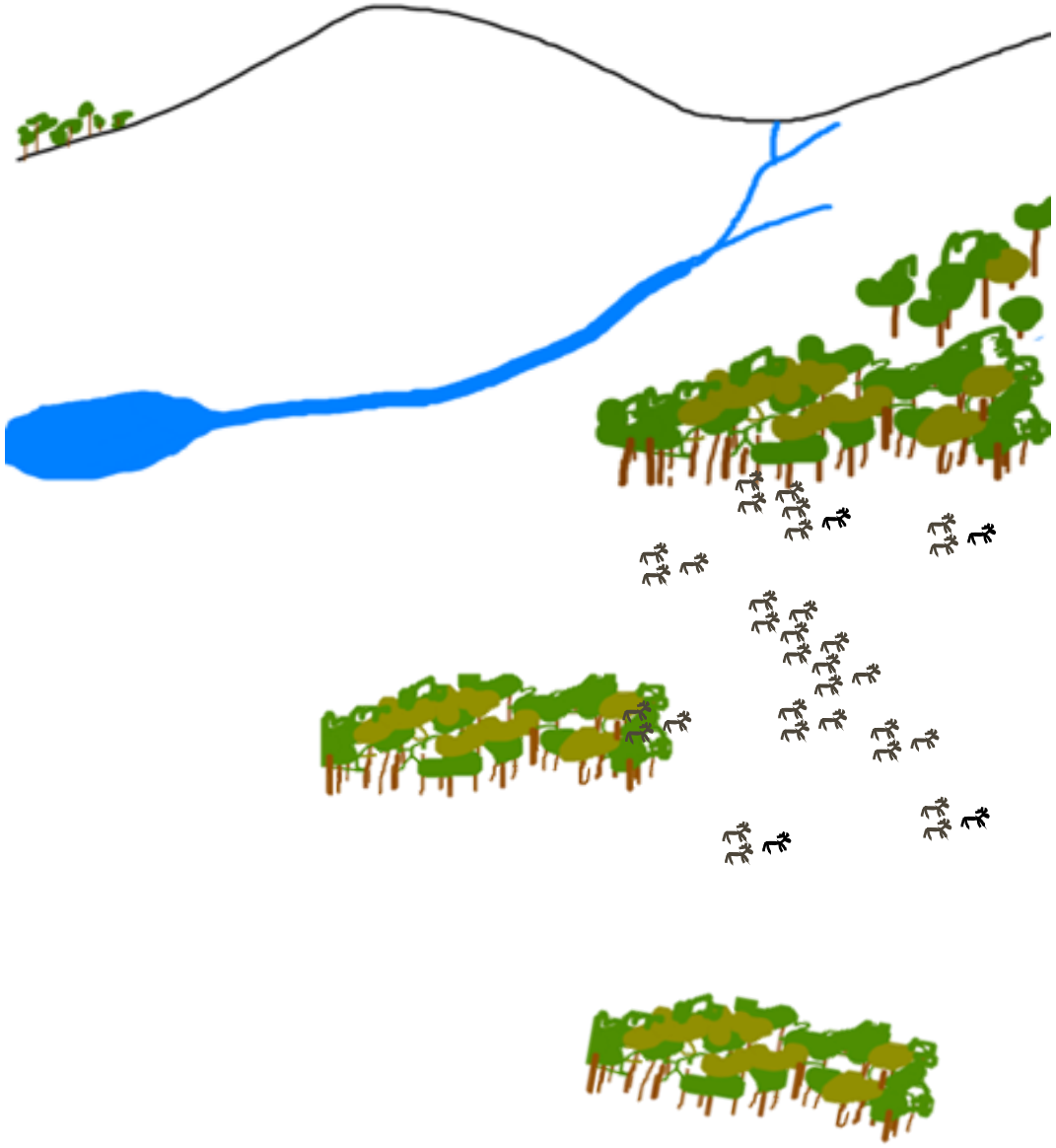
- Bulrush
- Salt grass
- Rushes
- Bulrush-Rushes
- Bulrush-Salt grass
- Mix Herb

0 250 500 750 m

An index of >1 indicates that the habitat is used according to availability, while an index of <1 indicates avoidance.

López-Pérez AM, et al. 2019 PlosOne

First-order selection



Habitat selection

- Where did it prefer to go?
- What is available?
- What resources are selected – resource selection
- “selective if components are used disproportionately to their availability”
- Different scales of selection - Johnson 1980
  - First ➔ fourth order of selection

Habitat selection

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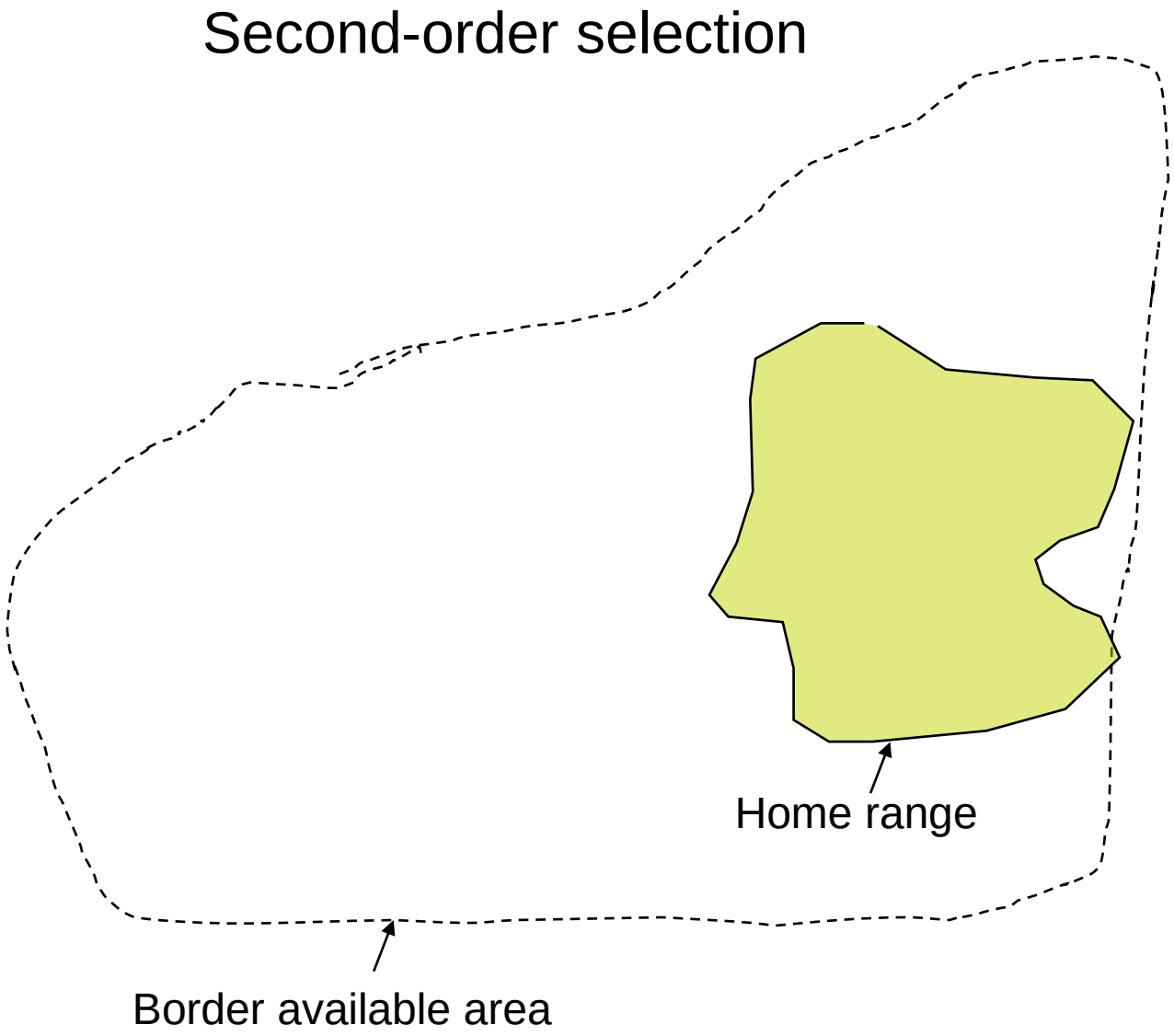
- Different scales of selection - Johnson 1980
  - First ➔ fourth order of selection



Habitat selection

- Where did it prefer to go?
- What is available?
- What resources are selected – resource selection
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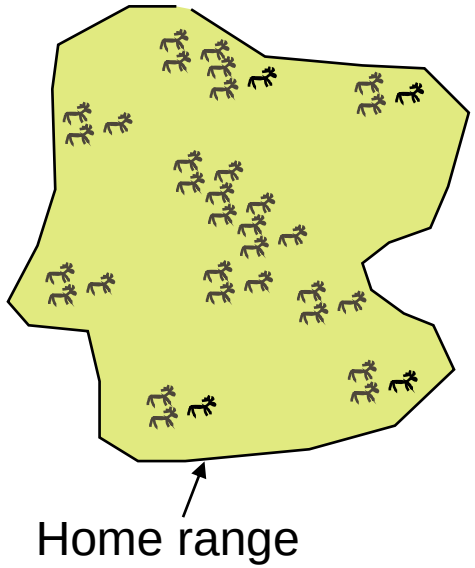
Third-order selection



Habitat selection

- Where did it prefer to go?
- What is available?
- What resources are selected – resource selection
- “selective if components are used disproportionately to their availability”
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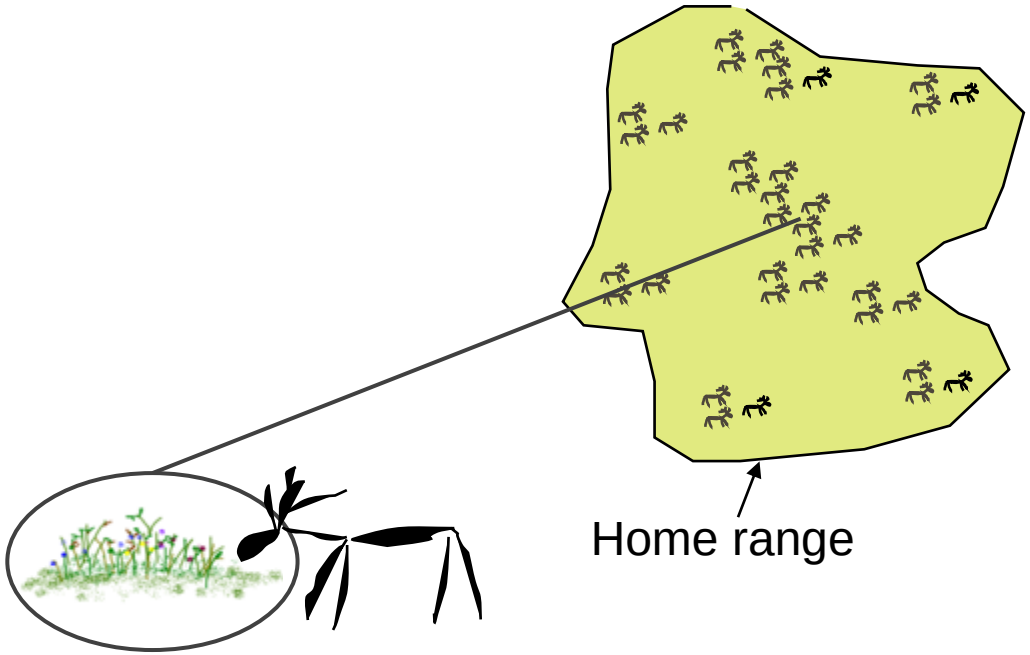
Fourth-order selection



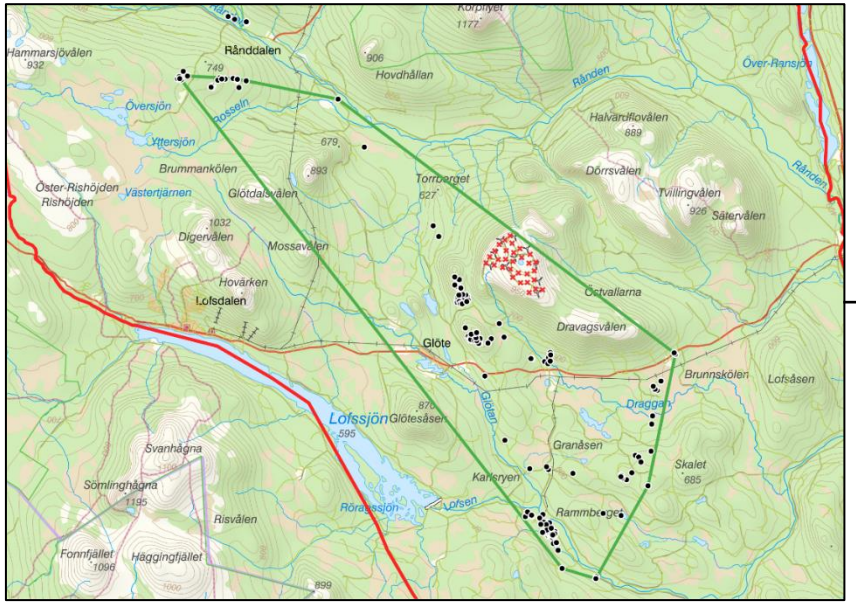
Habitat selection functions (HSF)

- Some kind of logistic regression

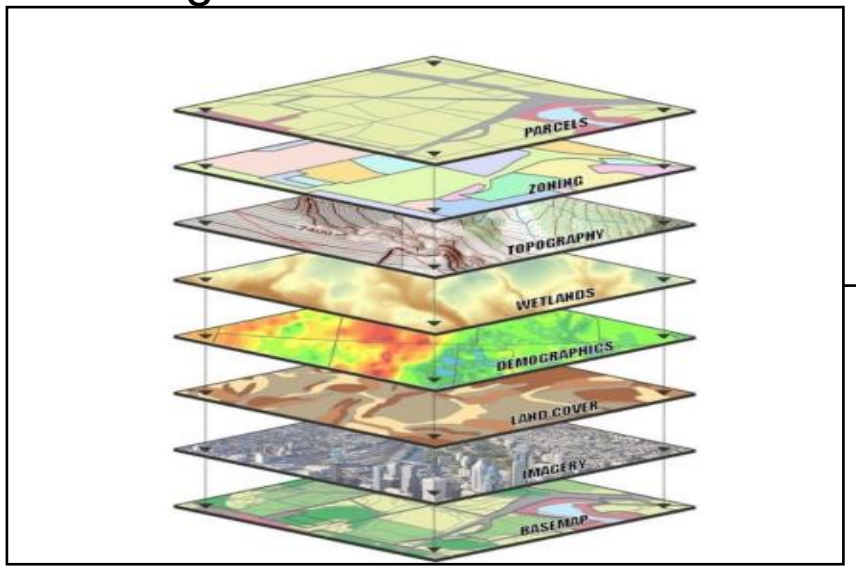
$$W(x) = ln[p|p-1] = \beta_0 + \beta_1 x_1 + \ldots + \beta_n x_n + \varepsilon$$

were w(x) is the log odds ratio estimated from the linear model, p is, in the context of resource selection functions, the probability of selection ranging from 0 to 1.

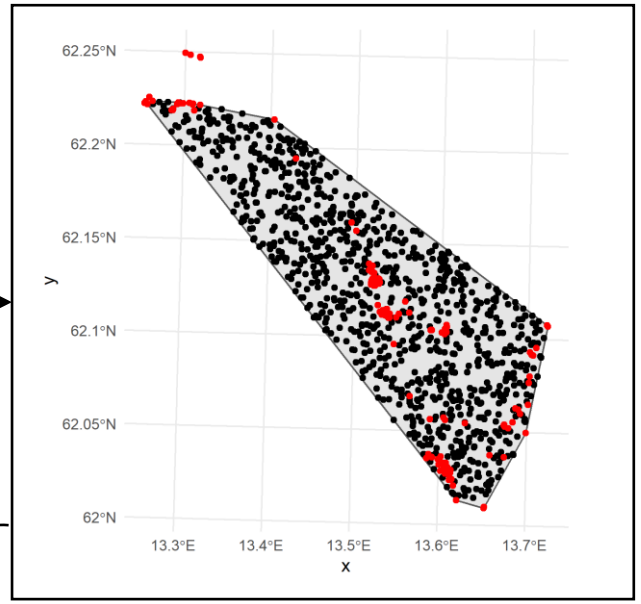
a. Animal movement (GPS) data



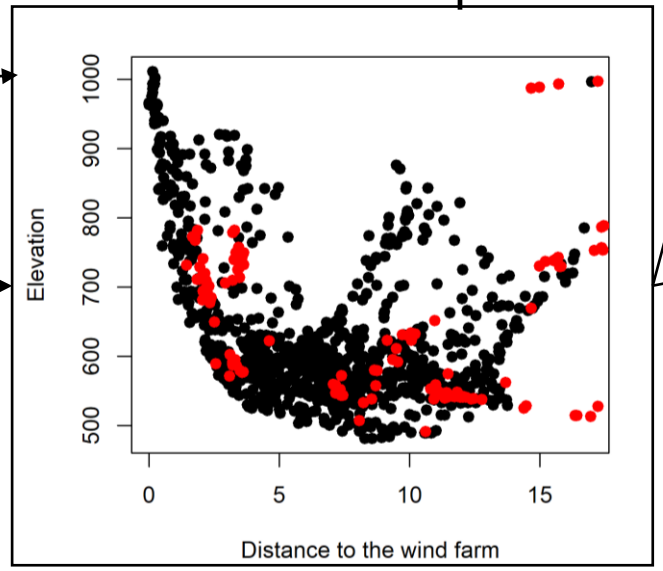
b. Background data



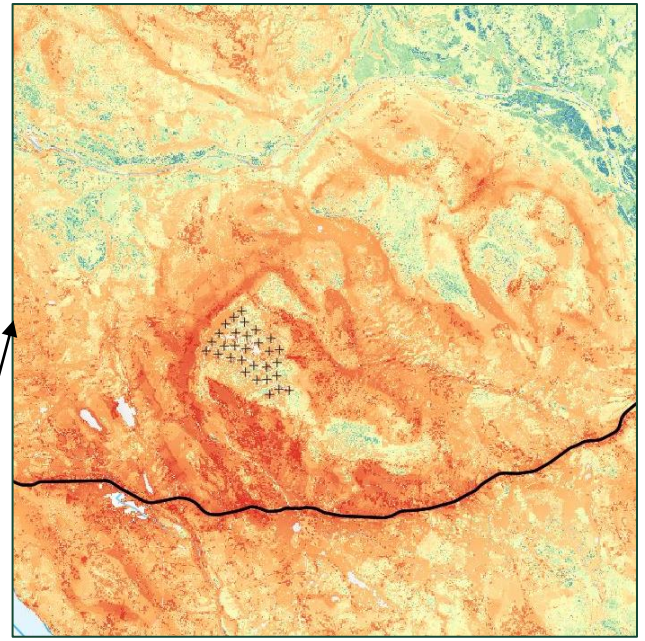
c. Use-availability design on geographical space

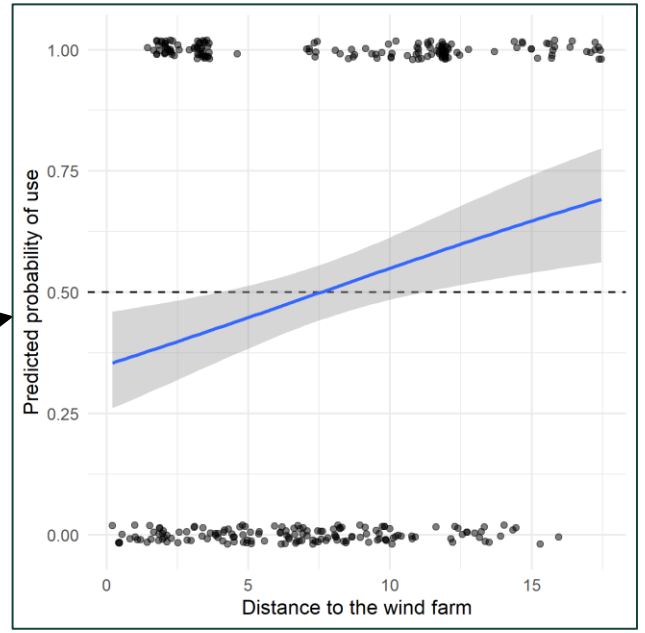


d. Environmental space

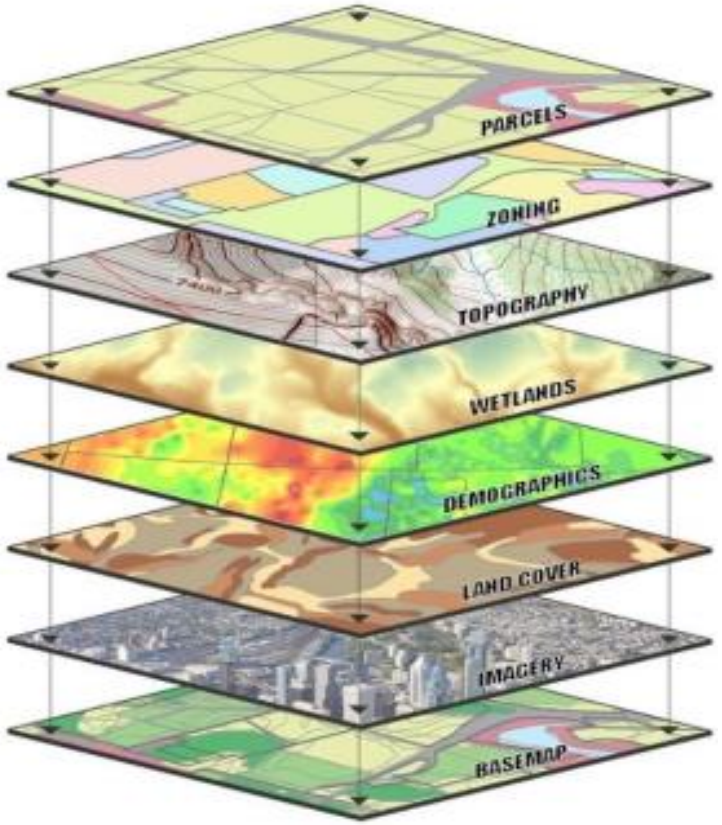


e. Predicted probability of use





Explanatory variables – what is relevant?



Foraging theories

- Optimal foraging theories
- Marginal value theorem – when should you leave a patch?
- Hierarchical theory of habitat selection - Senft 1987
  - The number of decisions taken for a specific process defines the scale of selection
  - Boundaries between units at each scale are defined by animal behaviour

Senft et al. 1987

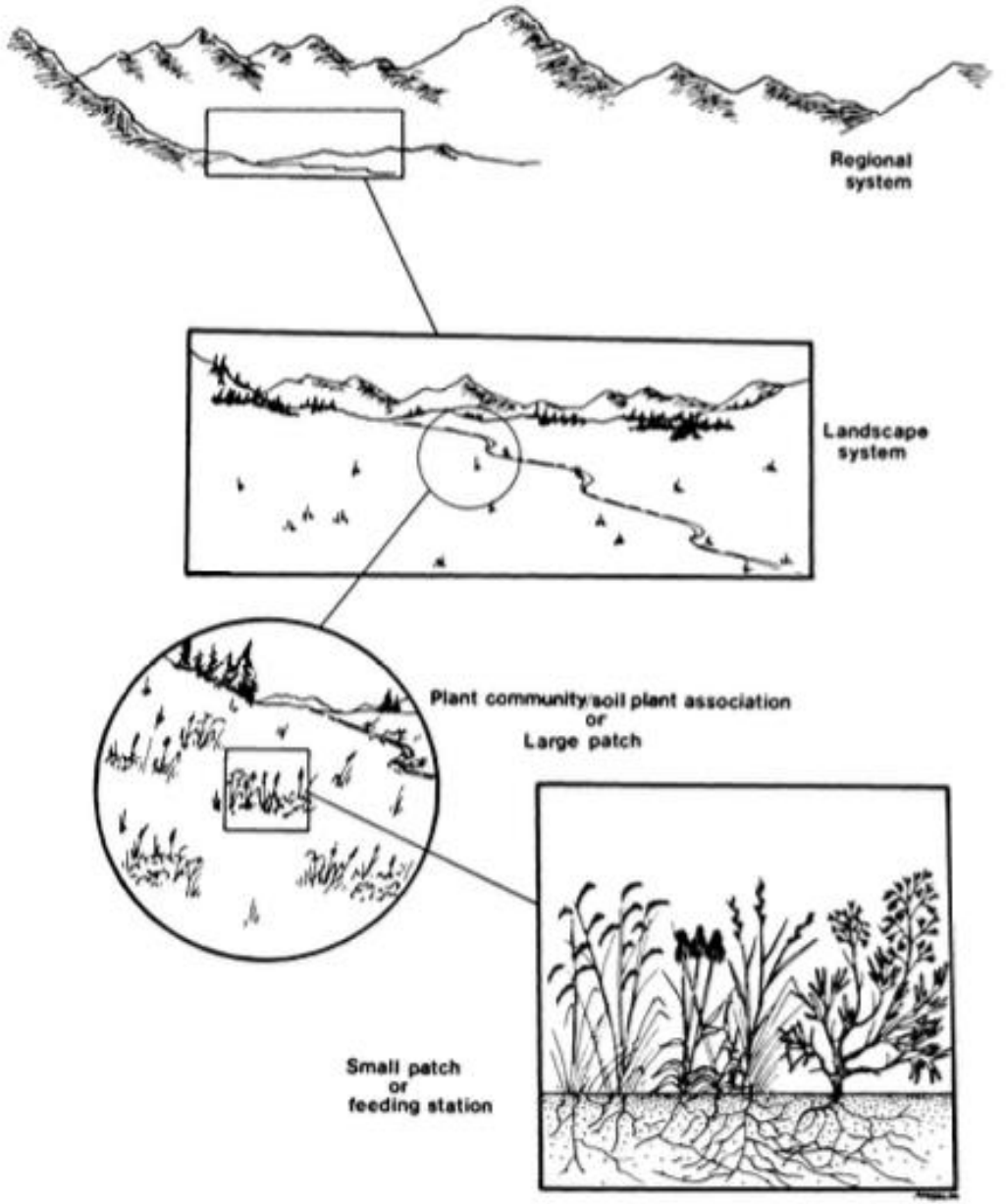


Figure 1. An ecological hierarchy encountered by large herbivores while foraging. Scales are defined by rates of foraging processes and ecosystem processes. Boundaries between units at each scale are defined by animal behavior.

Table 1. from Senft et al. 1987 explaining the conceptual model of herbivore foraging in an ecological hierarchy

	Scale in ecological hierarchy		
Foraging component	**Plant communities**	**Landscape**	**Region**
Units of selection	**Plants, feeding stations**	**Communities or large patches**	**Landscape**
Foraging behaviour	Diet selection	Feeding-area selection	Migration Nomadism Transhumance Home range
Behaviour frequency (decisions/yr)	10^{7}	10^{4}	10^{-1}-10^{1}
Interactive factors	Forage biomass Nutritive quality	Forage biomass Nutritive quality	Forage biomass
Non-interactive factors	Microsite variables	Substrate Topography Water location Microclimate	Geomorphology Regional climate Physical barriers Water location

Integrating habitat selection and foraging theories

- What factors are relevant to relate to the animals' locations at what scale?

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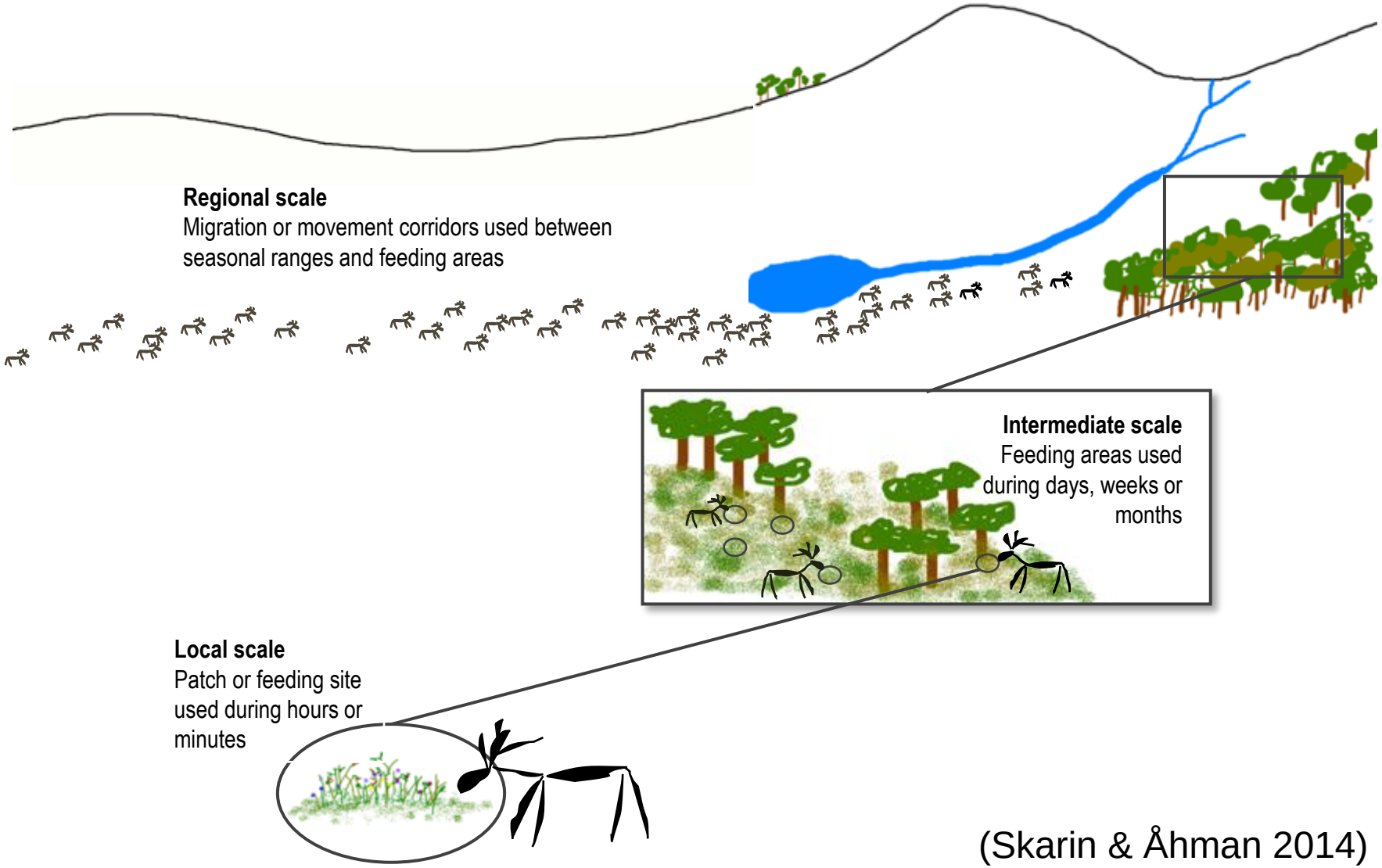


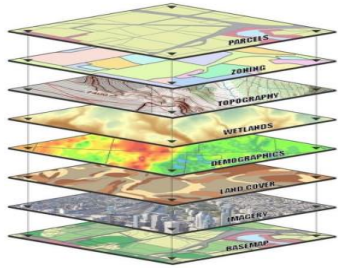
(Skarin & Åhman 2014)

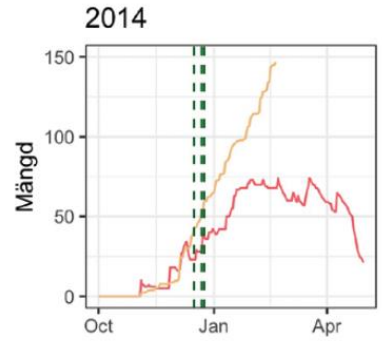
How can expert knowledge be included?

Qualitative data

GPS-data

Quantitative data



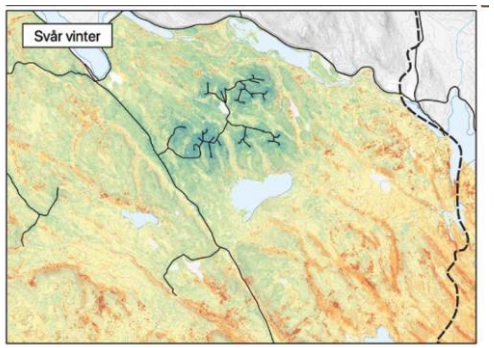


Interpretation of results together with herders

Resource selection models at 2nd and 3rd order

Analysis of movement rate

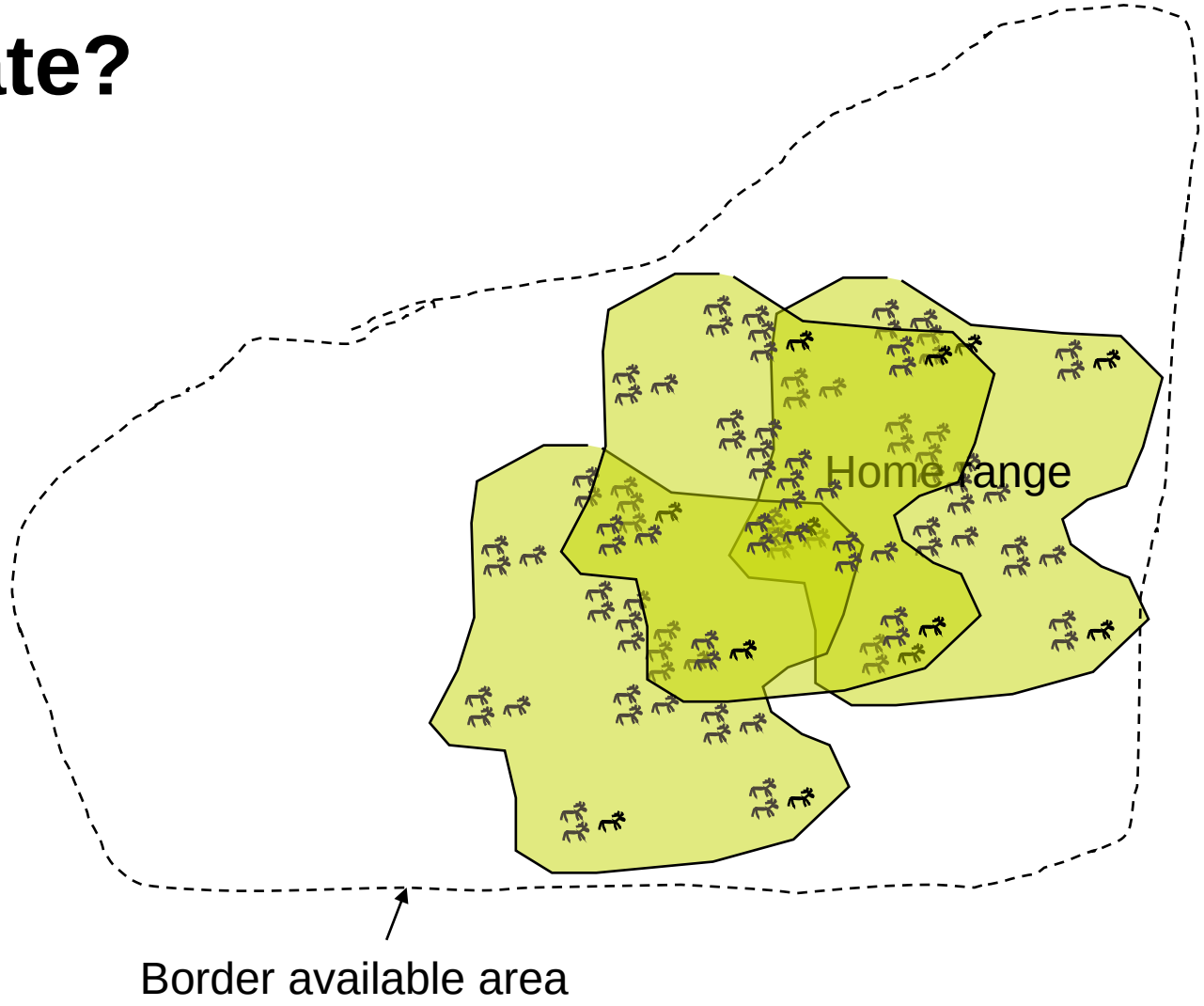
Predicted probability of use and predicted movement rate



Skarin et al. 2021 -
Vindval report no. 7011

Is HSF always appropriate?

- Independence between observations?
- What is available – group living animal?

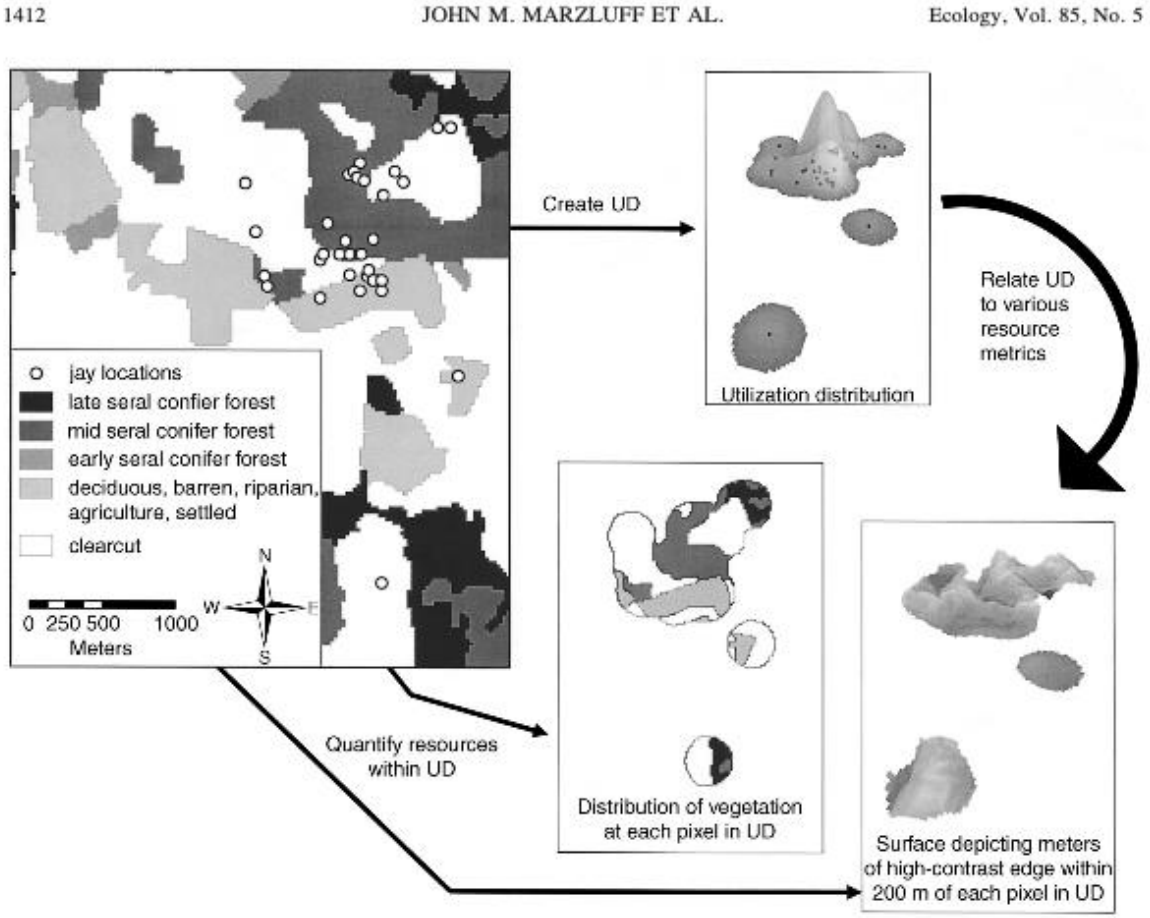


Resource utilisation function (RUF)

- Marzluff et al. 2004
- Use the estimated utilisation distribution in a home range and relate to environmental factors

➔ 3rd order selection

- Linear regression with estimated probability of used area as dependent variable



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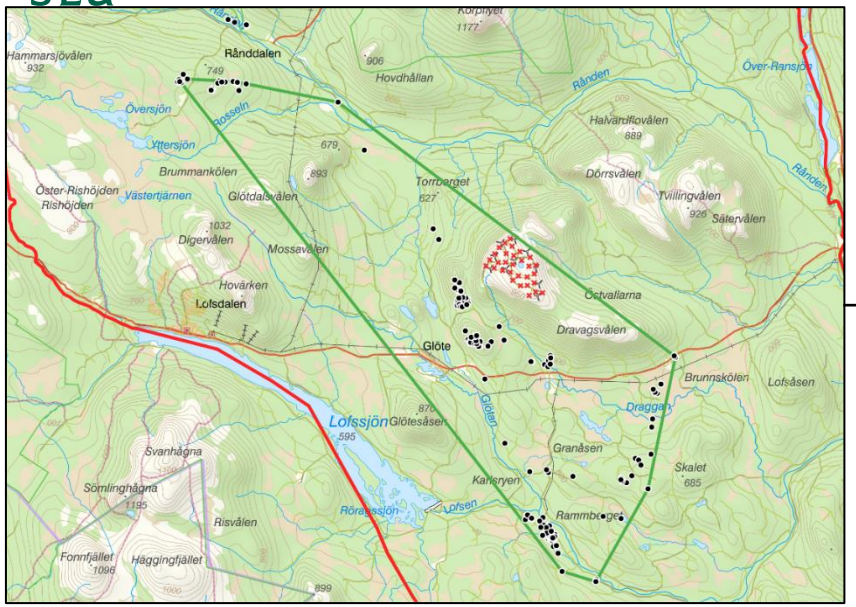

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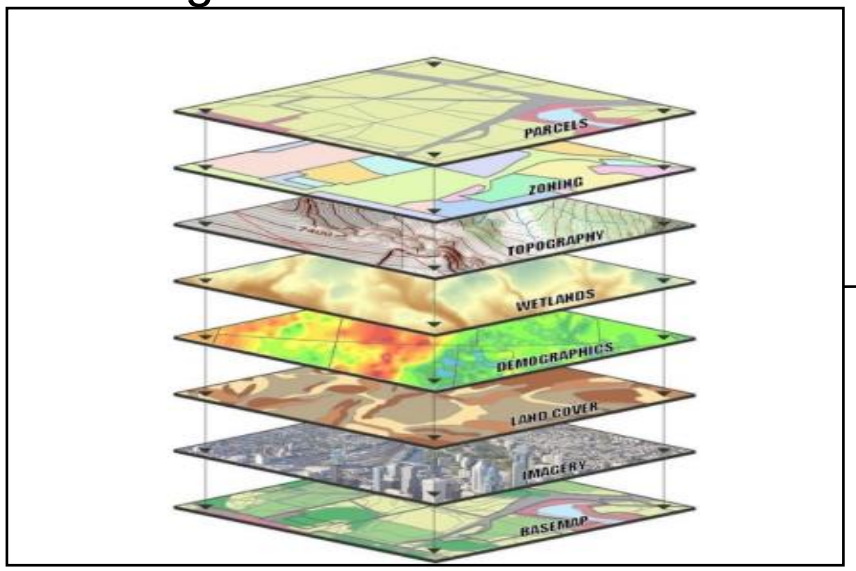

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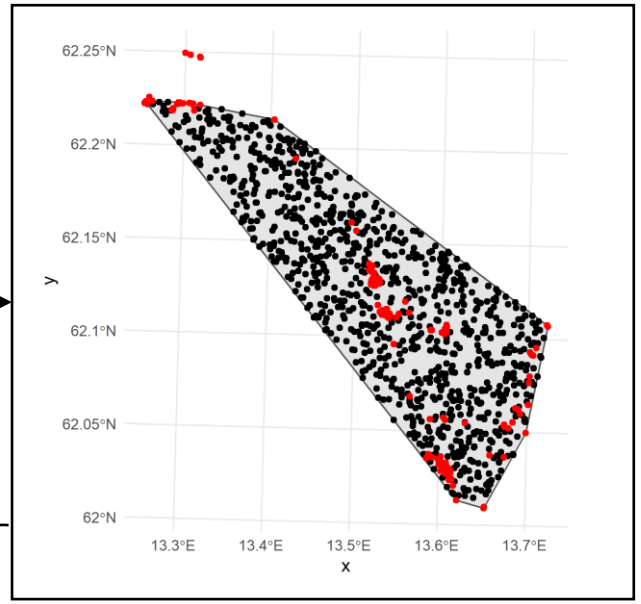

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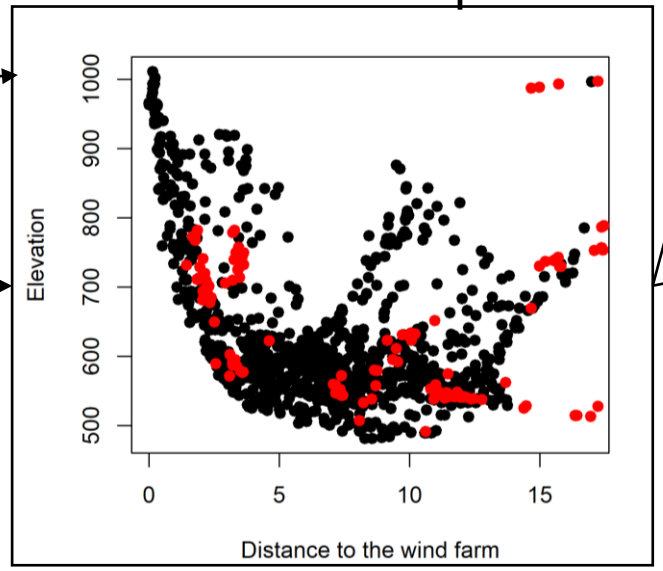

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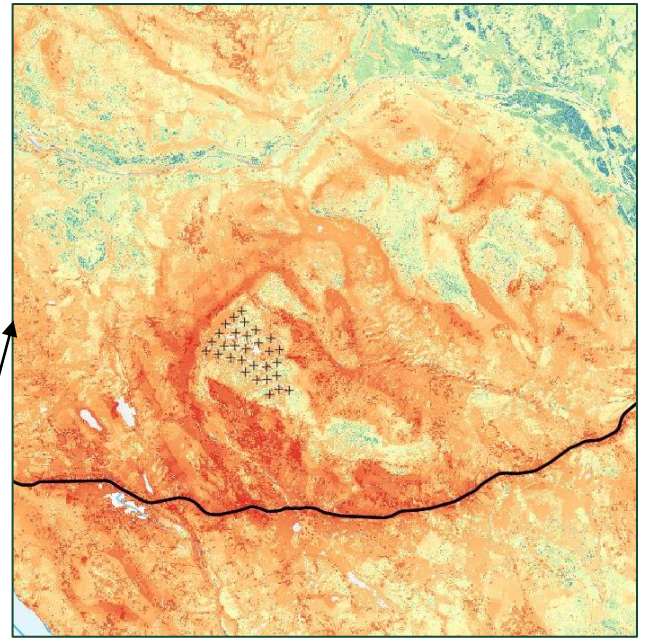
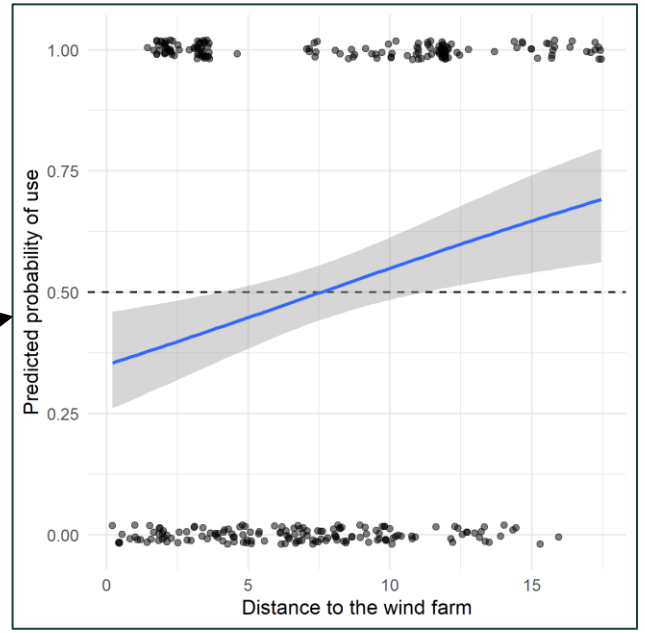
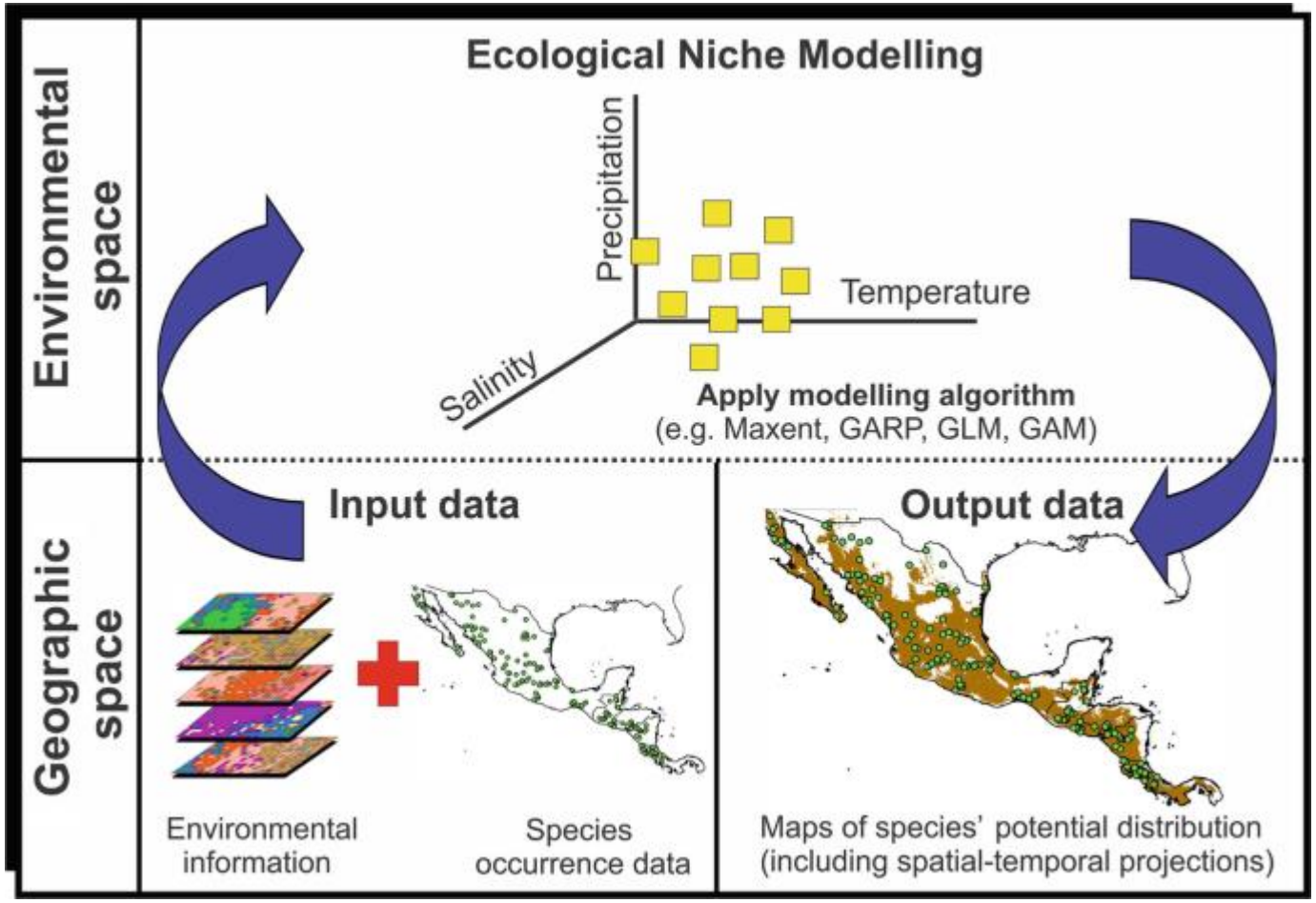




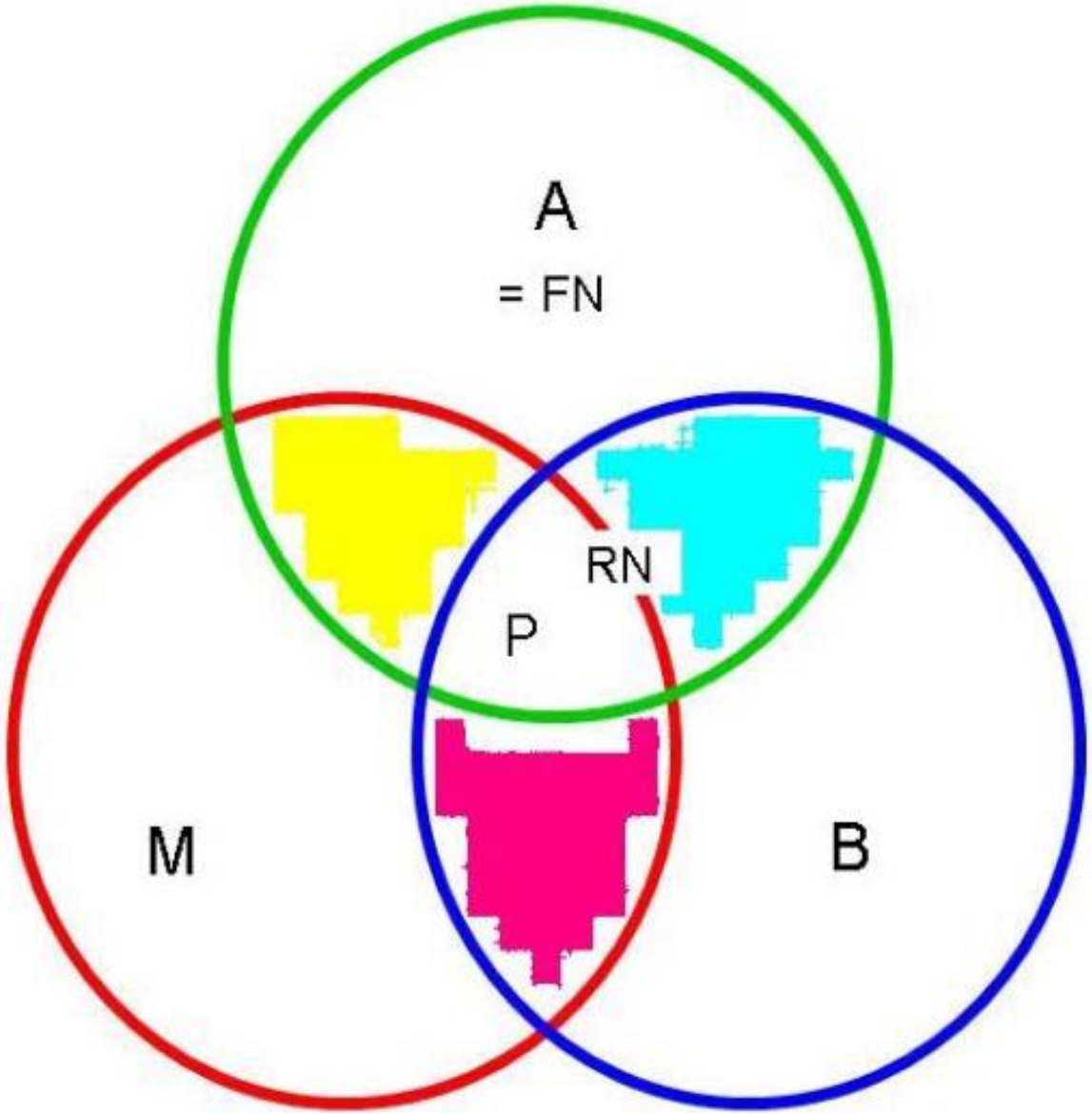
Ecological niche models



Prieto-Torres et al 2020

Ecological niche models

- BAM
  - Biotic
  - Abiotic
  - Movement



Soberon & Peterson 2005

Ecological niche models