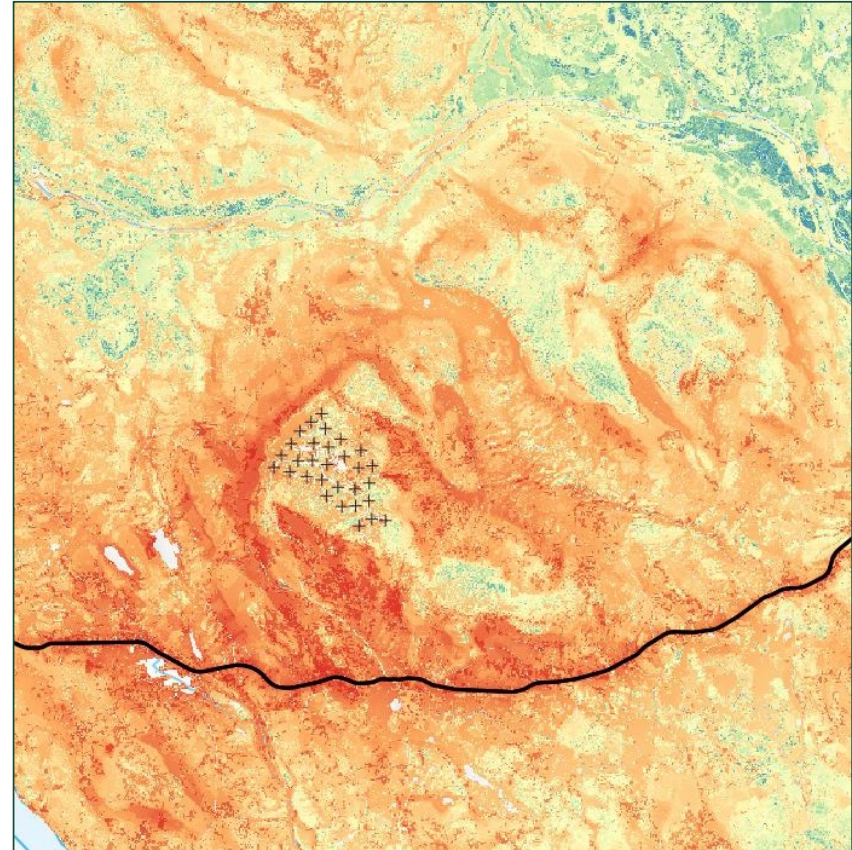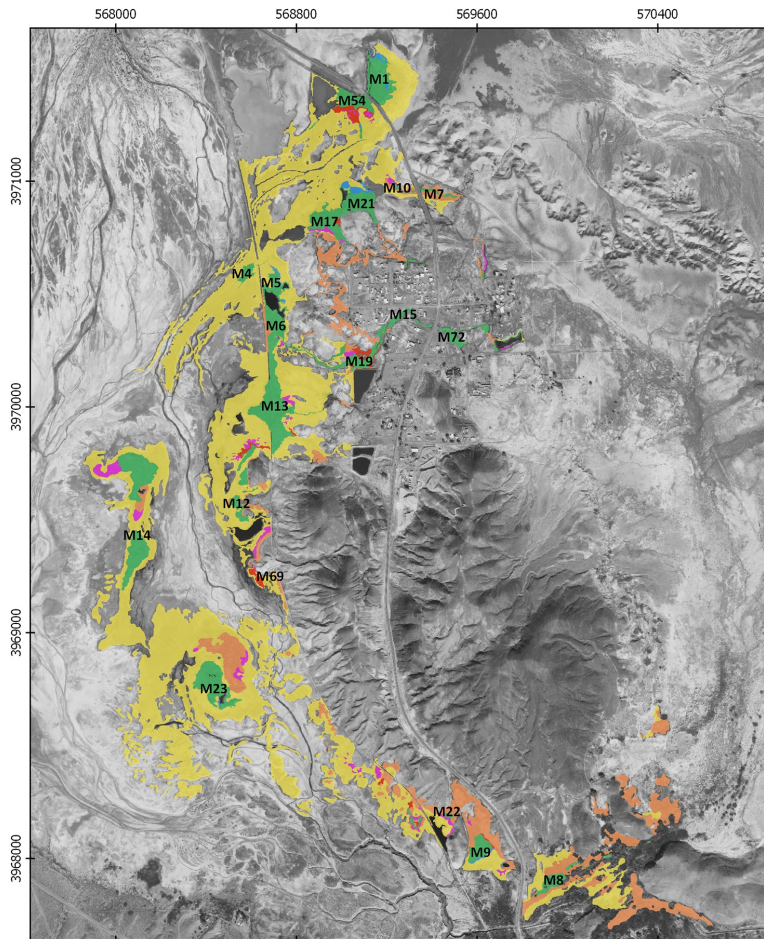# What is habitat selection?

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.
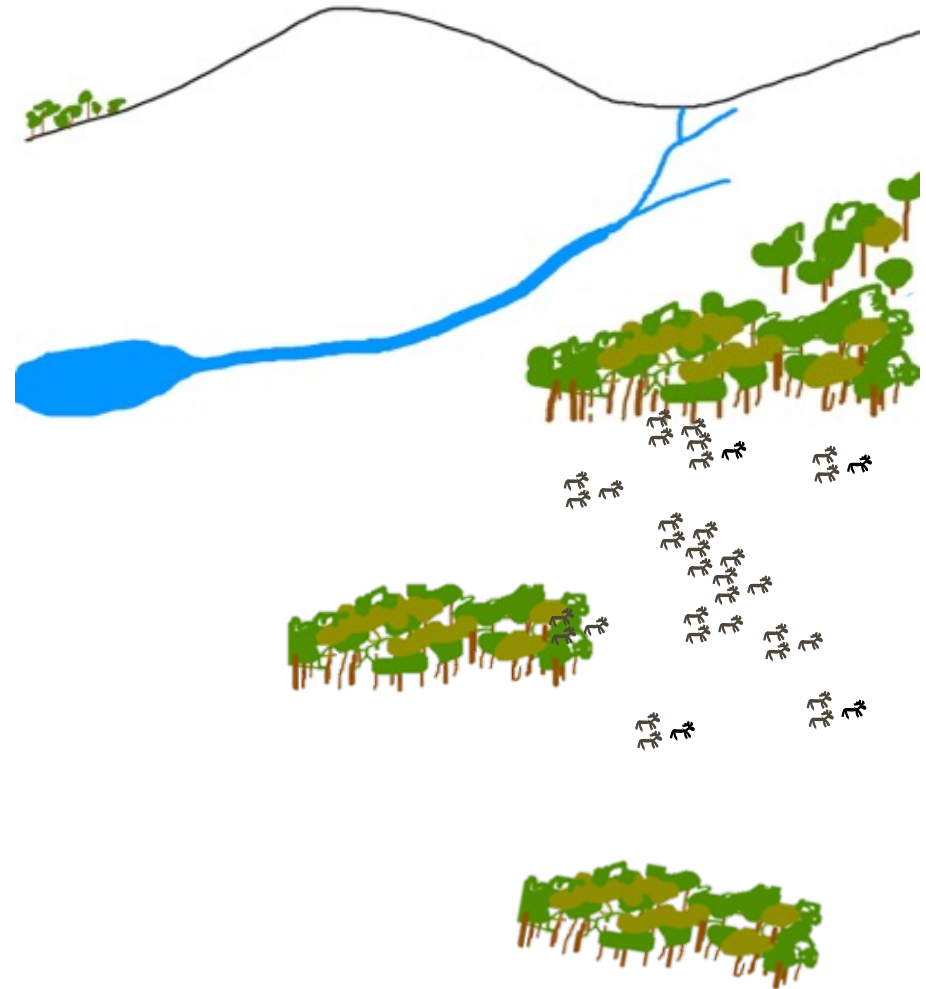
López-Pérez AM, et al. 2019 PlosOne

Habitat selection

First-order 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
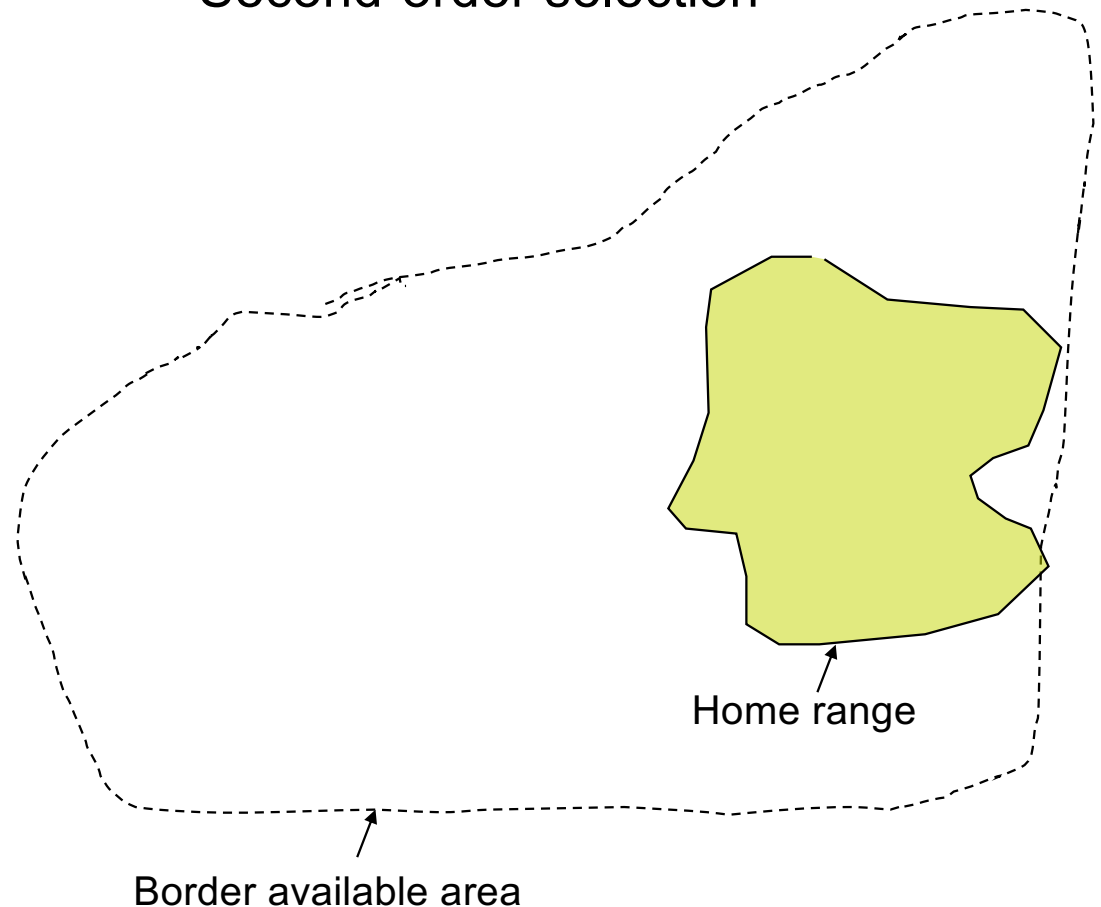 - First ➔ fourth order of selection

Habitat selection

- 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

Second-order selection

Home range

Border available area

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
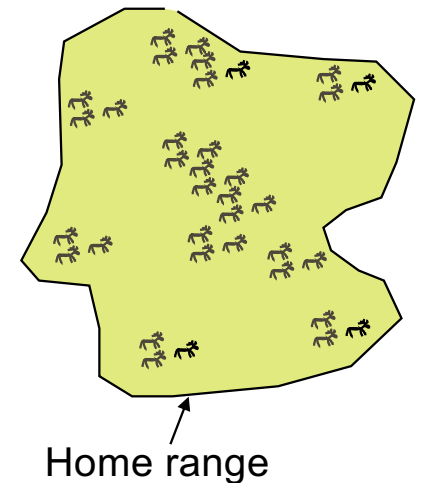 - First ➔ fourth order of selection

Third-order selection

Home range

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

Fourth-order selection

Home range
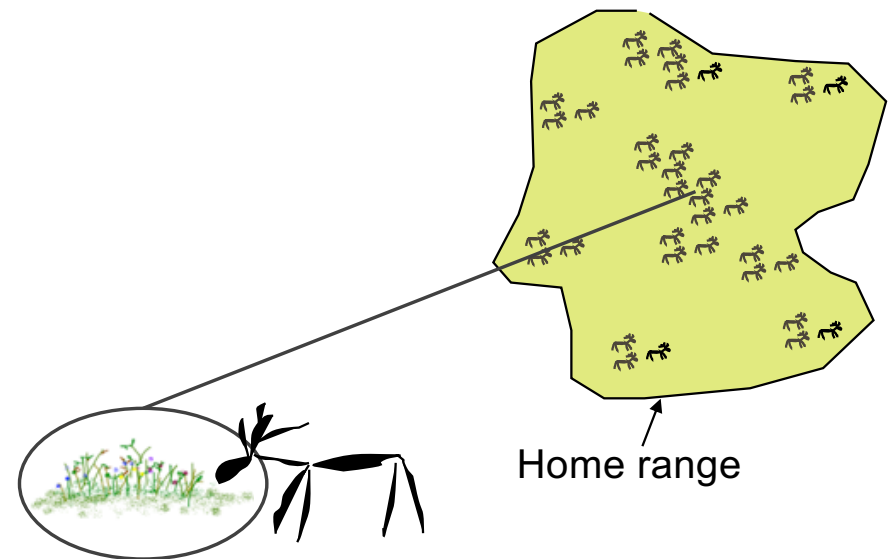
Habitat selection functions (HSF)

- Some kind of logistic regression
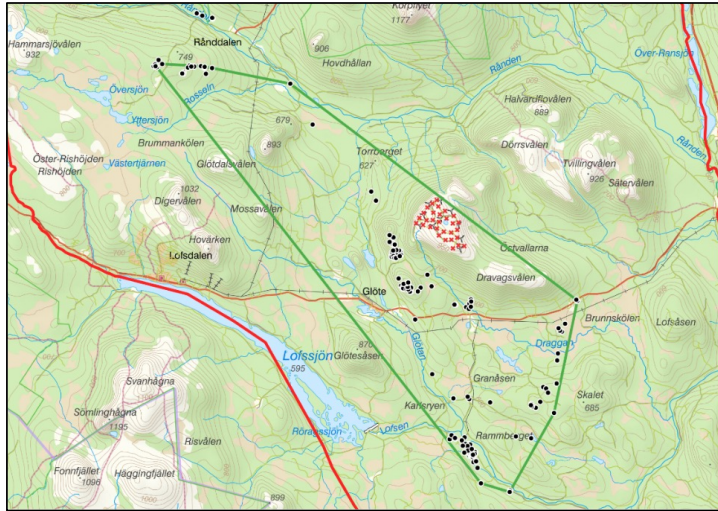
$W(x)= ln[p|p-1]= \beta_0 + \beta_1 x_1 + ... + \beta_n x_n + \varepsilon$

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.
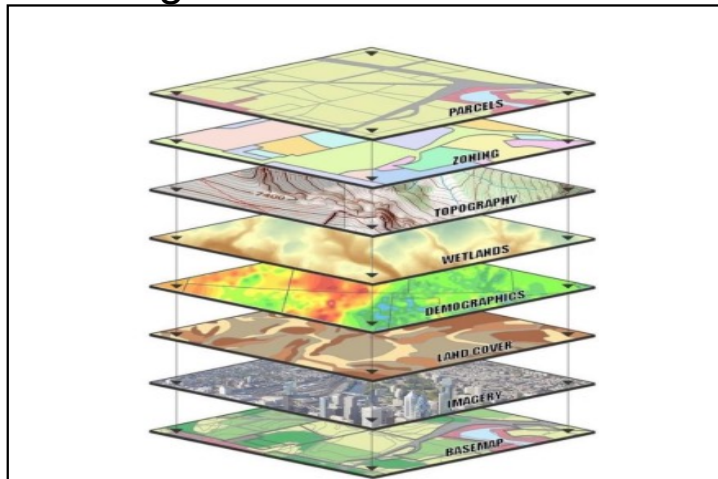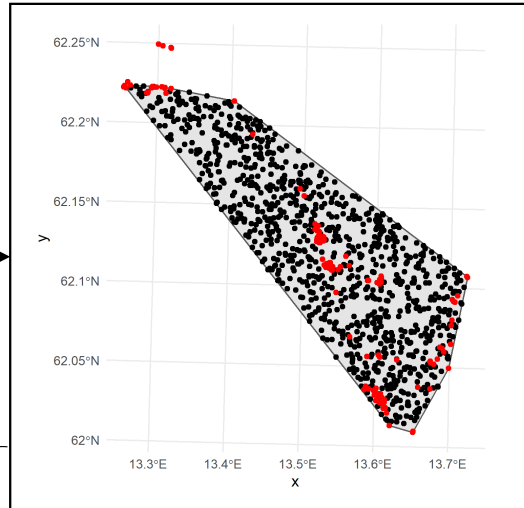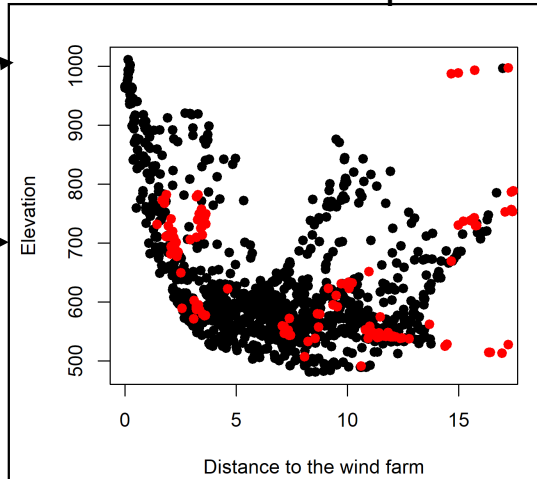
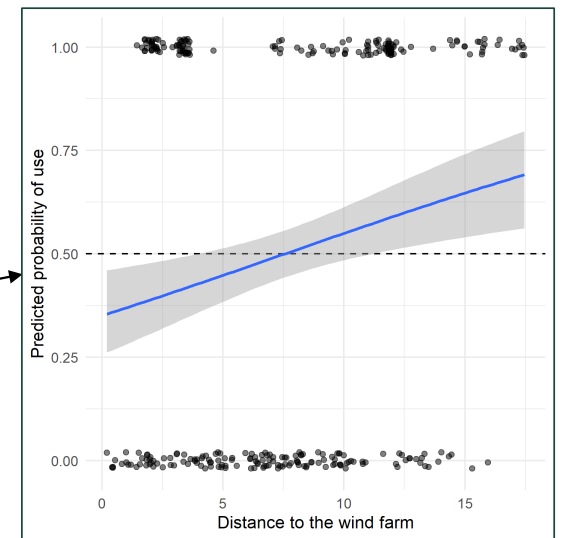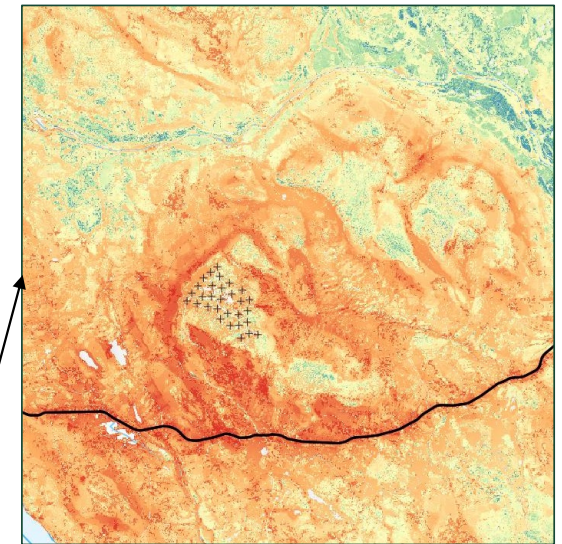a. Animal movement (GPS) data

b. Background data

c. Use-availability design on geographical space

d. Environmental space

e. Predicted probability of use

Explanatory variables – what is relevant?
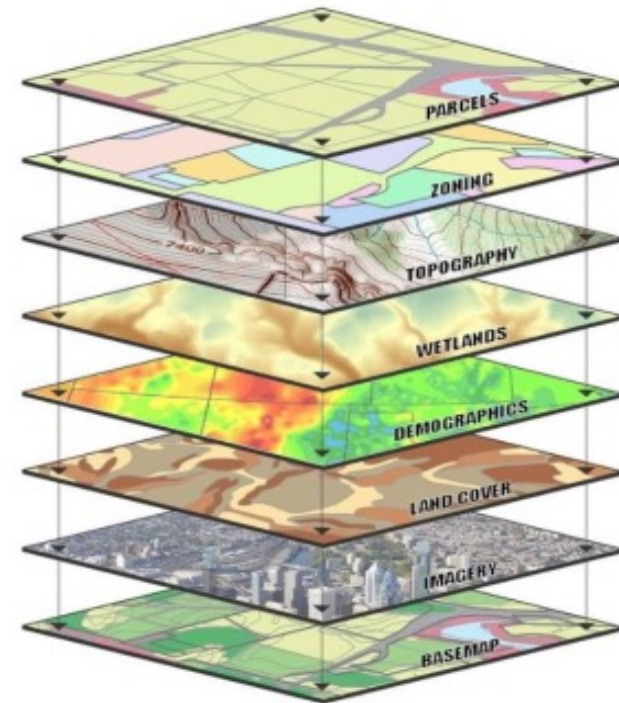
Foraging theories

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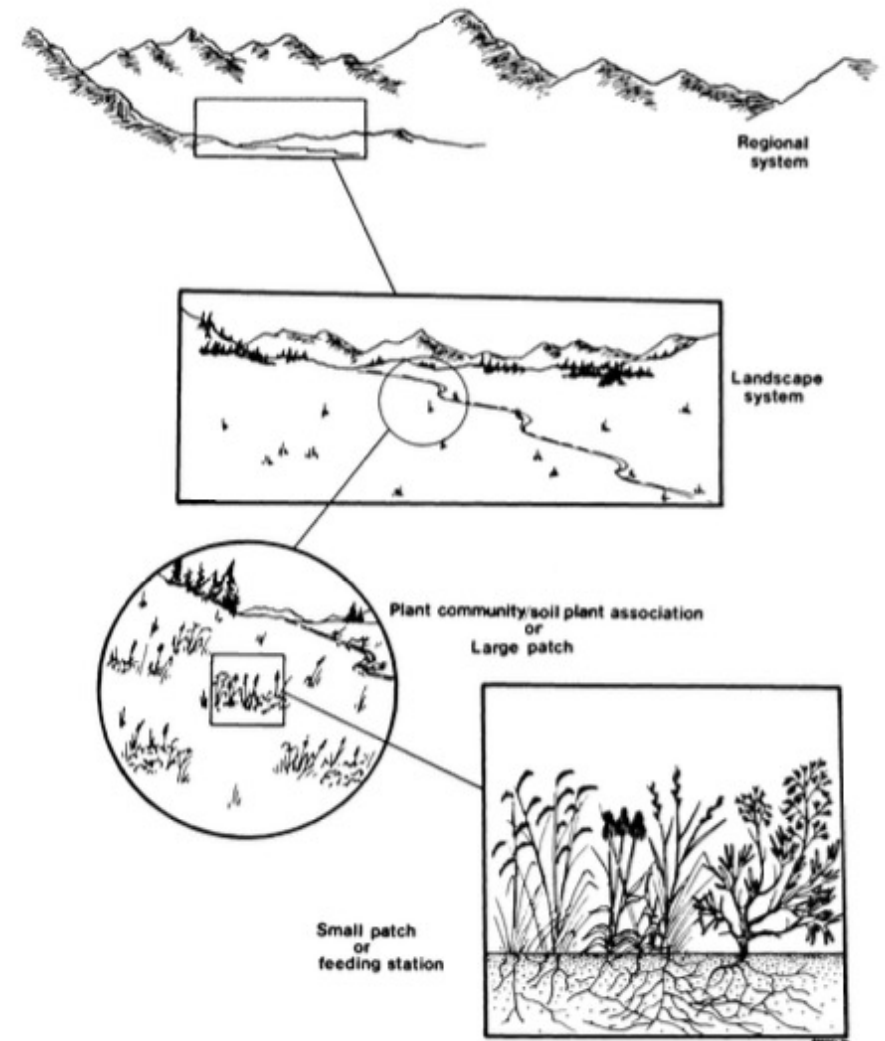
Figure 1. An ecological hierarchy encountered by large herbivores while foraging. Scales are defined by rates of foraging processes and ecosystem processes. Boundaries between units at each scale are defined by animal behavior.

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

Foraging component	Scale in ecological hierarchy		
	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?

Foraging component	Scale in ecological hierarchy		
	Plant communities	**Landscape**	**Region**
Units of selection	**Plants, feeding stations**	**Communities or large patches**	**Landscape**
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Integrating habitat selection and foraging theories

Regional scale
Migration or movement corridors used between seasonal ranges and feeding areas

Intermediate scale
Feeding areas used during days, weeks or months

Local scale
Patch or feeding site used during hours or minutes

(Skarin & Åhman 2014)
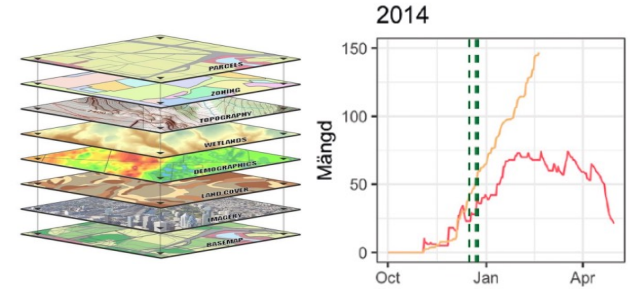
How can expert knowledge be included?

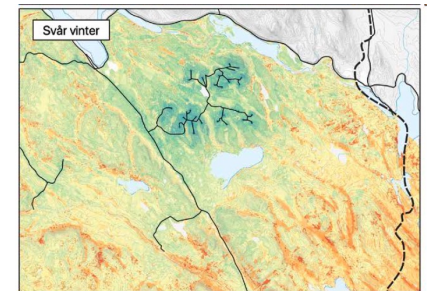**Qualitative data**

GPS-data

Quantitative data

2014

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

Svår vinter

Skarin et al. 2021 -
Vindval report no. 7011

Is HSF always appropriate?

- Independence between observations?

- What is available – group living animal?
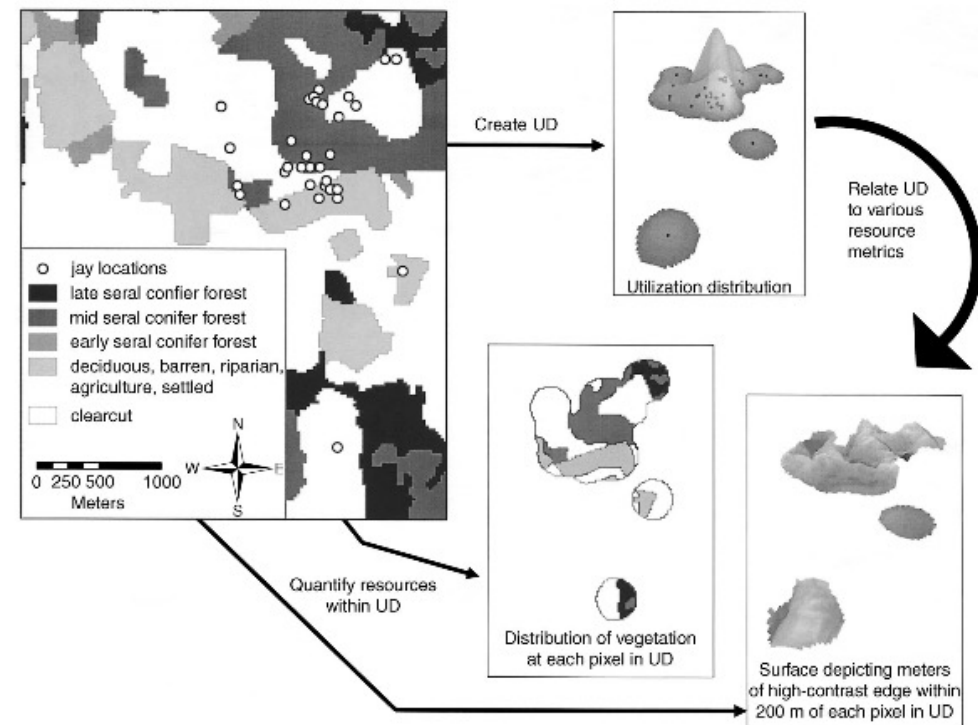

Home range

Border available area
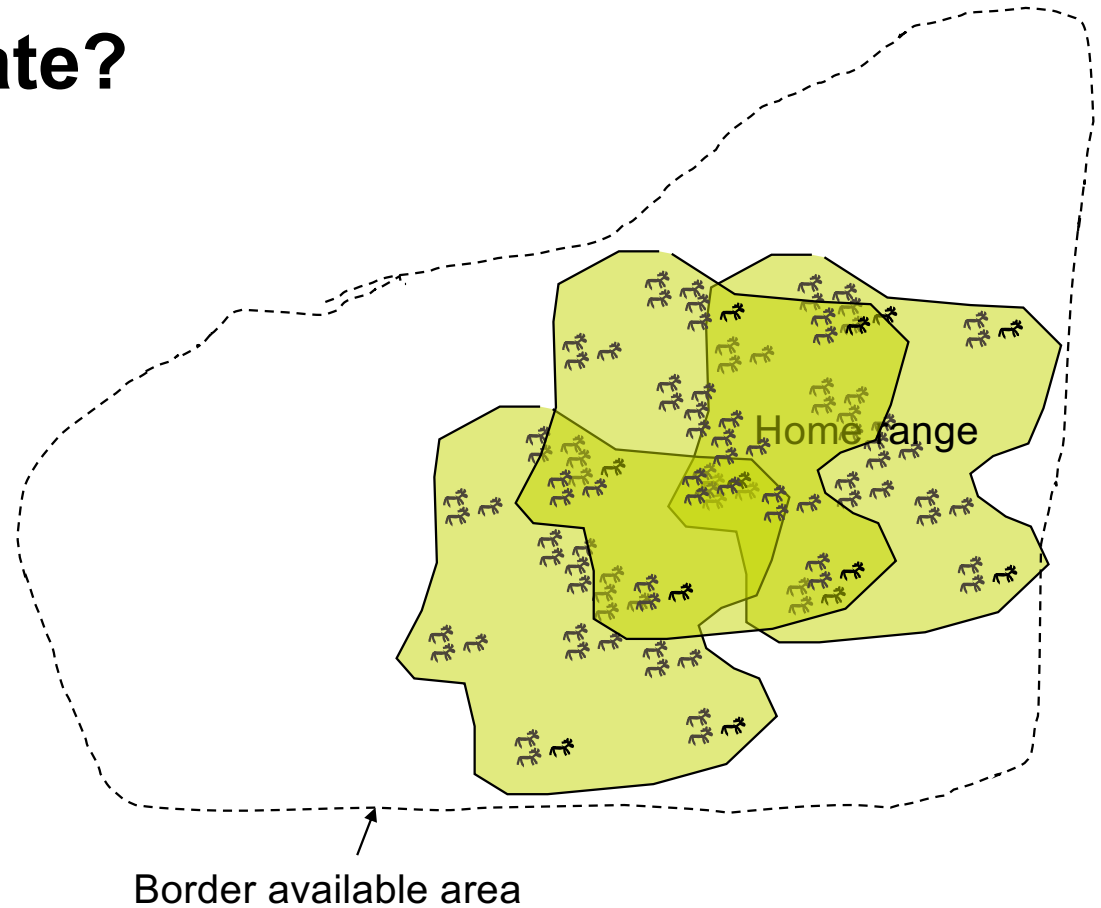
Resource utilisation function (RUF)

- 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

1412   JOHN M. MARZLUFF ET AL.   Ecology, Vol. 85, No. 5

Create UD

Utilization distribution

Relate UD to various resource metrics

Quantify resources within UD

Distribution of vegetation at each pixel in UD

Surface depicting meters of high-contrast edge within 200 m of each pixel in UD

- jay locations
- late seral conifer forest
- mid seral conifer forest
- early seral conifer forest
- deciduous, barren, riparian, agriculture, settled
- clearcut

0 250 500   1000
Meters

Ecological niche models

- Bernardo fill in here!!