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Plant preferences of an old native and a modern dairy cattle breed on mountain pastures

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Why study mountain pastures?

- Summer farming, i.e. seasonal moving of livestock to outlying land, often mountain pastures, is a very old tradition in Norway, creating some extremely species rich semi-natural grasslands.
- 30 % of the Norwegian red listed species depend on semi-natural grasslands.
- Modern livestock production systems have caused a strong decline in summer farming.
- Species rich semi-natural grasslands need special management, grazing by cattle is a main tool in this connection.

Why study differences between a native and a modern breed?

- The breeds have different selection history and different production capacity.
- It is important to test breed differences in other traits than body size and production level.
- There is a ”general understanding” of breed differences in utilisation of grasslands, but the presumptions are not scientifically proved.

The hypothesis and theoretical background

- Cows from a native dairy cattle breed have other grazing preferences than cows from a modern dairy cattle breed when grazing on semi-natural mountain pastures.

- The resource allocating theory claim that animals with high production capacity have lower activity than animals with lower production capacity.

Theoretical background

- It is observed in laboratory animals (i.e. mice and poultry) that lines with low production capacity prefer to ”work more” for their food than lines with high production capacity, the latter are more nutrient-oriented.

- If these behaviour patterns are transferable to cattle – it will be relevant to examine the possible effect of cattle breed on plant preferences.

The two cattle breeds

Black Sided Trønder and Nordland Cattle (STN)

-Old native dairy breed

-1 000 cows

- 4 000 kg milk/year, 4.24 % fat, 3.27 % protein

- Milk production and breed type are the main breeding goals

Norwegian Dairy Cattle (NRF)

- Modern Norwegian dairy breed (97 % of all dairy cattle in Norway)

- 277 000 cows

-6 190 kg milk/yr, 4.17 % fat, 3.22 % protein

- Broad breeding goal, both production and health traits included (included progeny testing of 250 daughters)

Recording procedures

- Two summer farms with STN and NRF cows at grass in mountain areas (semi-natural grasslands).
- Grazing sites and forage intake recorded.
  - Every 10 minutes, eight hours/day.
  - Two weeks one summer, 2002.
  - GPS on the bell cow.
- Faeces samples analysed by a micro histological method.
- Simple vegetation maps drawn for both sites.

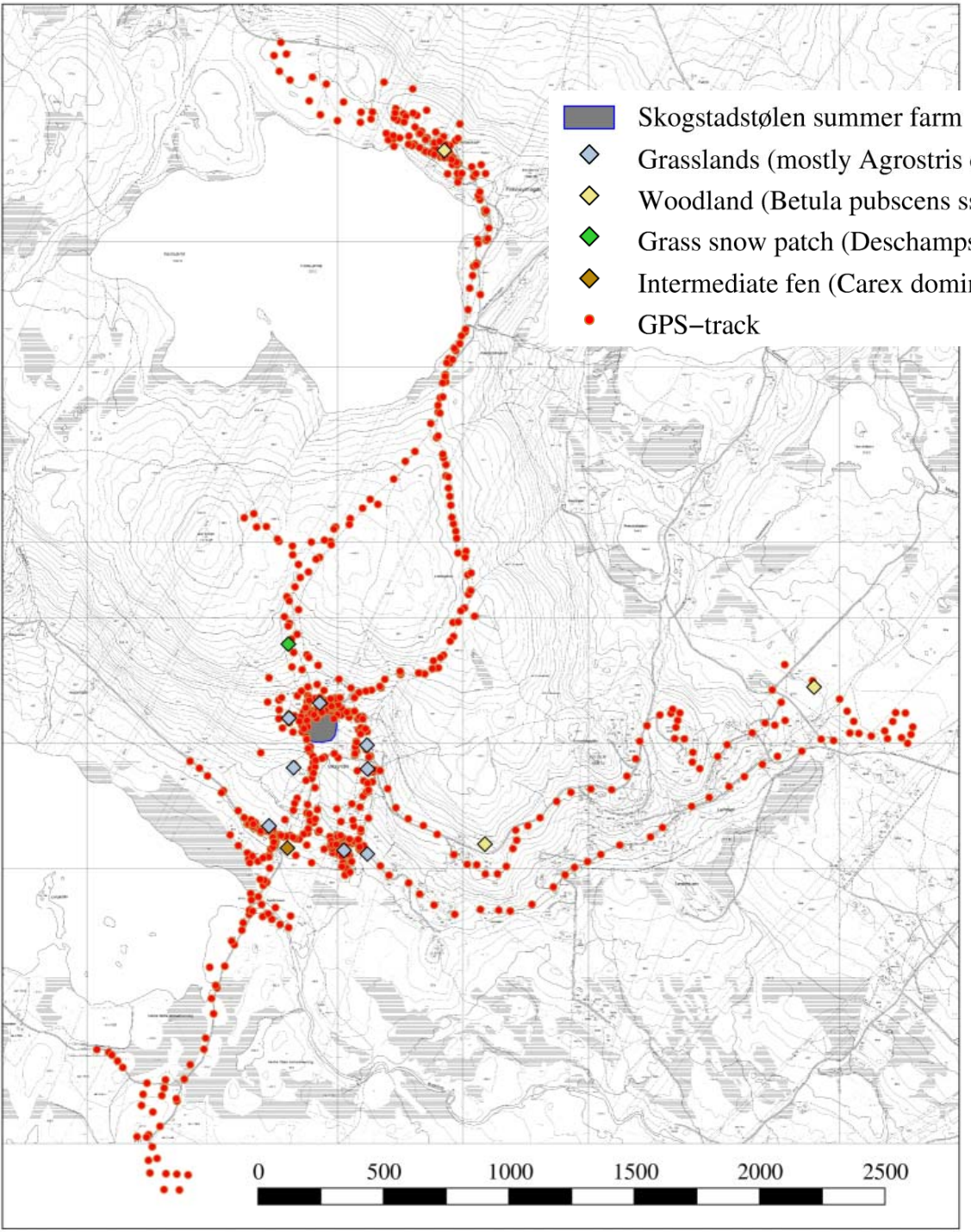
Study sites, grazing areas

Valdres

- 1 000 m asl
- Unforested area in the northern boreal zone
- 10.2 °C in July
- Species rich grasslands, though common species
- Mainly phyllite bed rock.

Skåbu

- 935 m asl
- Forested area in the northern boreal zone
- 11 °C in July
- Species rich grasslands, both common and base demanding species
- Phylitte, gabbro and leuconorite bed rock


Skogstadstølen summer farm
Grasslands (mostly Agrostris cappilaris – Festuca rubra – Anthoxanthum odoratum type)
Woodland (Betula pubscens ssp. czerepanovii)
Grass snow patch (Deschampsia flexuosa – Anthoxanthum odoratum ssp alpinum type)
Intermediate fen (Carex dominated)
GPS–track
0
500
1000
1500
2000
2500

Species rich old meadow with base demanding species, such as: *Plantago media, Botrychium lunaria, Thalictrum alpinum, Astragalus alpinus, Potentilla crantzii, Pulsatilla vernalis*

Betula pubescens spp. czerepanovii woodland of *Vaccinium myrtillus – Empetrum nigrum* coll. type with large amounts of *Deschampsia flexuosa* in the field layer.

Study sites, herds

	Valdres	Skåbu
Herd size	11 (5 STN, 4 NRF)	14 (6 STN, 3 NRF)
Mean age	5.6 years old	4.5 years old
Months since last calving	5.5 months	5.5 months
Mean walking distance per day	7.3 km	8.0 km
Maped areas	18 km^2	8 km^2
Herd density in the area	Three other herds	None
Milk production per year	STN: 4 500 kg, NRF: 5 800 kg	

Materials analysed

- 49 faeces samples analysed by a micro histological method for fragments from 29 plant and plant groups.
- Plant and plant groups with a mean of less than 2 % for found fragments were excluded in the statistical analyses.
- 15 plants and plant groups were tested for breed differences.

Results from the statistical model

Total grass = *Deschampsia cespitosa*, *Deschampsia flexuosa*, *Festuca rubra* ssp. *Rubra*, *Festuca ovina*, *Festuca* spp, *Poa* spp, *Moli cer*, *Agrostis* spp, *Anthoxanthum odoratum*, *Phleum alpinum*, *Nardus stricta*, *Melica nutans*, *Alop gen*, *Graminae*.

Total fescues = *Festuca rubra* ssp. *Rubra*, *Festuca ovina*, *Festuca* spp

Total heather = *Vaccinium myrtillus*, *Calluna vulgaris*

** 1 %, * 5 %

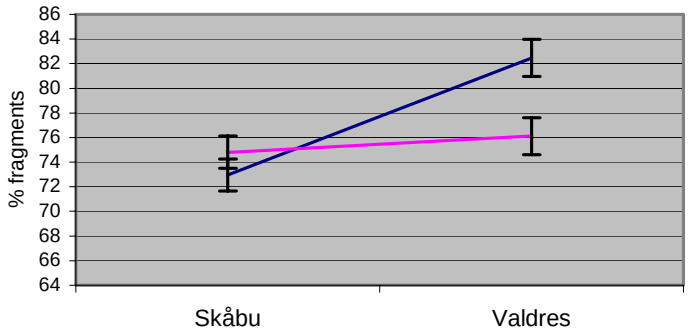
Species	Mean value (%)	R^2	Farm	Breed	Inter-action farm/breed
Blueberry *Vacc myr*	2.03	0.37	**		*
Heather *Call vul*	2.13	0.66	**		
Tufted hair-grass *Desch ces*	25.54	0.58	**		
Wavy hairgrass *Desch flex*	15.08	0.51	**		
Red fescue *Fest rub*	3.24	0.37	**		
Unidentified fescue *Fest* spp	7.04	0.26	**		
Meadow grass *Poa* spp	3.46	0.18	**		
Bent grass *Agro* spp	2.55	0.20	**		
Matgrass *Nard str*	3.82	0.72	**	*	*
Unidentified grass *Graminae*	12.80	0.28	**		
Sedge species *Carex spp*	8.36	0.66	**		*
Herbs spp	8.37	0.64	**		
Total grass	76.13	0.35	**		**
Total fescues	10.83	0.46	**		
Total heather	4.16	0.66	**		

Results

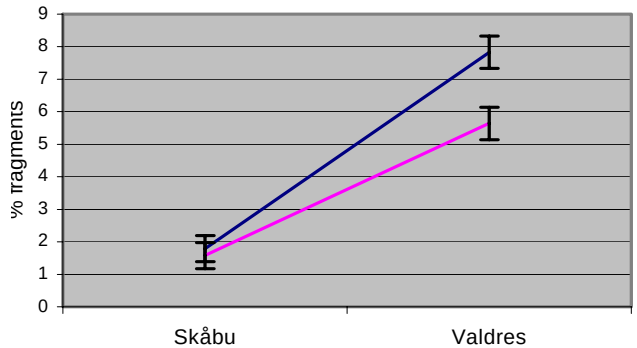
- Significant differences between farms for all plants and plant groups.
- No significant breed differences when farms tested separately, but some indications in Valdres (poorer bed rock)
- Significant breed difference for *Nardus stricta* (Mat grass) when analysed both farms together
- Genotype by environment interaction for four traits, strengthening the indications found in Valdres.

Genotype by environment interaction

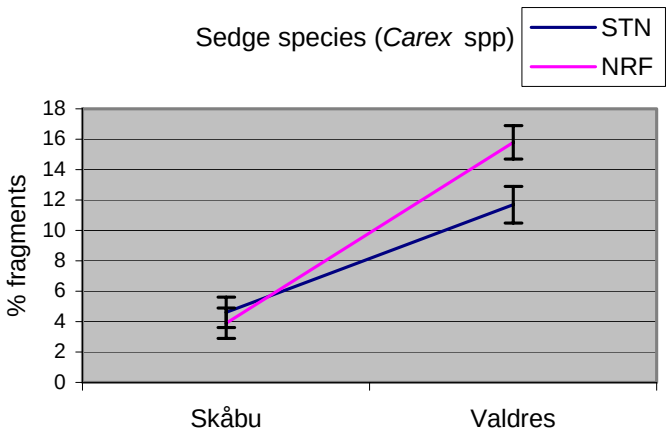
Grass species



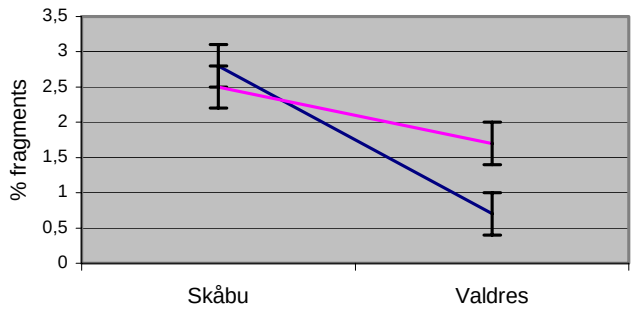
Matgrass (*Nardus stricta*)



Sedge species (*Carex* spp)



Blueberry (*Vaccinium myrtillis*)



Results

- Both recorded observations and results from faeces analyses indicate that the herds mainly grazed on grasslands rather than the other grazing areas.

- NRF seems to have preference for nutrient rich plants
  - Sedges contents more crude protein and less crude fibre than grass in July and August (Garmo, 1986)
  - Blueberry here mostly grows in quite nutrient rich areas.

Results

- STN seems to prefer to ”work more” when grazing
  - grazing on less nutrient rich plants (e.g. grass in stead of sedges) in dryer, more species rich and less nutrient rich areas where for instance *Nardus stricta* is easily accessible.

Conclusions

- When the semi-natural grazing area was very rich in species, had good nutrient access and very low grazing pressure, there were no breed differences in foraging strategy.

Conclusions

- When the grazing area is less nutrient rich breed differences seems to occure.

- The results fits the interpretation of the resource allocating theory that animals seek nutrients according to their production level.