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Status of WP2 in the FutureArcticLives program

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WP2: Dissemination plan

WP2	
<p>Climate change and reindeer herding – a bioeconomic model on the economic implications for Saami reindeer herders in Sweden and Norway</p>	<p>Ecological Economics</p> <ul style="list-style-type: none"> • Submitted April 14, 2023 • Referee comments received June 16 • Resubmission deadline October.
<ul style="list-style-type: none"> • Coping with climate change - reindeer herder’s preferences in Sweden and Norway OR • Reindeer herding in the face of climate change: How do the Sami adapt? 	<p>Suggested journal: Environmental and Resource Economics</p>
<ul style="list-style-type: none"> • Land use and worries in Saami reindeer herding OR • Cumulative worries in Sapmi – the interplay between climate change and other threats to reindeer husbandry in Sweden and Norway OR • Climate change and land use in Sapmi – Worries about and hope for the future 	<p>Suggested journal: Regional Environmental Change</p>
<p>Optimal adaption strategies for a sustainable reindeer husbandry in the face of climate change</p>	<p>Suggested journal: Land Use Policy</p>



Climate change and Saami reindeer herding in Norway and Sweden – impact of climate change on slaughter profits

Introduction

The impact of climate change is already evident in many natural resource-dependent Arctic societies, and perhaps especially for indigenous communities (Furberg et al. 2011). Saami reindeer herders in Norway and Sweden live close to nature and are directly exposed to the effects of climate change. Reindeer graze on natural pastures throughout the year following a migratory pattern between winter and summer grazing areas (Johannessen and Skonhoft 2009). This implies that climate

change affects reindeer herding conditions both in the summer and winter grazing seasons. The main changes to the Arctic climate include rapidly shifting warm and cold periods during the winter coupled with a year-round increase in precipitation intensity, which is expected to increase the frequency of wet weather, deep snow, and ice crust formation (Kelman and Næss, 2019). Winter grazing conditions are limiting factors for the survival and productivity of reindeer (Tveraa et al. 2003). Difficult winter

Simulation analysis - presentations

- Presented at:
 - World natural resource modeling conference (WCNRM) Leipzig 2022
 - Bioecon, Exeter 2022
 - European Association of Environmental and Resource economics, Limassol 2023
 - Seminar presentations: CERE seminar, Econpol research group Leeds, MRØ seminar series Tromsø
- Extension with supplementary feeding presented at:
 - World natural resource modeling conference (WCNRM) Amsterdam 2022

Simulation analysis – revisions

1. Minor comments on explaining the model and arguing for why supplementary feeding is not included.
2. Include a direct effect of difficult winters on mortality. Starvation possible during winter despite weight gain during summer.
3. Climate scenarios only represent one projected scenario for each scenario type.
4. The model and its optimisation is purely deterministic, but weather is stochastic. Are reindeer herders assumed to know the different conditions in advance for all future winters?

Extension of simulation model

- Extension with supplementary feeding as an adaption strategy.
 - Feeding is included as another control variable in additon to harvest level.
 - Preliminary results suggest that it is highly cost dependent.

Survey execution in Sweden

- In both countries the survey could be reached through an internet link - in Sweden to Netigate, in Norway to Nettskjema
- In Sweden the link was initially distributed through SSR (Svenska Samers Riksförbund) in June 2022
- Because of few answers link also distributed through advert in September in the online version of the magazine Samefolket.
- This was complemented with manual calls to chairmen of (almost) all 51 Saami villages. Sampling ended in December with 103 observations.



Survey execution in Norway

- In Norway the link was distributed to all unit leaders (leaders of siida shares), initially late September (Trøndelag and Nordland) and early October (Troms and Finnmark) 2022.
- Because of few answers link was also distributed through advert in Ságat and Ávvir.
- This was complemented with manual calls to 481 siida share leaders (30% answered the call) in October and with letters (including a Flax ticket) sent to all siida share leaders in December
- Sampling in Norway ended in December with 76 observations.
- Total sample thus 179 observations.



The questionnaire

The questionnaire (exactly the same in both countries) can be divided in 6 different parts:

- Part 1: Questions about factor that create worry for reindeer herders, the importance of reindeer husbandry, and the impact of climate change
- Part 2: Contingent valuation questions about reindeer herders willingness to either: *Reduce herds* or *Do supplementary foddering*.
- Part 3: Follow-up questions to the contingent valuation questions.
- Part 4: Socioeconomic questions, e.g. age, gender, etc.
- Part 5: Questions about hunting and fishing and income related to this.
- Part 6: A question about the reindeer herd size (sensitive...)

Sample characteristics

Variable	Norway, N = 76 ¹	Sweden, N = 103 ¹	p-value ²
Age			0.3
18-25	0 (0%)	3 (4.2%)	
26-30	1 (1.4%)	6 (8.3%)	
31-35	4 (5.5%)	8 (11%)	
36-40	7 (9.6%)	6 (8.3%)	
41-45	5 (6.8%)	6 (8.3%)	
46-50	15 (21%)	9 (13%)	
51-55	17 (23%)	10 (14%)	
56-60	13 (18%)	11 (15%)	
61-65	7 (9.6%)	8 (11%)	
66+	4 (5.5%)	5 (6.9%)	
Unknown	3	31	
Gender			0.5
Male	49 (67%)	52 (73%)	
Female	20 (27%)	18 (25%)	
Prefer not to say	4 (5.5%)	1 (1.4%)	
Unknown	3	32	

Education			<0.001
Middle school	1 (1.4%)	19 (26%)	
High school	7 (9.5%)	35 (49%)	
University < 4 years	20 (27%)	8 (11%)	
University > 4 years	14 (19%)	6 (8.3%)	
Trade school	13 (18%)	2 (2.8%)	
Other	19 (26%)	2 (2.8%)	
Unknown	2	31	
Herd size (Winter)			
1-49	2 (2.8%)	7 (10%)	
50-99	1 (1.4%)	6 (9.0%)	
100-199	2 (2.8%)	8 (12%)	
200-299	8 (11%)	4 (6.0%)	
300-399	12 (17%)	6 (9.0%)	
400-499	20 (28%)	7 (10%)	
500-599	6 (8.5%)	8 (12%)	
600+	8 (11%)	9 (13%)	
Don't want to answer	12 (17%)	12 (18%)	
Unknown	5	36	

¹ n (%)

² Fisher's exact test; Pearson's Chi-squared test

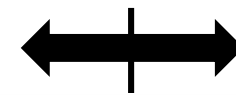
Results from the worry questions

Very or somewhat concerned

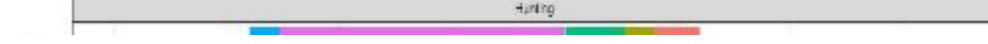
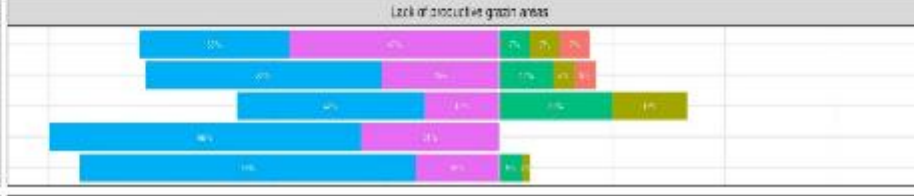
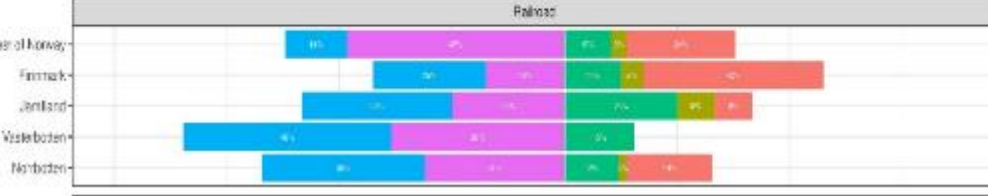
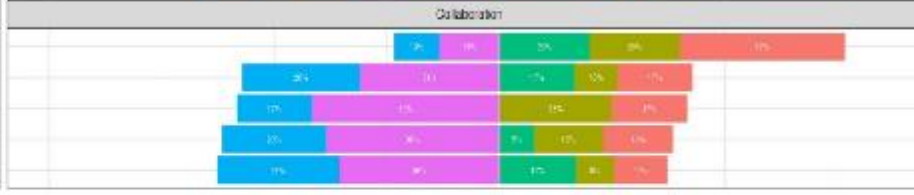
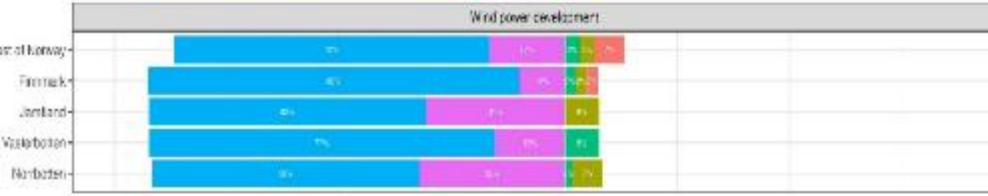
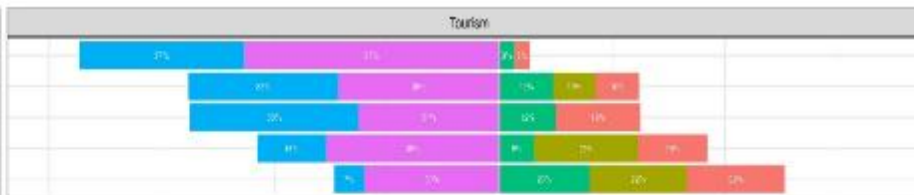
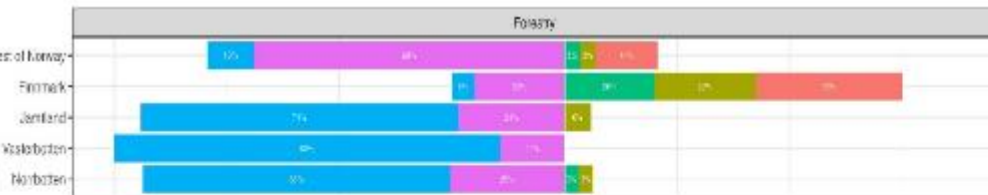


Neutral or unconcerned

Very or somewhat concerned



Neutral or unconcerned



Results from the worry questions (cont.)

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Very or somewhat concerned



Neutral or unconcerned

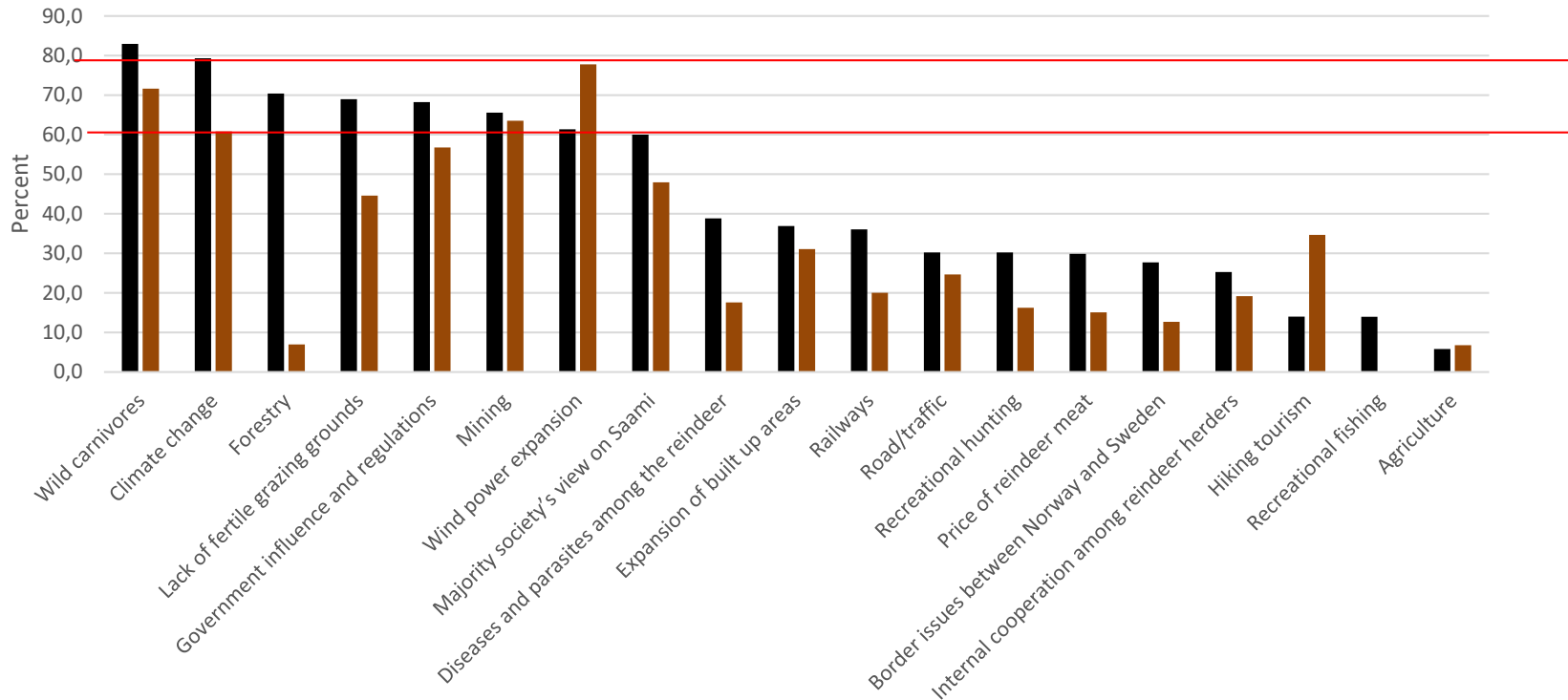
Very or somewhat concerned



Neutral or unconcerned



Top worry factors in Sweden and Norway



Top Sweden:

- Carnivores
- Forestry
- Climate
- Lack of grazing grounds
- Government influence and regulations.

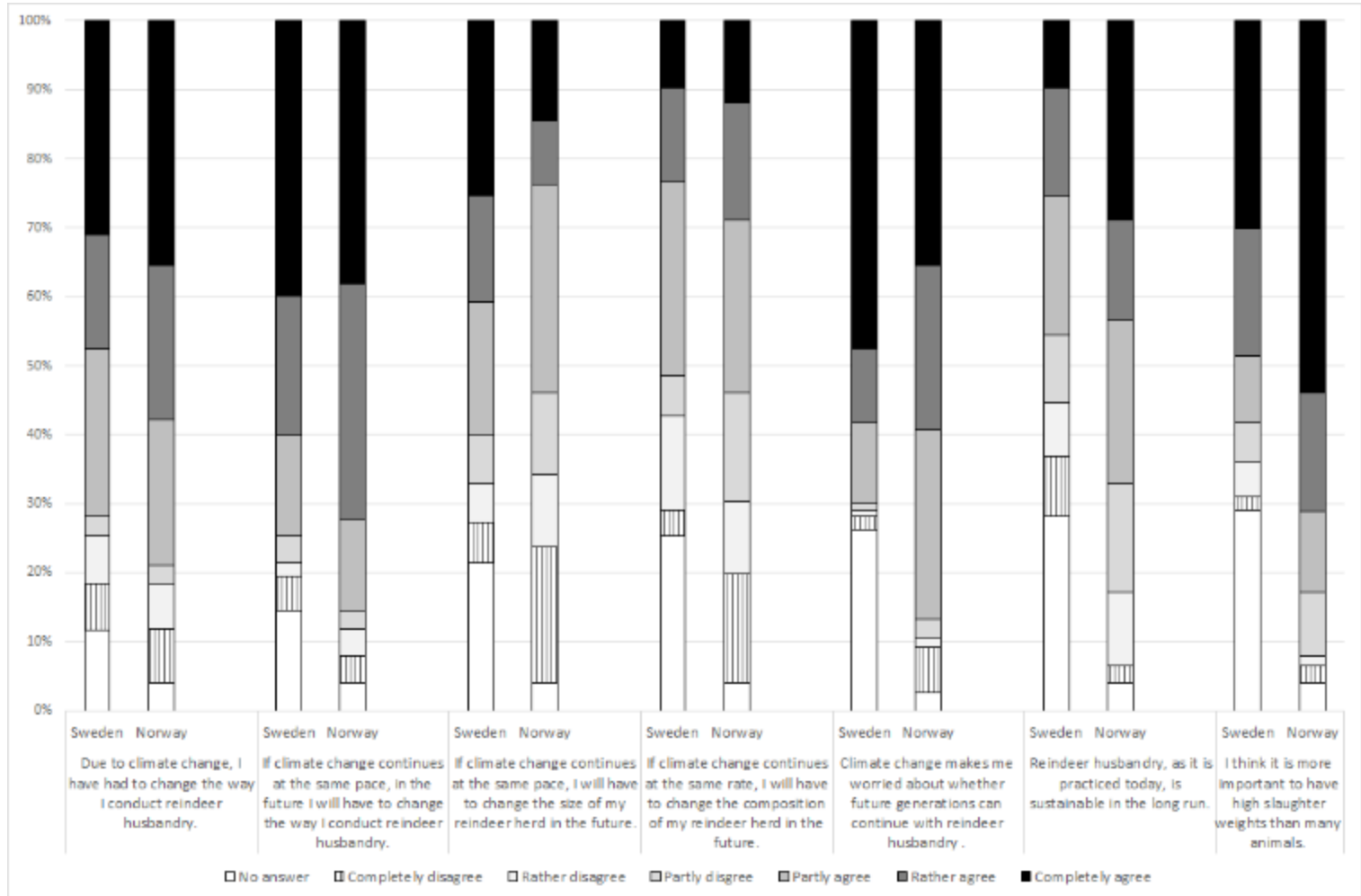
Carnivores and Forestry are higher/as high as Climate.
 Note the difference between Sweden and Norway
 in terms of **Forestry!**

Top Norway:

- Wind power
- Carnivores
- Mining
- Climate
- Government influence and regulations.

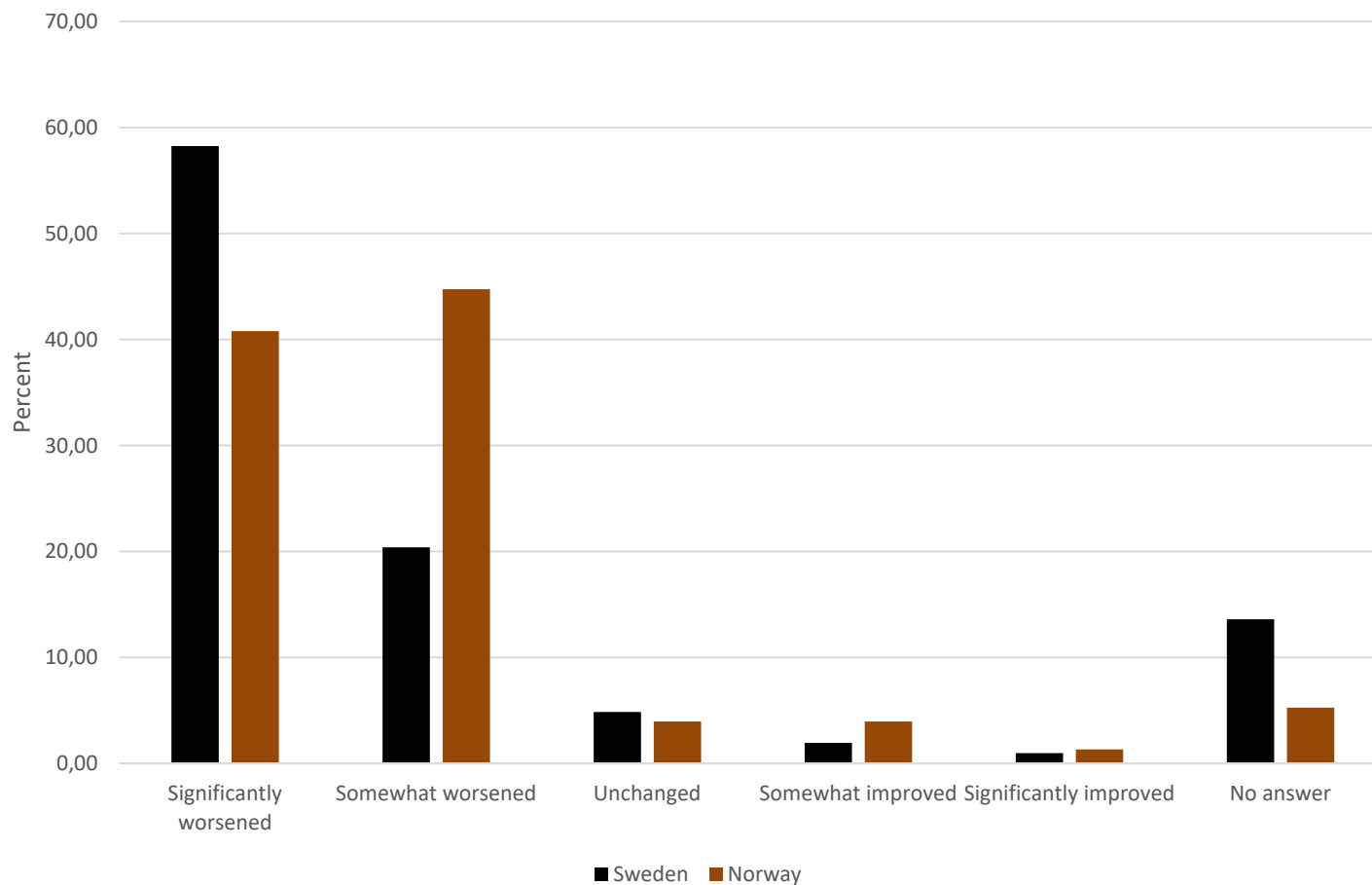
Wind Power, Predators and Mining are higher/as high as Climate.
 Note the difference between Sweden and Norway
 in terms of **Hiking tourism!**

Percentage distribution of response to various statements about the effects of climate change



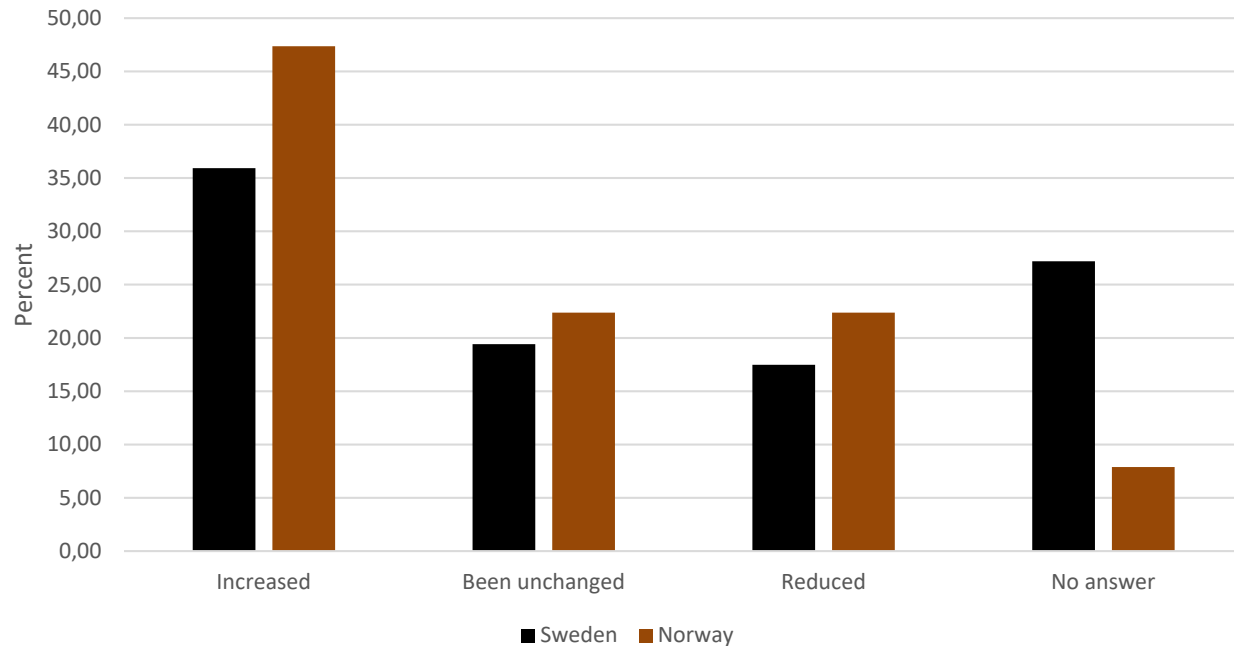
Climate change and grazing conditions

Overall, climate change is leading to reindeer's food availability becoming...



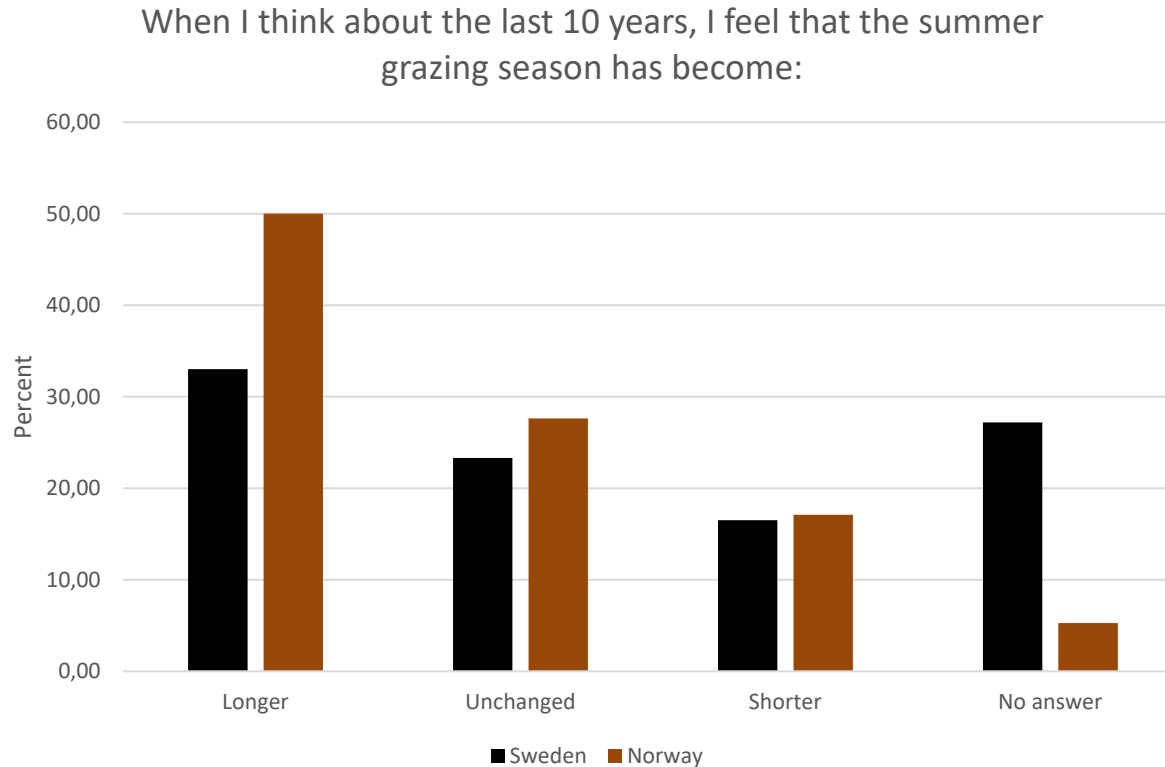
Climate change and snow depths

When I think about the last 10 years, I feel that the snow depth has:



Not very clear results - those who think the snow depth has remained unchanged plus those who think it has decreased roughly the same percentage as those who think the snow depth has increased.

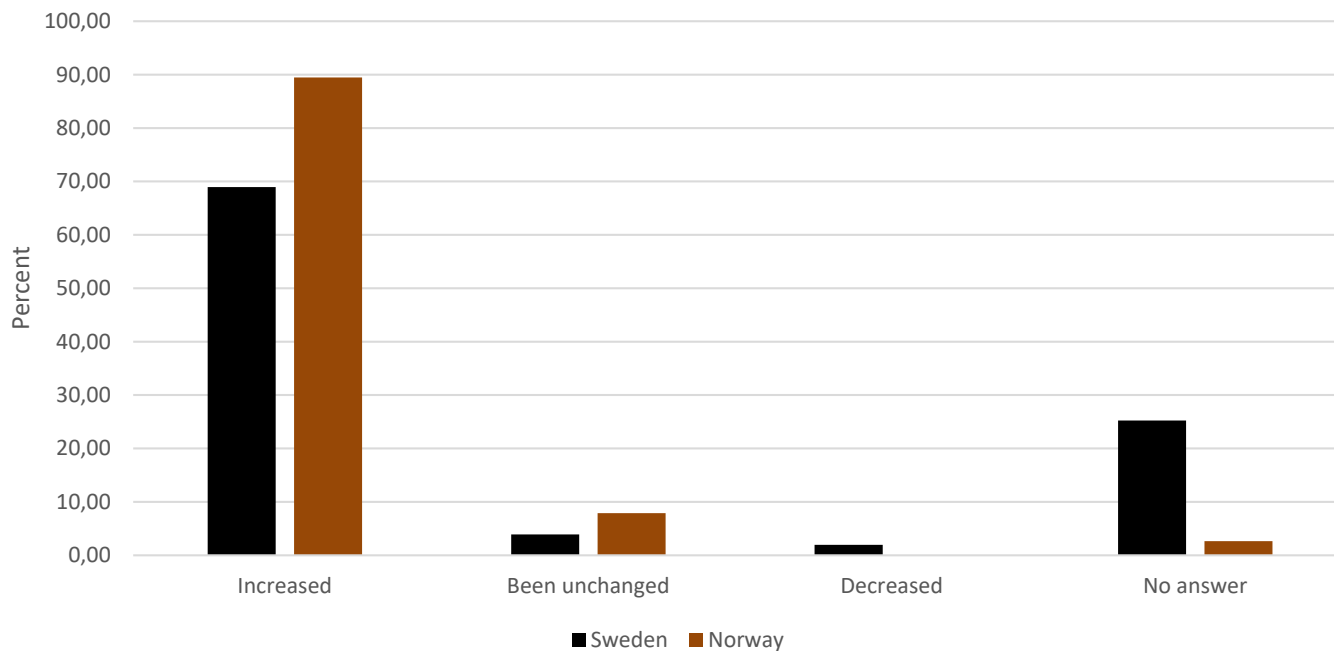
Climate change and the summer season



Not very clear results here either – those who think the summer season has been unchanged plus those who think it has become shorter are about the same percentage as those who think the summer season has become longer.

Climate change and ice capped grazing

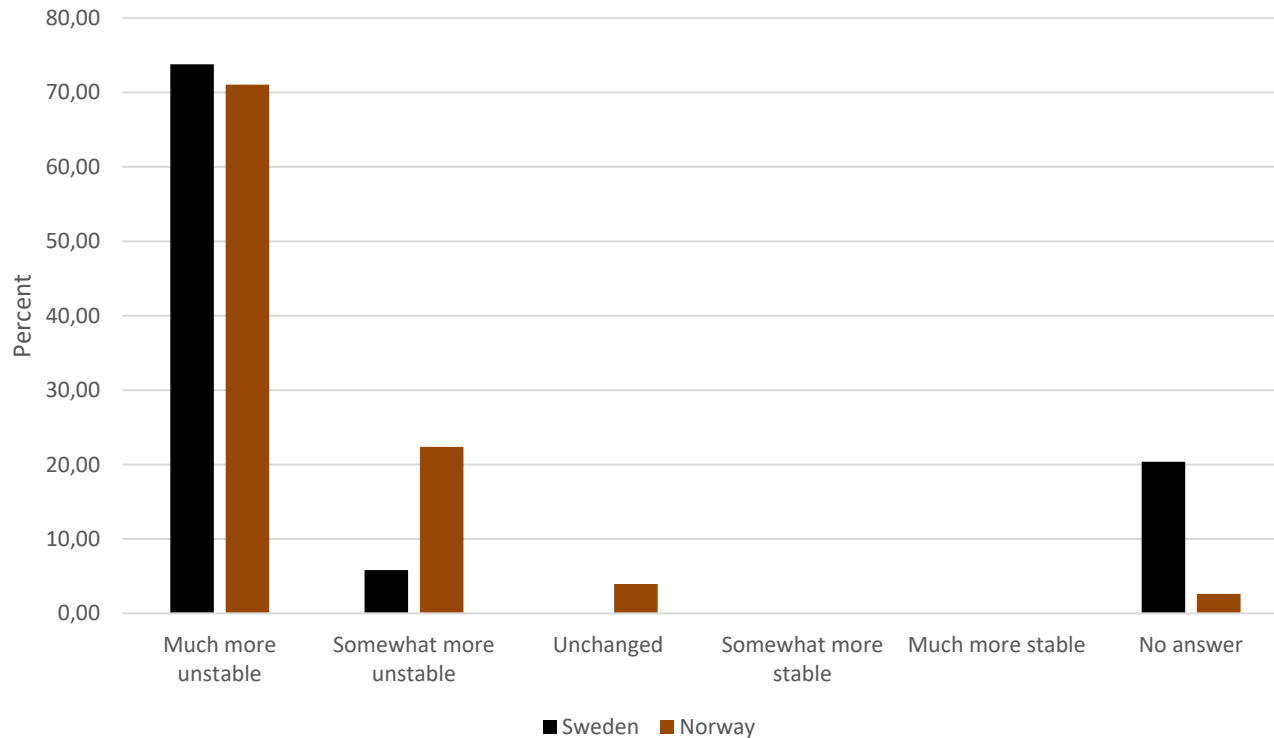
When I think about the last 10 years, I feel that problems with ice-covered pastures have:



Very clear results here!

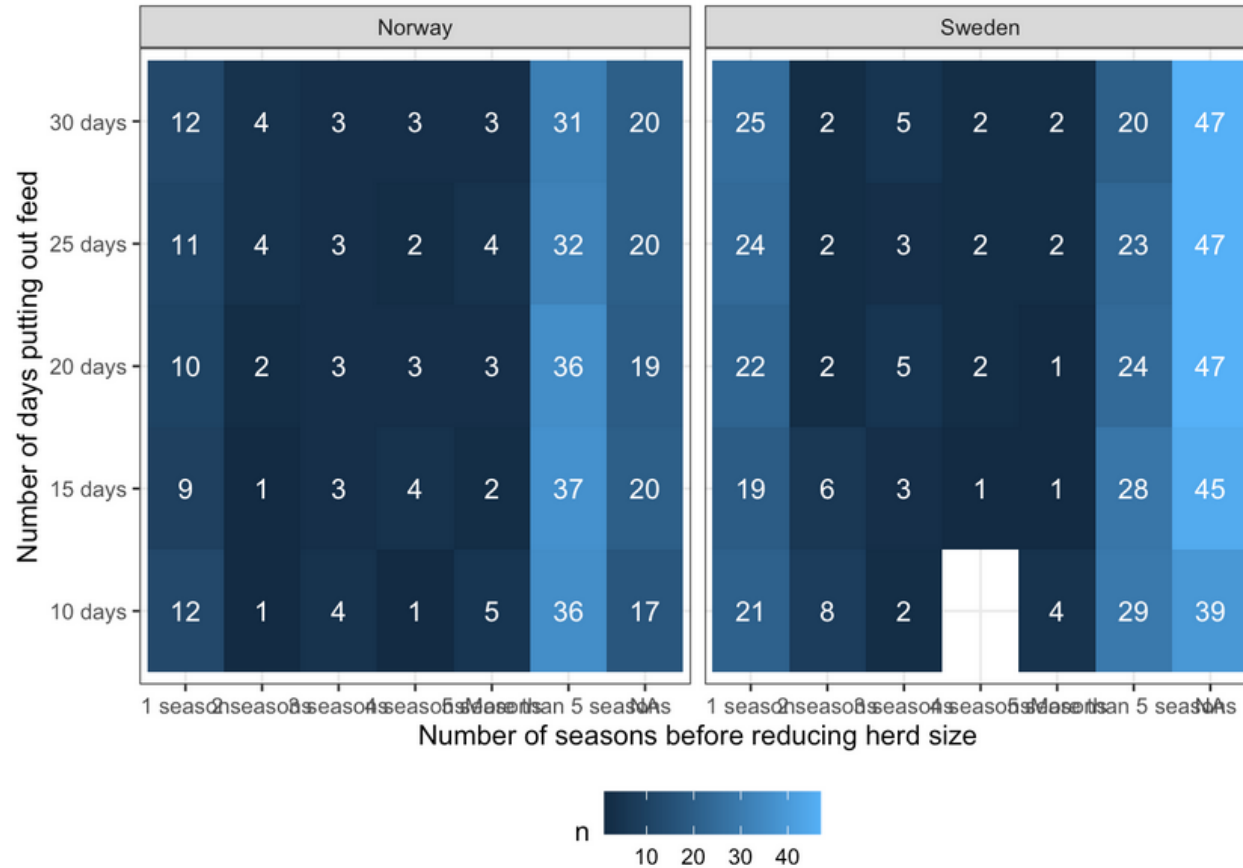
Change in climate stability

When I think about the last 10 years, I feel that the weather conditions are:



Very clear results here too!

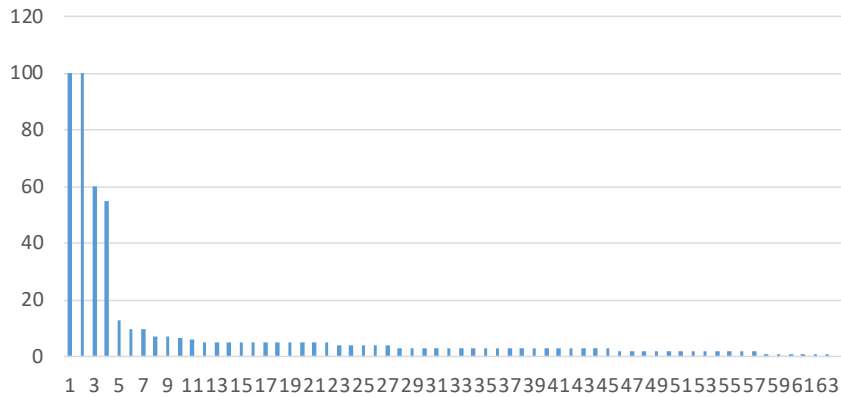
How long can herders do foddering before reducing herd size?



Self-sufficiency: reindeer husbandry

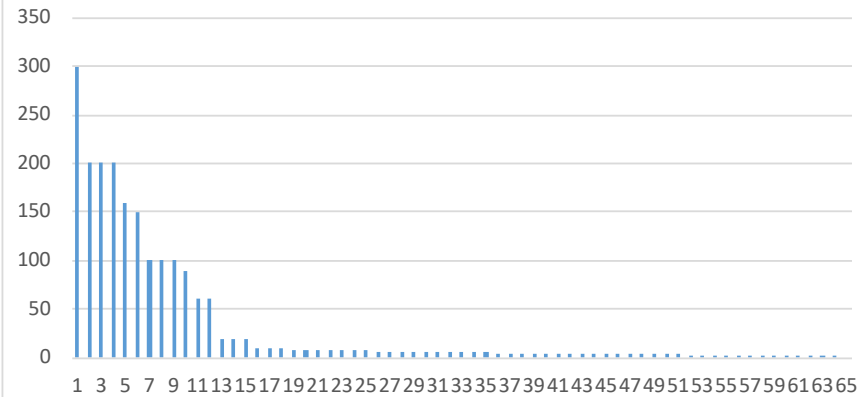
Sweden (Note: item non-response: 39 and 44 %)

Kg reindeer meat fro own reindeer consumed in household per week (Mean: 8 kg; Median 3 kg)

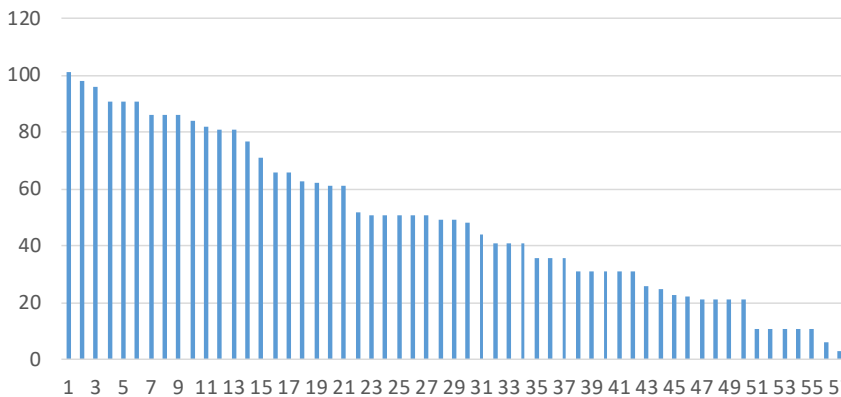


Norway (Item non-response: 14 and 8 %)

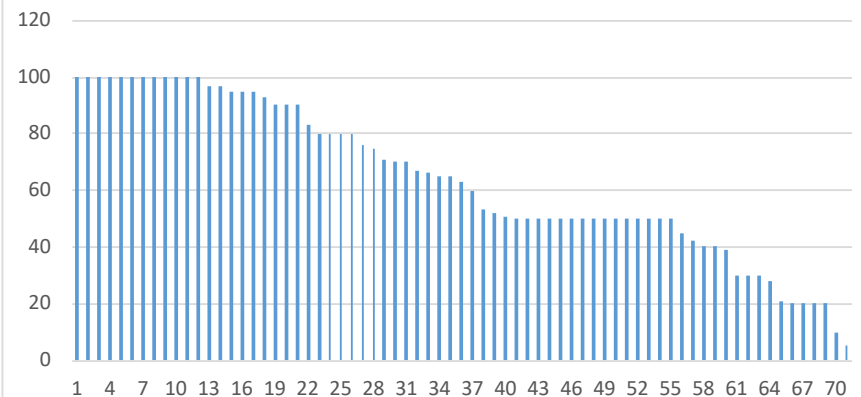
Kg reindeer meat from own reindeer consumed in household per week (Mean: 31; Median: 5)



Share of household income from reindeer husbandry (Mean: 49%; Median: 48%)



Share of household income from reindeer husbandry (Mean: 64%; Median: 61.5)

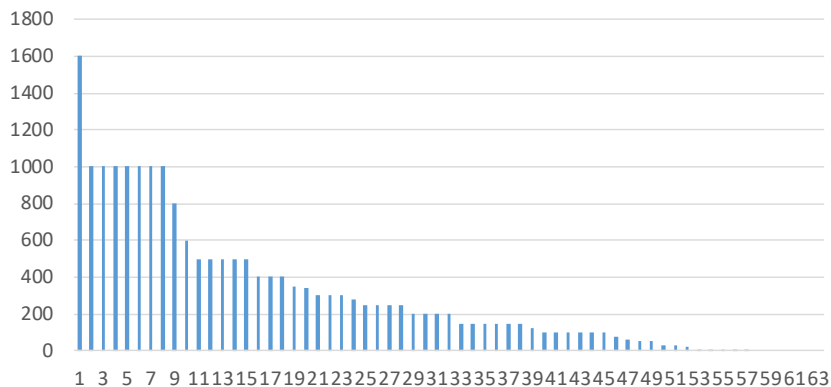


Self-sufficiency: ungulate hunting

Sweden (Item non-response: 39 and 58 %)

Norway (Item non-response: 20 and 41 %)

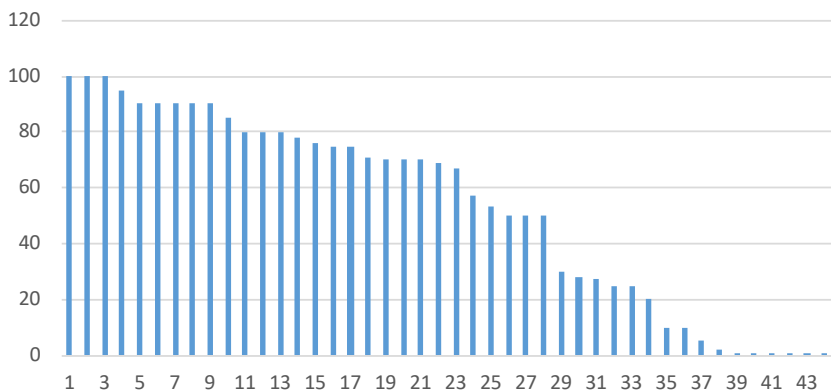
Kg of meat from ungulate hunt, per year (Mean: 307; Median: 200)



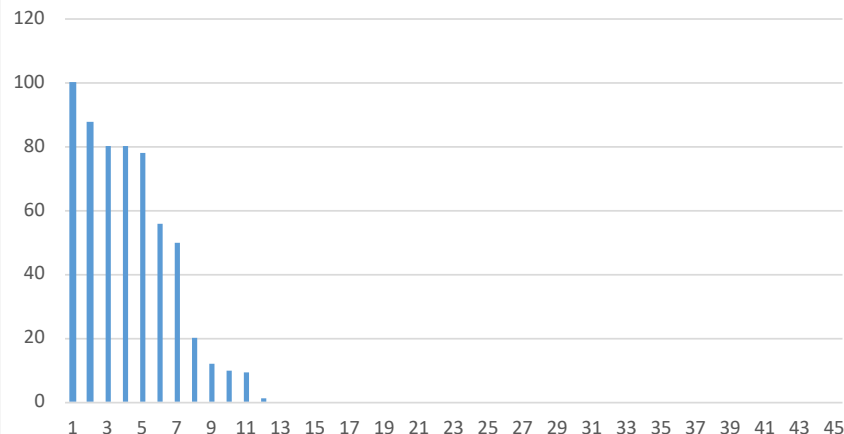
Kg meat from ungulate hunt, per year (Mean: 36; Median: 0)



Share ungulate game meat sold (%) (mean 53%; Median: 68%)



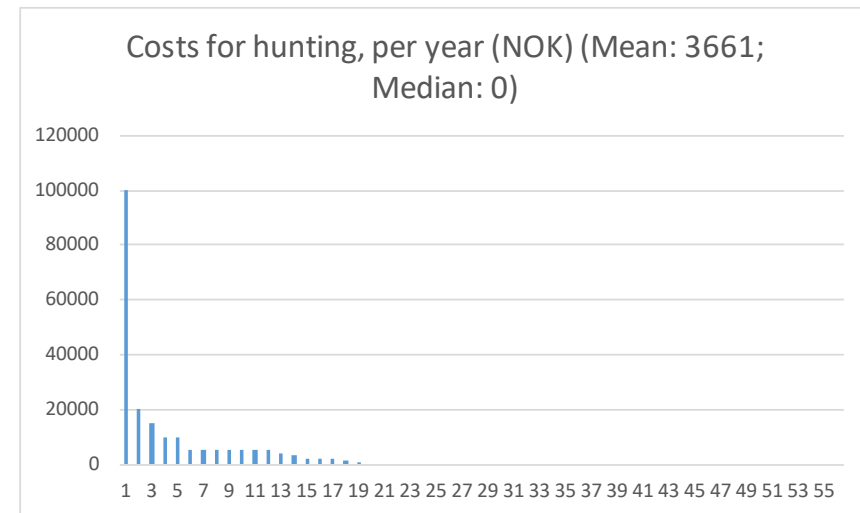
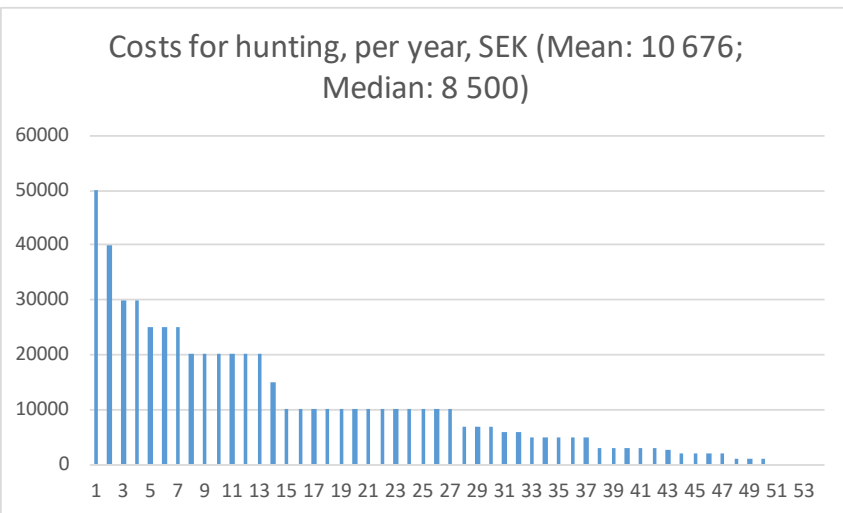
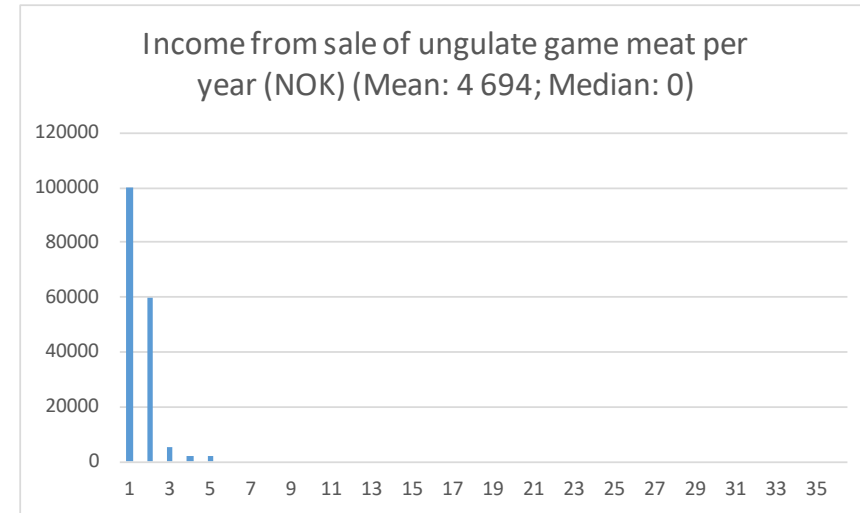
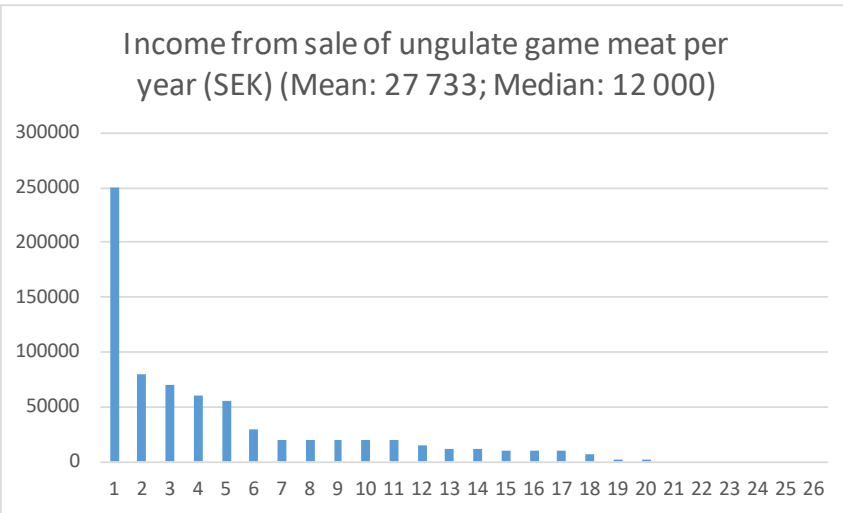
Share ungulate meat sold (%) (Mean: 13; Median: 0)



Incomes and costs for hunting

Sweden (Item non-response: 75 and 48 %)

Norway (Item non-response: 54 and 28 %)



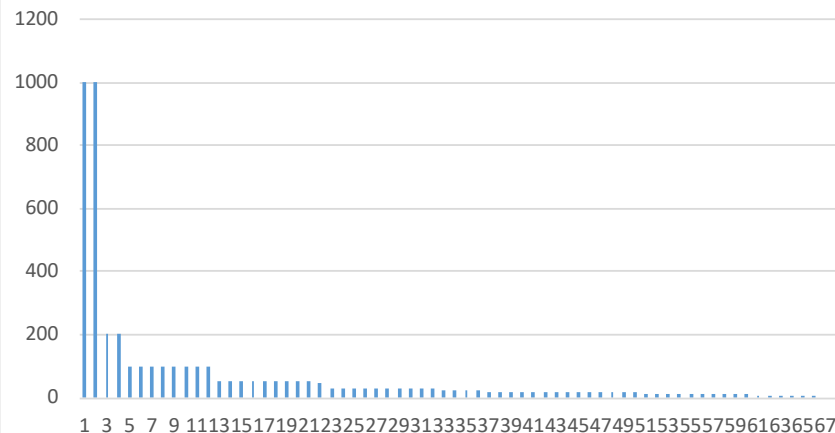
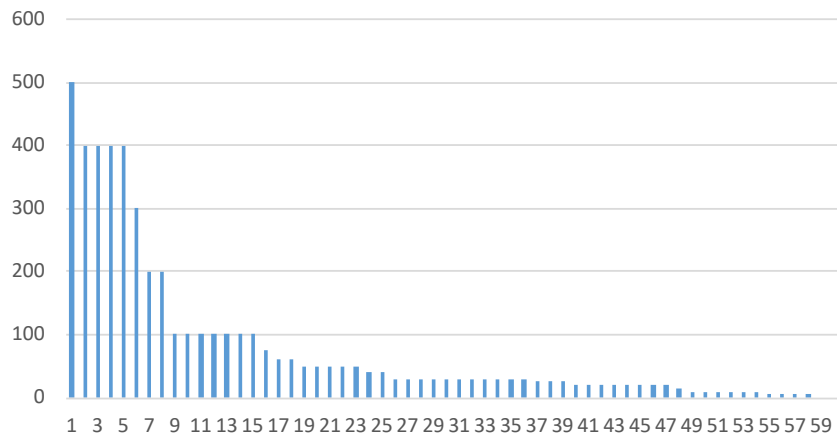
Self-sufficiency: fishing

Sweden (Item non-response: 43 and 52 %)

Norway (Item non-response: 12 and 22 %)

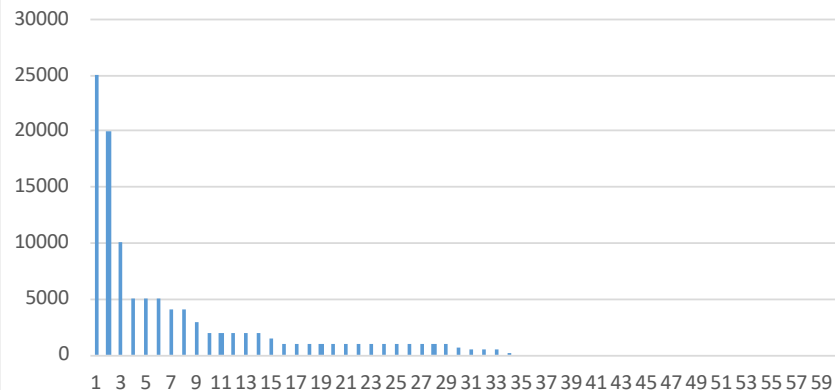
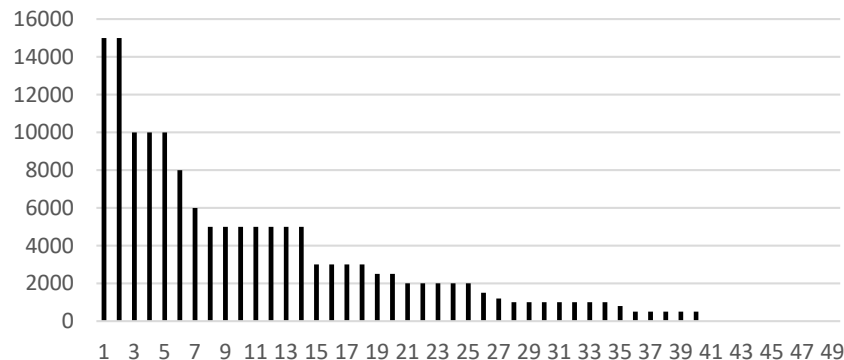
Kg fish caught per year (Mean: 78; Median: 30)

Kg fish caught per year (Mean: 66; Median: 25)



Costs for fishing per year, SEK (Mean: 3 041; Median: 2 000)

Costs for fishing per year, NOK (Mean: 1 813; Median: 550)



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Thank you!

