

Habitat preferences of ptarmigan hunters in Norway

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Abstract Hunting for willow ptarmigan (*Lagopus lagopus*) is a popular recreational activity in Norway, but studies of the hunters are limited. While large game management in Norway is based on sound models and research, management of small game hunters and hunting have not been subject to the same rigour. Compared to the extensive body of knowledge about ptarmigan behaviour and habitat preferences, the knowledge base on ptarmigan hunters is very limited. We surveyed the habitat preferences of 3,056 hunters to identify preferred landscape categories using pictures covering a range of landscape types. We also examined to which extent residence types and forms of hunting were related to habitat preferences. Through factor analysis, we identified three categories of hunting habitat; mountain forest, low alpine and high alpine. Mode of hunting is more important than residence status in terms of preferred habitat. Hunters using dogs preferred mountain forest and low alpine habitats more than hunters without dogs. Hunters without dogs had a higher preference than dog hunters for high alpine habitats. Hunters with mixed modes of hunting have wider habitat preferences. Residence status only affects the perception of the mountain forest habitat. The results may have implications for management as land use and place-based meanings are currently changing in many natural and rural landscapes, and hunting needs to be integrated with other recreational uses.

Keywords Ptarmigan hunting · Habitat preferences · Hunter types · Land use values · *Lagopus lagopus*

Introduction

Hunting for willow ptarmigan (*Lagopus lagopus*) and rock ptarmigan (*Lagopus mutus*) is highly popular in Norway (Pedersen 2007). The willow ptarmigan is found in a range of alpine and sub-alpine habitats and is well adapted to a harsh mountain environment. The characteristics of preferred habitats are well known (Sachot et al. 2003; Hannon and Martin 2006; Pedersen et al. 2006, 2007; Hakkarainen et al. 2007). However, the versatility of the bird is a challenge to the hunter since the birds frequently move between high and low ground and widely different habitats dependent on weather conditions, amount of disturbance in the area and the time of the year.

In Norway, there is a high number of hunters in relation to the general population. Historically, hunting has been accessible to the general public at low cost (Pedersen 2007). Currently, around 190,000 persons purchase the national hunting fee. Roughly 140,000 persons actually hunt, of which 25% hunt for both small and large game, while 40% hunt only large game, and 35% hunt only small game (Statistics Norway 2007). However, the number of ptarmigan hunters and harvest rates have declined since the mid 1980s. This decline seems to be part of a general decline in hunting in Europe and North America (Heberlein 2007). In 1985, approximately 750,000 ptarmigans were bagged, but in 2006/2007, a record low of 312,000 birds were harvested. The average hunter successfully bags six ptarmigans, but around 60% shoot less than this, and only around 10% harvest 20 or more birds in a season (Statistics Norway 2007).

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Hunting is deeply rooted in human behaviour. Modern reasons and motives for hunting are complex and range from survival to social prestige and recreation (Gat 2000). Hunters need to evaluate the probability of success when they choose locations and habitats in which to hunt. However, small game hunting is mostly carried out as a recreational activity where a range of motives are important (Ericsson and Stedman 2005; Wynveen et al. 2005; Barro and Manfredo 1996; Hammitt et al. 1990; Hendee 1974; Stankey et al. 1973). The purpose of hunting is to experience nature and change from everyday life, do pleasant things with friends, develop skills, work with dogs and catch game. Thus, success in hunting can be defined in many ways. Many hunters experience a high degree of satisfaction even though they report a low catch or even no catch at all. However, consumptive orientation differs among hunters, and highly harvest-oriented hunters are generally less satisfied than hunters who are motivated for other reasons (Burke and Hunt 2008; Faye-Schøll 2006; Gigliotti 2000). However, for most hunters, some level of harvest is required in the long run to maintain purpose and interest (Willebrand and Paulrud 2004). Success of bringing game home after the hunt is dependent on a range of factors such as previous experience with the area and habitat, knowledge of the behaviour of the species hunted, stalking and shooting skills, physical fitness and time spent in the area.

Because reasons for engaging in hunting are diverse, preferred habitat for hunting likely also varies. It is plausible that hunters evaluate hunting habitats both from probabilities of encountering game and likelihood of experiencing desirable recreational experiences. These experiences likely pertain to the accessibility of the terrain, such as how easy or difficult it is to move and navigate in, aesthetic properties and likelihood of meeting other hunters and other recreational user groups. Factors like cost of licences, distance to the hunting area and travel costs also shape decisions and hunting patterns. However, hunters, like other interest groups, likely hold certain perceptions and preferences for landscape or habitat types. The purpose of this paper is to examine habitat preferences among ptarmigan hunters in Norway, how these preferences vary among hunters and how they are related to different forms of hunting. Our specific objectives were to determine if a range of mountain landscape scenes can be grouped in broad categories of habitat types and to assess if preferences for these categories vary among types of hunters.

We segmented the hunter population according to whether they use dogs or not and between locals and outsiders. Hunting with or without dogs are two fairly different activities. Hunters without dogs are stalkers walking slowly through the terrain seeking to flush the birds themselves. Hunters with dogs mostly use pointing breeds and let the dogs quarter through the habitat in order

to pick up scents and locate the bird and hold the bird, which freezes in place until the hunter is ready to shoot. Given the considerable differences in using the landscape, one might expect differences in habitat preferences.

The outsider–local dichotomy is actually a three-category distinction since some local hunters also to some extent hunt outside their own municipality. Here, the difference is not related to how people hunt but to the fact that the hunter segments have differential access to hunting grounds and opportunities. Locals, i.e. people who have their main residence within the municipality, in most cases pay less for hunting licences and can normally start hunting at an earlier date in the season if they hunt with dogs than people who come from outside regions. Also, the number of licences is more limited for outsiders than resident hunters. Since locals live in or near the areas they hunt in, they are potentially, but not necessarily, more attached to these hunting areas. In many cases, they will also know the local geography and particular traits of the landscape better.

Methods and data collection

We used a cross-sectional case study design to conduct a survey measuring different aspects of hunter behaviour, preparations and training for hunting, attitudes toward hunting and wildlife management, outcomes and experiences related to ptarmigan hunting, encounters with other hunters, perceptions of game populations and environmental attributes, satisfaction and demand for different types of hunting-related services and products. In early 2007, 2,717 hunters from 23 areas with annual inventories of willow ptarmigan received a postal questionnaire. After two reminders, 1,602 completed questionnaires were received, providing a response rate of 59%. We simultaneously posted the survey on the Internet for anyone who wished to participate, and the link was administered through a range of relevant websites (hunting organisations, etc.). The web survey received 1,215 responses. This sub-sample did not contain variables linking each response to a particular hunting area with inventory data, but it could be broken down to the municipality level. The combined samples comprised 3,056 responses, which is estimated to be around 5% of the population of ptarmigan hunters in Norway (Statistics Norway 2007).

Respondents were asked to rate 12 colour photographs of different landscapes which represented some form of ptarmigan biotope. Ptarmigan biotopes are well known and range from sub-alpine forests and meadows to high alpine rocky ground, and this range was covered in the selection of photos. We selected scenes that portrayed similar weather conditions, lighting and depth (i.e. amount of terrain covered by the picture).

For each scene, the respondent was asked to indicate how attractive they found it as ptarmigan habitat on a five-point scale from 'not attractive at all' to 'very attractive'. Hunters were also asked to indicate which of the pictures best resembled the area they usually hunted. Furthermore, they were requested to rate how amenable this terrain was to hunting with four options ranging from very easy to very difficult. Landscape preferences were analysed by ranking the scenes based on their mean scores of attractiveness. Then, a factor analysis with principal components extraction and varimax rotation was used to elicit main aggregate dimensions of landscape images. Relationships between hunter types (dog hunters vs no-dog hunters and local residents vs outsiders) and habitat preferences was analysed using one-way analysis of variance.

Results

Hunter characteristics

Respondents in this survey reflected the population characteristics of ptarmigan hunters in Norway. The sample was heavily dominated by men (93.5% men, 6.5% women), and the mean age was relatively high (45 years of age). The average hunter had completed 14 years of school. Hunters with dogs had, on the average, been hunting for 21 years, while hunters without dogs had, on the average, hunted for 17 years.

Landscape preferences

The rating of all landscape scenes (except 2) in terms of how attractive they appear as habitat for ptarmigan hunting

were on the positive side of the scale, i.e. they were to some degree perceived as attractive for ptarmigan hunting (Table 1). However, none of the scenes were rated as very attractive in terms of mean scores. For all landscape scenes, individual scores ranged from one (not attractive at all) to five (very attractive).

The most attractive landscape was a typical sup-alpine terrain with mountain birch forest in the foreground and with high alpine and fairly rocky areas in the background (picture 1, mean score 4.3). More than one-half (53%) rated this as a very attractive biotope (score of five) for hunting. Approximately one-third of the hunters (34.4%) reported that this scene best resembles the terrain they usually hunt in. This scene reflected a typical early fall season willow ptarmigan biotope. The least preferred scene was a landscape with a boulder field in the foreground, a coniferous forest in the centre and alpine hills in the background (picture 3). More than one-half of the respondents (58%) rated this as an unattractive or not at all attractive biotope for ptarmigan hunting (score of one or two). This landscape is not a typical ptarmigan biotope, at least during the fall hunting season, although the species does exist in this type of landscape. The remaining landscape scenes all elicited mean scores between three and four.

All landscape scenes yielded a diversity of responses, indicating that the different biotopes were perceived differently among groups of hunters in terms of how suitable they are for ptarmigan hunting. This is also reflected in how the respondents reported on which landscape scenes best resembled the area they usually hunt in. Except for picture 1, there is a fairly even distribution across the other 11 landscape scenes (Table 1). When asked

Table 1 Mean scores for habitat preferences — individual pictures

Picture no.	Picture content	Mean score	Std. Error	N	Resembles the area usually hunted in (%)
1	Birch treeline with high alpine areas in background (autumn colours)	4.29	0.018	2,499	34.4
2	Rocky and barren high alpine areas with small lakes	3.15	0.025	2,486	11.2
3	Mixed coniferous forest, rocky fields and peaks in the background	2.43	0.023	2,474	2.0
4	Rolling high alpine area covered with low willow, grass and lichens	3.76	0.020	2,477	4.6
5	Lush/green rugged high alpine area	3.81	0.021	2,473	8.2
6	Mixed pine/birch sub-alpine forest	2.67	0.025	2,468	1.8
7	High alpine boulder field	3.31	0.026	2,481	9.2
8	Alpine valley with rich willow/birch vegetation surrounded by rugged peaks	3.39	0.022	2,471	1.6
9	Sub-alpine marshes interspersed with spruce forest and lake in the background	3.39	0.025	2,471	7.0
10	Sub-alpine birch forest with rugged peaks and several mountain lakes in the background	3.97	0.020	2,470	8.8
11	Open, barren high alpine slope with rocks and short grass/lichens	3.32	0.024	2,473	8.1
12	Open, sub-alpine pine forest and marshlands with small ponds	3.18	0.024	2,468	2.9

Response format: 1: not attractive at all–5: very attractive

how they would rate this biotope, i.e. the terrain they usually hunt in, one-half of the hunters (54.4%) stated that this biotope was suitable or easy to hunt in. Another 40% claimed that it is for the most part easy to hunt in this biotope, and only 5.5% found this type of landscape difficult or very difficult to hunt.

Categories of preferred habitats

The factor analysis produced a three-factor solution explaining 60.7% of the variance (Table 2). Reliability analysis produced satisfactory alpha values for the three landscape dimensions or categories (0.62–0.74). Two landscape scenes (pictures 1 and 10) were omitted from the final factor solution since these items lowered the reliability, i.e. unidimensionality of the scales. The remaining 10 landscape scenes were then grouped into three landscape categories; mountain forest, high alpine and low alpine (Table 2).

Effects of hunter types

The three landscape categories from the factor analysis were then used in the subsequent analysis to test the effect of hunter segments on habitat preferences. The main dichotomy in ptarmigan hunting in Norway is between hunting with or without dogs, and differences might be expected in habitat preferences among the two hunter types. The sample of respondents also contains a smaller group of hunters that are active in both forms of hunting. Significant differences were found for all three landscape categories (mountain forest, $F=79.14$, $\text{Signf.}=0.000$; high alpine, $F=198.38$, $\text{Signf.}=0.000$; low alpine, $F=16.28$, $\text{Signf.}=0.000$). Hunters with dogs rated the mountain forest and low alpine landscape categories as more attractive for hunting than hunters without dogs. High alpine landscapes were more preferred by hunters without dogs. Hunters who engage in

both forms of hunting rated the attractiveness of the mountain forest category higher than those who hunt solely without dogs but lower than those who hunt only with dogs. They rated the low alpine category attractiveness equal to, or slightly higher than, those hunting without dogs (depending on the individual scene) but lower than those who only hunt with dogs. For the high alpine landscape category, those with mixed hunting practices rated these landscapes as more attractive than those who use dogs all the time, but less attractive than those who never use dogs (Table 3).

Residence factor had less effect on habitat preferences than the difference between hunters using dogs and those hunting without dogs (mountain forest, $F=9.05$, $\text{Signf.}=0.000$; high alpine, $F=1.23$, $\text{Signf.}=0.292$; low alpine, $F=0.486$, $\text{Signf.}=0.615$). Significant differences in preferences were only found for the mountain forest landscape category. Locals who hunt both in their home areas and outside the local municipality rate the four landscape scenes in the mountain forest category highest of the three segments. Outside hunters rate the mountain forest landscape scenes higher than those who only hunt in their local area. Outsiders rate the four landscape scenes as significantly more attractive than local residents but less attractive than those who hunt in their local area as well as in other areas (Table 4)

Discussion

This study suggests that ptarmigan hunters are concerned with landscape characteristics and express distinct habitat preferences. However, the hunting experience is complex and usually comprised of various elements relating to companionship with others, skill development, experience of nature, physical activities, planning, equipment and relationships to place (Willebrand and Paulrud 2004; Kyle et al. 2005). Studies of recreational fishing have documented that the actual catch plays a limited part in the

Table 2 Habitat preference dimensions (principal components, rotated factor solutions and reliability analysis)

Factor	Eigen values	Pictures no.	Factor scores	Picture variance	Cumulative variance	Alpha for scale
Mountain forest	2.81	12	0.84	28.1	28.1	0.74
		6	0.77			
		3	0.73			
		9	0.61			
High alpine	2.0	11	0.83	20.0	48.1	0.71
		7	0.80			
		2	0.73			
Low alpine	1.25	5	0.84	12.5	60.7	0.62
		4	0.69			
		8	0.67			

Table 3 Habitat preferences for individual landscape scenes for hunters with and without dogs (mean scores and analysis of variance)

Picture no.	Hunter types			<i>F</i>	Signf.	<i>N</i>
	With dogs	No dogs	Mixed			
1	4.33	4.22	4.36	4.22	0.015	2,476
2 HA	3.02	3.33	3.20	14.81	0.000	2,461
3 MF	2.44	2.38	2.55	2.76	0.063	2,451
4 LA	3.79	3.72	3.72	1.47	0.231	2,454
5 MF	3.94	3.64	3.71	21.33	0.000	2,450
6 MF	2.85	2.40	2.64	34.80	0.000	2,445
7 HA	2.78	4.01	3.70	290.12	0.000	2,458
8 LA	3.51	3.22	3.37	17.45	0.000	2,448
9 MF	3.77	2.84	3.19	162.64	0.000	2,448
10	4.16	3.65	3.98	65.44	0.000	2,447
11 HA	3.02	3.79	3.37	109.90	0.000	2,450
12 MF	3.45	2.83	2.98	74.04	0.000	2,445

HA high alpine, LA low alpine, MF mountain forest

overall satisfaction with the activity (Kyle et al. 2007; Aas and Kaltenborn 1995). Hence, landscape perceptions and preferences may also be important for hunters for reasons other than judging the likelihood of finding game.

In this study, a range of habitats or landscape types were attractive to the hunters, although there was a range of responses for each landscape type. This indicates diversity in preferences and that different hunter segments perceive the same landscape scenes differently. The three landscape categories found here largely reflect a traditional geographical gradient from the upper reaches of the mountain forest and timberline up through sub-alpine brush, marshes and open fields to the high-level boulder fields and ridges. The mountain forest and low alpine areas constitute typical willow ptarmigan habitat, while the high alpine landscape category represents typical rock ptarmigan habitat. Not surprisingly, hunters who use dogs prefer the mountain

forest and low alpine areas, since these are the best habitats for willow ptarmigan. The rock ptarmigan is usually not hunted with dogs, due to its tendency to run or fly rather than freeze for pointing dogs. For hunters who engage in both forms of hunting (dogs and no dogs), the picture is less clear since their preferences are related to two types of hunting.

The way the hunting is performed is a better discriminator of landscape preferences than where the hunter resides. Residence probably influences other aspects of the hunting activity such as where, when, for how long and with whom one hunts, but it is not of paramount importance for how the hunter views the attractiveness and suitability of the habitat. In contrast, the local–outsider dichotomy may be important in terms of attitudes toward management, access to and pricing of hunting, knowledge of the area and attitudes toward other hunters. The potential importance of the local–outsider distinction is worth further research.

Table 4 Habitat preferences for individual landscape scenes for local residents and outsiders (mean scores and analysis of variance)

Picture no.	Residence types			<i>F</i>	Signf.	<i>N</i>
	Locals	Outsiders	Mixed			
1	4.34	4.26	4.37	3.20	0.041	2,449
2 HA	3.20	3.12	3.21	1.34	0.263	2,435
3 MF	2.43	2.41	2.55	1.71	0.180	2,425
4 LA	3.72	3.76	3.81	0.88	0.413	2,427
5 MF	3.82	3.81	3.86	0.21	0.810	2,423
6 MF	2.78	2.57	2.99	15.87	0.000	2,419
7 HA	3.31	3.31	3.34	0.08	0.926	2,431
8 LA	3.46	3.35	3.50	3.53	0.030	2,421
9 MF	3.50	3.30	3.53	8.57	0.000	2,423
10	4.09	3.91	4.14	6.62	0.001	2,421
11 HA	3.21	3.38	3.26	5.21	0.006	2,424
12 MF	3.23	3.13	3.31	3.12	0.044	2,419

HA high alpine, LA low alpine, MF mountain forest

We expect that preferences for habitat types may be affected by several factors. Naturally, most hunters seek to find game, although the consumptive orientation varies greatly among hunters. However, the knowledge level about the ptarmigan's behaviour and how this is related to landscape attributes is likely to vary greatly, and more specialised and knowledgeable hunters may seek out different terrain from the novice hunter.

Not all habitat types are equally available everywhere in terms of time, money, local geography and practical arrangements. Since hunting is a complex experience where bagging game is only one of several goals, we also expect aesthetic properties to play a part because the hunters seek overall positive experiences. Furthermore, hunting can be a physically demanding activity, and the perceived difficulty of moving through a particular type of area could well affect the perception of how suitable it is for hunting. One study showed that ptarmigan hunters put in long hours when they hunt, and in total, move considerable distances but stay relatively close to the point of departure. Eighty two per cent of the hunters remained within a 2.5-km range of their cabin or point of departure (Brøseth and Pedersen 2000).

Our results support conventional wisdom that ptarmigan hunting is performed in a range of habitats and that the birds are hunted in different ways. It has management relevance because those who hunt with dogs and those who hunt without dogs differ in their habitat preferences. The two forms of hunting are usually priced differently, and access is more controlled and limited for hunters using dogs since this is assumed to be a more effective method of hunting. Because the two forms of hunting may be somewhat incompatible, the differing habitat preferences could support zoning hunting areas for part or all of the hunting season. Interestingly, other studies have found that the presence of a dog did not affect hunter satisfaction or success (Frey et al. 2003). However, ptarmigan hunting is somewhat unique, so the relevance of comparing the importance of dogs may be limited.

Further research is needed on several topics related to recreational small-game hunting. Landscapes are changing throughout Europe as agricultural systems are being transformed, settlement patterns change and land is being used for new purposes (Bastian et al. 2006; Bujis et al. 2006). Furthermore, there is an interesting research challenge in the nexus between the commercialisation of hunting and old traditions of subsistence and recreation. This leads to increased differentiation in the market (MacMillan 2004; Willebrand and Paulrud 2004). Although the number of small-game hunters in Norway has declined over the last 25 years, the commercial value of hunting is growing as hunting rights are increasingly sold as components of a complete hunting package with logistics, accommodation, food, guiding and other services included. It is plausible that

this development will entail using new types of landscapes and game species, such as lowland areas and other grouse species. International trends and hunting practices are likely to influence the development of commercial small game hunting in Norway, and improved knowledge about the preferences, attitudes and expectations of the hunters will be important both for enterprise development and management.

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