GROUSE NEWS

Newsletter of the Grouse Group *of the*
IUCN/SSC-WPA Galliformes Specialist Group

Galliformes Specialist Group

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Contents

From the Editor

The earthquake and the following tsunami with the subsequent nuclear crisis stopped the conference in Japan this summer and forced the organizers to postpone it. As you all remember, it was decided to postpone it till July 2012. According to Hiroshi Nakamura, the organizer in Japan, it is planned to have the 12th International Grouse Symposium in July next year. The Japanese have control over the problems they had with the nuclear plants and other problems they had. The web site with more information will be up and go later this autumn.

There are many interesting articles in this issue of Grouse News. An article summarizing many years of research on grouse in Russia and Norway is published. Contribution dealing with different aspects of capercaillie is presented like winter roosting trees of Cantabrian capercaillie, genetic differentiation in western capercaillie, problems with disturbance and predation. It is also articles on sharp-tailed grouse, greater sage-grouse, and greater prairie-chicken. Research on how grouse prevent overdosing of plant chemicals in presented. Under snippets sage-grouse conservation strategy and potential threat, and information on a galliform project is found. We would also extend our congratulations to Jack Connelly who received the Hamerstrom Award for his grouse work.

In the last issue we had some discussion and early results of using GPS technology for studying grouse. We had hoped for a follow-up of this topic in this issue from those of you using the GPS technology, but unfortunately no contributions related to this has come. If you are working with this topic we ask you to write something for the next issue,

The 6th European conference on black grouse will be held 17-20 September 2012 in Gysinge in Sweden. An updated web page is soon coming.

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From the Chair

The next year, 2012, will be a tough one for our international conference travel agendas, with the International Wildlife Management Congress in Durban, South Africa (9-12 July 2012), the International Grouse Symposium in Matsumoto, Japan (20-24 July 2012, http://cert.shinshu-u.ac.jp/eco_lab/modules/tinyD4/), and the 6th European Conference on Black Grouse in Sweden 17-20 September 2012, http://www.ebc.uu.se/blackgrouse/).

Having both the IGS and the ECBG in the same year might not be ideal, and is a result of postponing the IGS due to the tsunami and nuclear catastrophe in Japan in 2011. Yet, based on previous lists of participants, there is normally not much overlap between the IGS and its international attendance of mostly scientists, and the conservation practice-focused ECBG. I therefore hope for both meetings being well attended.

Thanks to the dedication of organizer and host professor Hiroshi Nakamura and his team, the 12th International Grouse Symposium in Matsumoto, Japan, will take place largely as planned, with four days of conference followed by extended field trips either to the Japanese Alps to experience the famously tame Japanese rock ptarmigan, or to Hokkaido and the habitats of the Japanese hazel grouse. The (improved!) IGS website will go online soon to start the registration process. Please help spreading the information, and particularly also encourage student grousers to attend. I will be there, and I hope to see many of you in Matsumoto for a stimulating symposium.

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NEWS FROM GALLIFORMES SG

Issue 5 of *G@llinformed* (Edited by Gilbert Ludwig, Finland) went out in early July 2011. It included a further technical comment on the utility of satellite tags for tracking grouse. There is also a report on a WPA field training workshop in Pakistan in April, which was supported by James Goodhart through the GSG.

At the instigation of the SSC Chair's Office, we are continuing to discuss how Taxon Advisory Groups (TAGs) of the European Association of Zoos and Aquaria (EAZA) and IUCN/SSC Specialist Groups (SGs) could work together more closely for mutual benefit. Longstanding connections with the EAZA Galliformes-TAG and the World Pheasant Association's (WPA) European Conservation Breeding Group (ECBG) pre-adapt the Galliformes SG to forge strong links with zoos, private breeders, along with our many *in situ* experts. SSC has now asked us to become a pilot SG for this approach, one goal of which is to seek EAZA institutional support for the GSG, which would undoubtedly enable us to operate more efficiently and pro-actively. The other inevitable benefit would be increased interaction between *in situ* and *ex situ* species experts, resulting in better strategic planning of conservation action.

Richard Fuller (Red List focal point, Univ. of Queensland) has contributed for the Galliformes SG to a current consultation within SSC on the minimum standards of documentation required for assessment of a species to be valid. The object is to simplify the process.

BirdLife International, as the Red List Authority for all birds, has highlighted a few Galliformes species for re-assessment of their current threat category: Taiwan partridge, Grey-striped partridge, Venezuelan wood-quail, Siamese fireback and Sula megapode, the last two being reviewed last year also. This process is moderated by WPA via the Threatened Galliformes Forum on the BirdLife website. All GSG members have until 5 December to comment, and to suggest any other species for consideration in the light of the latest information on status and threats. Among the grouse species, the Siberian spruce grouse might deserve re-assessment. It is currently listed as near-threatened, and its habitat is rapidly deteriorating due to commercial forestry. Please get in contact if you should have information on population and/or habitat that would allow a re-assessment.

GSG Co-Chairs Peter Garson and Ilse Storch and WPA Director Phil McGowan will have a good opportunity to discuss the changing roles of and relationship between GSG and WPA at the SG Chairs meeting being organised by IUCN and SSC in Abu Dhabi (23-27 February 2012). We need to rationalise partners and members and strategically share the workload on behalf of all our 73 threatened species. The shape of the GSG for 2013-16 (the next IUCN quadrennium) needs to emerge from these and later discussions.

Peter Garson & Ilse Storch, Co-Chairs, IUCN-SSC/WPA Galliformes SG, October 2011

CONSERVATION NEWS

U. S. Fish and Wildlife Service lists Cantabrian Capercaillie and five other foreign avian species under the Endangered Species Act.

Don Wolfe

Recently, Ilse Storch asked me if I would be willing to write a note about this listing action for inclusion in the Grouse News. Without giving it much thought, I initially agreed, but have since realized that this listing action is quite a delicate and controversial issue. Rather than expressing strictly my own opinions and conclusions (likely erroneous), I sent a query out to several grouse biologists in the United States, some of whom presently work for the U. S. Fish and Wildlife Service, for their comments. Below are a few of the comments (names have been omitted to protect the guilty). I hope that the comments may provide some insight, or at least some entertainment. Following the comments received are the press release by the USFWS on this action, and the official USFWS policy on listing foreign species, which may help to clear things up.

Comment 1. *It isn't April first, is it? I was floored when I read this. I don't know the answer to any of the questions asked except that this has 'Trouble' written all over it.*

Comment 2. *I would assume that the action was requested by Spain or the IUCN as a measure to prevent the smuggling of birds that are hunted illegally in Spain. I doubt this would have happened unless USFWS border agents caught someone trying to do it. This action probably has no bearing on the listing status of domestic species. . . . they are "apples and oranges." For what it's worth.*

Comment 3. *It doesn't make sense that it would be easy to list a Capercaillie and impossible to list a Gunnison Sage-Grouse.*

Comment 4. *I'm as puzzled by all of this as (name omitted) is. Perhaps someone in USFWS can shed some light on these decisions. The grouse conservation issues in this country are befuddled by bureaucracies. Consider that the new BLM sage-grouse conservation strategy (not that new, just recycled, it was originally trotted out in 2004) will result in the formation of 17 new teams or groups or committees and that many of the most knowledgeable people on the subject are apparently not involved at all. The USFWS seems to be fine with this approach. I am reminded of a quote from Adlai Stevenson...There is nothing more horrifying than stupidity in action."*

Comment 5. *I'm ccing (name omitted) in our DC international listing division, as she will be able to provide a more detailed response. However, the short answer to the justification for foreign species is that the ESA, section 4, applies to both foreign and domestic species and Section 8 provides for international cooperation*.

USFWS Press Release – 11 August 2011

The U.S. Fish and Wildlife Service (Service) announced today a final rule to protect six foreign bird species found on islands in French Polynesia and in Europe, Southeast Asia, and Africa as endangered under the Endangered Species Act (ESA).

The rule implements federal protections provided by the ESA for the Cantabrian capercaillie, Marquesan imperial pigeon, Eiao Marquesas reed-warbler, greater adjutant, Jerdon's courser, and slender-billed curlew. Populations of each of these species are small, fragmented, and declining, making them particularly vulnerable to genetic threats associated with small populations and extinction.

This determination follows a thorough review of the best available scientific information, comments from the general public, peer reviews, and any new information received during the public comment period following publication of the proposed rule to list these species.

Significant threats to these six foreign bird species include habitat loss, overutilization and inadequate existing regulatory mechanisms. Information on climate change was available for only one species, the slender-billed curlew; based on this information the Service found climate change to be a potential threat to this species.

Granting foreign species protection under the ESA means that the import or export of any of the species, or their parts or products, as well as their sale in interstate or foreign commerce, is prohibited. Permits for these prohibited actions may be issued for specific purposes consistent with the ESA.

The final rule will publish in the *Federal Register* on August 11, 2011, and become effective on September 12, 2011.

Official USFWS policy on listing foreign species
(http://www.fws.gov/endangered/what-we-do/international-activities.html)
The Branch of Foreign Species (BFS), like the domestic listing side of the Endangered Species Program, determines the status of foreign species and whether they should be added to the Federal list of threatened and endangered wildlife and plants and receive protections provided by the Endangered Species Act of 1973, as amended. The BFS also assesses foreign species already listed as threatened or endangered to determine whether they should be reclassified from threatened to endangered, reclassified from endangered to threatened, or removed from the list (delisted).

Why List Foreign Species?
The Endangered Species Act (ESA) requires the Service to list species as endangered or threatened regardless of which country the species lives in. Benefits to the species include prohibitions on certain activities including import, export, take, commercial activity, interstate commerce, and foreign commerce. By regulating activities, the United States ensures that people under the jurisdiction of the United States do not contribute to the further decline of listed species. Although the ESA's prohibitions regarding listed species apply only to people subject to the jurisdiction of the United States, the ESA can generate conservation benefits such as increased awareness of listed species, research efforts to address conservation needs, or funding for in-situ conservation of the species in its range countries. The ESA also provides for limited financial assistance to develop and manage programs to conserve listed species in foreign countries, encourages conservation programs for such species, and allows for assistance for programs, such as personnel and training.

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RESEARCH REPORTS

Research on Russian grouse

Olav Hjeljord, Per Wegge & Andrey V. Sivkov

A big conservation problem in Europe is dwindling populations of forest grouse. In continental Europe grouse has disappeared from large areas. Northern populations in Scandinavia and Finland still inhabit most of their former ranges, but numbers are below what they used to be, and pronounced cycles and peak populations rarely occur. Causes may be natural or man-made. If the latter is the problem – direct (habitat destruction) or indirect (increased predation) - the grouse situation should be different in undisturbed forests. With this as a background we set out to study grouse in the huge forest reserves of Northern Russia.

Throughout the Russian taiga there is a network of nature reserves (zapovedniks). In Eurasia they represent the last remaining areas of large, undisturbed, boreal forest, some cover several 1000 km^2. These reserves are research laboratories, were only scientists and reserve staff have legal access. Extensive monitoring of animal abundance, plant phenology, berry and seed production and climate are done on a yearly basis. In some reserves such data have been collected for more than 50 years.

During the last 20 years, most intensively during the last 10 years, we have studied capercaillie (*Tetrao urogallus*), black grouse (*Tetrao tetrix*) and hazel grouse (*Bonasa bonasia*), in Russian forest reserves. A main objective has been to understand grouse habitat preference and range use in forests undisturbed by man. Recently, more attention has been on population dynamics. We have worked in the Pechora Ilich-, the Central Forest- and the Pinezhskiy State reserves. During the latter part of the study, we selected the Pinezhskiy reserve (421 km^2), in the Pinega region, 300 km south-east of Archangelsk, as most suitable for our work, and most of the data presented here are collected in this reserve. The Pinezhskiy State reserve has a gentle topography with patches of rugged karst relief. Mature forest dominate with spruce (51 %) on areas of poor and medium drainage, pure pine stands on elevated ridges (2%) and mixed forests (11 %). Secondary, younger forest is mostly fire generated (27 %). Part of the reserve is dominated by large bogs (10 %).

The project has been a collaboration between Norwegian and Russian scientists, and data on Russian grouse have been compared with similar data collected in Western Europe. During the study 85 capercaillie, 104 black grouse and 40 hazel grouse have been radio collared. Fourteen Norwegian and Russian students have completed their diploma and Master thesis work on the project.

Cycles still intact in Pinega

There is no straight forward answer to whether there are more or less grouse in the forests of the Pinezhskiy reserve compared to Scandinavian forests. In preferred habitats, densities of capercaillie and black grouse are higher but the difference to Scandinavia is not dramatic. The hazel grouse is another matter, their numbers may be huge (Figure 1). At population peaks hazel grouse may be the most common bird in the forest, more numerous than thrushes and smaller birds. Historically, the Pinega region was a centre for export of hazel grouse; during the winter hundreds of sledge loads of the bird went to the markets in the towns to the south. In St. Petersburg alone the yearly import of hazel grouse is reported to have been more than 2 million birds in good years. Also capercaillie and black grouse are common birds of the Russian taiga, and because most grouse-work in Europe has been on these species, we initially selected the two species as most suitable for comparative studies. Recently we have turned more of our attention to hazel grouse.

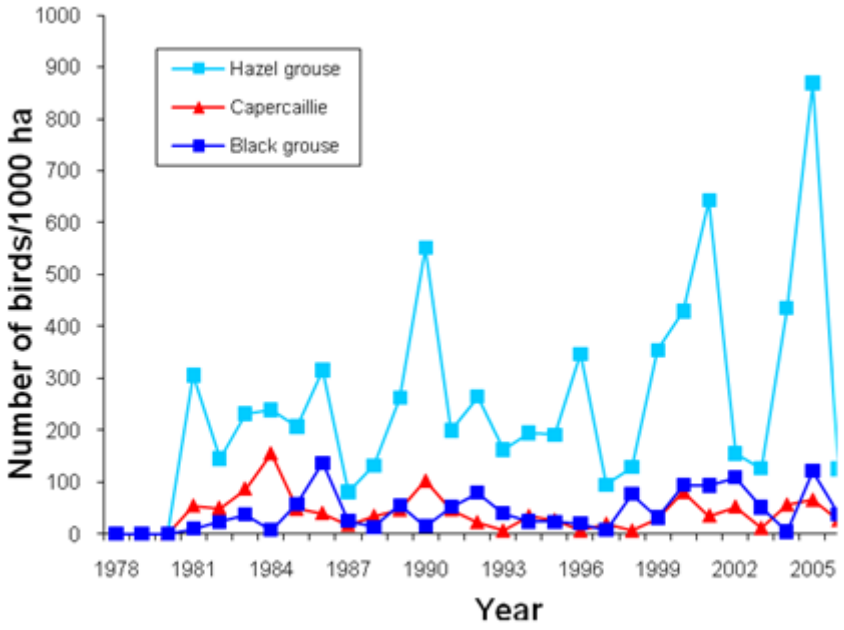

Figure 1. Fluctuations in grouse numbers in Pinezhskiy State Reserve, Pinega. Data collection and population estimates were done by reserve personnel from a modified Kings method.

Grouse habitat use and social organization in Pinega – similarities and differences to Europe

In general, the capercaillie of the Pinezhskiy reserve prefers continuous, older forest while the densest populations of black grouse are found in areas with large bogs and open landscape (Rolstad et al. 2009). Habitat preference of hazel grouse has not been analyzed. As we have the most complete data on habitat use of capercaillie the following discussion will be on this species. We have monitored 42 males and 13 females radio collared on leks.

Use of range. Capercaillie in Northern Russia use their range much like capercaillie in Europe. Birds occur in subpopulations around the leks (Figure 2). Most males stay within 2-3 km from the lek centre year around (Lande 2002). Local configuration of preferred summer habitat affects both direction and movements of birds from the leks in spring (Beshkarev et al. 1995, Hjeljord et al. 2000). Both sexes show great site fidelity and return to the same habitats in consecutive years. Their mean annual home range is generally 600-700 ha and the whole lek population of males may use 30-40 km^2 over the year. Hens move more freely in the landscape than males, and some may disperse to nesting areas beyond neighbouring leks (Lande 2002). They seem to use the same general areas both for nesting and brood movements in succeeding years (Gregersen & Olstad 2002, Wegge et al. 2005).

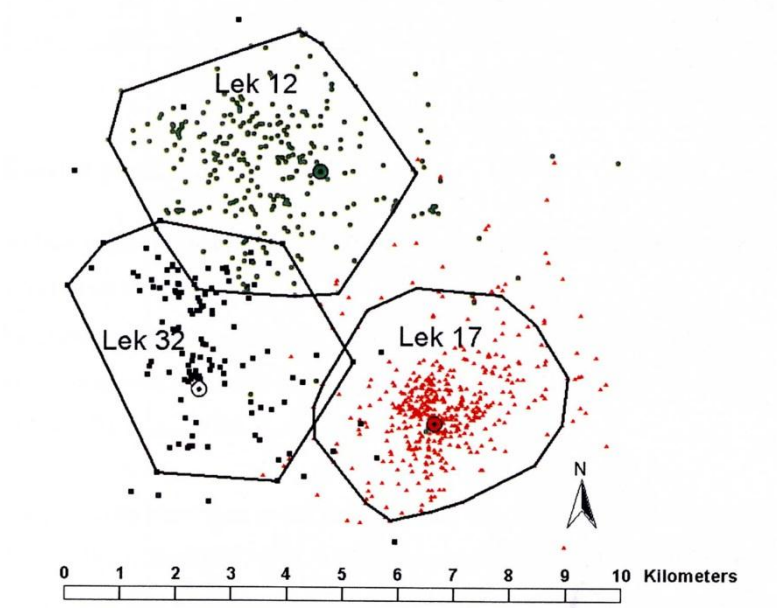

Figure 2. Annual range use by 44 radiotagged cocks on 3 adjacent leks based on 881 cock locations in Pinezhskiy State Reserve, Pinega. The lines represent 90 % MCP for each lek population. Centre of leks are indicated by a circle (Lande 2002).

Use of habitat. Choice of habitat resembles that of Western European capercaillie. When leaving the lek in late spring/early summer, male capercaillie search for shaded and humid sites dominated by rich vegetation of herbs and, interestingly, also by the moss *Polytrichum* spp (Bjordal & Hillmann 2002). Also Semenov-Tjan-Sanskij (1960) reported *Polytrichum* spp. to be part of capercaillie summer diet. A preference for shaded sites may be due to delayed phenology with higher quality of preferred forage plants.

Also young broods prefer moist forest types, particularly spruce–swamps and herb–spruce forest rich in insects and the drier, bilberry-rich Vaccinium spruce forest extensively (Wegge et al 2005). Caterpillars, probably the most important food for young broods (Picozzi et al. 1999, Wegge & Kastdalen 2008) were twice as abundant in Vaccinium spruce forests than in the other habitat types (Wegge et al. 2005). In the generally moist and insect-rich forest of the Pinezhskiy reserve we would expect rather short daily movements of broods searching for food. However, average daily movements of broods during the first 4 weeks were >500 m, similar to that of young broods at Varaldskogen, Norway (Wegge et al. 1982). This may indicate that predator avoidance rather than search for preferred forage is the main reason for extensive brood movements (Wegge et al. 2005). In summer, the average distance between male capercaillie positions when located during two consecutive days was 396 m, also indicating extensive movements by adults (Bjordal & Hillmann 2002). Partly overlapping home ranges of ca 200 ha were similar to that reported from Fennoscandia (Rolstad et al. 1988).

Social organization. Most leks are big. Between 20 and 30 males attended the biggest leks in the Pinezhskiy reserve. In Western Europe there are few leks of this size today. Apparently the large continuous blocks of old growth forest with little natural disturbance in Russian forest reserves provide capercaillie with enough time and space to build up large lek populations. In the fragmented and rapidly changing forests of Western Europe neither time nor habitat is sufficient for the establishment of such leks. As most copulations on a lek is performed by the highest ranking male, fewer but larger leks may increase competition for breeding within the population (Rolstad et al. 2009).

On the large leks in the Pinezhskiy reserve daytime home ranges of males were of the same size (ca 50 ha) and distributed within the same distance from the lek centre (within ca 1 km) as reported elsewhere (Wegge et al. 2003). However, contrary to what has been found elsewhere (but see Storch 1997) home ranges of the attending birds were almost completely overlapping (Figure 3), but with males mutually avoiding each other. The clumped spatial distribution may be an adaptation to avoid long commuting distance to centers of big leks, or a behavioural strategy by subdominants for gaining an opportunity to mate. The big leks drew birds from rather large areas causing an inter lek distance of nearly 4 km, compared to around 2-2.5 km reported from Fennoscandia. Probably, during population peaks, mutual avoidance will push males beyond 1 km from lek centre and contribute to space out leks maximally, and they remained spaced out also during subsequent population lows (Wegge et al. 2003).

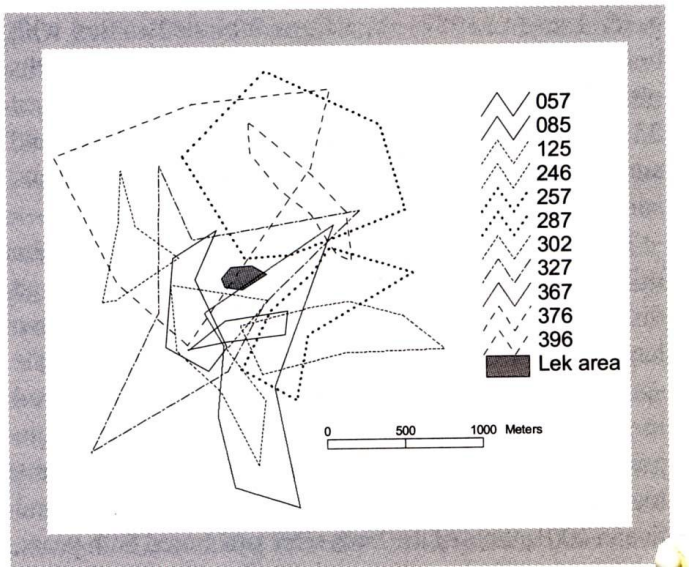

Figure 3. Distribution of daytime ranges of 11 radio-tagged males at a lek with > 25 attending males during spring 2000 in Pinezhskiy State Reserve, Pinega (Wegge et al. 2003).

Logging the northern taiga – the effect on grouse

Comparing grouse populations within the Pinezhskiy reserve with populations in a logged area adjacent to the reserve, we tested the hypothesis that logging causes an increase in density of generalist predators and a decrease in reproductive performance of grouse. Grouse were counted along survey lines during August 1999 and 2001 (Borchtchevski et al. 2003). The somewhat surprising result, however, was a positive rather than negative effect of logging on grouse reproduction (Figure 4) and no effect on abundance of small and medium-sized predators, except for red fox, whose tracks were recorded only in the logged area (Table 1). The estimated total density (adults plus chicks) of capercaillie was generally lower in the logged area compared to the reserve (3.6 vs 6.2 birds per km^2) whereas the opposite was found for black grouse (7.0 vs 5.4 birds per km^2) with no difference in density of hazel grouse (44.3 vs 46.0 birds per km^2) (Borchtchevski et al 2003). Tolerance of hazel grouse to logging was also demonstrated in Komi, southeast of the Archangelsk region, where hazel grouse density was similar or changed only slightly in logged compared to un-logged areas (Beshkarev et al. 1995, Romanov 1963), whereas capercaillie decreased almost three-fold in abundance in logged forest (Romanov 1979).

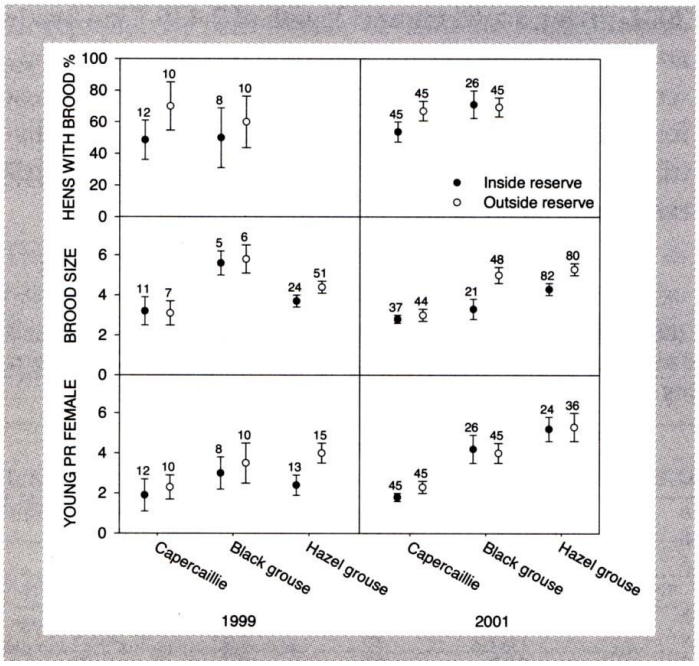

Figure 4. Reproductive success of grouse inside the Pinezhskiy State Reserve and in the logged area outside the reserve, during August 1999 and 2001. Bars show standard error (Borchtchevski et al. 2003).

Table 1. Track crossings per 10 km of survey lines per 24 hours[a] of carnivorous mammals, mountain hare and red squirrel. Recordings were made in the Pinezhskiy State Reserve and in the logged area outside reserve during February 2001 (Borchtchevski et. al. 2003) and in Varaldskogen during January-February 2006-2010 (J. Rolstad og P. Wegge unpubl. data). Significant differences (p, 0.05) in bold letters.

	Inside Reserve		*Outside Reserve*		*Varaldskogen*	
Species	*Tracks/10 km*	*SE*	*Tracks/10 km*	*SE*	*Tracks/10 km*	*SE*
Stoat/weasel	4.6	1.91	3.0	0.85	1.3	0.68
Pine marten	0.7[b]	0.27	0.6	0.39	1.0	0.31
Red fox	0	-	**1.0**	0.34	**3.1**	0.94
Wolverine	0	-	0.03	0.03	0	-
Otter	0.04	0.04	0	0	0	-
Lynx	0.1	0.08	0.3	0.12	0	-
Mountain hare	**24.6**	3.78	**53.5**	10.03	-	-
Red squirrel	**42.9**	7.05	**4.3**[c]	0.73	**2.8**[c]	1.13

[a] Badger (*Meles meles*) not sampled, relatively common in Varaldskogen and absent in Pinega, mountain hare not sampled in Varaldskogen.
[b] Long time average within the reserve is between 1 and 1.5 tracks/10 km/24 hrs.
[c] Different from inside reserve.

Goshawk as the important predator. A total of 105 remains of dead grouse were found during the survey (17 per 100 km, the same frequency in logged area and in reserve). From visual inspection, 72 % was killed by birds of prey, mainly goshawk, the rest by predatory mammals. The proportion killed by the goshawk was almost identical in the reserve and the logged area, 71 % and 73 %, respectively (Borchtchevski et al. 2003). These figures compare well with what was found for radio collared birds: 88 % killed by birds of prey (mainly goshawk), 10 % by pine marten and 2 % unknown. At Varaldskogen in Norway predatory mammals were much more important: 55 % was killed by goshawk, 40 % by red fox/pine marten and 5 % by unknown predators (Wegge & Rolstad 2011).

Few red foxes in the Russian taiga. Tracks of red fox were recorded only in the logged area. Here we encountered one fox track/10 km/24 hours (Table 1), compared to 4.4- and 12.3 tracks/10km/24 hours in northern and southern Finland, respectively (Kurki et al. 1998), and 3.1/10 km/24 hours in Varaldskogen, Norway (Table 1) (Wegge & Rolstad 2011). In the forests of northern Russia, with loose and deep snow, the red fox is rare and is mostly found around villages and on agricultural land (Vaisfeld 1985). Within the reserve, the red fox has not been recorded during the last 10 years of track surveys (Rykov 2000). More pine marten tracks were recorded in Pinega (0.6- and 0.7 tracks/10 km/24 hours in logged area and in the reserve, respectively) (Table 1), than in northern Finland (0.3 tracks/10 km/24 hours). However, the long term average of track counts within the reserve is between 1.0- and 1.5 tracks/10 km/24 hours, which is comparable to southern Finland (1.4 tracks/10 km/24 hours) and Varaldskogen (1.0 tracks/10 km/24 hours) (Table1).

Figure 5. The red fox is rare or absent in the Northern Russian taiga. Either big paws or broad, moose-skinned skis are required for travelling on the soft and deep snow.

A "grousefriendly" way of logging? The generally better reproduction of grouse in the logged area indicates that there are no numerical or functional effects from generalist predators on grouse following logging and fragmentation. On the contrary, our data indicate higher losses of eggs and chicks to predation within the old forest of the reserve.

We believe the particular cutting methods applied outside the reserve should be kept in mind when evaluating these results (Fig. 6). Although logging has caused a coarse-grained forest mosaic (average patch size varying from 0.5- to 2.8 km^2), single trees as well as groups and patches of trees of little economical value are left within clear cuts and stands of young forest, giving the area a heterogeneous composition. Approximate age distribution of forest stands is 41 % mature forest (> 80 years), 42 % secondary forest (20-60 years) and 14 % clearcuts and young forest (< 20 years). A factor contributing to the higher reproductive success of grouse in the logged area may be the populations of hares being double that recorded in the reserve (Table 1), and possibly acting as a buffer and reducing the predation on grouse eggs and chicks. Of special interest is a recent study from the same area by Borchtchevski and Sivkov (2009) indicating that clutch sizes of capercaillie may be larger in the logged forest compared to the reserve.

Figure 6. Selective cutting outside the Pinezhskiy State Reserve, Pinega.

Reproduction and survival of Pinega grouse

The long series of data on yearly change in numbers of grouse, predatory mammals and rodents as well as climate and fruit/seed production provides a unique opportunity for disentangling the factors causing the rise and fall of grouse populations in the Pinezhskiy reserve. However, additional data are needed for a thorough understanding, particularly on the dynamics of reproduction and survival of the Pinega grouse during the increase and downfall of the populations. We hope to obtain such information by radio collaring hazel grouse, the species with the widest fluctuation in numbers, and which is presently in the increase phase. Below we present some preliminary data on grouse population dynamics from the 229 birds we have already radio collared, and from data collected by reserve scientists over many years.

Adult survival appears to be on the same level as in Fennoscandia but may vary considerably from year to year. Loss of eggs varies between 10- and 50 %, which appears to be lower than in the west. A comparative study of egg loss in artificial nests indicated a significantly higher loss to predatory mammals in the logged forest at Varaldskogen, Norway compared to Pinega (Pollen & Ingul 2011, Wegge et al. subm. ms.). August brood size is usually between 4 and 5 chicks, and does not vary with the rise and fall of the population, but there is a close correlation ($R = 88$, $p < 0.001$) between the proportion of broodless hens and population change. Data presented in Fig. 1 indicate that recent population peaks of hazel grouse tend to be on a higher level than before. This coincides with the disappearance of small rodent cycles and concurrent decrease in populations of stoat and weasel over the past 20 years.

Dramatic population crashes. The most intriguing aspect of the population curve of the Pinega grouse populations is the sudden crashes of the hazel grouse. While populations build up for 2 or 3 years, the downfall occurs during a single year. Apparently the crash is caused both by high adult mortality during the winter following the autumn peak as well as poor reproduction the following summer. During spring of 2006 (crash year) we followed 8 radio collared females of black grouse intensively. Seven of these apparently lost their eggs during egglaying or early incubation and were never recorded with chicks. A pertinent question is whether we see a predator/prey oscillation in the Pinezhskiy reserve: a low rate of predation permit a high production of chicks in the increase phase, in Western Europe generalist predators, particularly the red fox, prevents such increases.

More data is needed, and a closer investigation is planned on the hazel grouse that we have now radio collared. Actually the fluctuation of grouse numbers in Pinega resembles those in Norway 50-100 years ago. Several reports from that time indicate sudden crashes when both adult survival and reproduction failed (Hjeljord 1980).

Acknowledgements
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Landscape connectivity modeling for sharp-tailed grouse and greater sage-grouse – An overview of current research in Washington State, USA

Leslie Robb and Michael Schroeder

Human altered landscapes have impacted the extent to which many grouse populations are fragmented and isolated, potentially resulting in restricted gene flow and loss of genetic diversity. In Washington State, sharp-tailed grouse (*Tympanuchus phasianellus*) and greater sage-grouse (*Centrocercus urophasianus*) currently occupy approximately 3% and 8% of their historical ranges, respectively. These areas are fragmented by habitat loss and tend to be isolated from each other and from occupied habitat in adjacent states and provinces. Consequently, maintaining and restoring landscape connectivity has been identified as a key conservation strategy for persistence of these grouse species in the state.

The Washington Wildlife Habitat Connectivity Working Group (WHCWG) is a public-private partnership of state and federal agencies, universities, tribes, and non-governmental organizations that was formed in part to address the need for a science based effort to help guide coordinated action to maintain or improve landscape connectivity for wildlife in Washington State. As part of this effort the WHCWG recently completed a modeling analysis of landscape connectivity for 16 focal species (WHCWG, 2010); two of the focal species examined were sharp-tailed grouse and greater sage-grouse.

The connectivity analysis used a cost-weighted distance modeling approach to identify linkages between areas of occupation (for grouse only). Cost-weighted distance modeling is a novel approach to understanding potential movement by a species as it moves throughout a landscape that has impediments and/or barriers created by natural and human related disturbance. In summary, the modeling process uses spatial data layers to create maps illustrating the ease and extent of movement outward from areas of interest. For sharp-tailed and greater sage-grouse, these areas were occupied range determined with the aid of lek surveys, radio telemetry, and habitat evaluation. The spatial data layers used included: 1) land cover/land use, 2) elevation, 3) slope, 4) housing density, 5) roads, and 6) forest structure. Parameters associated with each spatial data layer were assigned a resistance score reflecting the difficulty that particular feature posed to movement *relative* to "ideal" habitat. For example, for the two grouse species the parameter "shrub-dominated habitat" had the lowest resistance to movement score while "urban/developed" the highest. The data layers were then combined and the resistance scores summed for each grid cell to create a map illustrating the resistance to movement in the landscape for sharp-tailed grouse and greater sage-grouse respectively. Linkages illustrating the "easiest" movement pathway, in terms of landscape resistance, between specific pairs of occupied areas (Habitat Concentration Areas in the figures) were then modeled for both species (Figures 1 and 2).

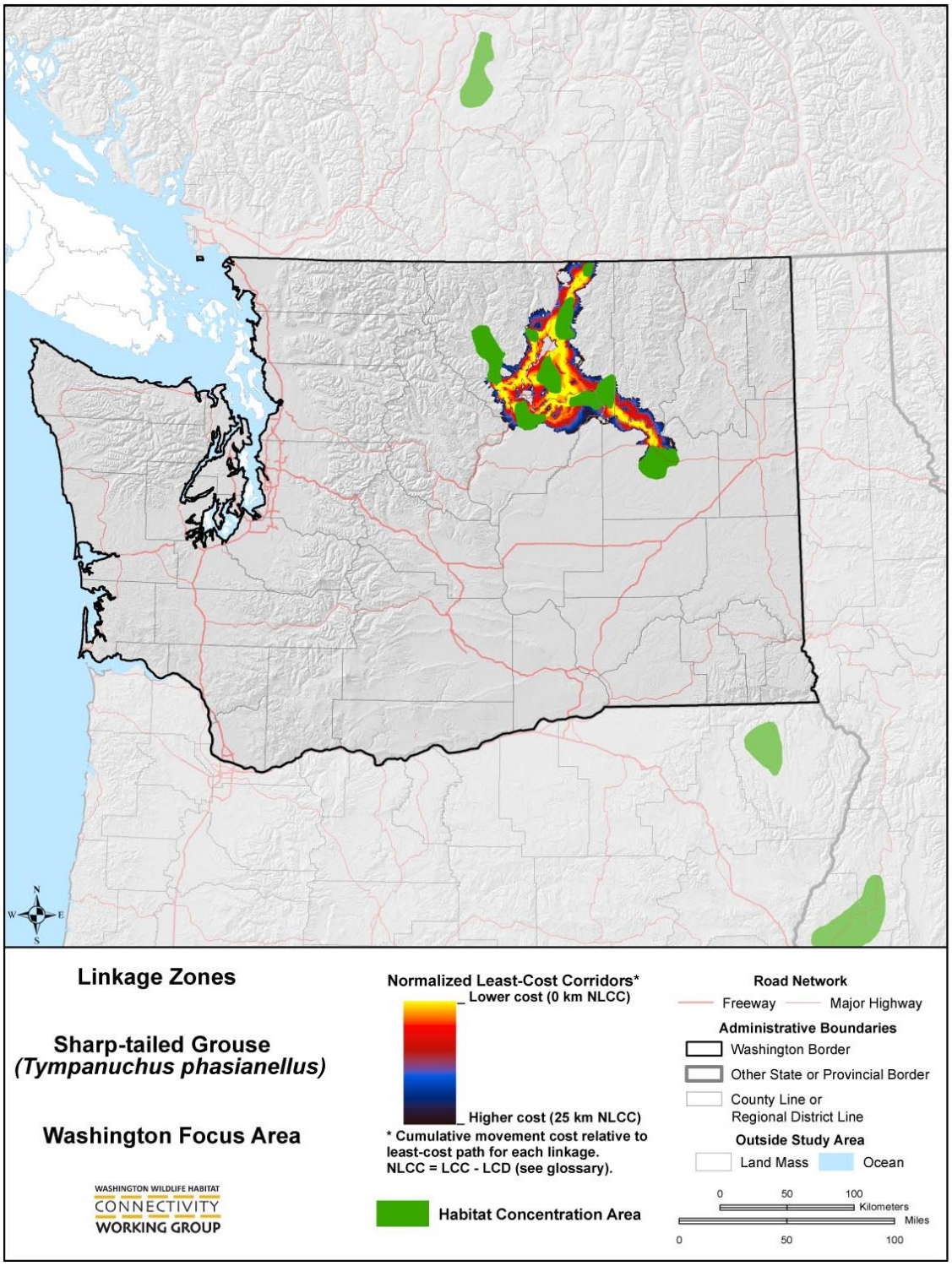

Figure 1. Sharp-tailed grouse linkages in Washington State, USA (WHCWG, 2010).

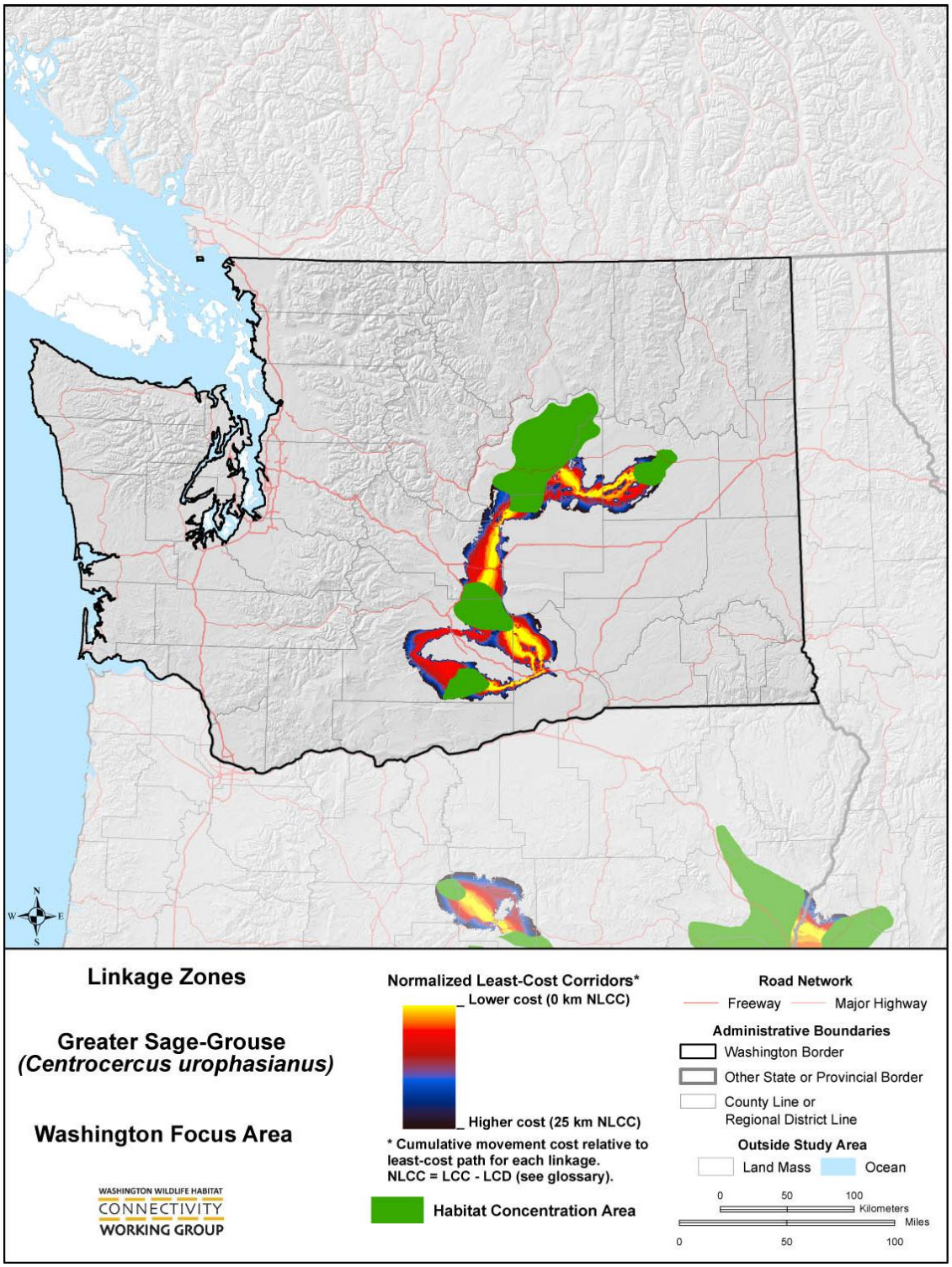

Figure 2. Greater sage-grouse linkages in Washington State, USA (WHCWG, 2010).

The WHCWG has begun a finer scale connectivity analysis of the Columbia Plateau Ecoregion in eastern Washington and sharp-tailed grouse and greater sage-grouse are included as focal species in this on-going effort. The Columbia Plateau Ecoregion analysis uses additional data layers and a smaller grid cell than the statewide analysis (30 m vs. 100 m). This finer scale of resolution will be used to examine occupied range with respect to landscape resistance as well as potential movement pathways within occupied areas by modeling linkages between leks. Additionally, the WHCWG is using telemetry, lek persistence, and genetic data collected from greater sage-grouse in Washington to help validate these

connectivity models.

Cost-weighted connectivity modeling products are useful tools for providing insight and guidance for management and conservation of grouse species. In Washington it is anticipated that these products will help inform: 1) implementation of agricultural programs to benefit sharp-tailed grouse and greater sage-grouse, 2) placement of structures such as wind farms and powerlines, 3) identification of potential reintroduction sites, 4) conservation efforts through the modeling of various restoration scenarios, and 5) maintenance and enhancement of linkage corridors. The full analysis by the WHCWG and all mapping products are accessible at http://www.waconnected.org.

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Notes on the Cantabrian capercaillie: winter roosting trees, historical distribution and lack of knowledge

Manuel A. González & Vicente Ena

Summary

In winter the capercaillie spend much time roosting to avoid energetic expenditures. This grouse mainly selects trees that facilitate food, detection of predators and escape flights. Although roosting sites are broadly documented in other European populations, few data exist on characteristics of Cantabrian capercaillie roosting sites. We report the first observations of roosting and foraging trees for Cantabrian capercaillie in a Mediterranean environment. The study area was within the historical distribution of the Cantabrian capercaillie although it has not been currently considered as occupied habitat by this subspecies. Scots pines and Pyrenean oaks were used differently by the Cantabrian Capercaillie. We recommend further research in this Mediterranean habitat for the capercaillie to assess the likely different habitat use (coniferous and deciduous) and its derived impact on the Cantabrian capercaillie behaviour. Historical Mediterranean distribution of this grouse should be further considered within any action plan and ecological studies of this primarily boreal bird.

KEYWORDS: Cantabrian capercaillie, historical distribution, Mediterranean forests, roosting trees, winter.

Introduction

Among the basic requirements of a bird, the roost site selection is a crucial behaviour with important fitness bearings (Cody 1981). In temperate latitudes, winter strongly affects survival in non-migrant birds (Lima et al. 2005), and poses strong challenges to the energy balance and homeostasis of individuals roosting at night (Walsberg 1986, Wegge et al. 1989). Capercaillie *Tetrao urogallus* is a big forest grouse that mainly occurs in boreal and temperate coniferous forests from east Siberia to the Iberian Peninsula (del Hoyo et al. 1994). It roosts at daylight and night using trees but also snow burrows (Thiel et al. 2007). In winter the main food resource throughout most of its range are pine needles, a superabundant but low-energy food resource but in the Cantabrian caducifolius forests capercaillie mainly eat understory plants as ferns, bilberry *Vaccinium myrtillus* or the evergreen holly *Ilex aquifolium* and alpine juniper *Juniperus communis* subsp. *alpina* if present (Gjerde and Wegge 1989, Storch 1993, Rodríguez and Obeso 2000, Blanco-Fontao et al. 2010). To overcome the energetic problem in winter capercaillie spends much time roosting and it selects needles with a high energy and a low resin content that is decomposed and digested in the caeca with the aid of bacteria (Lindén et al. 1984, Moss 1983, Spidso and Korsmo 1994). Overall, capercaillie in winter selects trees for both feeding and nocturnal roosting (Spidso and Korsmo 1994, Storch 1993, Thiel et al. 2007). These wintering sites usually show structural heterogeneity in tree age, species and size that facilitate food acquisition, detection of predators and escape flights (Spidso and Korsmo 1994, Storch 1993, Thiel et al. 2007). In Norway most spring roosting sites used by cocks were located underneath the lower branches in old coniferous trees and in stands with a higher density of trees than in the surroundings (Finne et al. 2000). In case of high snow-cover and low predator

densities, Capercaillie also use snow burrows (Thiel et al. 2007), but this behaviour is rare in capercaillie populations from central and southern Europe (Marjakangas et al. 1984).

The endangered Cantabrian subspecies *Tetrao urogallus cantabricus* lives almost entirely in deciduous forests of the Cantabrian Mountains. In winter it feeds almost exclusively on buds from deciduous trees as well as leaves of the evergreen holly tree *Ilex aquifolium* (Obeso 2003, Rodríguez and Obeso 2000). However, if Scots pine *Pinus sylvestris* plantations are available then pine needles occur in the winter diet of the Cantabrian Capercaillie (Rodríguez and Obeso 2000). The main habitats of the subespecies are Eurosiberian forests dominated by beech *Fagus sylvatica*, birch *Betula pubescens* or sessile oak *Quercus petraea* (Obeso and Bañuelos 2003), but it also occurs in Pyrenean oak *Quercus pyrenaica* forests both in the Eurosiberian (i.e., northern slope of the range) and in the Mediterranean biogeographic region (i.e., southern slope of the range). This Mediterranean environment is the only Cantabrian area where pine plantations constitute a relevant percentage (30%) of the forested surface as well as considered to be the warmest (i.e., two dry months in summer) and the southernmost limit distribution of capercaillie (González et al. 2010). Up to date 12 leks have been registered in the historical Cantabrian Capercaillie distribution within the Mediterranean region, however, more leks are likely to be located with further survey efforts (González *unpublished data*).

Pyrenean oak is a marcescent oak species more tolerant to xeric conditions than other oaks and cope better with fire so it can be seen recruiting in slopes covered by *Erica australis* / *aragonensis* (i.e., those slopes subject to recurrent man-made fires (Luis-Calbuig et al. 2010). In the Cantabrian range, winter roosting sites are likely to be trees rather than snow burrows since only once an anecdotic snow burrow was registered in a beech *Fagus sylvatica* forest when the snow cover exceeded half a meter permitting snow-roosting (Figure 1; Martínez 1993). Otherwise, observations in Eurosiberian forests (i.e., well known to be occupied by the capercaillie) suggest holly as the most likely roosting and/or foraging tree in winter since it is the only evergreen tree in these deciduous forests (Blanco-Fontao et al. 2010, Castroviejo 1975, Rodríguez and Obeso 2000).

The low numbers, secretive behaviour and rough habitat of the Cantabrian capercaillie makes much difficult to locate its winter roosting sites. Even more, in winter the leafless trees are not expected to act as feeding trees for the Cantabrian capercaillie except holly. Here, we present the first observations on winter roosting and foraging trees of Cantabrian capercaillie that curiously have been detected in its Mediterranean distribution.

Figure 1. The only snow burrow documented in the Cantabrian Mountains, in a Eurosiberian beech Fagus sylvatica *forest, snow cover ~1m, year 1982. Photo: Vicente Ena*

Methods

Our study occurs in two sites included in an area at the southern slope of the Cantabrian Mountains which corresponds to the southernmost edge of capercaillie distribution (González et al. 2010). The area is located in the Mediterranean region bordering to the north with the Eurosiberian region (González et al. 2010). Average temperature ranges between 4ºC and 9ºC and the annual precipitation ranges from 866 to 1,100 mm. Precipitation is unevenly distributed throughout the year, with rain mainly in spring and autumn and a severe drought for two months during summer, characteristic of the Mediterranean climate (Blondel and Aronson 1999). The landscape is slightly mountainous (elevation ranges from 800 to 1700 m a.s.l.). Dominant forests are supra-Mediterranean unburned (more than 50 years old) and post-fire Pyrenean oak forests, which account for the 20% of the area and monospecific Scots pine plantations younger than 50 years old (8%) (Costa Tenorio et al. 2005). Bilberry is completely absent or very scarce (<0.5% of the forest ground cover; González et al. 2010).

Remaining 72% of the area is covered by semi-natural habitats mainly composed of *Populus nigra*, *Fraxinus excelsior* and *Alnus glutinosa* riparian lowland forests, meadows, heaths *Erica australis*, brooms *Genista* sp. and man-made infrastructures such as crops, open mines, roads and villages. Human density is very low (0.6 people/km²) and population has declined by 85% since the 1950's (INE 2008). This decline has lead to the abandonment of pastures with the consequent increase of the forested landscape (Morán-Ordóñez et al. 2011). The main economic activity is livestock rearing, followed by coal mining industry, agriculture, forestry and hunting (Penas 1995).

The two studied sites are within the 17th century Cantabrian capercaillie distribution although in recent literature it has not been considered as occupied by the subspecies (Figure 2; González et al. 2010). At that time (i.e., 17th century) the main distribution of the Cantabrian capercaillie was in the Mediterranean region within the Pyrenean oak stronghold widespread from south of the Cantabrian mountains to Portugal such as today happens (Madoz 1848, Castroviejo 1975, Martínez 1993). Both studied sites are within the only area where the Cantabrian capercaillie commonly dwell both in deciduous and coniferous trees (i.e. Mediterranean distribution; González et al. 2010).

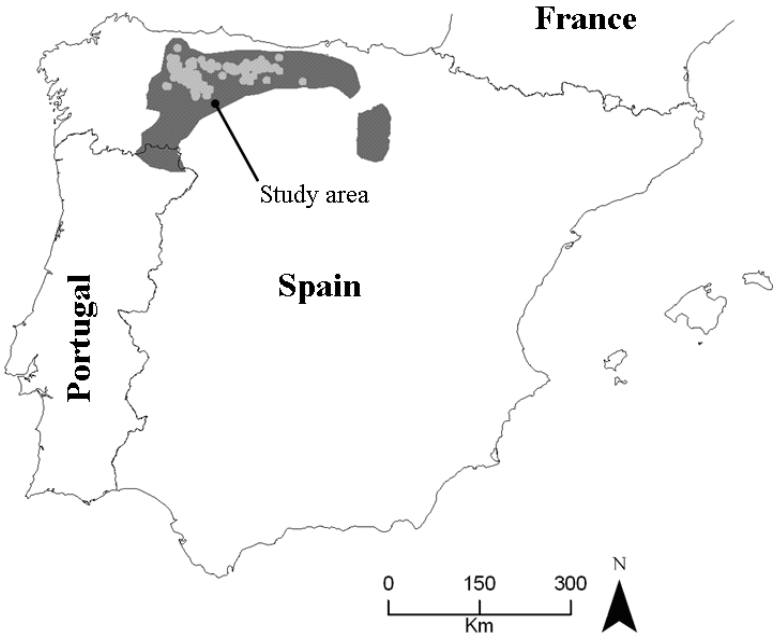

Figure 2. Dark grey historical distribution of Cantabrian capercaillie; light grey current Cantabrian capercaillie distribution; black dot study area.

From 2005 to 2011 we visited two wintering sites where previously Cantabrian Capercaillie night dropping groups were frequently detected (González *pers. obs*.). Distance between both sites was >10 km, thus we assumed that the birds visiting each winter site were mostly different. One of the sites consisted of 12 mature (>50 years old) planted Scots pines higher than 15 m occupying 40 m^2 surrounded by a 500 m^2 grassland (hereafter pine site; ***A*** in Figure 3). South ~20 m of the pine site a small Pyrenean oak fragment (20 ha) occurs while north ~200 m there is a big oak forest fragment (400 ha). The other site was a half hectare Pyrenean oak forest fragment (hereafter oak site; B in Figure 3). It was mainly composed by large oaks higher than 12m in open forest stand with clean undercanopy, surrounded by secondary cover after repeated fires (e.g. *Erica australis* heathlands).

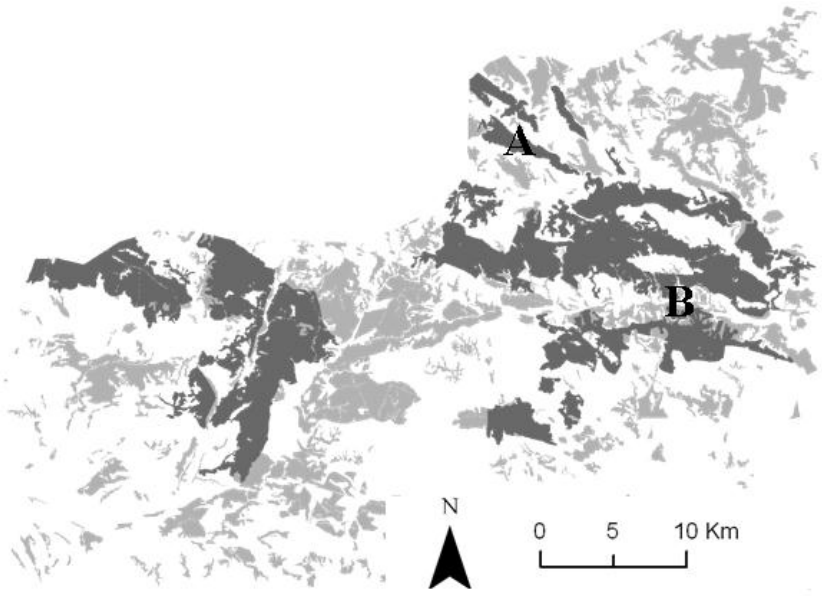

Figure 3. Forested patches of the study area: dark grey patches known to be occupied by the Capercaillie; light grey patches not known to be occupied by the Capercaillie; ***A*** *location of the winter pines site;* ***B*** *location of the winter oaks site.*

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Visits consisted of observations of the sites one hour before sunset until dark since it is the time when the grouse fly to the night sites (Johnsgard 1983; Watson and Moss 2008) and were repeated once a month from the first snowfall to the end of winter (35 visits to each site). Not to disturb birds, we aimed to detect capercaillie with a 85 mm 20-60x telescope and 10x40 binoculars from an elevated and reasonably distant fixed point (>20 m far from the edge site). The day after a visit with zero observations, an experienced observer completely surveyed the site to homogenize detectability in two different sized sites, as described in González et al. (2010) in order to find capercaillie night dropping groups. We considered a positive observation if we observed at least one capercaillie or one group of droppings the day after.

Figure 4. Capercaillie hen roosting in a Scot pine in the Cantabrian Mountains. Photo: Jorge Falagán

Results

Each field survey showed a positive observation in both pines (*n*=35) and oak site (*n*=35; Table 1). Capercaillie were always detected landing in the treetops of the pines site and never in the oaks site. After each negative observation (i.e., oaks site) during the next day at least one droppings group (range 1-12) was always registered. They were collected not to consider them in the next survey. It showed that the oaks site was constantly used at least once a month for roosting in winter. Otherwise, in the pines site two hens were detected in nine occasions, one hen and one cock in two occasions and one cock and two hens once. In the remaining 17 visits only one solitary hen occurred. Feeding records are incomplete since pine branches frequently hindered us from adequately observation of the Capercaillie behaviour. However, in nine occasions we observed birds pecking needles showing these pines act as both foraging and roosting trees (Table 1).

Table 1. Observation days and birds observed; feeding means any bird seen feeding or not on the pines.

	Pines site					Oaks site
Date	hens (*n*)	cocks (*n*)	total (*n*)	feeding	droppings groups (*n*)	droppings groups (*n*)
Nov´05	2	0	2	?		2
Dec´05	2	0	2	Yes		3
Jan´06	2	1	3	?		3
Feb´06	1	1	2	Yes		5
Mar´06	0	0	0		5	6
Oct´06	2	0	2	Yes		4
Nov´06	2	0	2	No		2
Dec´06	2	0	2	?		2
Jan´07	2	0	2	?		8
Feb´07	2	0	2	Yes		12
Mar´07	0	0	0		1	3
Oct´07	2	0	2	?		6
Nov´07	1	0	1	Yes		9
Dec´07	1	0	1	Yes		11
Jan´08	1	0	1	?		1
Feb´08	1	0	1	?		7
Mar´08	0	0	0		5	9
Oct´08	1	0	1	?		4
Nov´08	2	0	2	?		6
Dec´08	1	0	1	No		7
Jan´09	1	0	1	?		3
Feb´09	1	0	1	?		10
Mar´09	0	0	0	No		6
Oct´09	1	0	1	?		9
Nov´09	1	0	1	?		8
Dec´09	1	0	1	?		3
Jan´10	1	0	1	?		5
Feb´10	1	0	1	Yes		7
Mar´10	0	0	0		7	11
Oct´10	1	0	1	?		6
Nov´10	1	1	2	Yes		9
Dec´10	1	0	1	Yes		5
Jan´11	1	0	1	?		4
Feb´11	1	0	1	?		3
Mar´11	0	0	0		4	5
N of positive observations					35	35

Discussion

In the oak site we never observed capercaillie although signs of night presence were found in each survey. Otherwise, in the winter pines site we frequently observed capercaillie roosting and feeding. We only had one replicate per forest type which highly differed in size, however, to our knowledge both sites are the only monitored and known to be consistently used winter after winter in the Cantabrian range. It does not imply they build a proper study system, although they are anecdotic reports clearly suggest a different use between oaks (leafless in winter) and pines trees in winter in the Cantabrian range. This is highlighting the lack of knowledge on Cantabrian capercaillie ecology, especially winter habitat selection.

In March we neither detected birds in the pines site nor night dropping groups in the oaks site however we returned twice after the first March date. Hence, the abandonment date of both sites (February-March) coincides. This date corresponds with the end of winter, last snowfalls and the beginning of the reproductive period. We speculate about the Cantabrian capercaillie in winter distinctively use oaks and pines however both of them are abandoned on the same date.

Our five years observations in this Mediterranean area seems to agree with results from central Europe: Capercaillie in winter faithfully use large coniferous trees for feeding and/or roosting while large deciduous trees may be used just for roosting likely because leafless. These trees frequently occur in gentle slopes with open forest stands close to forest edges, while small trees in dense forest stands are avoided by the Capercaillie (Thiel et al. 2007). Outside this study area, pinewoods and plantations are very restricted within the Cantabrian capercaillie range and thus they are not likely to constitute an important resource for roosting and feeding for the entire population. We cannot infer advantages for capercaillie related to roost in pines or oaks but a different use of them. Otherwise, there is no reason to benefit pine plantations to improve the winter survival of this grouse which survived without conifers throughout the Holocene in the Cantabrian mountains (Rodríguez-Muñoz et al. 2010).

Due to the rough habitat of the subspecies, its difficult detectability and low numbers, this is the first description of two different winter sites for the Cantabrian capercaillie across several years. Although only two different sample sites were got and our results cannot be extrapolated to the entire Cantabrian population, this work highlights the different use between them, so further studies should be undertaken to assess the relative advantages of roosting in pines or deciduous trees in relation to winter-spring survival and breeding success and so to promote the Cantabrian capercaillie conservation. Taking into account the Cantabrian capercaillie singularity of living throughout the year in deciduous forests (Quevedo et al. 2006), the area here described is the only suitable for that assessment. This area is not only the area of the Cantabrian range where both forest types frequently occur and bilberry, a capercaillie key species elsewhere (Storch 1995), is near absent (González et al. 2010) but also it may sustain around 40 adult Capercaillie widespread in at least 12 leks (10 % of the total Cantabrian population; own unpublished data). We recommend considering historical distribution of the Cantabrian capercaillie both in action plans and ecological studies since requirements of this primarily boreal bird may highly differ in the underestimated Mediterranean forests of the historical distribution.

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Toxic Scat: A mechanism to prevent overdosing on plant chemicals by grouse

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Introduction

Although abundant and accessible, plants pose significant challenges to herbivores. The high fiber content and relatively low nutritional value of plants compared to animals makes plants a particularly difficult food source for birds. For example, birds lack teeth required to reduce particle size and flight limits the size and complexity of the gastrointestinal tract (Dudley and Vermeij 1992) required for fiber digestion. These limitations are thought to explain why herbivory is a rare foraging strategy in birds. A less studied explanation for limited herbivory in birds may also be the diversity of chemical defenses in plants. These chemical defenses can be toxic to herbivores and energetically costly to detoxify (e.g. Glick and Joslyn 1970, Lindroth and Batzli 1984, Robbins et al. 1987, Guglielmo et al. 1996, Sorensen et al. 2005). Similar to the limited digestive capacity, flight may limit the size of the liver which is the major organ used to detoxify and eliminate ingested toxins.

Despite these constraints, most members of the tetraonidae family are herbivores (Sedinger 1997) and many consume plants that are chemically defended. Moreover, many species of grouse are considered dietary specialists on chemically defended plants that are avoided by other herbivores. For example, dusky grouse (*Dendragapus obscurus*) and spruce grouse (*Falcipennis canadensis*) are winter specialists on the needles of conifers that contain large concentrations of monoterpenes, a class of toxins (e.g. Bryant and Kuropat 1980, Boag and Schroeder 1992, Zwickel and Bendell 2005). And ruffed grouse (*Bonasa umbellus)* are highly tolerant to the phenolic toxins in aspen (Jakubas et al. 1989, Jakubas et al. 1993).

How do these avian herbivores prevent overdosing on potentially toxic plants? To answer this, we must first understand the three general fates of ingested toxins (Figure 1, reviewed in Sorensen et al. 2006). The first potential fate of a toxin is to be excreted unchanged in the feces because it is not absorbed or metabolized in the gut. The second potential fate is for toxins to remain in the gastrointestinal tract where they can be metabolized by detoxification enzymes located in enterocytes of the herbivore or by gut microflora. Toxins metabolized in the gut are typically excreted as metabolites in the feces. The final potential fate is that toxins are absorbed, delivered to the systemic circulation, and detoxified in the liver by detoxification enzymes into more water-soluble and usually less toxic metabolites. These water-soluble metabolites are then excreted in the urine. Toxins that enter circulation and are not metabolized can be delivered to various organs where they may interact with target sites and cause toxicity. The ultimate goal of the herbivore is to minimize concentrations of toxins in organs by preventing their absorption and delivery and maximizing their detoxification and excretion.

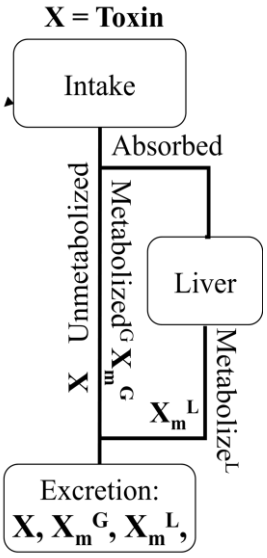

Figure 1. Simplified diagram of potential fates of an ingested plant toxin (represented by X): 1. Toxins (X) are not absorbed or metabolized in the gut and are excreted unchanged (X) in feces. 2. Toxins are not absorbed but are metabolized in the gut (^{G}) into new water-soluble metabolites (X_m^G) that are excreted in the feces. 3. Toxins are absorbed and metabolized in the liver (^{L}) into a new water-soluble metabolite (X_m^L) that is excreted in urine and then combined with feces in birds. These potential fates of toxins are not mutually exclusive

Although the majority of studies investigating the fate of ingested toxins in herbivores have focused on mechanisms of detoxification and elimination, we predict that regulated absorption of ingested toxins is a critical first line of offense for grouse specializing on chemically defended plants. We propose that mechanisms such as efflux transporters regulate the concentration of toxins that get absorbed into the bloodstream (Sorensen and Dearing 2006) and reduce reliance on detoxification by the liver. We are testing this prediction using greater sage-grouse (*Centrocercus urophasianus*; hereafter sage-grouse). Sage-grouse provide an extreme example of specialized herbivory in the tetraonids. The sage-grouse is a dietary specialist on sagebrush (*Artemisia* spp.). From late fall through early spring, sage-grouse consume nearly 100% sagebrush, and continue to feed on substantial quantities of sagebrush throughout the remainder of the year (Rasmussen and Griner 1938, Patterson 1952, Wallestad et al. 1975). Sagebrush leaves are defended by relatively large quantities of toxins that include monoterpenes,

sesquiterpene lactones, and phenolic compounds (Shafizad et al. 1974, Welch and Mcarthur 1981, Kelsey et al. 1982). Many of these compounds are known to have deleterious effects on animals (e.g. Koppel et al. 1981, Chugh and Jha 2003), yet sage-grouse are totally dependent on sagebrush for forage during much of the year.

This study is an initial effort to investigate whether regulated absorption is a mechanism of tolerance to sagebrush chemicals by sage-grouse. We are testing the regulated absorption hypothesis indirectly by comparing the chemical profile of monoterpenes in the plants consumed at foraging sites to those excreted in fecal droppings of sage-grouse at these foraging sites. We hypothesized that if sage-grouse could regulate absorption of ingested monoterpenes from sagebrush, we would see the same monoterpene profile in plants and excreta.

Methods

We collected browse and fecal samples from sage-grouse in Twin Falls county, Idaho, U.S.A. (42°11' N, 114°46' W). Vegetation in the study area is predominately a mosaic of dwarf sagebrush (black sagebrush, *Artemisia nova;* low sagebrush, *A. arbuscula*) and Wyoming sagebrush (*A. tridentata wyomingensis*). We located and flushed radio-collared sage-grouse between 23 January and 14 March 2011. At each flush site, we collected samples of browsed sagebrush plants. Browsed plants were defined as those of the same species of sagebrush with evidence of at least 10 distinct sage-grouse bite marks. Clippings from three browsed plants were collected from each flush site and pooled to form a single browse sample. At each flush site, we collected all fresh sage-grouse fecal droppings and pooled them to form a single fecal sample. We randomly selected paired fecal and browse samples from six independent flush sites for this preliminary analysis. We separated leaves from woody stems and debris, and ground leaf and fecal samples separately in liquid nitrogen prior to analysis.

We used headspace gas chromatography to measure the relative quantity of monoterpenes in the leaves of sagebrush and excreta of grouse. We sealed 100 mg of wet ground leaf or fecal sample into a 20 ml glass headspace autosampler vial. Samples were incubated at 100° C for 30 min in an Agilent 7694 headspace sampler (Agilent Technology, Santa Clara, CA). One ml of headspace gas was injected into a J&W DB-5 capillary column (30 m x 250 µm x 0.25 µm) installed in an Agilent 6890N Gas Chromatogram (GC). Splitless injection mode was used and injector temperature was 250° C. The flow rate of helium as carrier gas was 1 ml/min. The flame ionization detector was maintained at 300° C. Chromatographic separation of chemicals was achieved with a temperature program initially held at 40° C for 2 min and increased to 150° C at 15° C/min and held for 10 min. Monoterpene standards were prepared by adding 10µl of a mixture of several monoterpenes (50 µg/ml) to a 20 ml glass headspace autosampler vial and sealed. The standards were analyzed using the same protocol as used for leaf and fecal samples.

Monoterpene retention times and peak areas for each chemical were calculated by Agilent ChemStation version B.03.01. For each sample, we selected every major peak that was greater than 1% of the total area on the chromatogram. We determined the retention times (time detected by the gas chromatograph detector) and the area under the curve (AUC) for each monoterpene in samples. We confirmed the identity of monoterpenes in our samples by comparing retention times to those of monoterpene standards. We quantified the intensity of each peak as AUC for each peak divided by the dry weight of the sample (g).

We performed a qualitative assessment of chemical similarity by comparing the presence or absence of chemical peaks from fecal droppings to those from browsed sagebrush within each flush site.

Results

Our preliminary results show that within flush sites, all but the most volatile compounds were found in both browse and fecal samples (Table 1). Data pooled across foraging sites suggest a relationship between abundance of monoterpenes in browse samples and abundance of those in fecal samples. Compounds that were most abundant in plant samples also tended to be most abundant in fecal samples (Figure 2). Similarly, those that were less abundant in plant samples tended to be less abundant in fecal samples. However, without knowing the exact amount of leaves sage-grouse consumed and the amount of feces excreted at a given period of time, it is impossible to determine the percentage of monoterpenes ingested that were excreted in feces.

Table 1. Presence of major monoterpenes in plants and fecal droppings from sage-grouse at 6 different foraging sites (A-F) in south-central Idaho, U.S.A. Retention times (min) refer to the time each compound (listed as unknown or known monoterpene) was eluted from the gas chromatographer column and detected. Shorter retention times indicate more volatile compounds

	Retention Time (min)											
	2.67	4.41	12.64	13.25	13.75	14.36	15.47	17.28	17.46	17.57	18.57	21.61
Foraging Site	Unknown 1	Unknown 2	Unknown 3	Unknown 4	Alpha-Pinene	Camphene	Beta-Pinene	Cymene	Unknown 5	1,8-Cineole	Unknown 6	Camphor
A	Plant	Plant	*	*	*	*	*	*	*	*	*	*
B	Plant	Plant	*	*	*	*	*	*	*	*	*	*
C	Plant	Plant	*	*	*	*	*	*	*	*	*	*
D	Plant	Plant	Feces	*	*	*	*	*	*	*	*	*
E	Plant	Plant	Plant	*	*	*	*	*	*	*	*	*
F	Plant	Plant	Plant	*	*	*	*	*	*	*	*	*

Plant = Compound found only in plant sample
Feces = Compound found only in fecal sample
* = Compound found in both plant and fecal samples

Discussion

Sage-grouse appear to limit systemic exposure to ingested monoterpenes by excreting monoterpenes unchanged in feces. Toxin excretion is a less explored mechanism that, along with rapid detoxification, can lower the concentration of toxins in the blood and thereby reduce toxicity (Sorensen et al. 2004, Sorensen and Dearing 2006). To our knowledge, this is the first study to document that toxin excretion is a potential mechanism for toxin tolerance in an avian herbivore. In contrast to our results, a previous study did not detect significant concentrations of monoterpenes in feces collected from the large intestine of sage-grouse (Welch et al. 1989). However, this earlier study did not investigate fecal droppings from grouse and the storage of intestinal contents in an intact, slowly frozen and then thawed carcass may have resulted in volatilization of monoterpenes from the intestine. In addition, the headspace analysis we used offers a more sensitive assay for detecting and quantifying highly volatile monoterpenes than the analyses used by Welch et al. (1989).

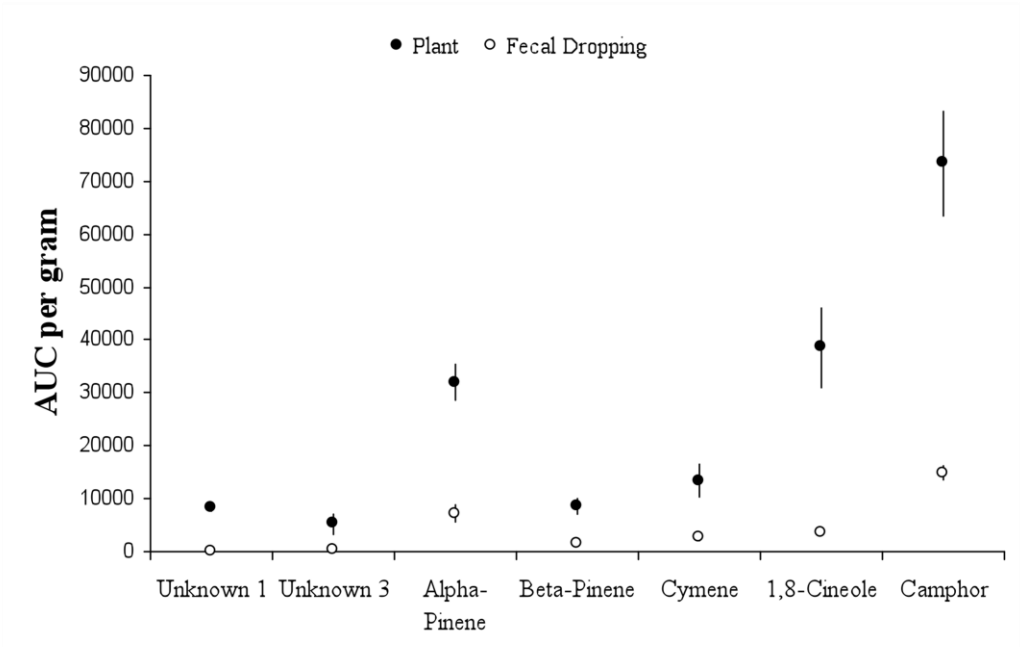

Figure 2. Mean concentrations (AUC/g dry weight ± SE) of major monoterpenes in browse (plant) and feces from sage-grouse in south-central Idaho. Although substrates differ (plant vs. fecal droppings), similar patterns in relative abundance of monoterpenes are evident across samples types. An exception to the pattern is the most volatile compound detected (Unknown 1), which never occurred in fecal samples.

Based on the chemical structure of monoterpenes, these chemicals should be readily absorbed in the intestine. For example, monoterpenes are highly soluble in blood (Falk et al. 1990) and less than 5% of either inhaled or orally ingested monoterpenes are typically recovered unchanged in the feces of mammals and often never detected (Igimi et al. 1974, Foley et al. 1987, McLean et al. 1999, Boyle et al. 2000). Our results suggest that sage-grouse possess mechanisms that actively prevent absorption of ingested monoterpenes. We propose that monoterpenes are transported out of the gut epithelium and into the gut lumen by various efflux transporter proteins (Sorensen and Dearing 2006) that are highly conserved across species (Annilo et al. 2003). Our results are consistent with a study on woodrats (*Neotoma spp.*) where ingested alpha-pinene, a monoterpene, was excreted unchanged in feces (Sorensen et al. 2004). The majority of studies investigating mechanisms of tolerance to toxins in herbivores have ignored regulated absorption. Our results suggest that this mechanism deserves further attention.

Although there is a strong pattern suggesting that sage-grouse can limit the absorption of many of the monoterpens in sagebrush, there are several limitations to our study. First, we did not measure the actual amount of monoterpenes consumed and the amount excreted unchanged and therefore cannot determine the percentage of ingested monoterpenes that were excreted. Second, additional studies are needed to identify why the more volatile monoterpenes in sagebrush (with retention times at 2.67 and 4.41 min) did not appear in feces. Rates of volatilization from the upper gastrointestinal tract (White et al. 1982) and the extent of metabolism in the gut should be investigated. Both of these require feeding studies with captive grouse that are logistically difficult. Finally, our results are restricted to a single population of sage-grouse in a single season. The extent of excretion of ingested toxins may be dependent on season, the chemotype of sagebrush consumed or developmental stage of sage-grouse and should be further explored.

Understanding the influence of tolerance to toxins by grouse may be important in efforts to decipher and predict habitat use patterns. For example, grouse at our study site, selectively used dwarf sagebrush habitats for foraging. The concentrations of toxins in dwarf sagebrush are markedly different from those in the alternative sagebrush species available on the study area (unpubl. data). Different chemotypes may influence the extent of absorption and detoxification by sage-grouse and therefore limit intake of a particular sagebrush taxa. Moreover, climate change may influence tolerance to toxins by herbivores and further restrict use of certain plant species. For example, rises in CO_2 are predicted to increase concentrations of toxins (Lindroth 2010), and toxins are likely to become more toxic with increasing temperatures (Gordon 2005, Dearing et al. 2008). Understanding the mechanisms that facilitate tolerance to toxins may help us predict how changes in land use regimes and climate will affect the ability of grouse to thrive on a given food source.

The regulated absorption hypothesis offers a novel explanation for the relatively high tolerance of tetraonids to chemically defended plants. We recommend developing a collaborative effort to investigate the extent to which regulated absorption plays a role in tetraonid foraging ecology. Such an effort requires integration of ecological knowledge of diverse plant-tetraonid systems with the bioanalytical insight and instrumentation available in our lab. The most informative systems will be those in which birds consume large amounts of potentially toxic plants (e.g. plants generally avoided by other herbivores). Plants defended by volatile or aromatic toxins (e.g. monoterpenes), such as conifers, are preferable as headspace analysis can easily be applied to these systems. Monoterpenes represent a lipophilic class of toxins that would require regulated absorption to be excreted, and comparisons can be made between these new species and our results from sage-grouse. However, we can measure a range of other chemical classes of interest (e.g. phenolics, di- and tri-terpenoids, alkaloids, etc). Initial efforts would require collecting browsed plants and fresh feces from foraging sites and then storing these samples immediately on ice or at -20°C until they can be analyzed for chemical concentration. We welcome those interested in this type of collaborative effort to contact us.

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Capercaillie lek within the city limit of St. Petersburg, Russia

Roald Potapov

I started my bird life studies near the suburban village Komarovo (known in Finnish as Kellomiaki) in 1947, when I was a 14-year-old schoolboy, and I continue to do so to this very day. Komarovo is situated 42 km north from the center of St.-Petersburg, in the southern part of the Karelian Isthmus and now is a part of the Greater St. Petersburg administrative area. It is surrounded by mixed and coniferous forests alternating with little bogs and clearings (former Finnish hayfields) being taken over by thickets. The flat relief alternates with long hills (former glacial moraines) with little bogs and lakes between them. In 1950-1970's, all these place were populated by a large number of hazel grouse, black grouse, and capercaillie. A large black grouse lek functioned at a distance of 500-700 meters from the houses at the village border. With the increase of the human population and of its activity (most importantly both legal and illegal hunting), the number of these game birds gradually decreased. In 1985, black grouse disappeared completely from the surroundings of Komarovo. Other grouse (hazel grouse and capercaillie) decreased in number by several times and it was hardly possible to find them at distances closer than 4-5 km from the village. However, the game birds' population stabilized owing to the complete prohibition of hunting in the wide suburban zone around St.-Petersburg, and especially because of the development of a negative attitude in society to hunters and to hunting in general. In 1950-1970's it was very common to meet a hunter with a gun in Komarovo's streets, however at present such encounters are simply impossible. As a result, the reverse process of recovery was gradually developing. Hazel grouse were the first; they appeared again in suitable forest habitats close to Komarovo. In 1979, I found a capercaillie nest at a distance of about 2 km from the nearest house, and in the following spring, I found a small capercaillie lek (3 males only) close to this place. During my winter skiing excursions, I began to find capercaillie snow-burrows, not frequently, but more or less regularly. At last, in January 18, 1993, I found a place in the pine forest with traces of feeding left by one or two males; they had evidently fed there on pine needles in pine crowns; I also found 2 fresh female snow burrows located at a distance of 3 m one from the other. It was only 10 A.M. early morning, and the number of fecal droppings in snow burrows (74 and 77) with the usual portion of frozen caeca's excrements demonstrated that the birds spent nearly 14 hours there (that is usual for this time and this ambient temperature constituting -24° C); these females obviously left their snow burrows undisturbed. The presence of the popular and intensively used skiing route along a high-voltage powerline 200 meters away from this lek site, as well as its location at a distance of 550 meters from the nearest houses was very unusual. Later, in March, I visited this place several times and every time I recognized traces of capercaillie feeding sites in so-called "fodder-pines". As it is well known, males prefer to feed on needles of ill or stressed pines around bogs or in marshy soils, where, because of disturbances in metabolism, such needles offer a higher nutritional value, with a larger amount of protein and with a smaller amount of calcium (Pulliainen, 1970). Birds will consume up to 50% of needles from such trees; this intense consumption leads to the appearance of new sprouts and,

as a result, tree tops become flattened (Lobachev & Tscherbakov 1936; Potapov 1985). This shape is retained for a very long time and allows the recognition of capercaillie's prior activity in places where these birds have since disappeared. Exactly this shape of pines is characteristic of the mentioned place; tree crowns were obviously changed by feeding capercaillie. At that time, I thought that this place is only a place suitable for bird's feeding; I could not even imagine that it was a real lek site. Because of this, in the end of March, it was a real surprise for me to see traces of 2 males that crossed the high-voltage line covered by deep snow and entered the forest in the direction of the place described above. In this place, traces were finished by clear prints in the snow of clear nuptial activity with walking with partly spread and lowered wings and flutter-jumps. The followed observations in April – May supported my first impression: it was a real capercaillie lek.

This place was typical of capercaillie's lek in this region of the southern taiga belt: it was a slightly swamped plot of pine forest; this plot was shaped as a long 300 m wide strip between spruce forests growing in more elevated ground. This plot differed from the neighboring areas of the pine forest in a sparser arrangement of trees and in the absence of the spruce undergrowth. Therefore, this place possessed a possibility of circus observation for a distance of 30 – 40 m. The presence of a large number of tubers, green leaves and winter flower buds of the cotton-grass (*Eriophorum vaginatum*) was another important feature. After a prolonged winter diet, this sedge is very important for capercaillie females for clutch production because of its extremely high nutritional value (Andreev, 1978; E. Potapov, 1993); as soon as the snow cover disappears prior to the breeding season; females seek for places rich in the cotton-grass and feed there intensively. In Leningrad District, capercaillie lek sites are associated with places rich in cotton-grass, presumably because the plant attracts females, and the females attract males to the lek (Potapov 2008). It is interesting to note one feature of female's food. After the consumption of such cotton-grass buds, females produce specific excrements that can be easily found, detecting these places. I found them constantly. Their excrements look like those of male, but they are sufficiently smaller, shorter, with a thickened rounded end, and with a white urine patch, without any traces of pine needles; they also possess a monotonous consistence of a dark green color. All these excrements look fresh at any time (Figure 1), but, by contrast to male excreta that can stay on the ground for a very long time, female excrements disappeared rapidly. I performed some experiments: marked such excrements with little sticks to check up their condition later, but I could not find most of them even the next day (only 20%-30% of old excreta were found; all the other were new ones). Those that preserved till the next day had not changed in weight, consistency, or color. However, this observation needs further studies. The great importance of the cotton-grass was shown in tundra ecosystems for populations of reindeer and especially for lemmings, including its great role in lemming's cycles (E. Potapov, 1993).

Figure 1. Dropping of a female capercaillie

Among my observations of that period, one was especially exciting. It happened in the evening of May 1. The snow was virtually gone. A single male visited the lek grounds this evening. The bird arrived immediately after sunset, landed in the crown on one of pines, uttered the usual raucous "u – au" (so-called Belching Canto), and was sitting motionless, listening and looking around (above) attentively during several minutes. After that, it performed the first demonstrative flight with loud wing beats to another pine at a distance of nearly 30 m. During the following 2 hours, this male performed several such flights and finished the last of them in the pine right above my shelter where I sat in my sleeping sack. This male landed on a large thick branch in the lower part of the crown, walked slowly along it and time and time ate bundles of needles. It began to sing in almost complete darkness, one song followed another. Intervals between songs sometimes decreased, sometimes increased. Songs became very active after the moon rise and the black silhouette of the male at the background of the full moon was a unique show. The uniqueness of this situation was strengthened by music, songs, joyful cries and woman's laughter that

were heard from the nearest cottage where the inhabitants celebrated the Mayday Holiday. Capercaillie did not pay attention to such unusual, but not so loud sounds, and continued singing until midnight. It slept soundless and recommenced its singing at 3.30 AM in full darkness. Two females appeared there about one hour later, in the beginning of the dawn, uttered their usual "ak…ak…ak" and after that the male stopped its singing and flew down to the ground immediately, to the center of the lek ground, where it began to sing again, alternating singing with flutter jumps. Judging by sounds, females approached the male, but subsequent events were invisible for me. Nevertheless, I had no doubts that despite the presence of only a single male in the lek, it fulfilled its reproductive function effectively.

Regular observations, performed by me since this time till nowadays, demonstrated that capercaillie regularly used this place for feeding on pine needles and for reproductive courtship activity in spring. As a rule, only a single old male and 2 – 3 females appeared in this lek. Only in 1998, in the first days of May, I observed the second male, only a yearling, who walked in a nearly complete lekking posture with his tail fully open and lifted vertically, but not approaching the old male. Narrow tail feathers of this young capercaillie in its open and lifted tail looked like spokes in a wheel.

Another problem: how one can explain the existence of the capercaillie lek in a heavy populated area, in this case in suburbs of such a large megapolis as St. Petersburg? By the way, officially, this place belongs to the territory of the city. There are two main explanations. First of all, it is the complete prohibition of any hunting and preservation of forests as around suburban villages, so between marginal cottages. Fragmentation of forest landscape by local roads and numerous high-voltage lines do not affect bird habits and behavior seriously. A constant presence of solitary pedestrians gathering berries and mushrooms in forests during summer seasons is not dangerous for capercaillie; birds avoided disturbance from such persons easily due to their fine auditory and visual abilities: they simply flew to calmer places. Problems may arise only with broods, but, as a rule, females place their nests deeper in the forest in marshy places, only occasionally or never visited by humans; at the beginning of the berry and mushroom season (-the end of June), Capercaillie chicks are big enough to avoid disturbance from peaceful visitors. In any case, this situation provides evidence that capercaillie, the symbol of the wilderness in the remote past, can dwell very close to humans. It is most unusual when one of the most wild and shy species, such as capercaillie, move the place of its most private and intimate ritual – the lek – close to heavily build up area inside the borders of the largest -Russian city Greater St-Petersburg!

There is some other evidence of such possibility. Sergey Kirpichev, one of the best experts of capercaillie's life, who is the only person in Russia able to breed successfully this bird in captivity, informed our colleagues about a wonderful story that had happened in the 1970's. In a single well-documented case, in Kamchatka, a new forestry settlement was established deep within a larch forest during winter. When spring came, the local black-billed capercaillie (*T. parvirostris*) birds began to gather, because this place was their traditional lek site. The forestry staff did what they could to minimize disturbance and the birds quickly became accustomed to them, ceased to be afraid and continued their activity with courtship displays and singing, occasionally with humans standing within distances of only 3–4 m. Now Sergey Kirpichev still studies capercaillie in a little village (Tver Province north from Moscow) without any help from Russian Game and Department officials. He believes that capercaillie possess all the necessary features to be the usual element of the modern heavily changed landscape and its future depends only on humankind.

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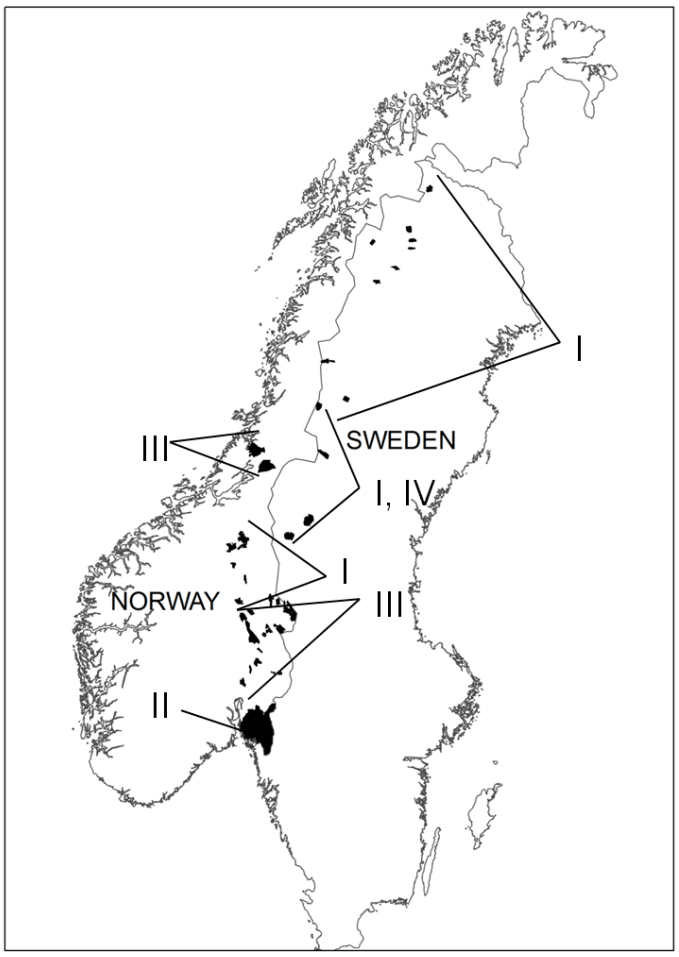
Grouse - Habitat Relationships: monitoring, scale, and management - A short summary of the PhD Thesis

Unni Støbet Lande

Capercaillie (*Tetrao urogallus*) and black grouse (*Lyrurus tetrix*) have declined over the last 20 – 30 years in central Europe, United Kingdom and parts of Fennoscandia (Storch 2007, Kurki et al. 2000). Bag statistics of willow ptarmigan (*Lagopus lagopus*) show a similar decline in Norway (Statistics Norway 2010). All grouse species are subject to recreational hunting in Fennoscandia and management aims to ensure sustainable use. To be able to identify factors causing population decline and initiate proper management actions, a well-functioning monitoring program and management are essential.

In this thesis I have used datasets on capercaillie, black grouse and willow ptarmigan (Fig.1). The datasets were sampled through large scale monitoring programs by volunteers. The volunteers were mainly hunters that already had field-experience and knowledge of grouse, and could do the work at low cost and with few logistical problems.). In Sweden, transect counts since 1960 exists (Hörnell-Willebrand 2005). In Norway, bag statistics from each county have been collected since 1972 (Statistics Norway 2010).

Distance sampling of willow ptarmigan in Norway and Sweden are conducted in slightly different ways, which makes the inference of the results from wildlife monitoring more challenging.The results showed that using a GPS to measure perpendicular distances less than 50m from line transects reduced the reliability of the density estimates. Adding covariates such as habitat (open or closed), and flushed by dog or handler, improved the models of density estimates. In non-systematic sampling designs where hunters were free to go wherever they wanted during sampling, I found little bias in the habitat selection of hunters compared to that of capercaillie and black grouse, probably caused by the diversity in habitat use among the hunters. This indicates that such sampling of data can also provide unbiased indices of population density, given a sufficiently high number of hunters is used for monitoring.



Figur 1. The geographic locations of all areas linked to each paper (I-IV) in this thesis.

Based on the adult density and chick production from the density estimates, I found a positive relationship between the heterogeneity of the landscape and both adult density and chick production of capercaillie and black grouse. Forest of moderate to high productivity had a positive effect on adult density of both species while contrary to expectation the proportion of old forest seemed to have a negative effect on chick production of both species. This is supported by findings of a negative relationship between old forest and capercaillie in Finland (Miettinen et al. 2008). Capercaillie and black grouse are described as synchronous in time and space (Kvasnes et al. 2010). It seems quite reasonable to consider an active management for both species rather than single

species management regimes. I did not detect any clear relationship between willow ptarmigan and habitat at either the individual or the landscape scale. However, at the population scale habitat relationships were detected.

Together, these results suggest that methods for monitoring grouse species are quite reliable, but could be improved by rather simple additions. Moreover, habitat composition seems to generate differences in demographic rates and population densities among populations, but these are not detectable at the individual or landscape scale. This suggests that management of grouse species should be done at a scale that captures the heterogeneity in the landscape, most likely over larger areas.

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Genetic differentiation of the Western capercaillie highlights the importance of South-eastern Europe for understanding the species phylogeography

Marko Bajc, Miran Čas, Tine Grebenc & Hojka Kraigher

Summary

Western capercaillie (*Tetrao urogallus* L.) is a grouse species of open boreal or high altitude forests of Eurasia. It is endangered throughout most mountain range habitat areas in Europe (Storch 2007). Considered to be an umbrella species, Western capercaillie serves as an indicator of sufficiently preserved structures of old coniferous or mixed forests. Genetic differentiation studies of Western capercaillie in Eurasia (Duriez et al. 2007, Rodríguez-Muñoz et al. 2007, Segelbacher and Piertney 2007, Segelbacher et al. 2003, Liukkonen-Anttila et al. 2004) revealed the existence of two main genetically identifiable lineages: the *southern* and the *boreal lineage*. The *southern lineage* has been discussed as a glacial relict (Duriez et al. 2007, Rodríguez-Muñoz et al. 2007) and has only been described at southern edges of the species distribution range in Europe. We addressed the question of genetic differentiation of Western capercaillie populations across all major habitat areas in the Balkans including Rhodope and Rila Mountains in Bulgaria, Dinaric Mountains (Slovenia, Croatia, Bosnia and Herzegovina, Montenegro, Serbia) and Southeast Alps in Slovenia. The contact zone between the two lineages and the resulting implications for conservation strategies in this so far under-studied area of distribution had not been determined previously.

The findings of an extensive genetic differentiation study based on analysis of mitochondrial DNA control region one (CRI) sequences of 319 samples revealed the existence and distribution of both Western capercaillie genetic lineages in the Balkans and Southeast Alps (Figure 1). Slovenian Alpine population was composed exclusively of *boreal lineage*, Dinaric population of both, but predominantly (96%) of *boreal lineage* and Rhodope-Rila populations predominantly (>90%) of *southern lineage* individuals. The Bulgarian mountains were, therefore, identified as the core area of the *southern lineage*, and Dinaric Mountains the western contact zone between both lineages in the Balkans. The Balkans region served as a refugium during the last glacial maximum and is as such of great importance for understanding phylogeography and genetic differentiation of the species. Genetic lineage composition of

Bulgarian and Dinaric capercaillie populations can be interpreted as similar to isolated Cantabrian (*southern lineage*) and Pyrenean (contact zone) populations (Duriez et al. 2007, Rodríguez-Muñoz et al. 2007, Segelbacher et al. 2003), respectively. According to high pairwise F_{ST} values, the results of Monmonier's maximum difference algorithm and AMOVA the Bulgarian populations appeared genetically distinct from Dinaric and Alpine populations. In contrast to Dinaric and Alpine populations Bulgarian Western capercaillie also exhibited characteristics of a long-term stationary population. Furthermore, the presence of unique Dinaric *southern lineage* haplotypes and high levels of genetic differentiation between the Dinaric and Bulgarian populations suggest that the two populations have been effectively isolated for considerable time and that the presence of *southern lineage* individuals in the Dinarides is very likely not a result of recent long-range dispersal events or illegal release of individuals from Bulgaria. Our results (Bajc et al. 2011) support the hypothesis that Bulgarian capercaillie should be considered as a glacial relict and potentially a distinct subspecies (de Juana 1994) and evolutionary significant unit (Duriez et al. 2007, Rodríguez-Muñoz et al. 2007). Furthermore, phylogenetic analysis produced evidence of two closest inter-lineage haplotypes, discovered to date, originating from the same geographic location (Bulgaria), suggesting the possibility that the *boreal lineage* had evolved from the *southern lineage* in the Balkans.

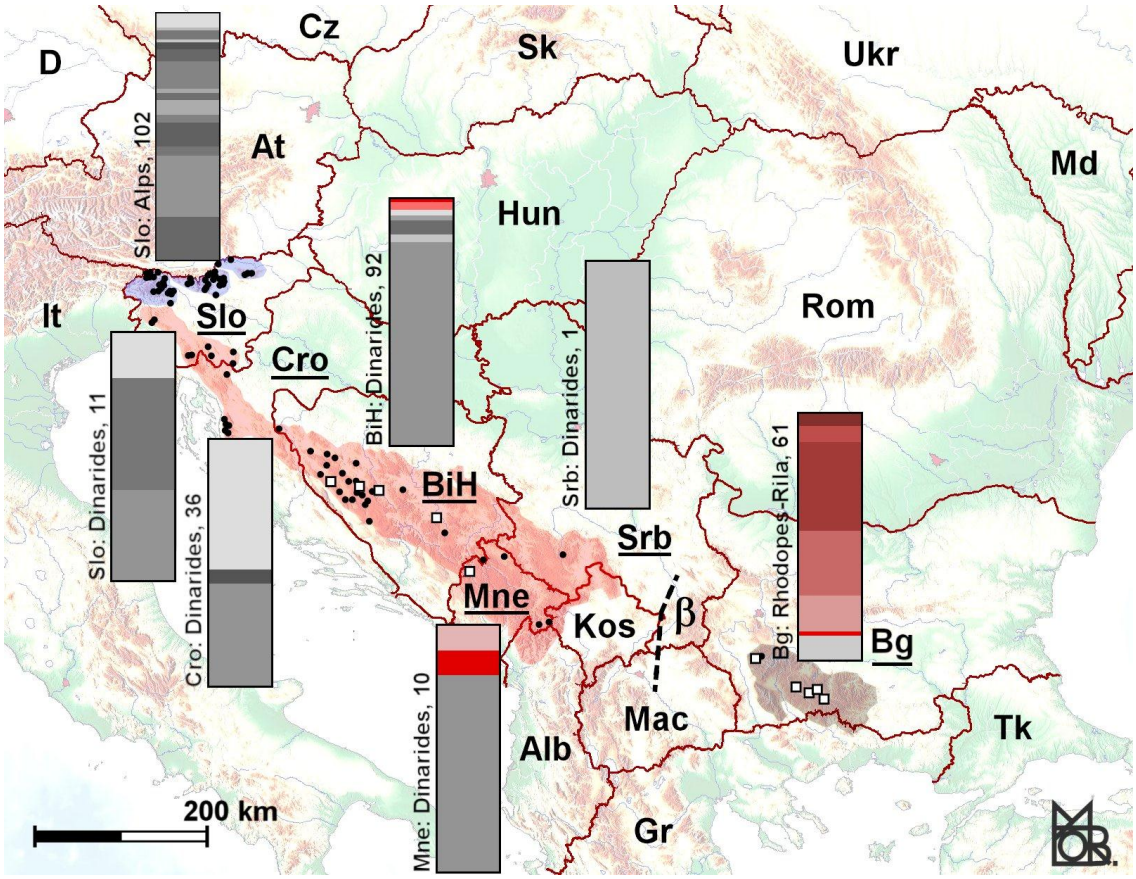

Figure 1. Map of T. urogallus sampling localities in the Balkans and Southeast Alps and haplotype composition per sampled countries/mountain ranges. Slovenian Alps are shaded blue, Dinarides red and Rhodope-Rila-Pirin Mountains grey. Black dots mark the localities where only boreal lineage individuals were discovered, white square markers in black outline represent localities where also southern lineage individuals were discovered. Each of the 30 unique mitochondrial DNA control region one haplotypes identified in this study is represented in a different colour: boreal lineage haplotypes in grey tones, southern lineage haplotypes in red tones. Country and mountain range names and number of sampled individuals are given for each haplotype composition bar chart. Dashed line marked β represents the only major genetic barrier detected in the studied region according to Monmonier's maximum difference algorithm. Alb: Albania, At: Austria, BiH: Bosnia and Herzegovina, Bg: Bulgaria, Cro: Croatia, Cz: Czech Republic, D: Germany, Gr: Greece, Hun: Hungary, It: Italy, Kos: Kosovo, Mac: Former Yugoslav Republic of Macedonia, Md: Moldova, Mne: Montenegro, Rom: Romania, Sk: Slovakia, Slo: Slovenia, Srb: Serbia, Tk: Turkey, Ukr: Ukraine; sampled countries codes are underlined.

The results are presented in the context of conservation of the species in the studied region, its principal threats and legal protection status. The influences of past forest use and differences in characteristics of natural habitats of the studied mountain ranges are discussed as important when interpreting the observed differences in genetic diversities and demographic histories of Western capercaillie populations. Although all of the studied populations had suffered a decline in the past (Čas 2006, Čas 2010, Adamič et al. 2006, Gačić et al. 2009, Zubić 2009, Petrov 2008), we identified the Dinaric Western capercaillie as particularly vulnerable to continuing population decline which may negatively affect the fitness of the population and ultimately its survival as this population exhibited significantly lower levels of genetic diversity compared to the neighbouring Alpine and Bulgarian populations. Reduction of genetic diversity has been reported previously for isolated and fragmented Western capercaillie populations (Segelbacher and Piertney 2007, Segelbacher and Storch 2002). Adding to the vulnerability of Dinaric Western capercaillie is the fact, that Dinaric population is functionally isolated due to the loss of connectedness with the Alpine population in Slovenia in 1960s (Adamič 1987, Čas 2006). The results of our study underline the fact that potential conservation strategies should consider the existence of the two Western capercaillie lineages and their contact zone, and support the specificities of the populations in the studied region.

For detailed information see the original paper: Bajc, M., Čas, M., Ballian, D., Kunovac, S., Zubić, G., Grubešić, M., Zhelev, P., Paule, L., Grebenc, T. & Kraigher, H. 2011. Genetic differentiation of the Western capercaillie highlights the importance of South-eastern Europe for understanding the species phylogeography. - PLoS ONE 6(8): e23602. doi:10.1371/journal.pone.0023602 available at: http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0023602

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Capercaillie (*Tetrao urogallus* L.), an endangered species due to disturbance and predation, can be named "the Rose of The Little Prince" in the southern edge of its distribution in Europe

Miran Čas

Introductory reflection

The recognition of causes for endangerment of rare species of wildlife animals, plants or fungi, is the first step for conservation of a species, including its genetic, ecosystem and landscape diversity and richness. The recognition of conditions for their optimal habitat and population structures are the second step, and analysis of each disturbance or habitat-population parameter is the third step for sustainable dynamical conservation and management of these species in time and space.

Adapting wildlife management for rare species conservation at the edge of their distribution area need special monitoring and sensitive research approaches between a thin interval of common parameters in all three steps. The Slovenian Alps and Dinaric mountains are south-eastern edge of the interrupted Western capercaillie habitats, representing an altitudinal corridor between the fragmented edge habitats in mixed or coniferous forests of spruce, beech and silver fir through the mountain chains between the Central and South-eastern Europe (Adamič 1987; Čas and Adamič, 1998; Čas 2001, 2006). The capercaillie in this area is a rare and endangered species. In Slovenia its hunting is prohibited by the Slovenian Hunting Association since 1984, and is protected by law since 1993 (Official Gazette of RS, 1993/57).

Distribution of habitats in the Alps is fragmented (Storch 1999, 2007, Čas 2001, 2006), which is predicted with topography, land use history and climate change (Čas and Adamič, 1998, 2007, Čas 2006, Kutnar and Kobler 2011), causing alteration of forest habitat (Čas and Adamič 1998, Čas 2002, 2006), as was confirmed in studies in some similar mountain areas of Europe (e.g. Graf et al. 2007, Braunisch and Suchant 2008, Anić et al. 2009).

Care and attention for capercaillie conservation in the temperate European mountain ranges requires great efforts by enthusiasts, environmentalists, biologists, foresters and hunters (e.g. Klaus and Bergmann 1994, Storch 1999, 2002, Čas 2001, Bollman et al. 2005, Quevedo et al. 2006, Raguž and Grubešić 2006, Zubić 2009). Just as the knowledge and concern for the conservation of different species and forest biodiversity differs in different countries around the world, so also differs conservation of

capercaillie populations. In some countries or their regions continuous or sporadic monitoring of birds number at leks and research of capercaillie populations ecology and demography are conducted, (e.g. Cattadori and Hudson 2000, Čas 2002, Pollo et al. 2005, Storch 2007, Graf et al. 2007, Petrov 2008, Gačić et al. 2009), as is in some boreal lands (e.g. Rolstad and Wegge 1987, Beškarev et al. 1995, Kurki et al. 2000, Angelstam 2004). Capercaillie is a protected species in most countries of the region even though its distribution and population density is not always known, while in some countries it remains unprotected, and is exposed to hunting, without knowing whether it is at risk or already reaching extinction (Čas 2010, Bajc et al. 2011). Therefore, the IUCN-GSG with their actions and initiatives are an important bridging organization between countries, promoting the needs for recording the status and conservation management strategies of forest grouse populations, and Grouse News is a mean for their successful deployment.

In some protected areas leks of capercaillie are under permanent supervision of foresters, environmentalists, biologists and hunters, with appropriate approaches for the species survival which is of a non-profit mutual interest (Čas 2008). Most of capercaillie leks are monitored by enthusiasts from different professions, mostly hunters and foresters, who watch over the suitability of the habitat, its disorders and pressures, and survival and rejuvenation of the sub-populations.

In these mountainous areas of the fragmented habitat boundary of southern Europe the Western capercaillie occurs as a rare and charismatic species, and each male or female is beloved as the "Rose of The Little Prince". With the abundance of large populations of capercaillie in the Boreal forest in the wide area of northern Euro-Asia, where it is an important game species, or in other countries with different habits and tradition, it may be difficult to understand our attention and precision to review leks and sub-populations.

Through this reflection we present the article: **Disturbances and predation on capercaillie at leks in Alps and Dinaric mountains** (**Čas, 2010**), which was published in **Šumarski list no. 9-10,** CXXXIV (2010), 487-495, as an initiative of members of the GROUSE SPECIALIST GRUP of IUCN in 2008. Publication of research results in this article is important for our orientation in the first step of studies of its vulnerability and ecology, necessary for the conservation management of habitats and populations of capercaillie in the Slovenian Alps and the wider area of the Alpine and Dinaric mountains.

Summary

Capercaillie (*Tetrao urogallus* L.) populations in Central and South-eastern Europe cover fragmented edge habitats and are recorded to be in decline since 1960ies (Klaus and Bergman 1994, Čas 2006). Survival of sub-populations is sensitive especially in period of winter and spring lek habitats occupancy and activity (e.g. Rolstad and Wegge 1987, Storch 1999, Elliason and Wegge 2007, Thiel et al. 2007, Čas 2010). Capercaillie leks in Slovenia are present at the south-eastern edge of the Alpine meta-population and at the north-western edge of Dinarics (Adamič 1987; Čas 2006). These populations were monitored at leks in two periods in 1980 (466 monitored leks) and 2000 (599). All leks were monitored by local specialists (hunters and/or foresters) and main causes of observed lek populations decline were addressed to each endangered lek. Special emphasis was given to predation at leks, as suggested by D. Jenkins (2008). Among the six identified causes in 1980ies which affected 39 leks the most pronounced were logging of old-growth forests (at 71.8% of leks) and construction of forest roads (7.7%). In 2000 nine causes affected 92 leks: (i) mountain tourism (26.1%), (ii) cutting of old-growth forests (19.60%), (iii) predators attacks (18.5%), (iv) forest management in spring time (9.8%), (v) pastures of livestock with wire fences in forests (6.5%),(vi and vii) berries picking and overgrowth of abandoned pastures by forest,(viii) constructions of forest roads and (ix) infrastructure. The most profound change in reasons between 1980 and 2000 mapping data were: predation at leks, mountain tourism development, and increase of forest management in spring time, uncontrolled grazing of cattle and sheep in forests, overgrowth of abandoned pastures into a forest-landscape. A comparison of the increasing percentage of leks endangered by predators since 1980 has shown positive correlations with increase of the main predator populations' densities. Population density of martens (*Martes sp.*) and wild boar (*Sus scrofa*) increased for 150% since 1980, while red fox (*Vulpes vulpes*) density increased only after 1990. Our results confirmed the assessment of causes for threats to leks based on descriptions and experiences of observers as a suitable approach for capercaillie habitat risk assessment. Conclusions from past decline and negative impacts on lek habitats are important guidelines for foresters and wildlife managers concerning sustainable forest management practices for maintenance of vital capercaillie populations.

Conclusions and suggestions for adapted forest and wildlife management

A sustainable and dynamic prevalent share of mountain old-growth mixed forests, a moderate road density and unaggressive and controlled mountain tourism was important for conservation of capercaillie habitat suitability. Control of the number and influence of predators (by their hunting) (Budiansky 1995,

Angelstam et al. 2001, Saniga 2002, Čas 2006, 2010, Sandercock et al. 2010) in the capercaillie lek areas and the nature of coherent population density of predators were crucial regulators of stable grouse densities in mountain forest landscapes of Central and South-Eastern Europe (Storch et al. 2005; Čas 2006). This analysis showed that the assessment of the causes of threats to leks on the basis of the descriptions and experiences of observers are a good indicator of the causes of risks to habitats. Our results on the current situation and differences regarding the negative impacts on habitats have resulted in an important guideline for forest and hunting management planning, and for a sustainable multipurpose landscape use with a continuous presence of forest grouse species.

For detailed information see the original paper: Čas, M. 2010. Disturbances and predation on capercaillie at leks in Alps and Dinaric mountains. - Šumarski list 9-10: 487-495.

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Spatial use of capercaillie in the southern Vosges Mountains inferred from non-invasive genetic sampling.

Arnaud Hurstel & Gwenaël Jacob

We report about the first results of capercaillie genetic monitoring in the Vosges Mountains, as a part of the European LIFE+ project "Des forêts pour le Grand Tétras". We set the non-invasive monitoring of the local capercaillie population with the aim to monitor the fragmentation of the species' habitat and identify movements of individuals within the Vosges Mountains.

The results presented here are based on the analysis of 256 faeces samples collected from early February to end of May 2010. Fresh faecal samples were collected in airtight tubes filled with silica gel and stored frozen upon analysis. After DNA extraction, samples were genotyped at 12 microsatellite loci (Jacob et al. 2009, Höglund et al., in prep) and an additional locus used to identify the sex of the individuals (Griffiths, 1998). Each marker was amplified 4–12 times to control for genotyping errors. Overall, 226 samples (88 %) provided a good-quality genotype that could be used in subsequent analyses and among those, we identified 71 unique genotypes. The probability of two individuals sharing the same genotype was low (PI_{sib} = 3.9 x10^{-3}), which indicates we can confidently distinguish among individuals based on their genotypes. Thirty-one individuals were identified as females, and 39 as males. The sex of the remaining individual could not be determined yet. We estimated a number of individuals in the range 76–106 (mean 88) based on genetic capture–recapture methods (program CAPWIRE, Miller et al. 2005).

Forty-four individuals were identified in more than one location. The distance covered within a day (Euclidean distance between sample locations) ranged from 0.2 to 1.4 km. Summed over the time period considered in the study, individual movements reached up to 4.2 km in 45 days. These movements occurred within individual home ranges, during prospection for food or other daily activities. We also observed movements of nine individuals (13 % of all the individuals) over longer distances, four individuals moved to areas at a distance of 3.4 –5.2 km, four moved distances of 9.4–14.3 km and one moved over 27 km.

Given the narrow time window and small number of records, the figures presented above are not representative of individual home ranges. Being primarily interested in identifying routes used during movements within the Vosges Mountains, the possibility to detect and track most individuals within the population makes genetic monitoring a method of choice to achieve this objective. Samples were collected in 2011 but were not analysed yet. Including a second year of data will provide further information on spatial use by capercaillie in this area. Hopefully, we will be able to identify preferred routes and key areas (stepping-stones) used during individual movements. This information will later be used to implement management measures.

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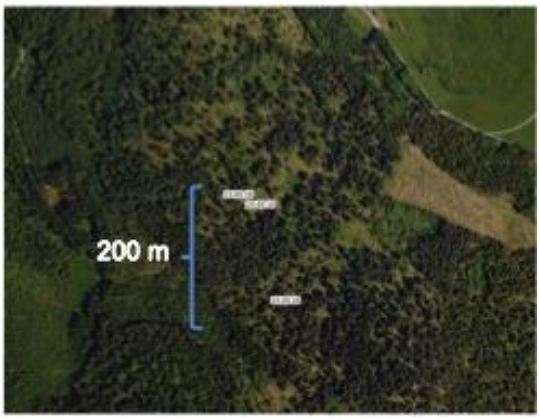
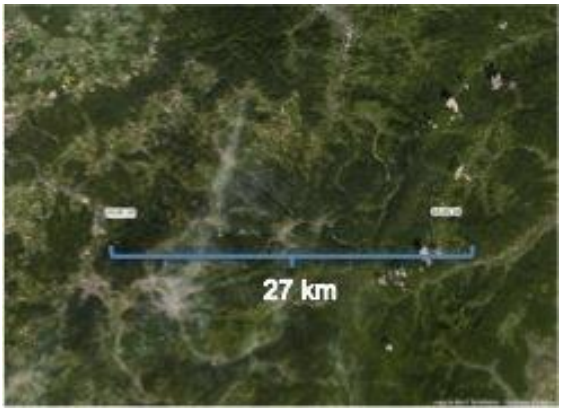


Location of three samples assigned to a female capercaillie and collected on the same day (25.03.2010). All samples were collected within a 100 m radius.



Approximately 40 days later (05.05.2010), a fourth sample assigned to the same female is found 27 km eastward.

Landscape genetics and behavioral ecology of greater prairie-chickens (*Tympanunchus cupido*)

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Ph. D. Dissertation
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Abstract
Anthropogenic activities and climate change have dramatically altered landscapes worldwide. The ability of species to cope and adapt to ongoing changes is likely a function of their behavior, movements, and sensitivity to fragmentation. Greater Prairie-Chickens (GPC) are a lek mating grouse native to the Great Plains Landscape Conservation Cooperative (GPLCC), for which inbreeding depression and anthropogenic avoidance are a concern. The goals of my dissertation were to: 1) identify genetic correlates of male performance which may influence population viability under current land use practices, 2) identify GPC habitat characteristics and delineate areas of critical GPC habitat necessary for GPC conservation, and 3) identify the relative importance of distance and habitat quality for maintaining genetic connectivity among spatially structured populations. First, I found male reproductive success and survival to be positively associated with genetic diversity. Using multistate modeling in Program Mark, male survival across the observed range of variation in number of alleles (15-22) increased more than fourfold from 0.17 to 0.77. Second, I found 35-40% of Kansas, and 1.5 % (11,000 Km2) of the GPLCC, were considered high-quality lek habitats. Top performing logistic models predicting lek presence (wi=0.95) included strong effects of grassland cover and avoidance of anthropogenic disturbance. When this model was applied to putative future landscapes based on climate change and current land use trends over a 70-year period, I found a 27-40% reduction in habitat area and a 137 Km southeast shift in habitat distribution. Under equilibrium conditions we expect isolation by distance (IBD) to explain the distribution of genetic diversity. However, if the landscape restricts dispersal, then we might observe isolation by resistance (IBR). I used model selection procedures to choose among competing IBR or IBD models to explain the distribution of genetic diversity among GPC populations across Kansas and the GPLCC. IBD was never supported ($R2<0.02$, $P>0.09$). The best models for Kansas ($R2=0.69$, $P<0.02$) and for the GPLCC ($R2=0.46$, $P<0.02$) indicated that human-mediated landscape changes have influenced landscape permeability for dispersal. The integration of behavioral, landscape, and genetic data provided new insights on prairie-chicken ecology, and is a powerful approach for developing conservation strategies for sensitive species.

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SNIPPETS

Pyrenean Network for the mountain Pyrenean galliforms - GALLIPYR Project

POCTEFA 2007 -2013 – 01/12/2008 to 30/11/2011

Céline Claustre (Forespir)

Partners:
· FORESPIR – Lead partner
· Govern de ANDORRA
· Office National des Forêts-ONF
· Office National de la Chasse et de la Faune Sauvage-ONCFS
· Fédération Régional des Chasseurs de Midi-Pyrénées-FRC MP
· Generalitat de Catalunya-GENCAT-DMAH
· Centre Tecnológic Forestal de Catalunya-CTFC
· Conselh Generau del Val d'Aran
· Gestión Ambiental Viveros y Repoblaciones de Navarra-GAVRN
· Diputación Foral de Alava
· Observatoire des Galliformes de Montagne - OGM
· Fédérations Départementales des Chasseurs

Co-financing: DREAL Midi-Pyrénées, Conseil Régional Aquitaine, Conseil Régional Midi-Pyrénées, Conseil Général Pyrénées-Atlantiques, Conseil Général Hautes-Pyrénées, Communautés de Communes des 3 Vallées, Communautés de Communes du Canton de Saint-Béat, la Généralité de Catalogne, le Gouvernement de Navarre et la Diputation Foral de Alava, Andorre.
Total Cost: 2 446 940 €
European Funding: 1 534 119 €
Contact: Virginie Fabre - Director of FORESPIR and GALLIPYR Lead Partner - 64 rue Raymond IV - 31000 TOULOUSE – FRANCE **Phone**: + 33 (0)5 34 41 43 20, geieforespir@forespir.com.

Context

The GALLIPYR project is designed to harmonize the methods of monitoring and management of 3 species of mountain galliforms between 3 States that make up the Pyrenean Massif (Spain-France-Andorra): capercaillie (*Tetrao urogallus*), rock ptarmigan (*Lagopus muta*) and mountain grey partridge (*Perdix perdix hispaniensis*). Actions are also conducted to encourage the return of hazel grouse (*Bonasa bonasia*), extinct species of the Pyrenees following due to human activity pressure. On the French side of the Pyrenees, methods of monitoring of these populations exist across the Mountain Galliform Observatory (OGM), the GALLIPYR project will expand and develop expertise between French-Spanish-Andorran specialists for the mountain game fowl, in the whole of the Pyrenean range for a better cross-border balance.

The GALLIPYR Project worklines

The project provides for the creation of a network of Pyrenean mountain galliforms, creation of a database of Pyrenees accessible (with restricted access) from the website of the project about these species and implementation of actions for the species and their habitats, with, in particular:

actions concerning the three species: realization of inventories of cables and lethal fences and visualization of a part of it; canalization of human movements on pilot areas of high strategic value for their preservation to diminish disturbance; monitoring of populations of this species and modeling the potential habitats for ptarmigan and grey partridge and breeding habitat mapping.

specific worklines for capercaillie: improvement of breeding and wintering habitats in strategic areas (core areas, corridors), on significant surfaces in regard to the present range; realization of a guide for forest management adapted at the important diversity of Pyrenean forests, and study to test the influence of terrestrial predators and the wild boar on Capercaillie populations.

specific worklines for rock ptarmigan: a program of translocation of individuals, from a strong population toward a population genetically weak, with long-term monitoring the participation in the reproduction of released birds, the evolution of the reproductive success, and an update of the data on the causes of mortality of Rock Ptarmigan will be also performed.

specific worklines for grey partridge: a practical guide of the mountain and subalpine meadows and shrublands management modes will be performed, actions to improve the habitat and recovery of populations in Navarre and the Basque country, where the species disappeared historically, by translocation of wild birds from strong populations of central Pyrenees.

specific worklines for hazel grouse (Bonasa bonasia): drafting of a plan to reintroduce it, and if the conditions are met, tests of reintroduction of hazel grouse can be realized in Val of Aran (Spain).

Expected results and perspectives

The actions of visualization of a big number of cables and fences should have a positive impact on the mortality rate of the mountain galliforms, but also have beneficial effects on a large number of birds species, including some rare species (owls, raptors,…). For rock ptarmigan: improve the efficiency of the reproduction and try to reduce a loss of genetic diversity found in a important but marginal population of this species in the East of the Pyrenees. The methodology of translocation could be transposed to other species. An increase of the carrying capacity of the habitats of capercaillie and grey partridge is expected from their improvement, and consequently we hope an positive effect in their demography.

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Desperately seeking stable, 50-year old landscapes with patches and long, wide corridors

Conservation corridors are a promising intervention to avoid and mitigate habitat fragmentation and to allow wildlife to shift their geographic ranges in response to climate change. Conservation scientists and managers have little evidence that corridors will work because most corridor research has been conducted at small spatial extents (≤ 150m corridor length, ≤ 50 m corridor width), in landscapes where the matrix is a natural landcover (e.g., grassland corridor and patches in a forest matrix), and using response variables (animal presence or short-term movement) that are weakly related to long-term gene flow and demographic persistence. To remedy this, we (Paul Beier and Andy Gregory) plan to test the ability of long (0.5 to 100 km), wide (≥ 100 m) corridors to maintain gene flow and demographic stability among populations embedded in human-modified matrix. We need your help to identify suitable landscapes with corridors and isolated patches. Please visit www.docorridorswork.org for more information on our project, and to suggest landscapes for our research. We offer a small finder's fee to those who suggest sites eventually used in our analysis.

Contact: Dr. Andrew Gregory, Andrew.Gregory@nau.edu 1 928 523 2167

12th International Grouse Symposium, Matsumoto, Japan,

20-24 July 2012

IGS News No. 6 (20th October)

As you know already, the 12th International Grouse Symposium postponed 1 year because of the March 11 earthquake-tsunami catastrophe and the nuclear crisis erupted at the Fukushima nuclear power plant in Japan. The Local Organizing Committee of IGS2012 announces that the 12th International Grouse Symposium held next year, 20-24 July 2012, in Matsumoto, Japan.

Seven months has passed after the March 11 catastrophe, Japan has recovered normal way of life except for the worst-hit coastal regions of Tohoku and the surrounding areas of the nuclear power plant. Except just after the earthquake, regulated periodic reduction in electric power in Tokyo and its surrounding areas had not done even the peak time of demand in this summer. We have now no traffic problems. Japanese government declared Sept. 20 they will try to achieve a stable condition called "cold shutdown" of the crisis-hit Fukushima nuclear power plant by the end of this year. The checks of radioactive substances in foods are done seriously, so we have no problems in diets. For these reasons, our Local Committee decided that it is possible to open the IGS in the next year.

Almost all our former symposium plans may be kept and adjustments can be made as needed. The details will be open in this November in web site.

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Jack Connelly receives Hamerstrom Award for his grouse work

At their fall 2011 meeting, the Prairie Grouse Technical Council presented Jack Connelly with the Hamerstrom award for his long-term work with prairie grouse. Jack Connelly is working as Principal Wildlife Research Biologist, Idaho Department of Fish and Game, Northwest Section Representative to The Wildlife Society, 83 West 215 North, Blackfoot, ID 83221, USA.

Jack has been involved with research and management of sage and sharp-tailed grouse for over 30 years. He is the senior author of the sage-grouse management guidelines and co-author of the habitat management guidelines for Columbian sharptailed grouse. Jack is co-editor with Steve Knick of the recently published volume "Greater Sage-Grouse: ecology and conservation of a landscape species and its habitats." The Hamerstrom Award is named for two of North America's premier early grouse biologists, Fred and Frances Hamerstrom. The Hamerstroms were a husband and wife team from Wisconsin that conducted extensive research on prairie chickens and sharp-tailed grouse.

BLM Developing New Sage-Grouse Conservation Strategy

The Bureau of Land Management (BLM) has announced it will develop a new range-wide conservation strategy for the greater sage-grouse in an attempt to avoid listing the imperiled species. Recent agreements require the U.S. Fish and Wildlife Service (FWS) to proceed with listing decisions for 251 Candidate Species, including the Greater Sage-Grouse, over the next five years. The Service must submit either a proposed listing rule or a "not warranted" finding for the sage-grouse by 2015.

"This plan is a step in the right direction, but we still need to know what BLM intends to do for sage-grouse," said Steve Holmer, Senior Policy Advisor at American Bird Conservancy. "What prescriptions will it include for energy development, livestock grazing, and cheatgrass control?"

The agency's announcement follows requests by conservation organizations including ABC, WildEarth Guardians, Advocates for the West, and Defenders of Wildlife, as well as FWS and directors of four western state fish and wildlife agencies that BLM develop new and improved regulatory mechanisms to conserve and restore sage-grouse and sagebrush habitat. FWS found current BLM resource management plans lacking when it declared the Greater Sage-Grouse a Candidate Species for listing under the Endangered Species Act in March 2010.

Greater sage-grouse by Alan Wilson

"To be successful, BLM must heed the available research that finds that oil and gas drilling, wind energy development, grazing, roads, and utility corridors are hazardous to sage-grouse and need better management," said Dan Casey, ABC's Northern Rockies BCR Coordinator. "Reserve areas for sage-grouse, and other bird species of conservation concern such as the Sage Thrasher, and Brewer's and Sage Sparrows should also be considered in the plan."

BLM is now expected to develop multiple environmental impact statements. The public will have an opportunity to be involved and submit comments on the proposals.

As part of a U.S. Department of Agriculture sage-grouse conservation initiative, $21.8 million was recently granted to Wyoming farmer and ranches. Funds will be used to tear down fences near breeding sites, implement sustainable grazing practices, and hire sixteen new staff to help farmers and ranchers adopt grouse conservation measures.

These measures are urgently needed as a recent study, *Factors Associated with Extirpation of Sage-Grouse* by the U.S.D.A. Forest Service and U.S. Geological Survey, found that a variety of human developments from roads to power lines are having a devastating impact on sage-grouse populations. The study concludes the birds avoid tall structures such as drilling rigs and communications towers, and found that abandoned sage-grouse habitat "contained almost 27 times the human density, three times more agriculture, was 60 percent closer to highways, and had 25 percent higher density of roads."

Steve Holmer, Senior Policy Advisor, American Bird Conservancy, sholmer@abcbirds.org.

Gateway West Transmission Line Project a Potential Threat to Sage Grouse

The Bureau of Land Management (BLM) is in the process of developing plans for the Gateway West Transmission Line Project, which would create the largest electricity transmission line in the U. S. According to the draft Environmental Impact Statement (EIS), transmission lines will stretch over 1,100 miles of southern Wyoming and southern Idaho, connecting solar, wind, and geothermal energy generation sites to population centers. The proposed route coincides with wildlife habitat for sage grouse (*Centrocercus urophasianus*), pygmy rabbits (*Brachylagus idahoensis*), burrowing owls (*Athene cunicularia*), and various species of raptor, raising concerns from conservation organizations. Of highest concern is the imperiled sage grouse, a candidate species for the federal Endangered Species List.

Wyoming has designated 15 million acres in the state as core sage grouse habitat and Idaho has delineated 9 million acres as key habitat for this species. The Gateway West Transmission Line could cross through approximately 235 miles of these areas, fragmenting important habitat for the sage grouse. Local sage grouse working groups are advising the BLM on the issue, and Idaho Power Company and Rocky Mountain Power have provided the BLM with a plan to mitigate or minimize impacts of the project on sage grouse, included as an appendix to the draft EIS. The BLM will be holding public hearings regarding the draft EIS in Wyoming during the first week of October 2011, where the public can submit comments. Anyone interested in submitting comments on the draft EIS can also do so through a web form provided by BLM, via e-mail to: Gateway_West_WYMail@blm.gov , or by written mail to: Bureau of Land Management, Gateway West Project, PO Box 20879, Cheyenne, WY 82003. Comments are being accepted through 28 October 2011. For more information on the transmission line project, please visit the BLM project website.

Sources: Bureau of Land Management, E&E Publishing LLC (Landletter)

Reprinted from Wildlife Policy News Volume 21, Issue 10, October 2011 (Editor: Christine Carmichael ccarmichael@wildlife.org).

Article on the effect of wind farms on Cantabrian capercaillie.

With the increasing importance of alternative energy sources, wind farms are erected throughout many parts of Europe. Mountainous areas are particularly attractive for wind parks, but also are the strongholds for grouse and other threatened species. Thus, conflicts of interest between environmentalists favouring wind energy and conservationist concerned about threatened species are common. In many places, the habitats of black grouse, rock ptarmigan, and also capercaillie, are highly suitable for wind parks. Unfortunately, we lack solid studies on the effects of wind turbines on grouse. From Norway, high mortality from rock ptarmigan flying into the turbine bases is documented. From central Europe, all we got are anecdotes. Thus, studies like the one below are filling an important gap, and may play a significant role in environmental impact studies for wind park development plans.

The Cantabrian capercaillie *Tetrao urogallus cantabricus* is the most endangered and the only inhabiting caducifolious forests. Significant differences in number of signs of Cantabrian capercaillie before and after the construction of the wind farm were found. In a recently described Mediterranean habitat, the authors assessed capercaillie occurrence before and after a wind farm construction in a wintering area. After construction of the wind farm signs of capercaillie decreased to zero and space use changed, likely due to human disturbances derived from the wind farm construction and maintenance. These changes in habitat use at a local scale and related negative effects on capercaillie are discussed. As part of the precautionary principle conservation measures for this subspecies should avoid any wind farm within the current Cantabrian capercaillie range while further research on Capercaillie and wind farms interactions should be urgently carried out.

González, M. A. & Ena, V. 2011. Cantabrian Capercaillie signs disappeared after a wind farm construction. - *Chioglossa* 3: 65-74.

New update of The IUCN Red List

The latest update of The IUCN Red List of Threatened Species™ has just been published. It illustrates the efforts undertaken by IUCN (International Union for Conservation of Nature) and its partners to expand the number and diversity of species assessed, improving the quality of information in order to obtain a better picture of the state of biodiversity. With now more than 61,900 species reviewed, another big step forward has been made toward developing the IUCN Red List into a true 'Barometer of Life,' as called for by leading experts in the magazine Science in 2010. This update offers both good and bad news on the status of many species around the world. The red list website is http://www.iucnredlist.org/.

The IUCN Red List is not just a register of names and associated threat categories. It is a rich compendium of information on the threats to the species, their ecological requirements, where they live, and information on conservation actions that can be used to reduce or prevent extinctions. The Red List is critical as an indicator of the health of biodiversity, in identifying conservation needs and informing necessary changes in policy and legislation to drive conservation forward. Red list assessments are essential for guiding conservation actions.

The text/info was taken from the IUCN press release from 10th November 2011.