



Key actions for Large Carnivore populations in Europe

SECTION 5: WOLVERINE

DRAFT

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DATA

PART I – Wolverine populations in Europe

1.1 Populations

Wolverines are found in four countries in Europe: Sweden, Norway, Finland and Russia. The distribution is divided into two populations; the Scandinavian population (common to Norway and Sweden, and the extreme north of Finland) and the Karelian population (Finland and Russia), but there is probably some connection between the two populations. In addition there are also wolverines on the Kola Peninsula, which are neither part of the Scandinavian nor the Karelian populations, but probably connected to both these populations. For this assessment data are presented on population trends and distribution from Sweden, Norway, Finland and Russia.



Figure 1. The two wolverine populations in Europe.

1.2 Status

The estimated total number of wolverines in Europe is about 1500 – 2000. The Scandinavian population is increasing in Sweden and north Finland, but is stable in Norway. The range is also increasing in Sweden and north Finland, but is more or less stable in Norway. The different developments in Sweden and Norway can be explained by the much higher legal harvest rate and use of lethal control in Norway, as compared to Sweden. The Karelian population in Finland is increasing both in numbers and distribution, whereas the population is stable in Karelian Republic, Russia.

Name of population	Population estimate (2011)	Trend 2006-2011	IUCN Red List assessment
Scandinavian	Sweden: 680 ± 100 St.dev. Norway: 385 ± 46 St.dev. Finland: ~ 70 - 80 TOTAL: ~ 1000-1300	Increase	Sweden: Vulnerable Norway: Vulnerable Finland: Critically endangered
Karelian	Finland: ~ 80-90 Russia: ~ 150-170 TOTAL: ~ 230-260	Increase	Finland: Critically endangered Russia: Vulnerable - endangered
Kola peninsula	Russia: ~ 350 TOTAL: ~ 350	Stable	Russia: Vulnerable - endangered

1.3 Threats

In the past the main threats to wolverines were over-harvest and poaching. The disappearance of the other large carnivores in the past might also have had a negative impact on the wolverine, as carrion provided by the kills of other predators is important for wolverines. Currently, wolverines in the Karelian population benefit from the presence of wolves, and wolverines in the Scandinavian population benefit from the presence of Eurasian lynx.

Today, the threat because of over-harvest is lower, as the harvest quotas are set in relation to management goals and the effects are evaluated by the results from annual surveys. The management system is coming closer to an adaptive management approach, which means that any undesired reductions in population size can be addressed by reducing harvest quotas. There has not been any harvest of wolverine in Finland since 1982.

An emerging threat is climate change as wolverines are presumed to be dependent on good snow conditions (deep snow that lasts into late winter/spring) for denning and food caching. Wolverines reproduce successfully also in forested areas in central and eastern Finland and Russian Karelia, where snow conditions meet the requirements of wolverine denning. The impacts of climate change call for attention and investigations to gain more knowledge on the possible impacts of climate change on the species distribution, and on the development of future monitoring methods.

A potential threat is the low population goals set by both Norway and Sweden because of conflict with semi-domestic reindeer herding in both countries and additionally with sheep farming in Norway. The Swedish reindeer husbandry industry has proposed certain tolerance levels for the total losses of reindeer to all predators, based on economically acceptable losses. These "acceptable" losses are much lower than the estimated losses today. Thus, if the

politicians decide to follow these tolerance levels, then the management goals for all predators, including wolverines, would have to be lower than today.

For the Karelian population, especially the Finnish part, there are no set population goals, and the population is increasing. Furthermore, the Karelian population (both the Finnish and Russian part) is outside the reindeer husbandry area. Thus, the situation differs from that in Sweden and Norway as there are no major threats on the Karelian population based on depredation of livestock. However, the conflict with semi-domestic reindeer herding is also severe in the Finnish reindeer husbandry area (where wolverines are mainly part of Scandinavian population), as wolverine depredation on reindeer have increased rapidly during the last years in northern Finland.

Genetic isolation and lack of connectivity between (sub)populations might be a threat for certain wolverine populations within the wolverine distribution range.

1.4 Conflicts

The main human-wolverine conflict is similar in Sweden, Norway and northern Finland, i.e. wolverine depredation on semi-domestic reindeer. In Norway, there is an additional conflict because of depredation on unguarded free-ranging domestic sheep. In all three countries the government pays compensation for wolverine-killed domestic animals. In Sweden the costs are between 2 - 2.5 M€ per year for reindeer and in Norway between 1.8 - 2.2 M€ per year for reindeer and between 2.7 - 3.8 M€ per year for sheep. In Finland, the compensations paid for wolverine-killed reindeer were between 1 – 2.6 M€ per year in 2010-2012. The Swedish system is based on a risk-based system where compensation is paid *a priori* based on the presence of reproductive wolverines, whereas in Norway the compensation is paid *ex post facto* based on both documented losses and estimated losses. Because of the difficulty of finding freshly killed animals under extensive grazing conditions only a small proportion of the losses compensated are based on documented kills. Finland pays for a combination of documented losses and estimated losses of calves in reindeer (occurring before the end of November).

An important management issue in Sweden is the high level of poaching that lowers the growth rate in the wolverine population, although the population is still increasing. An important management issue in Norway is that the current wolverine population is above the management goal and therefore the harvest quotas are set quite high in order to reduce the population. State wardens conduct lethal control operations (including using shooting from helicopters and digging out dens) in order to ensure that quotas are filled.

PART II – Objectives

2.1 Objectives of this list of actions

- To identify the most critical (*i.e.* important and urgent) actions for the conservation and management of the wolverine populations in northern Europe in coexistence with local stakeholders for the next 5 years.
- To provide the authorities responsible for the conservation and management of wolverine in the Member States and the European Commission with a strategic planning tool for relevant future activities in the next 5 years.

- To improve collaboration and relationship amongst relevant stakeholders for wolverine conservation and management in northern Europe by integrating them into the process of planning and implementing actions/activities.
- To raise awareness amongst authorities and the public for the most urgent needs for wolverine conservation and management in northern Europe.

PART III – Actions for all populations (order after level of urgency)

3.1 Scandinavian and Karelian populations, i.e. general actions for wolverine

ACTION 1	
Title of the Action:	Coordinate management plans for wolverine with lynx, wolf and bear
Objective :	To better take into account both ecological interactions and cumulative aspects of conflict associated with having multiple large carnivore species in the same region.
Description of activities:	Estimate the interactions between different large carnivore species and the cumulative losses of domestic prey. Wolverines are found in regions with several other large carnivores species. The tolerance levels for wolverines depend on both the abundance of wolverines and the abundance of other large carnivores. Good estimates of the cumulative losses of domestic animals to all large carnivores species are often more important for the reindeer herders and sheep farmers than the species-specific losses. The conservation value for an area can be higher when several large carnivore species co-exist.
Expected results:	<ul style="list-style-type: none"> • Estimates of the ecological interaction of multiple large carnivore species in the same region. There are both negative interactions (e.g. intra-guild predation) and positive interactions (e.g. scavenging opportunities). • Estimates of the cumulative impact of multiple large carnivore species in the same region on the total losses of domestic animals (reindeer and sheep) to large carnivores.
Responsibility for implementation:	National wildlife management agencies in Sweden, Finland and Norway Regional wildlife management agencies in Sweden, Finland and Norway Wildlife research institutions and universities.
Timing of the activities:	Three-years project Operation of system: Continuously a part of the management plans
Level of urgency:	Level: 1 (high)
Cost and potential	500 -1000 k€

funding sources:	
Benefit:	Improved coordination of cross species management to better manage the total impacts of all carnivores on stakeholder interests: 4-5 (High)

ACTION 2	
Title of the Action:	Measures to prevent depredation on reindeer and sheep
Objective:	Test and evaluate lethal and non-lethal preventive measures to reduce depredation on reindeer and sheep in close co-operation with stakeholders.
Description of activities:	<p>Test and evaluate different potential preventive measures (both lethal and non-lethal) to reduce depredation on reindeer and sheep. These tests should be done in very close co-operation with the reindeer herders and sheep farmers. The exact preventive measures should be decided after several stakeholder meetings. The cumulative effects of several carnivore species increase the challenge for cost effective preventive measures. Costs and benefits of various preventative measures should be viewed within the wider contexts of agricultural economics.</p> <p><i>Wolverine harvest can be one preventive measure to contain or reduce depredation, hence increase social acceptance, and should be evaluated within an adaptive management framework</i></p>
Expected results:	<ul style="list-style-type: none"> • Estimate the effect, costs and benefits of different non-lethal preventive measures to reduce wolverine depredation on reindeer and sheep. • Evaluate lethal control as a measure to reduce depredation within a adaptive management framework
Responsibility for implementation:	<p>National wildlife management agencies in Sweden, Finland and Norway</p> <p>Regional wildlife management agencies in Sweden, Finland and Norway</p> <p>National reindeer management agencies in Sweden, Finland and Norway</p> <p>Regional reindeer management agencies in Sweden, Finland and Norway</p> <p>Stakeholders (reindeer herders and sheep farmers) in Sweden, Finland and Norway</p> <p>Research institutions and universities</p>

Timing of the activities:	Start: Several stakeholder meetings to discuss and plan both lethal and non-lethal preventive measures. Three-years projects to evaluate the effects of different preventive measures.
Level of urgency:	Level: 1 (high)
Cost and potential funding sources:	> 1000 k€
Benefit:	Reduced losses of domestic livestock to wolverine predation. 4 (high)

ACTION 3	
Title of the Action:	Towards a robust adaptive management
Objective (what the Action aims to obtain):	Formalise the use of adaptive management in wolverine population management, i.e. use available knowledge, set clear goals, make decisions related to these goals and most importantly evaluate actions in relation to set management goals.
Description of activities:	Continue to develop the on-going adaptive management framework for wolverine management. Management actions are taken in relation to management goals and are evaluated based on both forecasted result and observed results. A working adaptive management will reduce the risk of undesired results of management actions and will increase the acceptance for some management actions. For example, if harvest/lethal control is used to reduce the depredation rate on reindeer and/or sheep, then the effect of harvest needs to be evaluated both in relation to the forecasted reduction in wolverine population size and the forecasted decrease in depredation on reindeer and/sheep. <i>Actions 2, 4, and 7 are parts of a working adaptive management system.</i>
Expected results:	<ul style="list-style-type: none"> • A working framework on how to apply adaptive management in wolverine management. • Clear management goals. Management actions that are related to these goals, that in turn are evaluated in relation to forecasted results as well as the observed results.
Responsibility for implementation:	National wildlife management agencies in Sweden, Finland and Norway Regional wildlife management agencies in Sweden, Finland and Norway Wildlife research institutions and universities.
Timing of the activities:	Establishment of the system: Several years

	Operation of the system: Continuous
Level of urgency:	Level: 1-2 (high)
Cost and potential funding sources:	100 - 500 k€
Benefit:	To create a formal and robust decision making framework that ensures that all management actions that are taken to reduce conflict do not impact wolverine conservation status. 4 (medium-high)

ACTION 4	
Title of the Action:	Introduce robust population models for managing harvest quota setting
Objective:	Robust population models and decision theory can help wildlife managers to use monitoring data and to set harvest quotas that minimise risks of unintended consequences and promote transparency in the process.
Description of activities:	<p>Use existing monitoring data, harvest data and other relevant population dynamic data to develop robust population models for forecasting the effect of different harvest levels on the wolverine population size at different spatial scales (e.g. regional, national and population levels). Use the experience from other similar population models. Annual update of the models based on the most recent monitoring results and harvest. The evaluations and forecasts could be included in the annual monitoring.</p> <p><i>Evaluate the observed effects of harvest with the predicted effects within an adaptive management framework.</i></p>
Expected results:	<ul style="list-style-type: none"> • Production of robust population models using monitoring data and other relevant population dynamic data for setting harvest quotas • Evaluate the observed effects of the harvest on the population size with the forecasted effects • Compliment annual monitoring reports with an evaluation of the most recent harvest by comparing the forecast and results from the monitoring. • Compliment annual monitoring reports with a forecast of different harvest levels on future population size (see below Action 7).
Responsibility for implementation:	<p>National management agencies in Sweden, Finland and Norway</p> <p>Regional management agencies in Sweden, Finland and Norway</p>

	Wildlife research institutions and universities.
Timing of the activities:	Establishment of the system: 1 or 2 years Operation of the system: Continuous
Level of urgency:	Level: 1-2 (high-medium)
Cost and potential funding sources:	100 - 500 k€
Benefit:	To improve the implementation of population level conservation. To reduce conflicts associated with uncertain impacts of different quotas: 4 (medium-high)

ACTION 5	
Title of the Action:	Coordinate national management plans for the Scandinavian and the Karelian (and Kola Peninsula) wolverine populations
Objective:	To better take into account management actions occurring at national levels affecting cross-boundary populations.
Description of activities:	Develop a conservation strategy that spans both populations, based on national management plans, and include the importance of connectivity between the populations. National management plans in each country should take into account management activities in the neighbouring countries. The connectivity between populations should be co-ordinated between countries. Review and revise the conservation strategy e.g. every 5-6 years.
Expected results:	<ul style="list-style-type: none"> • A common population-wide conservation strategy for the Scandinavian and Karelian wolverine populations, including the importance of connectivity between the populations. • National management plans that include the population-wide conservation strategy and are coordinated with the management plans in the neighbouring countries. • Continue the regular meetings between the national wildlife management agencies to discussion management actions and coordinate management actions between the countries.
Responsibility for implementation:	National wildlife management agencies in Sweden, Finland, Norway and Russia
Timing of the activities:	Continue and develop the on-going coordination between the countries. Operation of the system: Continuous
Level of urgency:	Level: 2 (high-medium)

Cost and potential funding sources:	<100 k€
Benefit:	To improve the implementation of population level conservation: 4 (medium-high) The ensure that wolverine populations have sufficient connectivity for long term viability: 2 (low-medium)

ACTION 6	
Title of the Action:	Investigate and promote connectivity within and between the Scandinavian and Karelian populations
Objective (what the Action aims to obtain):	Conduct joint investigation of distribution and the degree of genetic exchange between Norway, Sweden and Finland to determine the extent to which these populations are connected. Promote monitoring of the Russia part of the Karelian population.
Description of activities:	Estimate the genetic structure of the Scandinavian and Karelian wolverine populations, the genetic differences and the gene flow between them, by collecting and analysing samples from both populations. If the connectivity is low, then actions need to promote dispersal of wolverine individuals between the populations. Promote, by cooperation, monitoring and compilation of the status of the Russian part of the Karelian populations.
Expected results:	<ul style="list-style-type: none"> • Estimates of the connectivity (both the genetic differences and the gene flow) between the Scandinavian and the Karelian wolverine populations. Standardised protocols for genetic sampling, analyses and storing. • A compilation of the status of wolverines in Russia for the Karelian population, as well as the abundance and distribution in Russia further north (Kola Peninsula and Murmansk province) and east.
Responsibility for implementation:	National wildlife management agencies in Sweden, Finland, Norway and Russia Wildlife research institutions and universities
Timing of the activities:	Three-years project, Operation of the system: Continuous
Level of urgency:	Level: 2 (high-medium)

Cost and potential funding sources:	100 - 500 k€
Benefit:	To improve the implementation of population level conservation: 4 (medium-high) The ensure that wolverine populations have sufficient connectivity for long term viability: 2 (low-medium)

ACTION 7	
Title of the Action:	Standardisation of monitoring across borders
Objective (what the Action aims to obtain):	Continue the on-going work to standardise monitoring protocols between Norway and Sweden and extend this to Finland to create a common assessment of population status with standardised methodology. Explore ways to motivate stakeholders and the public to continue their involvement in reporting of tracks and observations.
Description of activities:	Establish, based on the already on-going standardisation, a common transboundary monitoring system in Sweden, Norway and Finland. The system will be based on: (1) the on-going natal den surveys (2) line transects (Finland) and (3) the development of new monitoring methods (e.g. camera trapping and DNA-sampling), especially in areas without stable snow conditions. Common reports on the status of the population (abundance and distribution) will be published every year. <i>Robust monitoring is a part of adaptive management.</i>
Expected results:	<ul style="list-style-type: none"> • Shared databases for monitoring data (on-going work for Sweden and Norway). • Annual common assessment and reports of the population status (on-going work for Sweden and Norway, Finland should be included as soon as possible). • The annual monitoring report with an evaluation of the most recent harvest by comparing the forecast and results from the monitoring. • The annual monitoring report with a forecast of different harvest levels on future population size (see above Action 4).
Responsibility for implementation:	National management agencies in Sweden, Finland and Norway Regional management agencies in Sweden, Finland and Norway

Timing of the activities:	On-going for Sweden and Norway. Finland should be included as soon as possible. Operating of system: Continuous
Level of urgency:	Level: 2 (high-medium)
Cost and potential funding sources:	< 100 k€
Benefit:	Reduced uncertainty over wolverine numbers and the extent of population isolation. 3 (medium)

ACTION 8	
Title of the Action:	Foster the expansion of wolverines into forested areas outside the reindeer husbandry area
Objective (what the Action aims to obtain):	<p>Adopt necessary management actions to promote wolverine expansion into forested areas outside the reindeer husbandry area in Sweden, Finland and parts of Norway.</p> <p>Enable translocations to mitigate conflict (increase social carrying capacity) in reindeer husbandry area with high wolverine density and high levels of depredation as well as to improve connectivity and genetic diversity of wolverines in forested areas.</p>
Description of activities:	<p>Data on abundance and distribution of wolverines in forested areas outside the reindeer husbandry area without stable snow conditions is not as good as in other areas. Therefore, one needs to improve the monitoring in these areas, before any action can be taken to promote the expansion.</p> <p>Mapping suitable habitats and examining the opinions of local people to prepare for translocation of wolverines to areas outside the reindeer husbandry would foster the expansion and benefit the wolverine population status. By translocation, gaps between subpopulations could be filled and thus obtain improved connectivity and genetic diversity.</p> <p>One action can also be to evaluate the effect of different management action that might counteract the expansion, e.g. harvest at the edge of distribution might decrease the expansion rate.</p>
Expected results:	<ul style="list-style-type: none"> • Improved monitoring in forested areas outside the reindeer husbandry • Improved social carrying capacity in reindeer husbandry area • Improved connectivity and genetic diversity • Evaluate the effect of different management action that might counteraction the expansion

Responsibility for implementation:	National wildlife management agencies in Sweden, Finland and Norway Regional wildlife management agencies in Sweden, Finland and Norway
Timing of the activities:	Continue the on-going development of monitoring methods (see Action 6). Operation of the system: Continuous
Level of urgency:	Level: 2 (high)
Cost and potential funding sources:	100 - 500 k€
Benefit:	Expand the area over which wolverine are distributed in Sweden to permit the reduction in wolverine pressure in reindeer herding areas. It will also permit the restoration of ecosystems where all four large carnivores can interact ecologically. 3 (medium)

ACTION 9	
Title of the Action:	Create structured forums and protocols for the involvement of a diversity of stakeholders
Objective (what the Action aims to obtain):	Strive towards involving stakeholders in development and implementation of management actions
Description of activities:	Developing management plans and implementing management actions mean compromises between different stakeholders. An adaptive management framework could improve the acceptance of controversial decision, as there should be quantitative predictions for a decision. Forums that involve a diversity of stakeholders and that also have credibility among the stakeholders will improve the acceptance of different management actions.
Expected results:	<ul style="list-style-type: none"> • Establish a process for (workshop) and a platform supporting the local/regional/national wolverine management through involvement of a diversity of stakeholders. • Develop the existing forums for discussing wolverine management at national and regional levels.
Responsibility for implementation:	National wildlife management agencies in Sweden, Finland and Norway Regional wildlife management agencies in Sweden, Finland and Norway National reindeer management agencies in Sweden, Finland and Norway Regional reindeer management agencies in Sweden, Finland and Norway Stakeholders (e.g. reindeer herders, sheep farmers, conservation

	NGO:s) in Sweden, Finland and Norway
Timing of the activities:	Continue and develop the existing forums at both national and regional levels. Operating the system: Continuous
Level of urgency:	Level: 2 (high-medium)
Cost and potential funding sources:	< 100 k€
Benefit:	Improved communication and trust between stakeholders. 4 (medium-high)

ACTION 10	
Title of the Action:	Improve compensation systems
Objective (what the Action aims to obtain):	Evaluate and where needed modify compensation systems so that they are efficient and fair and provide positive incentives for wolverine conservation and effective husbandry. Exchange experience of different compensation systems in Europe.
Description of activities:	There are several different methods to compensate the losses of domestic animals, from paying incentives for large carnivore presence to those that pay compensation for documented and estimated losses. The different compensation systems have their pros and cons. Modifications of existing compensation systems should therefore include the transfer of experience from other systems. One important aspect is how different compensation systems can improve the coexistence of large carnivores with local stakeholders. Should also be addressed within the future framework of European Union agricultural policy.
Expected results:	<ul style="list-style-type: none"> • A review of different compensation system (e.g. risk-based a prior compensation and ex post facto documented losses) in Europe for large carnivores and the pros and cons of different compensation system under different circumstances.
Responsibility for implementation:	<p>National wildlife management agencies in Sweden, Finland and Norway in cooperation with other national wildlife management agencies throughout Europe.</p> <p>Regional wildlife management agencies in Sweden, Finland and Norway</p> <p>National reindeer management agencies in Sweden, Finland and Norway</p> <p>Regional reindeer management agencies in Sweden, Finland and</p>

	Norway Stakeholders (reindeer herders and sheep farmers) in Sweden, Finland and Norway Research institutions and universities.
Timing of the activities:	Two-three years project
Level of urgency:	Level: 3 (medium)
Cost and potential funding sources:	< 100 k€
Benefit:	Fairer and more efficient systems that redistribute the costs of large carnivore conservation. 4 (high)

ACTION 11	
Title of the Action:	Investigate the effects of climate change on wolverines
Objective (what the Action aims to obtain):	Investigate how climate change may influence wolverine ecology and management procedures (including monitoring).
Description of activities:	An emerging threat is climate change as wolverines are dependent on persistent snow cover (later winter/spring) for denning and food caching. Climate change will also influence monitoring methods. Data on reproductive success should be collected from different areas as well as during years with different weather/snow conditions and use this information as a proxy for climate change.
Expected results:	<ul style="list-style-type: none"> • Improved monitoring in areas without stable snow conditions. • Quantitative assessment of the impact of different weather/snow conditions on reproductive success, as a proxy for climate change. • Forecast the effect of climate change on abundance and distribution of wolverines.
Responsibility for implementation:	Wildlife research institutions and universities. National wildlife management agencies in Sweden, Finland and Norway.
Timing of the activities:	Continue the on-going development of monitoring methods (see Action 7). Three-years project
Level of urgency:	Level: 4 (medium-low)

Cost and potential funding sources:	> 1000 k€
Benefit:	Improved knowledge base for making policy decisions relevant for wolverine viability in the long term. 3 (medium)

