

IUCN Red List Mapping for the regional assessment of the Wolverine *Gulo gulo* In Europe

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I. The map product

The mapping approach follows the methods described in Chapron et al. (2014) and Kaczensky et al. (2013). It updates the published Species Online Layers (SPOIS) to the period 2012-2016.

In short, large carnivore presence was mapped at a 10x10 km ETRS89-LAEA Europe grid scale. This grid is widely used for the Flora-Fauna-Habitat reporting by the European Union (EU) and can be downloaded at: <http://www.eea.europa.eu/data-and-maps/data/eea-reference-grids-2>.

The map encompasses the EU countries plus the non-EU Balkan states, Switzerland, Norway, and the Carpathian region of Ukraine.

Presence in a grid cell was ideally mapped based on carnivore presence and frequency in a cell resulting in:

- **1 = Permanent** (presence confirmed in ≥ 3 years in the last 5 years OR in $>50\%$ of the time OR reproduction confirmed within the last 3 years)
- **3 = Sporadic (highly fluctuating presence)** (presence confirmed in <3 years in the last 5 years OR in $<50\%$ of the time)

Where grid cells have portions in more than one country and cells were assigned different values in neighbouring countries; the “disputed” cell was always given the “higher” presence value; that is a cell categorized as “sporadic” by one and “permanent” by the country was categorized as “permanent”.

To assess the quality of carnivore signs we used the SCALP criteria developed for the standardized monitoring of Eurasian lynx (*Lynx lynx*) in the Alps (Molinari-Jobin et al. 2012):

- **Category 1 (C1):** “Hard facts”, verified and unchallenged large carnivore presence signs (e.g. dead animals, DNA, verified camera trap images);
- **Category 2 (C2):** Large carnivore presence signs controlled and confirmed by a large carnivore expert (e.g. trained member of the network), which requires documentation of large carnivore signs; and
- **Category 3 (C3):** Unconfirmed category 2 large carnivore presence signs and all presence signs such as sightings and calls which, if not additionally documented, cannot be verified

Table 1 provides an overview of the mapping details (time period, coverage, data unit, data categories used, extrapolation methods). The table also provides the contact people that compiled or provided the national/regional maps which were subsequently compiled into the Europe-wide map. Table 5 lists further contributors for the national/regional mapping.

Table 1: Overview of large carnivore data basis for the presence layer 2012-2016.

Country/Region	Period	Method change	Major effort change	Data unit ¹	Coverage of range ³	Extrapolation ²	Estimated % of cells based on 2012-2016 signs	LC sign category	Map contacts
Norway & Sweden	2012-2016	no	no	Points	All - annually	10km buffer all	58	C1&C2	Henrik Brøseth
Finland	2012-2016	yes	no	Points	All - annually	none; in reindeer husbandry area: cells around permanent	100%; in reindeer husbandry area for permanent: 19%	C1&C2	Ilpo Kojola

¹Points=Location coordinates

²All-annually=monitoring covers entire range every year

³Cells around repro=if a cell had reproduction, the 8 surrounding cells were also marked permanent

II. Presence definitions for the IUCN Red Listing

Our SPOIS definitions “permanent” and “sporadic” had to be transferred to the IUCN Red via the two categories PRESENCE and SEASONAL. A third category also delineates the ORIGIN of populations (native versus (re)introduced). For detailed background documents see: <http://www.iucnredlist.org/technical-documents/red-list-training/iucnspatialresources>.

All SPOIS cells “permanent” and “sporadic” were assigned a PRESENCE status of 1 (Extant). Under SEASONAL “permanent” cells were assigned to 1 (Resident), “sporadic” to 4 (Passage). Under ORIGIN “sporadic” cells were assigned to 4 (vagrant), while “permanent” and “present” were assigned to native (1) as there are no reintroduced wolverine populations

Assigning “sporadic” cells to “Vagrants” saved us from delineating “sporadic” cells to specific populations. For many sporadic cells such an assignment can be done, but for enough other cells it is rather subjective and with expanding populations it will become even more difficult to assign these cells in any standardized way. For an overview of the SPOIS and subsequent IUCN Red List coding see Table 2.

Table 2: SPOIS and translation into IUCN Red List criteria – metadata table.

SPOIS code		IUCN Red List presence criteria*			Presence comment	IUCN*
		Presence	Seasonal	Origin		Subpopulation
1	Permanent	1 (Extant)	1 (Resident)	1 (native)	Extant (resident)	Population names
3	Sporadic	1 (Extant)	4 (Passage)	4 (vagrant)	Extant (sporadic)	Vagrants

*Obligatory cells for the IUCN Red List shape files

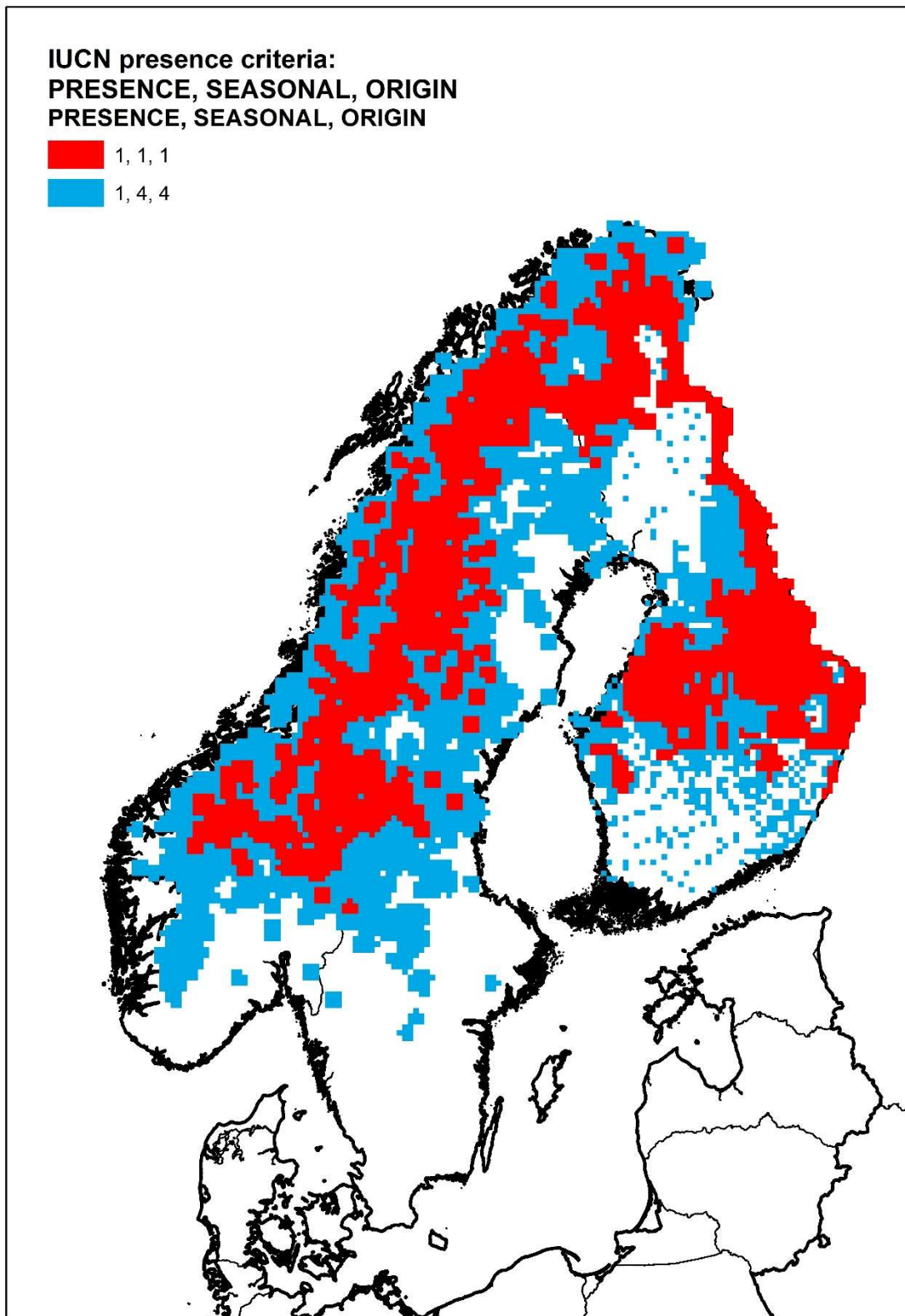


Fig. 1: Wolverine presence in Europe 2012-2016 according to IUCN presence criteria for PRESENCE, SEASONAL, and ORIGIN (for codes see Table 2).

III. Area calculations

We only used the permanent cells for the calculation of the Extent of Occurrence (EOO) and Area of Occupation (AOO). The EOO is calculated as the 100% Minimum Convex Polygon (MCP) around all permanent cells and the AOOs are the sum of all permanent cells in each population (Fig. 2, Table 3).

Table 3: EOO and AOOs of wolverine populations in Europe 2012-2016.

Populations	Area (km²)
EOO	925,750
AOOs:	
Karelian	110,300
Scandinavian	232,000
Sum of AOOs	342,300

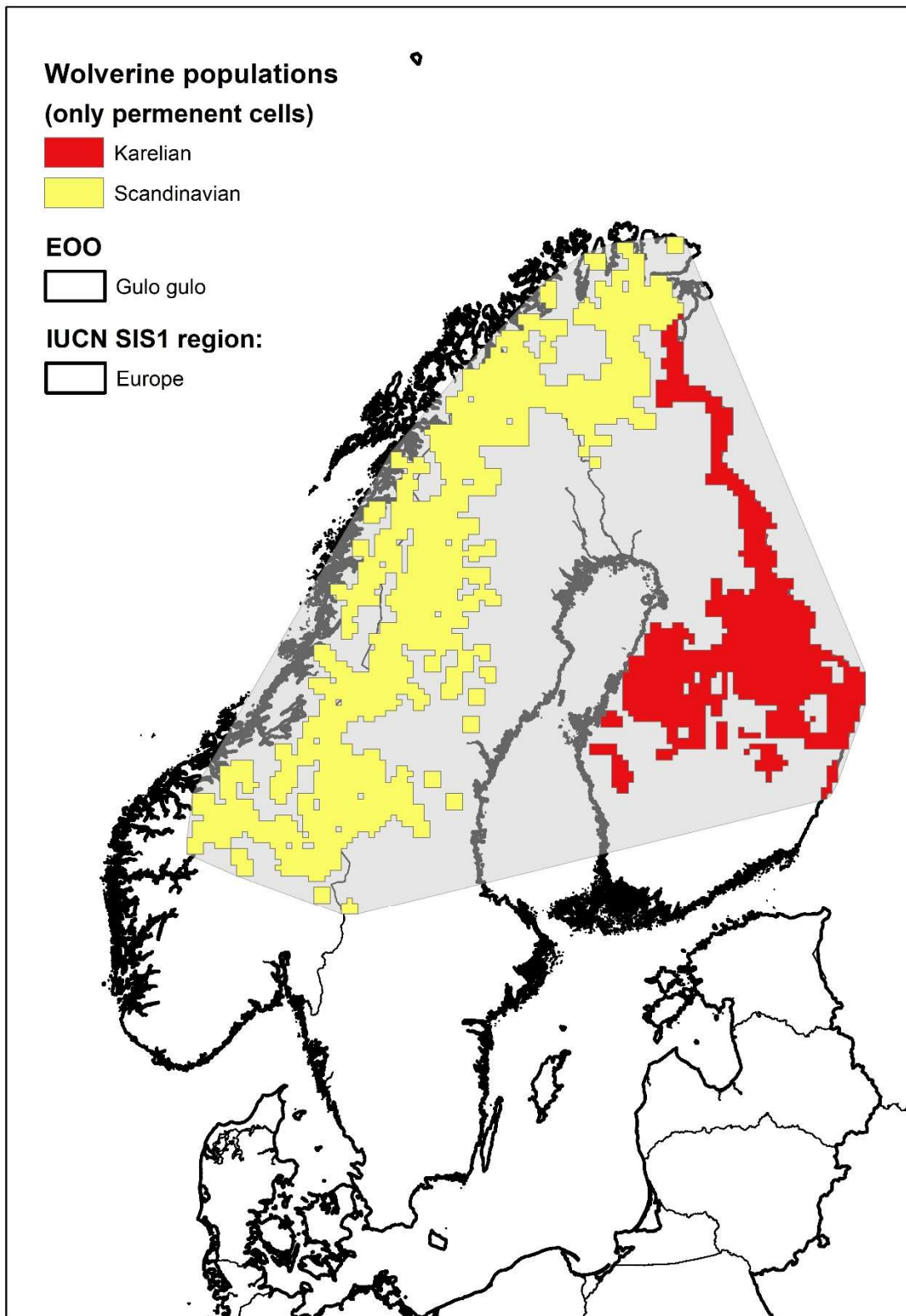


Fig. 2: Wolverine populations (cells with Presence 1.4.4. “sporadic” not shown) and total extent of occurrence (EOO) in Europe

IV. Shapefiles for the regional assessment

The shapefiles provided for the regional assessment contain one line for each cell where presence is defined as described in Table 2. Additional metadata for each line are listed below (Table 4).

Table 4: Metadata attached to the presence shapefile provide together with the regional IUCN Red List assessment for wolverines in Europe.

Metadata table	Information provided
SPOIS	see Table 1
BINOMIAL	<i>Gulo gulo</i>
Presence	see Table 1
ORIGIN	see Table 1
SEASONAL	see Table 1
COMPILER	Large Carnivore Initiative for Europe (LCIE)
YRCOMPILED	2018
DEC_LAT	Latitude of cell centroid
DEC_LONG	Longitude of cell centroid
SPATIALREF	WGS84
EVENT_YEAR	2016
EVENT_comm	data collected for period 2012-2016
CITATION	Large Carnivore Initiative for Europe IUCN/SSC Specialist Group et al. 2018
SOURCE	see supplementary material
DIST_COMM	Data compiled by region/county representatives on a 10x10km ETRS grid
SUBPOP	see Table 2

V. Contributors

Table 5: Contributors to bear map 2012-2016.

Country/Region	Names of main data/map contributors	Affiliation [and in some cases also acknowledgement of data sources]
Norway & Sweden	Henrik Brøseth	Norwegian Institute for Nature Research - NINA; Norwegian/Swedish database www.rovbase.no
Finland	Ilpo Kojola, Vesa Nivala	Natural Resources Institute Finland (Luke); Finish database https://tassu.luke.fi

VI. Acknowledgements

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