

Special Issue

N° 14 | Autumn 2021

CAT FLOWS

The Eurasian lynx in Continental Europe



Stiftung Natur und Umwelt Rheinland-Pfalz





CATnews is the newsletter of the Cat Specialist Group, a component of the Species Survival Commission SSC of the International Union for Conservation of Nature (IUCN). It is published twice a year, and is available to members and the Friends of the Cat Group.

For joining the Friends of the Cat Group please contact Christine Breitenmoser at ch.breitenmoser@kora.ch

Original contributions and short notes about wild cats are welcome

Send contributions and observations to ch.breitenmoser@kora.ch.

Guidelines for authors are available at www.catsg.org/catnews

This **Special Issue of CATnews** has been produced with support from the Stiftung Natur und Umwelt Rheinland-Pfalz, HIT Umwelt- und Naturschutz Stiftung, and Foundation KORA.

Design: barbara surber, werk'sdesign gmbh

Layout: Christine Breitenmoser

Print: Stämpfli AG, Bern, Switzerland

ISSN 1027-2992 © IUCN SSC Cat Specialist Group

The designation of the geographical entities in this publication, and the representation of the material, do not imply the expression of any opinion whatsoever on the part of the IUCN concerning the legal status of any country, territory, or area, or its authorities, or concerning the delimitation of its frontiers or boundaries.

Editors: Christine & Urs Breitenmoser
Co-chairs IUCN/SSC
Cat Specialist Group
KORA, Thunstrasse 31, 3074 Muri,
Switzerland
Tel ++41(31) 951 70 40
<u.breitenmoser@kora.ch>
<ch.breitenmoser@kora.ch>

Cover Photo: Camera trap picture of two Eurasian lynx kittens in north-eastern Switzerland. 11 December 2014 (Photo KORA).

SYLVIA IDELBERGER^{1*}, JOCHEN KREBÜHL¹, MICHAEL BACK², JUDITH OHM¹, ANNINA PRÜSING¹, JULIAN SANDRINI¹ AND DITMAR HUCKSCHLAG²

Reintroduction of Eurasian lynx in the Palatinate Forest, Germany

In the reintroduction programme in the Palatinate Forest – as part of the French/German biosphere reserve Palatinate Forest / Vosges du Nord – a total of 20 wild born lynx *Lynx lynx* from Swiss and Slovakian origin were released until 2020 to form a nucleus for the further expansion of the subpopulation. The reintroduction was accompanied by involvement of stakeholders, a management plan, environmental education, and public relations. Stakeholders, including hunters and livestock keepers, predominantly supported the reintroduction. The reintroduction has been indispensable to re-establish a subpopulation of lynx in its formerly natural range in the Palatinate Forest. The subpopulation will contribute to the conservation of the species, which is classified as critically endangered in the Red List of threatened species in Germany (Meinig et al. 2009) and is present in Germany and France only in few segregated, more or less isolated occurrences.

With the help of the European Union's funding programme LIFE, the Stiftung Natur und Umwelt Rheinland-Pfalz (SNU) and its project partners Landesforsten Rheinland-Pfalz, SYCOPARC in France and WWF Germany are implementing the project for the reintroduction of the Carpathian lynx in the Palatinate Forest, Germany. The reintroduction programme with translocation of 20 wild born lynx from Swiss and Slovakian origin started in January 2015 and will continue until September 2021. The EU LIFE programme co-finances 50% of the project costs of 2.75 million Euros. The Palatinate lynx occurrence will contribute to the protection and preservation of a species that only occurs in a few isolated areas in Europe (Breitenmoser & Breitenmoser 2008). The Palatinate Forest covers 1,790 km² of forests and is considered to be the largest coherent forest in Germany. 360 km² of the area are protected as Natura 2000 sites. The area is part of the transboundary UNESCO Biosphere Reserve Palatinate Forest / Vosges du Nord, covering a total area of 3,028 km².

Several feasibility studies conducted on behalf of the state Rhineland-Palatinate documented the suitability of the Palatinate Forest in connection with Northern Vosges for a reintroduction of the lynx (Van Acken 1977, Wotschikowsy 1990, ÖKO-LOG 1998). An active release of the lynx to the German part of the Biosphere Reserve Palatinate Forest / Vosges du Nord was recommended (ÖKO-LOG 2010) as natural immigration of lynx into the Palatinate Forest had not been documented in the last decades and had not been

expected due to the conservative dispersion behaviour of the species. However, lynx released in the Palatinate Forest may disperse to the Northern Vosges and will ultimately enable genetic exchanges with the Southern Vosges (FR), the Jura Mountains (FR/CH) or, across the Rhine River, even with the Black Forest (DE) (Fig. 1).

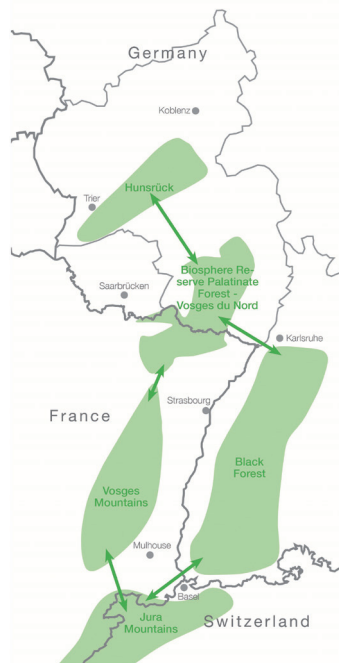


Fig. 1. Palatinate Forest and neighbouring extant or potential lynx habitats and dispersal opportunities. Dispersals were documented from Jura to Vosges (Drouet-Hoguet et al. 2021), from Jura to the Black Forest (Herdtfelder et al. 2021) and Palatinate Forest to Vosges (see text).

Preparatory phase

The acceptance of the lynx in the local society has been generated slowly and steadily over years. Authorities and the civil sector acted jointly over a long period of time and generated a positive appreciation towards the lynx. In the release area Palatinate Forest approx. 60% of the land is owned by the state, 30% by municipalities. The state and all nine local municipalities in and adjacent to the Palatinate Forest welcomed the reintroduction.

The local population and all relevant interest groups have been informed and consulted before the project started. The reintroduction programme provided for well-designed reporting and public relation activities during the releases and subsequent monitoring. Staff of the project visited local meetings of hunters and livestock owners on a regular basis and gave talks about the project. The direct exchange with people was a very important task. This allowed installing continuous feedback and improvement in the work of the project building up trust between all parties. To ensure that the acceptance work is favourable, in addition to several information events, a wide variety of materials have been compiled which provide interest-group-specific information surrounding the topic of the lynx. In particular, the Rhineland Palatinate Hunting Association (Landesjagdverband Rheinland-Pfalz) is actively supporting the project communications.

Within the communication platform "Parliament of the lynx" regional spokespersons of livestock farming, hunting, forest, nature conservation, tourism, public authorities, and associated institutions were regularly informed on the current status of the reintroduction and were invited to the exchange of opinions and to develop joint resolutions on future developments or research needs. The parliament was meeting in two separate chambers, one in the Palatinate Forest, the other in the Northern Vosges Mountains. Once a year both chambers met jointly. A comprehensive monitoring programme has accompanied the resettlement. The data gathered in the monitoring programme includes occurrence, distribution and behaviour, and the reports were included into the participative processes with the various interest groups. The "Parliament of the lynx" has itself established as an interest-spanning institution, which is recognised and actively participating in the adjustment of the project. The open and direct communications have helped to develop a basis

of trust between all of the parties, and to both anchor and strengthen the acceptance for the lynx and the reintroduction project.

A management plan for the handling of lynx in Rhineland-Palatinate had been published before the release of the first lynx (MUEEF 2016). It covers aspects of demographic monitoring, proposed solutions in case of conflicts, prevention and compensation measures, rules for conflict management and responsibilities. The regulations were adopted in consensus with the stakeholders and can be changed jointly if the situation requires.

A German-French homepage as a pivotal communication platform was implemented with regularly updated information about the development of the project, current events and a monthly updated map showing the approximately range of the lynx in the transboundary biosphere reserve and its surroundings. The large attendance of the homepage showed the relevance of this information for the public. Through the incorporation of local institutions and schools, the provision of environmental education materials and the education of so-called regional lynx consultants, multipliers have been given training with the effect of raising the levels of awareness in the public for the project objectives. For school classes, the environmental education programme "Eye of the Lynx" has been established, which allows children to look at the return of the lynx to their former habitat on an intensive and creative basis.

The Forstliche Versuchs- und Forschungsanstalt Baden-Württemberg, Prof. Schraml, conducted a survey of the acceptance of the lynx in the Palatinate Forest in the context of a bachelor thesis (Fräger 2016). More than 300 respondents of the telephone survey had a predominantly positive attitude towards the lynx. 70% of the interviewees said they had a positive or very positive feeling about the lynx; only 1% expressed negative feelings. More than 55% of the interviewees mentioned only advantages when asked about the advantages and disadvantages of reintroduction. About 10% view the presence of the lynx critically, mainly people who were afraid about negative consequences for the tourism.

In addition and in order to examine the idea of establishing the lynx as an image carrier of the Palatinate Forest Biosphere Reserve, an assessment of the lynx's tourism potential as an attractor for the region was carried out (Sigmund 2017). In cooperation with the

Table 1. lynx translocated into the Palatinate Forest (2016 – 2020), state May 2021. Country of origin SLK = Slovakia, CH = Switzerland. * orphaned lynx.

Released	Origin	Lynx	Sex	Born	Fate
2016	SLK	LUCKY*	m	2015	dead (May 2019, car accident)
2016	SLK	KAJA*	f	2013	last record June 2020
2016	SLK	LUNA*	f	2011	last record April 2017
2017	CH	ARCOS	m	?	migrated to the Southern Vosges, last record November 2020
2017	CH	BELL	f	2013	migrated to the Donnersberg, last record September 2019
2017	CH	ROSA	f	2012	last record January 2021
2017	SLK	CYRIL	m	~ 2011	last record June 2019
2017	SLK	LABKA*	f	2016	found dead (February 2018, train accident)
2017	CH	ALOSA*	f	2016	euthanized (February 2018, infected paw)
2018	CH	JURI	m	2016	found dead (February 2020, infection)
2018	CH	JARA	f	2012	last record December 2018
2018	SLK	WRANO*	m	2017	last record August 2020
2018	SLK	ALFI*	m	2017	last record May 2021
2019	CH	MALA	f	2010	last record May 2021
2019	CH	GAUPA	f	2012	last record March 2021
2019	CH	LIBRE	m	2016	GPS-collar active
2019	SLK	BRAŇO	m	2017	last record June 2020
2020	CH	ISIS	f	2017	last record April 2021
2020	CH	LYCKA	f	2011	GPS-collar active
2020	CH	TARDA	f	~ 2018	last record March 2020

Pfalz.Touristik e. V. a bachelor thesis was developed under the supervision of Prof. Bachinger, from the University of Applied Sciences Rottenburg. The thesis concluded that lynx can create values for the sustainable tourism in the Palatinate Forest and offers corresponding potential. In an online survey the guests showed great interest in the lynx in the Palatinate Forest. Guests would be willing to extend their holidays by two days on average because of the presence of the lynx. For lynx-specific offers guests would invest about 18–20 Euros. In comparison to other (wildlife) offers, the challenge for the lynx and its secret way of life lies in an appealing offer development.

Releases and post-release monitoring

The partners from the countries of the lynx donor population Slovakia (DIANA, Zoo Bojnica) and Switzerland (KORA, FIWI) and the project coordinator and partners in the receiving country Rhineland-Palatinate (SNU, MUEEF) agreed in a Memorandum of Understanding to defined procedures and protocols

for the translocations. The rules of transport, quarantine, necessary veterinary medical examinations, preventive measures, exclusion criteria for transport and release were fixed before the start of the translocations. The purpose was to guarantee a smooth and coordinated operation of the translocation project. The determination of a reintroduction plan, as well as capture and release protocols enabled all partners to act in a concerted way and to fulfil all necessary regulations of the different legislation between the countries and to conform to international standards (e.g. IUCN, IATA, CITES). The handling of the lynx respected the best practice experience. The animals had to be surveyed during capture, quarantine and transport, and received medical treatment whenever required by experienced veterinarians. Reasonable precautions for possible emergency cases were established. Health requirements were fixed, e.g. tests, tolerable versus intolerable pathogens (as FeLV, FIV) and possible non-infectious problems. The quarantine time in Switzerland lasted between five and eleven



Fig. 2. Female TARDA from the Swiss Jura Mts, the last of the 20 lynx released in the Palatinate forest in 2020 (Photo A. Prüssing, SNU).

days, whereas the quarantine time in Slovakia varied between three and five weeks, respecting the need of antibody-titre of rabies. The partners reviewed the situation and the release strategy several times during the implementation of the translocations and optimised them if necessary.

Based on monitoring results, the donor countries defined capture areas with the numbers of possible captures regarding to the sex of the animals to ensure that translocations do not threaten the donor population. Main capture season was from February to beginning of April to avoid the early separation of juvenile lynx from their mothers or the capture of pregnant females in late stages. Lynx were set free in a “hard release”, that is immediately after arrival in the release area and final (health) check. All released lynx were equipped with GPS/GSM telemetry collars e.g. Lotek Wildcell SL or SD and a mechanical drop-off (predetermined breaking point made of wire). The GPS tracking collars allowed the monitoring of the spatial behaviour, findings of prey and the development of the reintroduction process.

Supplementary monitoring methods were established to evaluate the development of the population. A genetic monitoring was performed to build up a pedigree and to be able to evaluate the development of the genetic variability within in the new subpopulation on the long term. An extensive opportunistic mo-

onitoring was expanded including a network of trained field-experts to collect and verify lynx-indications from the public and to gain additional information about appearance and distribution. This was needed especially for the time, when the different GPS collars stopped data transfer after the end of their operating time (1–2 years) and for non-collared offspring. A systematic camera trapping has been conducted in the last two winters of the project to estimate the size of the population. The overall result of the two runs is imminent.

With the reintroductions from July 2016 to March 2020 a total of 20 lynx (12 female, 8 males) have been captured and relocated with the help of the origin countries' partners and authorities. Twelve lynx were captured in Switzerland (Fig. 2), eight originated from Slovakia, of which seven were orphans temporarily held in captivity. Until the end of April 2020 there had been four documented losses of released lynx due to (traffic) accidents (Table 1). The lynx showed their physical capacities and adaptability on various occasions. One male (ARCOS) migrated to the Higher Vosges Mountains covering a distance of approx. 350 km in one month. Another male (CYRIL) took the liberty to cross the river Rhine (width about 200 m) close to the industrial areas of Mannheim and Ludwigshafen. He was captured and brought back to the Palatinate Forest, because the landscape on the other side

of the Rhine was heavily fragmented through streets and settlements and other lynx population have not been accessible. After his relocation CYRIL stayed in the Palatinate Forest. Major parts of the transboundary Biosphere Reserve and also beyond have been explored by lynx (Fig. 3).

Reproduction success

The first two cubs were already observed in 2017. The young male lynx LUCKY took already part in the reproduction in his second year of life. Three more litters followed in 2018 and two litters each in 2019 and 2020. Reaching a total documented offspring of at least 16 cubs for the first four years (Fig. 4). More litters are possible. Preliminary results from monitoring might suggest not yet (genetically) detected additional lynx in Rhineland-Palatinate too.

Verifiably seven individuals out of 20 released lynx took part in reproduction until 2020, three of the 20 were just relocated in spring 2020. Two litters are from Swiss-Slovak lynx pairings, while two litters were from already pregnant translocated females from Switzerland, bringing in additional genetic material beside the releases. Three Lynx couldn't take part in the reproduction due to prompt spacious migration or death (ARCOS, LABKA, ALOSA). A contribution to the reproduction of the other lynx remains open. Remarkable is the high number of male cubs (verifiably eight males to two females) in the project, from six cubs the sex is still unknown. Den sites were inside rock caves or under logging residues. Although forest roads were close by, there were low human activity or the access to the den was difficult.

Prey

A random, unsystematic search of kills has been conducted with the help of collected GPS-data. Among 205 registered kills of wild animals, the main prey of lynx was roe deer (82%), followed by red deer (7%) and fox (6%). Mouflon, marten, hare and wild boar was killed as well. This is similar to other studies in Germany (Mayer et al. 2012).

Eleven attacks on livestock happened in eight different places, sometimes flocks or enclosures were affected twice shortly one after the other. Killed species were sheep, goats, respectively fallow and red deer in enclosures. The livestock owners were compensated for the losses. Prevention measures like electrification of fences were paid and the owners implementing those measures

received support in the field from the staff of the project and a network of volunteers.

Preliminary results and conclusions

A notable aspect in the project is the integration of orphaned lynx in the reintroduction. This procedure allowed a faster establishment of the new lynx subpopulation, because capture success in the wild can partly depend on random incidents. A fast population growth fosters the genetic diversity within a new population (Frankham 2009). The first releases in 2016 were realised with three orphans from Slovakia. The lynx were held in captivity for different time spans. At the date of the release the individuals were 1 (M), 3 and 5 (both Fs) years old. The three lynx explored their new surrounding quite cautiously. It appears that the cautiousness facilitated for the three animals to stay in touch, which helped to increase the chances of mating and to establish a first nucleus of a lynx subpopulation in the greater area of the release site. All following releases took place at approximately the same site to allow translocated lynx to recognize the presence of lynx in their new habitat. Main background for this procedure was to avoid migration into areas outside the Palatinate Forest and to expand the newly established nucleus. Most of the released lynx established their territories in this nucleus. Apparently, three of the non-orphaned lynx started spacious excursions directly after release, leaving the populated area within a very short time, while the orphaned lynx explored the area in a more conservative manner. Otherwise, there might be a higher probability of early losses with unexperienced subadults (e.g. death of LABKA through train collision shortly after release). The ability to catch and kill prey seemed not to be a problem for the orphaned lynx; most of them killed roe deer successfully after a short period of time. The scientific analysis of the data is not completed yet. Further research on this topic may help to evaluate the suitability of orphans for introductions or reinforcement projects.

In conclusion, the major objective to establish a first nucleus of a lynx subpopulation in the Palatinate Forest has been achieved. Major parts of the Palatinate Forest have been populated by lynx, parts of the Northern Vosges too. A first home range in the north of the Palatinate Forest was established (BELL). The observed migrations of male and female lynx (ARCOS, LIBRE, KELY, LYCKA) documented the possible exchange between the Northern

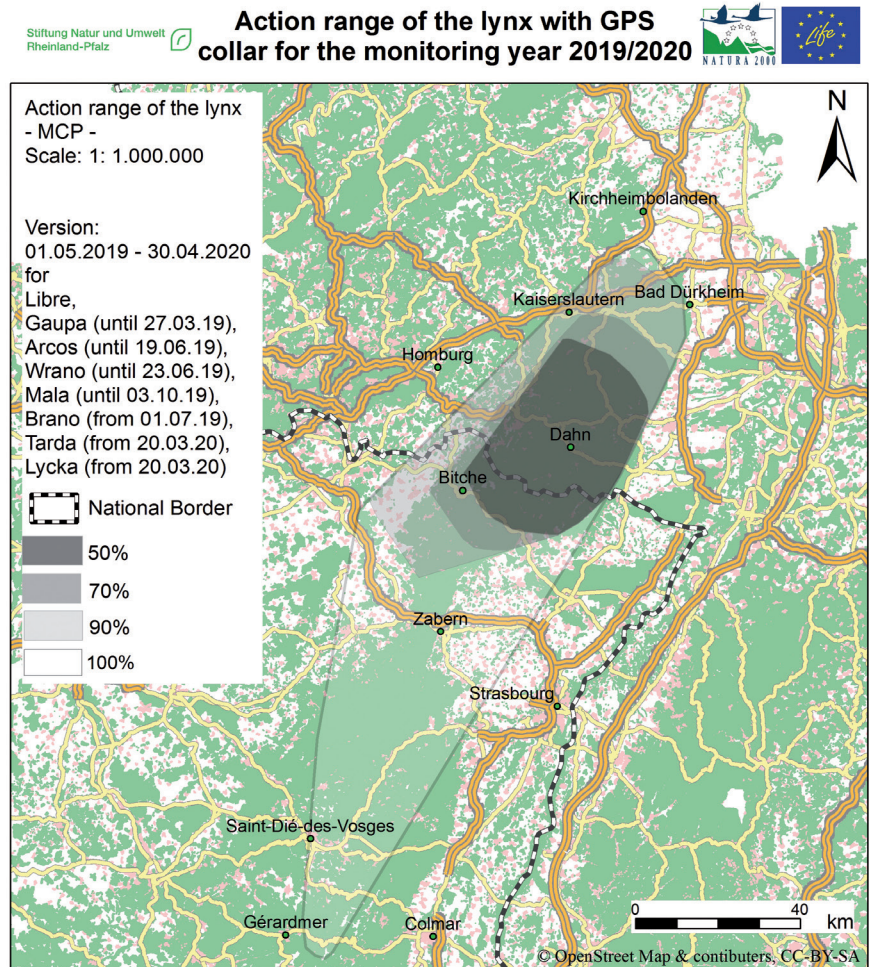


Fig. 3. Combined action range of 8 GPS-collared lynx in the Palatinate Forest, presented as MCP (minimum convex polygon) for the monitoring year 2019/2020, © SNU.

and the Southern Vosges Mts. The successful passing of the migration barrier at the Col de Saverne, the narrowest passage of the Vosges Mountain with crossing of highway, express railway line and water canal, was questioned before by many people. This

was an important signal for the possibility of a natural dispersal of lynx between the subpopulation in the Upper Rhine metapopulation. Now the lynx occurrence in the Palatinate Forest offers another link for migrating lynx originating from all geographic



Fig. 4. Two cubs of female ROSA documented in Palatinate Forest (Photo B. Allmoslöchner).

Table 2. Offspring in the Palatinate Forest (2016–2020), status May 2021.

Cubs (name)	Year	Mother (country of origin)	Father (country of origin)	Sex of cubs	Fate
1 (PALU)	2017	KAJA (SK)	LUCKY (SK)	m	last record January 2020
2 (FILOU)	2017	KAJA (SK)	LUCKY (SK)	m	last record April 2021
3	2018	JARA (CH)	unknown Swiss lynx	m	last record June 2018
4	2018	KAJA (SK)	unknown	unknown	last record September 2018
5 (FRAN)	2018	ROSA (CH)	LUCKY (SK)	} 1x m, 1x unknown	last record March 2021
6 (FIFO)	2018	ROSA (CH)	LUCKY (SK)		last record March 2021
7 (RUMO)	2018	ROSA (CH)	LUCKY (SK)	m	last record April 2021
8 (PIP)	2019	MALA (CH)	WRANO (SK)	} 2x m, 1x unknown	last record April 2020
9 (TWIK)	2019	MALA (CH)	WRANO (SK)		last record April 2020
10 (KELY)	2019	MALA (CH)	WRANO (SK)		last record March 2021, migrated to S Vosges
11	2019	GAUPA (CH)	prob. unknown Swiss lynx	m	last record December 2019
12	2020	ROSA (CH)	unknown	f	last record November 2020
13	2020	ROSA (CH)	unknown	f	last record November 2020
14	2020	ROSA (CH)	unknown	unknown	last record November 2020
15	2020	GAUPA (CH)	unknown	unknown	last record July 2020
16	2020	GAUPA (CH)	unknown	unknown	last record February 2021

directions. Nevertheless, the newly founded lynx nucleus is still small and fragile. The success of the reintroduction depends on further offspring especially female, and contribution of as much as possible of the released lynx in the reproduction for genetic variability in the long term.

Further conservation efforts will focus on the further growing of the subpopulation, demands of genetic variability, sufficient opportunities for dispersal to adjacent subpopulations, maintaining a high-acceptance, establish a permanent management and a common management of the Upper Rhine metapopulation (Krebühl et al. 2020).

For further information visit www.luchs-rlp.de

Acknowledgements

Beyond the contribution of the mentioned project partners, additional funding is provided by the state of Rhineland-Palatinate, the Deutsche Wildtier Stiftung, the regional associations of NABU and BUND, the HIT Environmental Foundation as well as other sponsors. Sincere thanks to all partners and authorities (BAFU - Federal Office for the Environment Switzerland, Ministry of Environment of the Slovak Republic, State Nature Conservancy

of the Slovak Republic) in the donor countries for making the reintroduction possible, special thanks to Urs Breitenmoser for giving advice during the course of 10 years!

References

- Breitenmoser U. & Breitenmoser-Würsten C. 2008. Der Luchs – Ein Grossraubtier in der Kulturlandschaft. – Salm Verlag, Wohlen/Bern, Schweiz, 584 pp.
- Drouet-Hoguet N., Chenesseau D., Kunz F. & Zimmermann F. 2021. Situation of the Eurasian lynx in the Jura Mountains. *Cat News Special Issue 14*, 29–34.
- Fräger C. & Schraml U. 2016. Die Akzeptanz des Luchses im Pfälzerwald – eine vergleichende Studie. *Wildbiologische Forschungsberichte 2018*. Schriftenreihe der Vereinigung der Wildbiologen und Jagdwissenschaftler Deutschlands (VWJD) (Eds), pp. 141–144.
- Frankham R. 2009. Genetic considerations in reintroduction programmes for top-order, terrestrial predators. *In* Reintroduction of top-order predators. Hayward M. W. & Somers M. J. (Eds). Blackwell, Hoboken, New Jersey, USA, pp. 371–387
- Krebühl J., Idelberger S., Zimmermann F., Breitenmoser-Würsten Ch., Breitenmoser U., Herdtfelder M., Suchant S. & Drouet-Hoguet N.

2021. Transboundary cooperation in lynx conservation under the auspice of the Upper Rhine Conference. *Cat News Special Issue 14*, 55–56.

- Germain E. & Schwoerer M.-L. 2021. Situation of the Eurasian Lynx in the Vosges Mountains. *Cat News Special Issue 14*, 34–37.
- Herdtfelder M., Schraml U. & Suchant R. 2021. Steps towards a lynx population in the Black Forest? *Cat News Special Issue 14*, 45–46.
- Mayer K., Belotti E., Bufka L., Heurich M. 2012. Dietary patterns of the Eurasian lynx (*Lynx lynx*) in the Bohemian Forest. – Zur Nahrungsökologie des Eurasischen Luchses (*Lynx lynx*) im bayerisch-böhmischen Wald. *Säugetierkundliche Informationen Jena*, 8, H. 45, 447 – 453.
- Meinig H., Boye P. & Hutterer R. 2009. Rote Liste und Gesamtartenliste der Säugetiere (Mammalia) Deutschlands. *In* Rote Liste gefährdeter Tiere, Pflanzen und Pilze Deutschlands. Band 1: Wirbeltiere. Haupt H., Ludwig G., Gruttker H., Binot-Hafke M., Otto C. & Pauly A. Naturschutz und Biologische Vielfalt 70 (1), Bonn (Bundesamt für Naturschutz), pp. 115–153.
- MUEEF (2016): Managementplan für den Umgang mit Luchsen in Rheinland-Pfalz, https://mueef.rlp.de/fileadmin/mulewf/Publikationen/Managementplan_fuer_den_Umgang_mit_Luchsen_in_RLP.pdf, 37 pp.
- ÖKO-LOG. 1998. Der Luchs im Pfälzerwald. Gutachten im Auftrag des Ministeriums für Umwelt und Forsten Rheinland-Pfalz. Ottweiler Druckerei und Verlag GmbH, 51 pp.
- ÖKO-LOG. 2010. Aktionsplan Luchs/ Plan d'action pour le lynx Pfälzerwald / Vosges du Nord, Empfehlungen zur Bestandsstützung. Im Auftrag von SYCOPARC und Naturpark Pfälzerwald e.V., Interreg III. 12 pp.
- Sigmund J. 2016. Der Luchs und sein Potenzial für den nachhaltigen Tourismus im Biosphärenreservat Pfälzerwald. Hochschule für Forstwirtschaft Rottenburg, unpublished, 92 pp.
- Van Aacken D. & Grünwald A. 1977. Überlegungen zur Einbürgerung des Luchses im Pfälzerwald, Beiträge zur Landespflege 5, 36–55.
- Wotschikowski U. 1990. Der Luchs im Pfälzerwald, Gutachterliche Stellungnahme zu seiner Wiedereinbürgerung im Auftrag des Ministeriums für Landwirtschaft, Weinbau und Forsten Rheinland-Pfalz, 8 pp.
- ¹ Stiftung Natur und Umwelt Rheinland-Pfalz (SNU), Mainz, Germany
*sylvia.idelberger@snu.rlp.de
- ² Landesforsten Rheinland-Pfalz, Forschungsanstalt für Waldökologie und Forstwirtschaft Rheinland-Pfalz (FAWF), Trippstadt, Germany