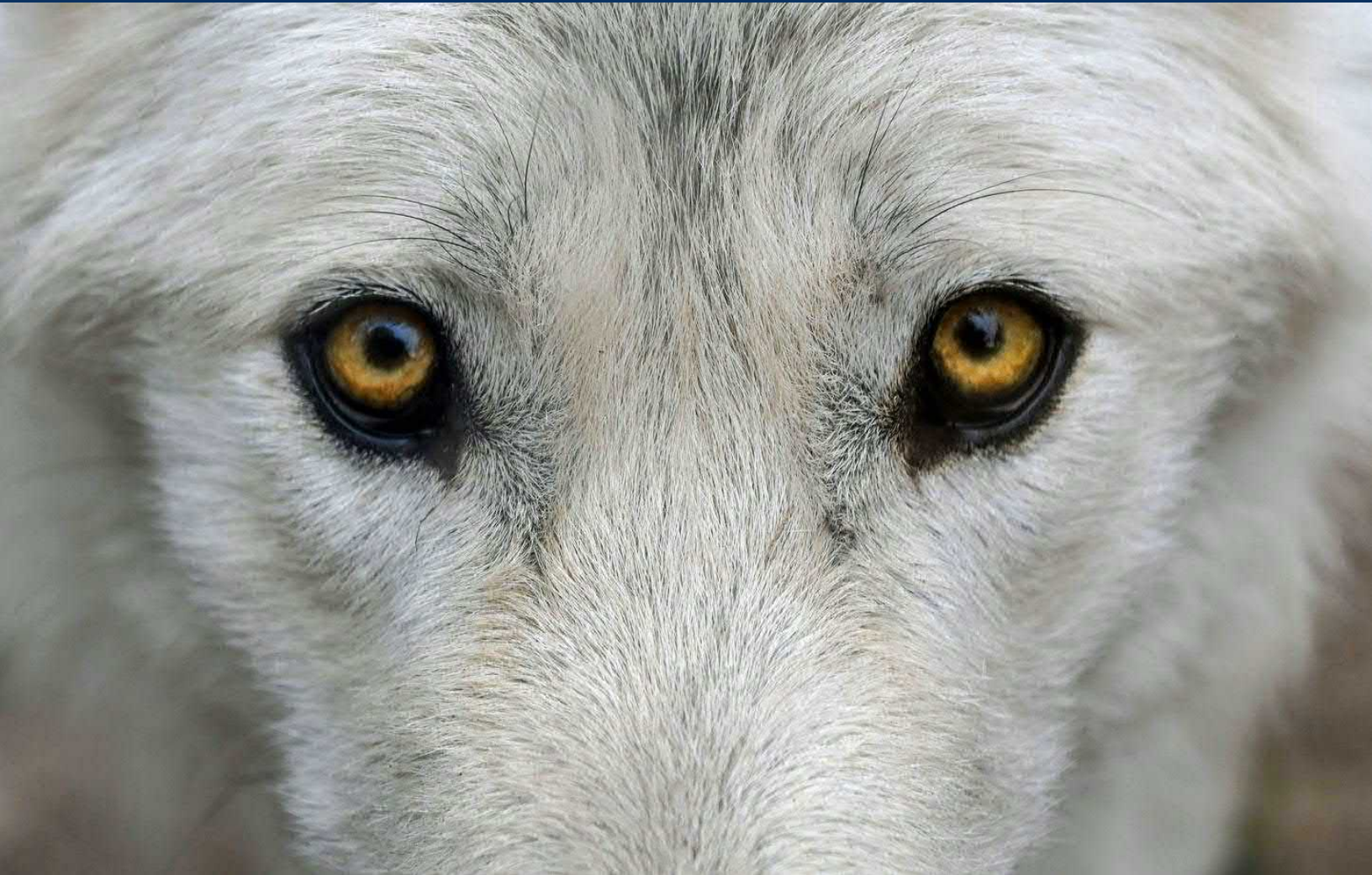




WOLVES ACROSS BORDERS

International Conference on Wolf Ecology and Management



DJURÖNÄSET HOTEL & CONFERENCE CENTER
MAY 8-11, 2023 | STOCKHOLM, SWEDEN

————— www.wolvesacrossborders.com —————

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EUROPEISKA UNIONEN

PROGRAM OVERVIEW



MONDAY, MAY 8TH

- Keynote Speaker: Luigi Boitani
- Plenary Speakers: Luigi Boitani, Tariku Gutema, David Mech, and Yadvendradev Jhala

TUESDAY, MAY 9TH

- Workshops 7-12
- Plenary Speakers: John Vucetich and Astrid Vik Stronen
- Interactive Poster Session

WEDNESDAY, MAY 10TH

- Plenary Speakers: Camilla Wikenros, Barbara Zimmermann, Francesca Marucco, Laura Scillitani, Josip Kusak, and Çağan Şekercioğlu
- Panel Discussion
- Closing Banquet and Party

THURSDAY, MAY 11TH

- Plenary Speakers: Douglas Smith, John Linnell, and Erica von Essen
- Workshops
- Closing Ceremony



DETAILED PROGRAM

SUNDAY, MAY 7TH



Sunday, May 7, 2023	
15:00 - 19:00	Hotel Check-In
15:00 - 19:00	Conference Check-In / Presentation Drop-Off
19:00 - 21:00	Dinner (*must be registered for Sunday*)

DETAILED PROGRAM

MONDAY, MAY 8TH



Monday, May 8, 2023				
7:00 - 9:00	Breakfast (*must be registered for Sunday*)			
10:00 - 10:30	Fika (*must be registered for Sunday*)			
10:00 - 12:30	Conference Check-In / Presentation Drop-Off			
11:30 - 12:30	Lunch (*must be registered for Sunday OR lunch*)			
12:30 - 12:40	Conference Opening			
12:40 - 13:40	Keynote Talk - Luigi Boitani <i>Wolves know no boundaries: The challenge of coexistence in Europe</i>			
13:40 - 14:20	Plenary Talk - Tariku Gutema <i>Ecology and conservation status of the two wolf species (Canis lupaster and Canis simensis) in Africa, with a focus on the Ethiopian highlands</i>			
14:20 - 14:50	Fika			
14:50 - 15:30	Plenary Talk - David Mech <i>Borders? 154 of them: Wolf Conservation in the U.S.</i>			
15:30 - 16:10	Plenary Talk - Yadvendradev Jhala <i>Status, ecology, and conservation of the ancient Asian wolves</i>			
16:10 - 16:20	Break			
16:20 - 18:00	Break Out Talks			
	Harvest and Mortality	Wolf Behavior	Conflict Mitigation	Genetics / Demography
	Main Hall	Building 7 (Room 7A)	Building 5 (Room 5A)	Building 6 (Room 6A)
16:20 - 16:35	Ausband; From protected to harvested: What have we learned after 15 years of wolf harvest in Idaho, USA?	Kluth; Do wolves living in highly human dominated landscapes inevitably become bold?	Petridou; Effectiveness of husbandry practices in reducing wolf depredation in free-ranging livestock in Greece	Cerreta; Genetic consequences of differing management regimes in a cooperatively breeding carnivore: A case study of wolves from two regions in Alaska
16:40 - 16:55	Grente; Better understanding the links between wolf depredation behavior, culling, and depredations levels with an individual-based model	Sampedro Garrido; Himalayan wolf occupancy is determined by elevation	Ribeiro; Long-term use of livestock guarding dogs in Portugal: Overall results and future challenges	Johansson; Finnish wolves: The population genetic perspective

DETAILED PROGRAM

MONDAY, MAY 8TH



	Harvest and Mortality	Wolf Behavior	Conflict Mitigation	Genetics / Demography
	Main Hall	Building 7 (Room 7A)	Building 5 (Room 5A)	Building 6 (Room 6A)
17:00 - 17:15	Milleret; Mapping population-level mortality risks of an emblematic and controversial large carnivore, the wolf	Hobkirk; Feeling like a wolf: Quantifying and classifying the complexities of facial communication in wolves and domestic dogs to determine if dogs can convey 'emotions' via facial expressions like their wolf ancestors?	Schuette; Acceptance of wolf presence through effective preventive measures: Livestock protection with volunteer support	Planillo; Spatio-temporal and demographic dynamics in German recolonizing wolf population
17:20 - 17:35	Morales-González; Complacent wolves: Human-caused local mortality and high turnover of territories may explain the lack of wolf expansion in the Iberian Peninsula	Hipólito; Behavioural interpretation of bold wolves: If I can't see you, I can't fear you!	Smith; Ecological effects of using livestock guarding dogs as large carnivore deterrents	Roffler; Island biogeography and demographic history influences genetic structure of Alexander Archipelago wolves
17:40 - 17:55	Pinto da Silva; Spatial heterogeneity in wolf disappearance rates in Scandinavia	Di Bernardi; Linking wolf feeding behavior to individual predator traits	Jansman; Wolves in The Netherlands: How to reach coexistence in a highly urbanized landscape	Srinivas; Population genetics of unique and ancient wolf lineages in India
18:00 - 19:00	Break / Hotel Check-in			
19:00 - 21:00	Opening Dinner			

DETAILED PROGRAM

TUESDAY, MAY 9TH



Tuesday, May 9, 2023				
7:00 - 8:00	Breakfast			
8:00 - 10:00	Workshops			
	Building 7 (Room 7A)	Building 5 (Room 5A)	Building 6 (Room 6A)	Building 4 (Room 4A)
	Preventing livestock predation by wolves: co-designing a strategic research plan to move forward with "alternative" aversive methods (Vanderheyden)	What can passive acoustic Recorders Do For You? Using Sound to Study Wolves (Howden-Leach)	Towards a SNP-based standard for wolf/ dog hybrid detection in Europe (Nowak)	Towards an effective and socially just governance of human-wolf interactions in Europe (Donfrancesco)
	Building 3 (Room 3A)			
	Participatory Stakeholder Identification and Network Mapping – purpose, preparation, participation and helpful outcomes (Grossmann)			
10:00 - 10:30	Fika			
10:30 - 11:10	Plenary Talk - John Vucetich <i>What ecological knowledge can and cannot do for wolf conservation</i>			
11:10 - 11:50	Plenary Talk - Astrid Vik Stronen <i>Tracking drivers of wolf genetic change in increasingly human-dominated landscapes</i>			
12:00 - 13:00	Lunch			
13:00 - 15:00	Break Out Talks			
	Interspecific Interactions	Wolf-Human Interactions	Population Status	Wolf-Human Interactions
	Main Hall	Building 7 (Room 7A)	Building 5 (Room 5A)	Building 6 (Room 6A)
13:00 - 13:15	Tallian; Seasonal drivers of competition between wolves and bears	Gieser; When a wolf meets a group of wild boars: An anthropologist's critical reflection on the term 'hunting strategy'	Olsen; Recolonization and population patterns of wolves in Schleswig-Holstein and Denmark, 2007-2022	Lino; Livestock depredation in Portugal: Is the wolf guilty, innocent, or simply co-responsible?

DETAILED PROGRAM

TUESDAY, MAY 9TH



	Interspecific Interactions	Wolf-Human Interactions	Population Status	Wolf-Human Interactions
	Main Hall	Building 7 (Room 7A)	Building 5 (Room 5A)	Building 6 (Room 6A)
13:20 - 13:35	Gutema; Competition between sympatric wolf taxa: An example involving African and Ethiopian wolves	Surer; Interactions between wolves and cattle: Reviewing global experience, analysing encounter rates and depredation patterns in Switzerland and factors affecting cattle depredation by wolves	Helle; Determining favourable reference population for wolves in Finland: What did we do and learn?	Versluijs; Towards a shared forest: Studying the compatibility of free-ranging cattle and carnivores in boreal forests
13:40 - 13:55	Nordli; Beware or be aware? Temporal foraging strategies of wolverines and wolves at wolf-kills	Gula; Near humans: How wolves acclimatize to the anthropogenic landscapes of Poland	Werhahn; Phylogeny, ecology, and conservation status of the Himalayan/Tibetan Wolf	van Beeck Calkoen; Numerical top-down effects on red-deer (<i>Cervus elaphus</i>) in human-dominated landscapes
14:00 - 14:15	Orning; Spatial and dietary consequences of apex carnivore competition following gray wolf recolonization in the Pacific Northwest	Kudrenko; Walking on the dark side: Anthropogenic factors limit suitable habitat for the wolf in Polesia	Kusi; A non-invasive assessment of density, diet, and distribution of Himalayan wolves in Nepal	Rossberg; Livestock protection in the German-speaking Alps: First results of the only livestock protection LIFE project "LIFEstockProtect"
14:20 - 14:35	Satterfield; Space use patterns of recolonizing wolves (<i>Canis lupus</i>) and co-occurring cougars (<i>Puma concolor</i>) in a human-impacted forest landscape (Washington, USA)	Nakamura; Dynamic occupancy models predict wolf spatial use in human-dominated landscapes	Lelieveld; Wolf monitoring in the Netherlands	Sunde; Wolves in fenced nature areas: Scientific opportunities and management headaches
14:40 - 14:55	Diserens; The impact of wolves on mesocarnivore denning and foraging behaviour in Białowieża Forest	Hipólito; Afraid of the unknown: The role of humans on range limit wolf population activity	Naderi; Predicting the potential distribution of grey wolves in Türkiye under climate change scenarios	Kabir; Understanding the patterns of livestock depredation by wolf (<i>Canis lupus</i>) in northern Pakistan
15:00 - 15:30	Fika			

DETAILED PROGRAM

TUESDAY, MAY 9TH



15:30 - 16:30	Break Out Talks			
	Monitoring and Methods	Demography	Diet	Conflict Mitigation
	Building 7 (Room 7A)	Building 5 (Room 5A)	Building 6 (Room 6A)	Building 4 (Room 4A)
15:30 - 15:45	Andr�n; Harvest model of wolf population using Bayesian forecasting	Simpson; Demographics of gray wolf (<i>Canis lupus</i>) packs recolonizing variable habitat types in Central Wisconsin	Chetri; Patterns of distribution, habitat use and seasonal diet of Himalayan wolf (<i>Canis lupus chanco</i>) in the central Himalayas, Nepal	Camara; Media mayhem! Wolf reintroduction and the impact of media
15:50 - 16:05	Bauduin; Using occupancy to monitor populations. Case study: The wolf in France	Kramer-Schadt; Reconstructing 20 years of wolf comeback in Germany with individual-based models	Dymit; DNA metabarcoding reveals extensive marine resource utilization by coastal wolves in Southwest Alaska	Qu�tier; Getting ready for the wolves: Lessons learned in anticipating its return to central France and the case for 'wolf-smart communities'
16:10 - 16:25	Marucco; Wolf population size estimation: An integrated approach for long term conservation practice	Kojola; Regional differences in reproductive success of wolves in Finland: Potential causes and consequences	Freund; Freshwater fish as a more common prey for wolves than originally thought: Annual observations from a boreal ecosystem	D�az Vaquero; Coexistence between wolves and extensive livestock farming in northern Spain
16:30 - 17:00	Break / Poster Set Up			
17:00 - 19:00	POSTER SESSION			
19:00 - 21:00	Dinner			

DETAILED PROGRAM

WEDNESDAY, MAY 10TH



Wednesday, May 10, 2023				
7:00 - 8:00	Breakfast			
8:00 - 8:40	Plenary Talk - Camilla Wikenros & Barbara Zimmermann <i>The Swedish-Norwegian border causes source-sink dynamics for wildlife but results in a win-win for research</i>			
8:40 - 9:20	Plenary Talk - Francesca Marucco & Laura Scillitani <i>Transboundary wolf conservation actions for better wolf-human coexistence at the population level: Challenges and perspectives</i>			
9:20 - 10:00	Plenary Talk - Josip Kusak & Çağan Şekercioğlu <i>Challenges and opportunities of wolf studies in Croatia and in Türkiye</i>			
10:00 - 10:30	Fika			
10:30 - 12:00	Break Out Talks			
	Predator-Prey Relationships and Trophic Interactions	Wolf-Human Interactions	Cross border management and relations	Genetics - Methods, Diversity, and Inbreeding
	Main Hall	Building 7 (Room 7A)	Building 5 (Room 5A)	Building 6 (Room 6A)
10:30 - 10:45	Eriksson; Sea otter recovery affects feeding ecology and population demography of an isolated wolf pack	Reinhardt; Fencing against African Swine Fever poses barriers for wolves	Lelieveld; Interactive mapping of wolves across borders	Salado; Out of the woods? Decline of genomic diversity in a demographically stable gray wolf population in Western Europe
10:50 - 11:05	Nowak; From forest dweller to suburb tenant: Wolf territories and food habits in human-dominated landscapes of central Europe	Kjeldgaard; Human activity drives diel activity patterns of wolves in Denmark	Lyly; Wolf territory cooperation: Local platforms for joint management and knowledge sharing	Dziech; A step closer towards enriching and unifying the methodology of grey wolf genetic studies
11:10 - 11:25	Kuijper; Paws without claws? Ecological effects of large carnivores in human-dominated landscapes	Ausilio; Environmental and anthropogenic features mediate human hunting risk and wolf predation risk for moose	Martinsen; Flexibility or free-riding? Challenges of transboundary management of a wolf population	Nowak; CEwolf: Harmonized genetic monitoring allows to reconstruct wolf recolonization of Central Europe's human-dominated landscapes
11:30 - 11:45	Dickie; Resource exploitation efficiency collapses the home range of an apex predator	Blount; Habitat selection of wolves in a highly disturbed anthropogenic habitat	Wabakken; Wolf management challenges across an international border: Predation on domestic sheep in Norway are dominated by Swedish-born, crossborder dispersers	Valtonen; Validation of a recent method for identification of hybrids in the Finnish wolf population
12:00 - 13:00	Lunch			

DETAILED PROGRAM

WEDNESDAY, MAY 10TH



13:00 - 15:00	Break Out Talks			
	Harvest and Mortality / Wolf Behavior	Wolf-Human Interactions	Conflict Mitigation	Monitoring and Methods
	Main Hall	Building 7 (Room 7A)	Building 5 (Room 5A)	Building 6 (Room 6A)
13:00 - 13:15	Liberg; Origin and dispersal distances for individual wolves establishing territories on the Scandinavian Peninsula 1999 -2020	Antonucci; Maiella wolves do not like livestock? 20 years of research and experience on feeding ecology of Apennine wolf (<i>Canis lupus italicus</i>)	Blanco; When wolf damage to livestock causes a major conflict: The challenge of wolf and cattle coexistence in Ávila province (central Spain)	Dupont; Landscape-level patterns in wolf home range size revealed by non-invasive spatial capture-recapture
13:20 - 13:35	Sand; High turnover rates of territories in the Scandinavian wolf population: Causes and consequences	Iliopoulos; Wolf ecology in agricultural areas at the Axios-reiver basin national park in northern Greece	Brandisauskas; From relatives to enemies: Evenki reindeer herders and hunters agreement with wolves in the changing environment of East Siberia and the Russian Far East	Boiani; How much is enough? Effort optimization for wolf population size estimation at a regional scale
13:40 - 13:55	Kusak; Wolf territory sizes and winter densities of wolves in Croatia and Türkiye	Ale; Recolonizing Himalayan wolf and conflict with pastoralists in Gaurishankar Conservation Area, Nepal	Camara; Wolves & Gen. Z: How to communicate to the next generation about wolves	Bojarska; Wolf activity patterns revealed by camera traps and accelerometers: What are we missing?
14:00 - 14:15	Bump; Wolf personalities, ecosystem impacts, and the possibility of wolf cultures	Tikkunen; Wolf attacks on dogs in Finland and a potential solution to mitigate the conflict	den Hartog; Carnivore depredation on cattle, and measures to prevent this: Comparing experiences across Europe and North America	Costa; Impact assessment on wolves: Can we do it better?

DETAILED PROGRAM



WEDNESDAY, MAY 10TH

	Harvest and Mortality / Wolf Behavior	Wolf-Human Interactions	Conflict Mitigation	Monitoring and Methods
	Main Hall	Building 7 (Room 7A)	Building 5 (Room 5A)	Building 6 (Room 6A)
14:20 - 14:35	Stepniak; Communication between wolf and domesticated dog revealed from experimental scent marking	Romanski; Status of wolf introductions in Isle Royale National Park, USA	Eriksen; Wolf conflicts in Denmark: Management between a rock and a hard place	Angelucci; Physiologic evaluation of capture and anesthesia with Fremont® Humane Foot Snare and Medetomidine–Ketamine –Acepromazine in free ranging Apennine wolf (<i>Canis lupus italicus</i>) and implications on animal welfare
14:40 - 14:55	Vorel; Formation of wolves' territorial system during the colonization process	Sillero; Conservation with hard borders: Wolves and people in the highlands of Ethiopia.	Ambarli; The relationship between wolves' food habits and human-wolf conflicts in Turkey	Fahlman; Reversible immobilization of free-ranging wolves by helicopter darting: Advantages and challenges
15:00 - 15:30	Fika			
15:30 - 16:30	PANEL DISCUSSION 1			
16:30 - 16:40	Break			
16:40 - 17:40	PANEL DISCUSSION 2			
17:40 - 18:00	Break			
18:00 - 24:00	<p><u>Closing Dinner and Banquet:</u> Folkparken Games (18:00 - 22:00) BBQ Buffet Dinner (18:30 - 20:30) Folkparken Band (20:00 - 22:00) Main Building DJ (22:00 - 24:00)</p>			

DETAILED PROGRAM

THURSDAY, MAY 11TH



Thursday, May 11, 2023				
7:00 - 8:00	Breakfast			
8:00 - 8:40	Plenary Talk - Douglas Smith <i>When protected areas don't protect</i>			
8:40 - 9:20	Plenary Talk - John Linnell <i>Games without frontiers? Challenges of conserving wolves in politically, socially and ecologically fragmented landscapes</i>			
9:20 - 10:00	Plenary Talk - Erica von Essen <i>Goodwill hunting: Co-existence through culling?</i>			
10:00 - 10:30	Fika			
10:30 - 11:00	Pack and Check-out			
Break Out Talks				
	Predator-Prey Relationships and Trophic Interactions	Legislation, Policy, and Social Science	Monitoring and Methods	Wolf-Dog Hybridization and Anatomy
	Main Hall	Building 7 (Room 7A)	Building 5 (Room 5A)	Building 6 (Room 6A)
11:00 - 11:15	Guimaraes; The role of wolf predation on wild boar to control African Swine Fever: Insights from a multi-prey system in central Europe	Hommen; Applying human-wildlife-conflict-research in practical management	Marti Domken; Identifying the presence of pups in a chorus to monitor wolf populations	Donfrancesco; Transcending problematic dualisms in managing wolf-dog hybridisation
11:20 - 11:35	Hoy; The role of wolves in regulating a chronic non-communicable disease, osteoarthritis, in prey populations	Pettersson; Key insights for proactive wolf governance in the Anthropocene	Palacios; Detection of howling activity around rendezvous sites using automatic recorders and its usefulness for wolf monitoring	Mystajek; Management and ecology of wolf-dog hybrids in Poland
11:40 - 11:55	Gerber; Effects of wolf return on red deer movement behaviour and habitat selection in a cultural landscape: Insights from a long-term telemetry study	Kraus; The role of social drivers in shaping attitudes towards wolves and the spatial prediction of human-wolf conflicts in Sweden and Italy	Smith; Acoustic localisation as a tool for non-invasive monitoring of wolf movement and behaviour	Rostovskaya; What big skulls you have! Cranial morphometry of grey wolf (<i>Canis lupus</i>) in Eurasia

DETAILED PROGRAM

THURSDAY, MAY 11TH



	Predator-Prey Relationships and Trophic Interactions	Legislation, Policy, and Social Science	Monitoring and Methods	Wolf-Dog Hybridization and Anatomy
	Main Hall	Building 7 (Room 7A)	Building 5 (Room 5A)	Building 6 (Room 6A)
12:00 - 12:15	Szewczyk; Spatial organization and population dynamics of a recolonizing wolf population are affected by the presence of an introduced ungulate species, the fallow deer <i>Dama dama</i>	Mink; The effect of wolves on the exit and voicing exit of Swiss mountain farmers	Santos; Can physiology inform management? Extrinsic determinants of hair cortisol concentration in Iberian wolves	Kwiatkowska; "How do I look?" Changes in phenotype in wolf-dog hybrids
12:20 - 12:35	Mols; Humans and wolves together create a landscape of fear for deer in a human-dominated landscape	Kaushik; Social understandings of categorizing biodiversity: Using wolves and tigers as a case study	Kozyra-Zyskowska; Modeling roads and railways mortality hotspots of gray wolf (<i>Canis lupus</i>) in Poland	Figura; Rescue, rehabilitation, and post-release monitoring of wolves injured in snares and traffic accidents
12:45 - 13:45	Lunch			
13:45 - 15:45	Break Out Workshops			
	Building 7 (Room 7A)	Building 5 (Room 5A)	Building 6 (Room 6A)	Building 4 (Room 4A)
13:45 - 15:45	The role of poaching in wolf research and management (Liberg)	Lessons Learned to Achieve Conservation Success: It's about Working with People! Human Dimensions Research with Applied Facilitation and Conflict Resolution Creates Solutions (Bath)	Challenging positions and perception in wolf conflicts (Hansen)	Enhancing stakeholder engagement through dialogue, case studies and examples (Nyman)
	Building 3 (Room 3A)	Building 1 (Room 1A)		
	Trapping wolves with leghold traps when bears are around (Kusak)	Changepoint analysis and animation of movement data in R (Versluijs)		
15:45 - 16:15	Closing Ceremony			
16:30	Buses leave for Stockholm (Arlanda and Stockholm C)			

KEYNOTE SPEAKER



LUIGI BOITANI

*Professor
University of Rome, Italy*

Luigi Boitani is professor of Conservation Biology and Animal Ecology at the University of Rome, and Head of the Department of Animal and Human Biology. He is also Founder and Director of the Masters program "Conservation of animal biodiversity". He is an Affiliated Professor at the Department of Natural Resources, Idaho University, Moscow and member of the College of Graduate Studies. Luigi's primary research focuses on the study of wolf ecology in Italy, modelling of mammal distributions in Italy, Africa and South East Asia, and protected areas design and management in Italy and Africa. He is a member of more than 25 professional organizations, working groups, and Boards of Governors including Founder and President of the Institute of Applied Ecology, Rome. Luigi has been involved with IUCN and SSC for many years, including as one of the leaders in the development of the Species Information Service, Red List Committee member, and a member of several Specialist Groups.

PLENARY SPEAKERS



JOHN LINNELL

*Senior Research Scientist
Norwegian Institute for Nature
Research, and Inland Norway University
of Applied Sciences, Norway*

John Linnell is a Senior Research Scientist at the Norwegian Institute for Nature Research and a Professor at the Inland Norway University of Applied Sciences. John received a PhD in Ecology at University College Cork in 1994. He works with multiple disciplinary approaches to issues related to wildlife conservation - focusing mainly on large carnivores and large herbivores. Topics range from sustainable harvest, behaviour, demography and habitat use to human-wildlife conflicts. John's work aims to provide policy relevant science that can promote human-wildlife coexistence in shared landscapes. He has conducted projects in Norway, the Baltic States, the western Balkans, Brazil, India, Myanmar, Kazakhstan and Turkmenistan.



JOSIP KUSAK

*Professor
University of Zagreb, Croatia*

Josip Kusak is a professor at the Biology Department, Veterinary Faculty, University of Zagreb, Croatia. He is a DVM with an MS in bear ecology and a PhD in wolf ecology, and did his initial "wolf" training at the "K-lab" in Ely, Minnesota in 1996. He has worked on: large carnivore habitat analysis, predation and attacks on livestock, animal diseases and mortality, development of carnivore management plans, assessment of the impact of infrastructure development on large carnivores, monitoring of large carnivores, delivery of specialized trainings (large carnivore's capturing and handling, telemetry, distinguishing signs of predators on prey, emergency response). He has consulted on and participated in wolf/brown bear study projects in Slovenia, Bosnia & Herzegovina, Greece, Italy, and Turkey. Josip is a member of National Comity for Large Carnivores in Croatia since 1996 and contributed in the developing and implementation of wolf, bear and lynx management.



FRANCESCA MARUCCO

*Professor
University of Torino, Italy*

Francesca Marucco is a contracted professor at the University of Torino (Italy), in charge of the wolf monitoring program in the Italian Alps by ISPRA (Institute of Environmental Research of Italy), and project manager and scientific coordinator of the former project LIFE WOLFALPS. She has a BA from the University of Torino (Italy), and Master of Science and PhD in Wildlife Biology from the University of Montana (U.S.). She has over 20 years of experience in wolf research and management in the Alps and the U.S. Since 1999, she has been the scientific coordinator at the Center for Management and Conservation of Large Carnivores of the Piemonte Region. She has published numerous scientific papers at international level, and collaborates in several research projects on large carnivores in Europe and the U.S. She has been a member of the Large Carnivore Initiative for Europe (LCIE) since 2012, which is a Specialist Group of the IUCN SSC.



DAVID MECH

Senior Research Scientist

Biological Resources Division, USGS, USA

L. David Mech is a Senior Research Scientist with the Biological Resources Division, U.S. Geological Survey and an Adjunct Professor in the Department of Fisheries, Wildlife and Conservation Biology, and Department of Ecology, Evolution and Behavior at the University of Minnesota. He has studied wolves and their prey since 1958, working on Isle Royale, in Minnesota, Yellowstone National Park, Denali National Park, and Ellesmere Island. David is also founder and vice chair of the International Wolf Center, and chaired the IUCN Wolf Specialist Group from 1978 to 2013. In 2013, the Wolf Specialist Group merged into the IUCN Canid Specialist Group, and David became advisor for wolves in that Group since then. He has published some 450 articles and 11 books, and received the Wildlife Society's Aldo Leopold Award.



TARIKU MEKONNEN GUTEMA

Assistant Professor

Jimma University, Ethiopia

Tariku Mekonnen Gutema is an Assistant Professor of wildlife conservation and management at Jimma University, Ethiopia. He received his PhD in Wildlife Conservation from the Norwegian University of Life Sciences. Since 2007, Tariku has been working in Jimma University as head of the Department Natural Resources Management and teaching wildlife ecology. Tariku's studies focus primarily on the ecology and interaction of two wolf species of Africa, Ethiopian wolf (*Canis simensis*) and African wolf (*Canis lupaster*). Recently, in order to reduce human-carnivore conflict and promote co-existence with wolves, Tariku has initiated a new project that increases community awareness toward wolf species in Africa.



DOUGLAS SMITH

Senior Wildlife Biologist

Yellowstone National Park, USA

Douglas Smith is a Senior Wildlife Biologist in Yellowstone National Park and has been involved with wolf restoration there since 1994. Doug received a B.S. in Wildlife Biology from the University of Idaho in 1985, an M.S. in Biology under Rolf Peterson at Michigan Technological University in 1988, a PhD from the University of Nevada, Reno in Ecology, Evolution and Conservation Biology in 1997 under Stephen H. Jenkins. Besides Yellowstone he has also worked with wolves on Isle Royale, in Minnesota, and Indiana (captive). He is a member of the Mexican Wolf Recovery Team and the IUCN Re-Introduction Specialist Group. His main interest is wolf conservation, wolf-prey ecology and population dynamics and has published numerous scientific and popular articles and books on the subject.



ASTRID VIK STRONEN

*Assistant Professor
University of Ljubljana, Slovenia*

Astrid Vik Stronen is an Assistant Professor in the Department of Biology at the University of Ljubljana, Slovenia. Astrid received a Masters in Environmental Science from the University of Calgary, a PhD in Biology from the University of New Brunswick, and was a postdoctoral researcher at Aalborg University. Her recent studies include genomic analyses of wild species and domestic populations at risk in Europe and Canada, including bison, cattle, dogs, and wolves. Astrid is interested in contemporary evolution resulting from human activities, and how we can best preserve wild species and their habitats in the face of rapid environmental change. She has a strong interest in applied conservation genetics, and in projects that integrate ecology, evolution, and conservation and connect these fields to human dimensions including ethics and human-wildlife interactions.



ERICA VON ESSEN

*Associate Professor
Swedish University of
Agricultural Sciences, Sweden*

Erica von Essen is an Associate Professor of Environmental Communication, at the Swedish University of Agricultural Sciences in Sweden. Erica's research focuses on future directions in wildlife conservation, biosecuritization in the context of wildlife, and people's resistance to environmental directives - from protests, everyday forms of resistance to violent extra-legal actions. Her projects have dealt with the ethics around animals that are 'at the wrong place at the wrong time' in society, and what sorts of measures, infrastructures and technologies are deployed to correct such transgressions. Her PhD was on illegal killings of wolves in Scandinavia, and has since been invited to speak at both Swedish and EU parliaments regarding wolf controversies.



JOHN VUCETICH

*Associate Professor
Michigan Technological University, USA*

John Vucetich is an associate professor of animal ecology at Michigan Technological University. He also leads the Isle Royale Wolf-Moose Project, the longest continuous study of any predator-prey system in the world. He has authored more than 75 scholarly publications on a range of topics, including wolf-prey ecology, extinction risk, population genetics and environmental philosophy. His contributions to the wolf-moose project have been officially recognized by the United States Senate. He has also collaborated with wolf researchers from Canada, Sweden and Yellowstone, and has served on the Mexican wolf recovery team for more than a decade.



CAMILLA WIKENROS

*Associate Professor
Swedish University of
Agricultural Sciences, Sweden*

Camilla Wikenros is an Associated Professor at the Swedish University of Agricultural Sciences, where she received her PhD, and Program Coordinator for SKANDULV. Camilla's research is focused on trophic interactions between mammalian apex predators and their prey species, how the results from those interactions propagate through to lower trophic levels, and in turn affect other mammals, bird species as well as human use of natural resources. She is interested in both basic ecology and behavior, and applied scientific research questions. Her work aims to provide ecological knowledge to inform the conservation of threatened species and their effects on biodiversity in relation to wildlife management and sustainable use of natural resources.



YADVENDRADEV JHALA

*Senior Professor
Wildlife Institute of India, India*

Yadvendra Dev Jhala is a Senior Professor and the Head of the Animal Ecology and Conservation Biology Department at the Wildlife Institute of India, which is based in Dehradun. For the past 15 years, since his doctoral work on the Indian wolf and blackbuck in 1990 at VPI & SU, Virginia, Jhala has been researching Indian canids. His other research and conservation interests include Asiatic lions, tigers and striped hyenas, all of which have ongoing research projects. His major job responsibility has been to design and conduct country wide assessments for assessing the status of tigers, large carnivores, prey and their habitat.



BARBARA ZIMMERMANN

*Senior Researcher
Inland Norway University of
Applied Sciences, Norway*

Barbara Zimmermann is a senior researcher with SKANDULV and a Professor at the Inland Norway University of Applied Sciences (INN), where she received her PhD. Barbara is a project leader for GRENSEVILT, a cross-border collaboration between Norway and Sweden that works to provide a solid base for a better transnational, inclusive, conflict-reducing multispecies management of moose, wolves and wolverines in Inner Scandinavia. She is also the head of INN's research group LARGE, a group committed to knowledge generation to meet common goals for a sustainable management of large-bodied species and dampening wildlife-human conflicts, and a member of SKOGSJERV, which studies Scandinavian large carnivores and their interactions with wild and domestic herbivores. Barbara is originally from Switzerland, but has been living and working in Norway since 1993.

INTERACTIVE EVENTS

Speed Fika

Speed fika is a fun, interactive way of connecting participants and breaking down some of the barriers between senior researchers, students, managers, and other stakeholders! Approximately 50 people (selected at random) will join for each session. Participants will then have 2 minutes to chat with the person across from them until the bell rings. Once the bell rings, people switch positions and do it again. We encourage all participants to attend.

Where - Main Building - Basement Bar

When - At Fika! See your session number for your date and time

How - Each participant will receive a number in their welcome packet (Fika Session 1 through 7). Simply show up to your assigned Speed Fika. **Be sure to collect your coffee downstairs when participating in Speed Fika!**

Around the World - Sticker Collection Game

The Around the World Sticker Collection Game is a way to encourage people from different world regions to interact and break down borders! Each participant will receive a set of stickers that represent the world region they come from. Participants will try and collect two stickers of every color (including their own) and paste them to the game card. Collect a minimum of 2 of each sticker color to enter, write your name at the top, and submit to the box in the Main Congress Hall by 1800 on Wednesday to be entered into a drawing to win prizes!

Where - Everywhere!

When - Throughout the conference! **Submissions must be in by Wednesday at 1800.**

How - Each participant will receive a set of stickers with their world region's color. Chat with participants from other world regions to collect all the necessary stickers.

Submission Box will be located in the Main Congress Hall.



RED - Northern Europe

BLUE - Western Europe

GREEN - Central Europe

WHITE - Asia / Africa / Middle East

YELLOW - North America

INTERACTIVE EVENTS

Workshops

We are offering 12 different workshops hosted by researchers, managers, and stakeholders from around the world. Please see the Workshop Section of this booklet for further details.

Where - See the schedule

When - See the schedule

How - Participants should have signed up for their workshops at registration. If you forgot, simply join one!

Interactive Poster Session

Join us at our Interactive Poster Session for posters, exhibitors, games, and other fun activities! You will be able to move around the Main Hall where the posters will be set up. Engage with the presenters, participate in the activities, and enjoy some food and a beverage. Drinks and appetizers will be served during the event (drinks at your own expense). **Drink tickets are for sale at the front desk!**

Where - Main Congress Hall

When - Tuesday, May 9 (1700 - 1900)

How - Show up!

Poster Competition

We will be holding a Poster Competition during the Interactive Poster session, which you are all invited to participate in! You will be able to vote for the best poster in each of the four categories during the poster session, and the winners will be announced at the Banquet where they will receive prizes!

You may nominate one poster for each of the following categories:

Best Overall Student Poster (for the best poster presented by a student)

Most Concise and Compelling (for the least wordy and most communicative poster)

Most Interactive (for the poster with the most engaging interface)

Best Story-Teller (for the poster with the most absorbing poster and presenter that will keep us passionate about their research story)

INTERACTIVE EVENTS

Panel Discussion

Two panel discussions will take place on the last evening of the conference, right before the closing banquet. Please see the Panel Discussion Section of this booklet for further details.

Where - *Main Congress Hall*

When - *Wednesday, May 10 (1530 - 1740)*

How - *The audience may participate by submitting questions online during the Panel Discussion!*

To vote, go to: <https://onlinequestions.org/>

*** The entry code will be on display during the session ***

Closing Banquet

Join us for an evening of celebration! The conference venue has, on-site, a quaint traditional "Folkparken" where people gather to meet, listen to music, and generally enjoy each other's company. Weather providing, we will have outdoor games, a barbeque-style dinner buffet, drinks, and live music. We will also announce the winners of our various competitions and games. Quiet hours at the Folkparken start at 2200, so we will move the party indoors after that where a DJ will play all the best hits. Drinks are available for purchase throughout the event at your own expense.

Where - *Outdoor Folkparken / After-party downstairs in Main Building*

When - *Wednesday, May 10 (1800 - 2400)*

How - *Show up!*

Games - *Open 1800 - 2200*

Buffet Dinner - *Open 1830 - 2030*

Band - *"Hot Nozzle" will play from 2000 - 2200*

DJ - *"DJ Rolle" will play from 2200 - 2400 in the Main Building*

PANEL DISCUSSION 1

Do wolves control their own numbers?

Moderator:

Henrik Andren - Swedish University of Agricultural Sciences, Sweden

Panel Members:

Douglas Smith - Yellowstone National Park, USA
David Mech - US Geological Survey, USA

In 1967 Doug Pimlott published that wolf density would not compress any more than 1 wolf/10 square miles which led to the conclusion that wolves self-regulate. Later, this was referred to as 'protected rearing space' a behavior partly in response to the possibility of infanticide by conspecifics. L. David Mech wrote on the subject in 1970 in his landmark book *The Wolf: Ecology and Behavior of and Endangered Species* and agreed with this conclusion. Then in 1983, Lloyd Keith and later his student Todd Fuller, re-evaluated this idea and found that wolf density was correlated with ungulate biomass a finding Mech agreed with. In this research 25 unexploited, in other words wolf populations that were not impacted by humans, wolf populations were used to test this relationship and the correlation was 72% and a linear relationship. However, others using different analytical procedures found at higher prey densities the relationship was not linear but curva-linear, or wolf density could have been higher based on food but was not.

More research followed, including Mech's, and a consensus formed about the linear relationship with the most recent evidence from Yellowstone National Park. These findings were interesting because in 1997 Jerry Wolff published a paper on mammal population regulation and defined the terms 'intrinsic' vs 'extrinsic' regulation. In short, intrinsically regulated species are territorial and protective of young from attack from conspecifics which acts to space individuals preventing higher densities even if food was available. Territoriality was also used to sequester food and was responsive to food abundance. Extrinsically regulated species are those regulated by food and are non-territorial. Wolves are classically territorial so therefore are the only mammalian species described in his paper that would be territorial and extrinsically regulated. D.W. Smith and others in a book on Yellowstone wolves discussed this debate in the context of wolf vital rates: birth, death, immigration and emigration concluding that framing the argument in a population biology context may be revealing. They also stated more work and collaboration were needed. Mech responded to this chapter by indicating a need to discuss these findings in greater detail.

Acknowledging that there are few places left where wolf numbers are not limited by humans, the underpinning factors behind wolf population regulation is still worthwhile to understand. Thus, Doug and Dave will openly discuss in a public forum intrinsic vs. extrinsic control of wolf populations, or do wolves self-regulate, a topic of great importance to the public and management decisions (e.g., killing wolves is not necessary as they 'self-regulate').

PANEL DISCUSSION 2

Wolf hunting as a management tool? ---

Moderator:

Luigi Boitani - *University of Rome, Italy*

Panel Members:

Mona HansErs - *Swedish Environmental Protection Agency, Sweden*

Evelyn Merrill - *University of Alberta, Canada*

Sami Niemi - *Ministry of Agriculture and Forestry of Finland, Finland*

Ilka Reinhardt - *German Institute for Wolf Monitoring and Research, Germany*

Kjell Vidar Seljevoll - *Norwegian Environmental Protection Agency, Norway*

Yadvendradev Jhala - *Wildlife Institute of India, India*

The recent recovery of wolf populations worldwide results in large conflicts with human activities and causes challenges for conservation and management in general. In some areas prevention and mitigation measures related to depredation on livestock are the main actions taken to ease this conflict. In other areas, different types of hunting (license, quota or management culling) have been used to limit further growth of the population. Alternatively, removal (killing) of problem individuals or total packs by the management personnel have been used to reduce depredation events or local conflicts. However, management authorities in different countries are restricted by a variety of laws linked to different national and international directives and conventions that may preclude or restrict the use of license hunting or removal of problem individuals by managers.

This panel discussion will target this dilemma and discuss the need, pro's and con's with quota hunting/wolf removal as a useful tool in wolf management and if these actions should be more linked to the number of wolves present in the population or the size of conflict. Another question is whether it is possible to identify specific problem individuals within packs and remove those or if total packs should be removed. If the adult individuals are recognized as the responsible for an undesired behaviour within reproducing packs, what time of the year is the best for removal of those with regards to pup survival?

Finally, the two different types of wolf killing (quota hunting versus removal by management) may have different acceptance levels by the public. May regulated quota hunting performed by public hunters lead to improved acceptance and conservation levels for wolves within this group of the society, as the species may be perceived as a valuable resource among hunters? At the same time, this type of hunting may lead to an even more polarized conflict over wolf management among groups in the society.

WORKSHOPS – SESSION 1

Preventing livestock predation by wolves: co-designing a strategic research plan to move forward with “alternative” aversive methods

Matthieu Chastel - University of Antwerp, Belgium

Melissa Vanderheyden - Justus-Liebig University in Gießen, Germany

Background: Livestock predation by wolves is one of the main issues hindering the peaceful coexistence of livestock farming and the carnivore, as desired, for instance, by the European policy. Popular preventive methods include shepherding, electric fences and livestock guarding dogs, but these are not always feasible or effective. With the wolf population rapidly increasing, alternative methods to supplement existing practices are increasingly demanded to provide stakeholders with a set of socially, environmentally, and financially viable options.

Preventive methods using aversive stimuli against the predators or aversive conditioning have been studied in the past and suggested relevant for livestock protection, but no solutions have been found for potential large scale implementation. Conceiving novel methods and testing them is technically demanding. Early trials often suffered from technical issues or constraints weakening the internal and/or external validity of the tests, hence rendering interpretation difficult, and key behavioural concepts at play were only understood later. Presently, animal welfare requirements and (local) political environment can pose additional challenges. As PhD students dedicated to this topic, we also experience that there is no clear consensus among the scientific community, hindering the progress of the research of alternative methods. This research topic raises interest across borders and discussing practical ideas and experimental designs at an international level maximises our chance to find suitable solutions.

Workshop aim: We invite you to a brainstorming/workshop session, aimed at discussing the main questions raised by predator deterrents, aversion conditioning and livestock protection research. Topics we propose to consider include: underlying behavioural mechanisms, pros and cons of experimental methods available. We intend to synthesise a consensual strategy forward and compile it into a jointly signed conference paper/road-map. We hope that this will help present and future stakeholders concerned with this topic to find the relevant scientific, financial, technical and political/social support they will need.

Participatory stakeholder identification and network mapping – purpose, preparation, participation and helpful outcomes

Carol Großmann - Forest Research Institute Baden-Wuerttemberg, Germany

Recent events in Europe showed that multiple organizations and individuals have a strong interest in large carnivores. Self-identification and commitment of stakeholders follow a dynamic process: where controversy is limited fewer people self-identify as stakeholders, in acute conflicts an increasing number of people can be drawn into the topic. Similarly the level of interest and the commitment of a stakeholder to actively

WORKSHOPS – SESSION 1

engage often increase or fade rather quickly. Stakeholders that are actively engaged can positively contribute and give conservation actors a chance to hear and address their concerns. Conversely, stakeholders that feel excluded from large carnivore management often create intense political pressure and maximize their demands in order to ensure their concerns are acknowledged. The overarching aim of the EU-LIFE EuroLargeCarnivores project (www.eurolargecarnivores.eu) under the lead of WWF Germany was to enhance frame conditions, fact based knowledge and practical tools for a better coexistence with large carnivores in Europe. The project therefore addressed these crucial stakeholder related aspects proactively by developing a methodology and process guidelines how to conduct systematic stakeholder identification and participatory stakeholder network mapping workshops to enhance inclusiveness and transparency in stakeholder representation and engagement. The interaction during these workshops and the results thereof laid the foundations for more fruitful communication and cooperation between the different and a times diverging interest groups within and beyond the activities of the project.

In this conference workshop, we will first briefly introduce this methodology. Together we will then actually go through a short version of a participatory stakeholder identification and network mapping workshop, to experience the sometimes surprising and always helpful insights that can be gained by all participants of such a workshop.

Towards a SNP-based standard for wolf/ dog hybrid detection in Europe

Carsten Nowak - Senckenberg Centre for Wildlife Genetics, Germany

Astrid Vik Stronen - University of Ljubljana & DivjaLabs Ltd., Slovenia

Romolo Caniglia - Istituto Superiore per la Protezione e la Ricerca Ambientale, Italy

Hugh Jansman - Wageningen Environmental Research, Netherlands

Hybridisation with domestic dogs is a major challenge for wolf conservation and management in human dominated landscapes. Recent studies show that European wolf genomes comprise traces of dog introgression, and locally elevated levels of wolf-dog-hybridisation have been found in in different regions. While molecular genetic and recently genomic tools have greatly facilitated the detection of hybrids, the multitude of markers used for hybrid detection in the frame of regional wolf monitoring programmes and research activities still hampers the comparability of results across regions.

In the workshop we will present and discuss the applicability of recently developed reduced SNP panels as a potential standard method for hybrid identification across Europe. Tests in various counties have documented the high reliability of the approach for the identification of recent hybrid and backcross generations as well as its suitability for noninvasive samples, such as scats or saliva traces from kills. Availability of the method for European labs could be ensured by the establishment of reference laboratories with the required equipment, who offer analyses in regular time intervals at reasonable costs. Recent application of this approach in Germany, Italy and other countries have shown that SNP-assisted hybrid identification increases the reliability of hybrid detection in the frame of national wolf monitoring and

WORKSHOPS – SESSION 1

permits calibration of commonly used microsatellites panels. The establishment of standardised SNP-based hybrid detection may (i) reduce the rate of falsely assigned as well as overlooked hybrids, (ii) allow for comparison of hybridisation rates across Europe, and (iii) increase public trust in local wolf monitoring and management programmes.

Towards an effective and socially just governance of human-wolf interactions in Europe

Valerio Donfrancesco - University of Cambridge, United Kingdom

Valeria Salvatori - Istituto di Ecologia Applicata, Rome, Italy

Camilla Sandström - Umeå University, Umeå, Sweden

Human-wolf interactions are becoming increasingly common across Europe and can assume various forms depending on the values, interests and needs of those involved. These interactions can lead to tensions among interest groups and become a cause of social injustice, risking to further entrench social conflicts and affect the outcomes of conservation initiatives. In recent decades, there has been growing recognition of the role that social and political contexts play in the production and experience of human-wolf interactions. Increasingly, attention has shifted towards the application of participatory forms of governance, whereby local actors are intended to have a greater voice in management decisions. These contrast with top-down forms of governance whereby decisions are taken at the national and supranational level. Collaborative governance is generally sought because it can help foster better relations between stakeholders, promote socially just outcomes and ultimately increase the success of conservation initiatives. However, there has been relatively little development of the concept of 'social justice' in contexts of human-wolf interactions, such as what it actually means and how it could be applied in practice. This is in contrast to other fields such as marine conservation where such discussions have been advanced. This workshop adapts the ocean equity and justice framework put forward by Bennett (2022; <https://doi.org/10.3389/fmars.2022.873572>) to contexts of terrestrial predator conservation. In particular, this workshop aims to explore how each of the six equity dimensions elaborated by Bennett (2022) can and should be considered and incorporated within the issue of wolf management. After a brief introduction by the key panellists, the workshop will involve a series of targeted activities in smaller groups, before reconvening all together at the end for a general discussion. The production of a scientific manuscript from the workshop activities will be considered.

** This workshop is synergistic with the Session 2 Workshop "Toward enhancing stakeholder engagement through dialogue, case studies and examples"*

WORKSHOPS – SESSION 2

Enhancing stakeholder engagement through dialogue, case studies and examples

Madeleine Nyman - Natural Resource Institute of Finland

Mari Lyly - Finnish Wildlife Agency, Finland

Hanna Pettersson - University of York, United Kingdom

Background: Wolves are often at the centre of disputes over wildlife management since they have come to symbolise both threats to rural livelihoods and cultures (e.g. farming and hunting with dogs), and the salvation/restoration of “wild” nature (through their role as charismatic keystone species). These conflicting worldviews make the task of establishing a robust, transparent, and socially accepted management approach increasingly urgent, especially since the range of the wolf populations keeps expanding into human-dominated landscapes. Most countries are struggling to build consensus and find a common frame to operate within, which has resulted in an unstable and politicized wolf policy that is sensitive to outer pressures and agendas. Most approaches to date have focused mostly on the impacts to and from wolves and the wolf-human interaction (e.g. technical and economic solutions). While many of the management incentives and good practices have been successful at reducing negative impacts (e.g. wolf attacks on livestock), and are central for successful management, they have not been able to solve the conflict. It is now well-established that wolf management is about more than what can be quantified, and that effective and socially just management requires the establishment of a stable platform where all levels of authorities, stakeholders and citizens are included and considered. Thus, it is time to turn our attention towards the human-human wolf conflict and assess the applicability of dialogue tools that could help in enhancing the engagement and commitment of all actors involved in the management of wolves, with a special focus on the stakeholders and NGOs.

Aim: The purpose of the workshop is to assess different dialogue tools in the wolf conflict context. We invite scientists of different backgrounds, practitioners and students to join the workshop to share their own experiences in conflict management. Such tools will be discussed in particular relation to a definition of “social justice” in contexts of wolf management that will have been developed in a previous synergistic workshop at this conference (i.e., Donfrancesco, Salvatori & Sandström, “Towards an effective and socially just governance of human-wolf interactions in Europe”). We focus on how to engage stakeholders and NGOs, both vertically and horizontally, to accept and agree on a common agenda and enhancing stewardship.

Programme: The workshop will consist of two entities: 1) short presentations of the frames and institutional (norms and rules) criteria of a viable wildlife management and group discussions on possible dialogue tools and approaches that could be implemented, and 2) evaluation report on the outcome of the workshop that will be shared among the participants

This workshop is synergistic with the Session 1 Workshop "Towards an effective and socially just governance of human-wolf interactions in Europe"

WORKSHOPS – SESSION 1

What can passive acoustic recorders do for you? Using sound to study wolves

Paul Howden-Leach - Wildlife Acoustics Inc., UK

This workshop will explore how bioacoustics can be used as a non-invasive survey and research tool to identify wolf vocalisations, and how Kaleidoscope Pro (Wildlife Acoustics' sound analysis software) can be used to extract those signals from hours and hours of audio recordings. Kaleidoscope Pro includes a cluster analysis feature that extracts audible signals of interest from larger files, and then sorts those signals by similarity. Cluster analysis is a powerful tool for species survey and presence/absence determination. Cluster analysis is also the first step towards building simple and advanced classifiers to allow specific data to be extracted from hours of recordings. Attendees will get a chance to look at and handle different pieces of recording equipment and look at different deployment methods. In addition, a temporary Kaleidoscope Pro license will be provided to attendees, along with example recordings so you can “play along” with the software element of the workshop. We will discuss the theory of how cluster analysis works, including tuning parameters specifically for wolf research, and then we'll put it into practice with actual audio files.

WORKSHOPS – SESSION 2

Lessons learned to achieve conservation success: It's about working with people! Human dimensions research with applied facilitation and conflict resolution creates solutions

Alistair Bath - Memorial University, Newfoundland, Canada

Anton Näsman - WWF, Sweden

Dr. Alistair Bath will take us all around the world where he has combined human dimensions research and applied conflict resolution and facilitation skills to achieve conservation successes. Whether working with lion killers to become lion guardians in Kenya, Israelis and Palestinian authorities working on urban biodiversity issues, tigers in India, bison restoration in Alaska, Indigenous peoples and caribou issues in Canada's north, jaguars in Brazil, most recently Andean cat conservation in the high Andes of Argentina, and of course wolf issues throughout Europe and in Yellowstone National Park, conservation successes occur when you understand that you are born with two ears and one mouth, so you should be listening at least twice as much as talking when working with local communities, key interest groups and government authorities. Listen to Alistair share stories of how listening and learning from people is the key to conservation success. Learn how to use HD research to involve all groups, balance vocal viewpoints, and gain valuable insights to issues, but also to then apply facilitation and conflict resolution skills to resolve those issues. A 4-phased approach to conservation success will be shared and demonstrated to participants.

This interactive workshop training course is directed to wildlife and natural resource conservation professionals (e.g., government, NGOs, students and practitioners) who are dealing with programs to mitigate human-wildlife conflict, effectively understand the complex nature of gaining public support, designing effective communication strategies and strategically planning best ways forward to achieve wolf conservation.

The role of poaching in wolf research and management

Olof Liberg - Swedish University of Agricultural Sciences, Sweden

Håkan Sand - Swedish University of Agricultural Sciences, Sweden

Illegal killing of wildlife, also termed poaching, is a common and global problem. Although most acute in species poached for monetary gain, often related to large scale illicit trade, poaching is also a significant problem for the conservation of large carnivores that threaten and compete with human interests. Grey wolves (*Canis lupus*) have limited commercial value but are probably the most controversial and conflict-prone carnivore species on Earth. Poaching of wolves appears to be prevalent wherever wolves and humans coexist. The idea that legal harvest or culling might increase tolerance of wolves, and even reduce poaching, has been raised and put in practice, but also questioned.

WORKSHOPS – SESSION 2

In some areas of the world, illegal killing of large carnivores seems to be largely a rural protest against conservationist restrictions, which are perceived as threats against the residents' traditional rights and the quality of life in the countryside. This view has been extensively supported and discussed in a large and fast-growing body of social science literature. It has even been suggested that a remedy against poaching of wolves could be to increase legal culling and turn them into a “valued quarry in traditional hunting”.

One important factor that may obstruct a better understanding of the relationship between legal culling and poaching is the difficulty of quantifying poaching. Poaching is a criminal act and the offenders are therefore expected to conceal the offences. The term “cryptic poaching” has been used to define the hidden proportion of poaching that is not discovered or reported.

In this workshop, we will focus on reasons for and effects of poaching on wolves, and discuss how important and general this factor may be in limiting wolf population growth. We here define poaching as any type of illegal killing of wolves, irrespective of method. In particular, we want researchers to critically re-evaluate their own data and experiences on wolf mortality patterns so as to give an updated view over the importance of poaching, how this can better be estimated by researchers, and what management actions may possibly be used to reduce this in the future.

Challenging positions and perception in wolf conflicts

Hans Peter Hansen - Aarhus University, Denmark

After centuries of absence, the grey wolf (*Canis lupus*) has again become a natural inhabitant of many western landscapes. From a biological perspective the return of wolves has been successful but with wolves severe tensions and conflicts between humans, on wolves and wolf management, has followed. The main drivers of these conflicts are competition between wolves and humans about resources, fear and anxiety, and revoked myths and narratives about wolves and their introduction to the landscape. In many countries we have seen an escalation of the conflict level, leading to illegal killings of wolves, threats and violence, as well as political populism. This to the extent that a well-functioning management has become difficult and in some cases impossible. Due to the high conflict level many wildlife researchers, wildlife managers, and governmental agencies, have entered a state of despair not being able to identify any viable way forward.

Together we will explore how our own perceptions, as wildlife researchers, wildlife managers or representatives of NGO, on conflicts related to wolves, shape our ability to imagine and test possible solutions to conflicts. We will apply and facilitate a future oriented workshop methodology, and document the results for a possible common paper in a scientific outlet.

WORKSHOPS – SESSION 2

Trapping wolves with leghold traps when bears are around

Josip Kusak - University of Zagreb, Croatia

Katarzyna Bojarska - Polish Academy of Sciences, Poland

Background: Every seasoned wolf trapper knows that capturing non-target animals is an inevitable annoyance which decreases chances of capturing wolves, and for which one should always be prepared. We will not elaborate on the general techniques of wolf trapping with leghold traps, but only on the aspects of this craft which are important when bears are present in the same area and could be captured. Leghold traps are not designed and set in a way to safely capture bears. Capturing bears in wolf traps is not only an annoyance, but also can be dangerous, regardless the bear size. Bear cubs are accompanied by very protective mothers, while older bears up to 70-80 kg are still not strong enough to free themselves from the trap, but they may do so in a moment of maximal excitement, which usually occurs when a trapper approaches them for darting.

Several measures can be undertaken to minimize the probability of capturing bears and to increase the chance for capturing wolves. These measures include the choice of the season, the area, and lure. Some apparently obvious technical solutions, like fixing the trap to the ground or to a tree along a drivable road to enable safe darting from the car, may prove not feasible in case of wolves, mostly because of human-related factors. Josip Kusak discussed the topic with Mr. Carter Niemeyer and asked him: "What would you do if you needed to trap wolves in an area where brown bears are present?" Mr. Niemeyer answered: "I would not do this."

Workshop aim: We invite you to a brainstorming session, aimed at discussing the challenges and options on how to trap wolves safely and efficiently for research purposes in the presence of bears, but also people in human-dominated landscapes.

Changepoint analysis and animation of movement data in R

Erik Versluijs - Inland Norway University of Applied Sciences, Norway

Recent advances in GPS and battery technology enable studies on fine-scale movement of radio-tagged individuals. During bursts of intensive positioning, researchers can study behavioural responses of individuals to e.g. external stimuli, such as human disturbance. In this workshop, Erik Versluijs will give an introduction to the application of changepoint analysis in R to identify changes between different behavioural states, such as resting and flight. He will also show how movement of e.g. wolves and humans can be visualized as animated paths in R. Animation is useful to explore movement and interactions, and helps to communicate research results. The workshop will be hands-on, so bring along your laptop, preferably with R installed.

VIRTUAL SESSIONS

Post Conference Virtual Workshops

Estimating wolf occupancy with R

Olivier Gimenez - National Centre for Scientific Research, France

In this workshop, we will show how to infer occupancy while accounting for imperfect detection. Using a real case study on wolves (*Canis lupus*) that have been recolonizing France since the early 1990s, we will show how to estimate the proportion of area occupied by the species. We will also show how to assess the dynamic of occupancy by estimating colonization and extinction processes. If time allows, we will also cover recent models that allow accounting for false positives due to species misidentification as well as species interactions. The workshop will be a combination of lecture and live coding demonstrations in R (using package `unmarked`).

Date and Time: May 16th, 2023 - 14:00 - 17:00 CET

Understanding the wolf through cultural narratives

Saloni Bhatia - Ashoka Trust for Research in Ecology and the Environment, India

In many parts of the world, researchers have documented folklore around the wolf that has enabled us to understand the origin of various emotions, values, beliefs and stereotypes that people have come to associate with the animal. In several parts of Europe, for example, the wolf is associated with witchcraft whereas in parts of Central Asia, it is considered to be the ancestor of Genghis Khan. In parts of the Indian high Himalaya, people believe that uttering the wolf's name will bring bad luck whereas others believe the wolf to be a vehicle for several deities. The richness and nuance in folklore can allow us to better interpret human-wolf relationships and help with inclusive and culturally-relevant conservation messaging.

Storytelling is an essential part of human societies which enables people to make sense of the world and their place in it. The proposed workshop can be a place of learning and 'unlearning' of the ways in which we see the wolf. It aims to be an interactive session which can provide a platform for the consolidation of wolf narratives across geographies and also facilitate discussion on how to a) better document and preserve biocultural heritage for posterity and b) integrate it with on-ground conservation.

Date and Time: May 26th, 2023 - 19:00 - 21:00 IST

VIRTUAL SESSIONS

Post Conference Virtual Panel Discussion

Overshadowed by large cats: Wolves in the Asian highlands

David Macdonald, WildCRU, University of Oxford, United Kingdom

In west and central Asian highlands, wolf management and conservation is generally overshadowed by more charismatic larger cats, such as Persian leopards, snow leopards and tigers, which are considered to need more protection. Consequently, conservation resources and mitigation efforts in different landscapes are usually channelled into cat conservation, rather than addressing the entire guild of large carnivores.

The aim of this virtual panel is to bring up ideas how to advance wolf conservation in these regions where charismatic cat species often leave less space for wolf conservation. In this virtual panel, we will be discussing about different aspects of the ecological processes of wolf-large cat interaction and socio-economic consequences of their ecology and current conservation practices, based on empirical studies from Pakistan, Iran, India, Mongolia, Georgia and Nepal.

Panel Speakers and Talks:

Mohammad Farhadina - University of Kent / University of Oxford, United Kingdom
(Different effects of land-use management on wolves and leopards in Iran)

Shivam Shrotriya - Wildlife Institute of India, India
(Living in the shadow of big cats: The ancient wolves of India deserve conservation attention)

Muhammad Kabir - Wildlife Ecology Lab, University of Haripur, Pakistan
(Coexistence of wolves, snow leopards and communities in northern Pakistan)

Geraldine Werhahn - University of Oxford, United Kingdom
(Exploring causes and consequences for underrepresented wolf conservation in the Nepalese Himalayas)

Claudio Augugliaro - University of Lausanne, Switzerland
(Co-occurrence between carnivore communities and pastoral activities in the Mongolian Altai)

Bejan Lortkipanidze - Noah's Ark Centre for the Recovery of Endangered Species (NACRES)
(Conservation of wolves, lynx, and leopards in Georgia)

Date and Time: May 17th, 2023 - 14:00 - 16:00 CET

Recolonizing Himalayan wolf and conflict with pastoralists in Gaurishankar Conservation Area, Nepal

Purna B. Ale (1, 2), Madhu Chetri (3), and Morten Odden (1)

(1) Inland Norway University of Applied Sciences, Norway

(2) Third Pole Conservancy, GPO Box 26288, Kathmandu, Nepal

(3) National Trust for Nature Conservation, Khumaltar, Lalitpur, Nepal

The Himalayan wolf (*Canis lupus chanco*) also known as Tibetan wolf which is genetically close relation with the African wolf (*Canis lupaster*) but distinct lineage from the Holarctic grey wolf. The Himalayan wolves are widely distributed in the Himalayan range of centre Asia including Nepal, India and China. The higher Himalayas in the Gaurishankar Conservation Area (GCA) i.e. Lapchi and Rolwaling valleys are the potential habitat of the species. The national status of the Himalayan wolf has been assessed as “Critically Endangered” in Nepal. However, IUCN Red List of Threatened Species classification of the species is still pending. The population of the species is on decreasing trend due to retaliatory killings. Recent studies showed that the Himalayan wolves are recolonizing in the high altitude of Nepal Himalaya. The majority of the mountain people depend on their pastoralist lifestyle. The reappearance of wolves in GCA increases conflicts with the pastoral communities. Thus, human-wolf conflict mitigation is crucial in promoting the coexistence and long-term survival of wolves. We conducted a camera trap survey using systematic grids cells and a questionnaire survey with local herders (n=160). The data on livestock kills were also collected opportunistically and when possible, to cross-validate the information obtained from the respondents. The aims of this study are to i) mapping human-wolves conflict hotspots in GCA ii) assess the intensity of livestock depredation iii) explore local people’s perceptions and possible mitigation measures. The majority of respondents in GCA demand more relief funds for their livestock depredation. Consequently, people have less positive attitudes towards the conservation of wolves. However, compensation provided by the conservation authority are found useful in raising positive hopes among pastoralists.

The relationship between wolves' food habits and human-wolf conflicts in Turkey

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Revealing the feeding ecology of wolves is not only an introductory essential study for understanding the wolves' diet but also for helping to predict prey-predator relations and human-wildlife conflicts. In Turkey where the wolf has a large distribution from hills about 500 meters to high mountains over 3000 meters, the diet of wolves also varies throughout regions but the reason is still obscure. To learn the dietary behavior of wolves in Turkey, we have collected faeces from northwestern deciduous and mixed forests (n=76, mean elevation=900 m a.s.l), and northeastern coniferous forest and alpine grasslands (n=35, mean elevation 1500 m a.s.l) with differing ungulate population abundances and livestock numbers (n=292K vs n=191K). We analyzed the diet item parameters (VO%, FO%, Biomass%, and number of items) by using point frame methods and rarefactions. We also recorded the numbers of human-wolf conflicts in the two regions and compared those to the domestic livestock and ungulate percentages in wolves' diets. We found 17 different food items in the diets of wolves from domestic animals, wild ungulates, and carnivores to plants, birds, and reptiles. The volume of wild animals in the diet decreases from 91% in the western to 59 % in the eastern Black Sea Region. In comparison, the volume of domestic livestock in the diet dramatically increases from 4% to 36% respectively in regions. This also correlates with the severity of the human-wolf conflict mainly related to food-based conflict although the livestock numbers are less than in western regions. In conclusion, compared to the results of former studies, we conclude that the diet of wolves and the severity of human-wolf conflict are mostly related to wild animal abundance, elevation, and animal husbandry practices rather than livestock numbers. We suggest more personal and small-scale livestock protection implementations in the northeastern Black Sea Region.

Harvest model of wolf population using Bayesian forecasting

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Harvesting large carnivores can be a management tool for meeting politically set goals for their desired abundance. However, harvesting carnivores creates its own set of conflicts in both society and among conservation professionals, where one consequence is a need to demonstrate that management is sustainable, evidence-based, and guided by science. Furthermore, because large carnivores often also have high degrees of legal protection, harvest quotas have to be carefully justified and constantly adjusted to avoid damaging their conservation status. We developed a Bayesian state-space model to support adaptive management of wolf harvesting in Scandinavia using data from the annual monitoring of wolf abundance and harvest. We used the model to predict the probability that the forecasted population size will be below the favorable conservation status when subjected to different harvest quotas. The model presented here informs decision makers about the policy risks of alternative harvest levels. The model has been used by wildlife managers in both Sweden and Norway to guide wolf harvest quotas and the model predictions showed good agreement with observations. The annual assessment of the monitoring results and the use of forecasting models will reduce the risk of wolf population sizes moving outside the desired goals. The approach we illustrate could be adapted to other wolf populations worldwide.

Physiologic evaluation of capture and anesthesia with Fremont® Humane Foot Snare and Medetomidine–Ketamine–Acepromazine in free ranging Apennine wolf (*Canis lupus italicus*) and implications on animal welfare

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The Maiella National Park (MNP) has been one of the parks that has worked most on the research and management of the Apennine wolf (*Canis lupus italicus*) in recent years. As coordinating beneficiary of the Life Wolfnet project (LIFE08 NAT/IT/000325) in the years 2010-2014, and currently of the Wolfnext project, financed by the Italian Ministry of the Environment, the Park's staff has been working since 2010 on various capture activities for research and to acquire information to prevent illegal mortality and promote coexistence with human activities. 20 wolves were captured from 2010 to 2017: 12 of these, with the same mixed technique (Fremont® snare, a spring-activated foot snares equipped with a GSM-based alarm and chemical immobilization with a mixture of 0.05 mg/Kg of medetomidine -Domitor®, 4.30 mg/Kg of ketamine -Imalgene®- and 0.15 mg/Kg of acepromazine -Prequillan®-) and under similar operating conditions (we have excluded wolves previously injured, recovered, captured in occasional or opportunistic situations or anesthetized with different mixture) were evaluated on the physiological response to the capture technique and animal welfare. Induction, handling and recovery time were monitored, total capture time was registered and physiologic parameters checked. The wolves were equipped with global positioning system (GPS) radio-collar (Followit® GPS collars or Vectronic Aerospace®) and were left to recover close to the trap site. As reverse drug, 0.04mg/Kg of atipamezole (Antisedan®) was administered. Clinical parameters (Heart rate, Respiratory rate, Temperature, SpO₂, Noninvasive Blood Pressure and Electrocardiogram) were monitored instrumentally with a multiparameter portable monitor (Comen - Monitor Star 8000 VET®) during anesthesia on field conditions and by means of haematologic and biochemical test. We also evaluated injury scores due to the snare action on legs and mouth. Intensive post release GPS monitoring allowed us to verify that none of the captured wolves died after capture events nor showed abnormal social behavior.

Maiella wolves do not like livestock? 20 years of research and experience on feeding ecology of Apennine wolf (*Canis lupus italicus*)

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The feeding ecology is a fundamental issue to understand the role of wolves in shaping the structure and functioning of ecosystems. This is particularly crucial in a system of complex relationships and strong humane presence, such as for the Apennine wolf in Italy. Wolves expanded from the Apennines towards the Alps and this recolonization raised many questions about conflicts with human activities, mainly concerning livestock predations. On the other hand, the occurrence of wild ungulates in the wolf diet increased from the 70s to today, mainly due to wild boar and deer, together with a decrease of livestock. On the Maiella massif wolves disappeared, and their feeding behavior radically changed in the last decades. Among the conservation and management activities of the Maiella National Park, since 2002 we apply several methods to understand the wolf-preys relationship. At first we investigated livestock wolf predation (98 events; 524 preys) occurred in 2002-2007, through a standardized assessment procedure based on field necropsies. In this preliminary study, we quantified that the amount of livestock could not exceed 7% in the wolf diet. Then, in 2007-2008 we investigated food habits of 9 packs using scat analysis. Wild ungulates resulted the main source of food and accounted in total for 91% of frequency of occurrence, whereas livestock reached just 5.87%. Afterwards, thanks to the radiocollaring activities carried out from 2010 to 2015 we studied the predation behavior of 5 packs using GPS positions clusters surveys, obtaining the same results. Finally, in a last reconnaissance on the wolf livestock predations we established that the average damage in the period 2015-2019 is just 0.7% of the Park livestock grazing population. In this long-term work we evaluated that the factors generating this limited interest for the livestock by our wolves are the abundance of wild preys, the stability of the packs and the good practices of integrated protection systems applied on the flocks of sheep, for which the farmers usually provide for continuous custody with the presence of the shepherd and dogs during the grazing periods.

From protected to harvested: What have we learned after 15 years of wolf harvest in Idaho, USA?

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Gray wolves (*Canis lupus*) were removed from the Endangered Species List in the United States in 2009 and hunting and trapping began immediately. There has been fierce debate about how harvest might affect gray wolves in Idaho, USA. Using a long-term genetic dataset as well as harvest information we now better understand how hunting and trapping affects wolves. We used harvest data to examine the mechanics of wolf harvest throughout Idaho. For example, were there “safe havens”, were pups more vulnerable to harvest, and were few wolves harvested via rifle? We also used noninvasive genetic sampling to construct pack pedigrees and estimate pup survival for the harvested wolf population. We hypothesized that harvest reduces pup survival because of 1) reduced group size, 2) increased breeder turnover and/or 3) reduced number of female helpers. Wolf harvest occurs virtually everywhere in Idaho, pups are not more vulnerable to harvest than adults, and most wolves are harvested via rifle during the general big-game season. Harvest rates between 10-25% reduces pup survival by half. In addition to harvest, turnover of breeding males and the presence of older, nonbreeding males also reduces pup survival. Large groups and breeder stability increase pup survival, however. Wolf pup survival is negatively influenced by both the direct (i.e., pup is harvested) and indirect effects of harvest that change pack size and composition.

Environmental and anthropogenic features mediate human hunting risk and wolf predation risk for moose

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When predators have different hunting modes, the combined effects of multiple predators are mediated by the physical landscape and can result in overlapping or contrasting patterns of predation risk. Humans have become super predators in many anthropogenic landscapes by harvesting game species and competing with large carnivores for prey. Here, we used the locations of wolf (*Canis lupus*)-killed and hunter-killed moose (*Alces alces*) in relation to random locations inside two wolf territories in south-central Scandinavia to investigate how the landscape affects the spatial patterns of risk. We found that relative hunting risk increased with increasing moose density but decreased with increasing building density, terrain ruggedness, distance to bogs and distance to main and secondary roads. During the moose hunting season, relative wolf predation risk decreased with increasing building density, distance to young forests and distance to secondary roads, but increased with increasing wolf space use. After the moose hunting season, relative wolf predation risk increased with increasing moose density, wolf space use and terrain ruggedness, but decreased with increasing building density, distance to main and secondary roads and distance to young forests. Because we accounted for the spatial distribution of both predator and prey, our results indicate that environmental and anthropogenic features shape where hunters and wolves kill moose.

Using occupancy to monitor populations. Case study: The wolf in France

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In France, and in Europe, the gray wolf is protected under the Bern convention and the Habitats Directive. A monitoring of the population state and trend are necessary to evaluate the species conservation status and adapt its management. Today, France is monitoring its wolf population using a demographic indicator: an estimation of the population size. Population size is estimated with a capture-mark-recapture (CMR) model using genetic data. However, as the population keeps growing over time, it becomes more and more difficult to obtain reliable estimates because of the CMR limits for large population at large scale (i.e., time and monetary costly). A way to assess the changes for such population is to rely on a spatial indicator to evaluate changes in the distribution of the species over a defined area. We used occupancy modeling to estimate each year the area occupied by the wolf in France. We compared the changes over time of this indicator with those of the demographic indicator and tested its sensitivity to detect wolf permanent presence appearance or disappearance. The indicator is better at informing on wolf settlement than disappearance though. This indicator can inform, at the scale of the country, how much area of occupancy the wolf gains or losses from year to year. At a local scale, it can also indicate if an area became colonized or extinct. This spatial indicator may be completed by an estimate of demographic parameters such as survival to make a full evaluation of the species status.

When wolf damage to livestock causes a major conflict: The challenge of wolf and cattle coexistence in Ávila province (central Spain)

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In Spain there are about 300 wolf packs that kill every year some 10,000 heads of livestock, causing damages estimated in 3-4 million euros. But this conflict is particularly important in the province of Ávila (central Spain), where wolves are fully protected by the Habitat Directive. The 8-10 wolf packs living there kill annually more than 1,600 heads of extensive beef cattle. In 2020, the direct costs of these attacks were estimated at approximately 700,000 €, which were compensated to farmers by the regional government. The indirect costs of the attacks are also very high but very difficult to quantify. We have addressed this conflict through a detailed monitoring of the damage on cattle and the effectiveness and costs of various damage prevention methods implemented in a 1,100 hectare estate which contained 230 extensive beef cattle from 2012 to 2021. The combination of the turbo-fladry and large guarding dogs showed the best cost/benefit ratio. Nevertheless, the economic cost of implementing prevention methods (10,000 to 18,000€ a year) are equal to, or even exceed, the direct costs of the damages avoided. We discuss the challenge of wolf-livestock coexistence in this and other areas of Spain where damage is also very high.

Habitat selection of wolves in a highly disturbed anthropogenic habitat

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Most wolf research has taken place in mostly natural systems with intact food webs. While habitat selection has been shown across several of these landscapes, it has yet to be equally explored in highly anthropogenic systems with simplistic food webs. However, as gray wolves (*Canis lupus*) are reintroduced or repopulate more urban and fragmented landscapes, understanding how they may use these ecosystems is critical for conservation, management, and reduction of human-wildlife conflicts. We used GPS data to understand which habitats wolves selected for in a highly disturbed anthropogenic area in northeastern Turkey. The study site is a fragmented, highly human dominated ecosystem with limited natural resources and a high density of other carnivores (brown bears, Caucasian lynx, red foxes). Notably, the native ungulates are almost entirely absent from the system and are replaced by livestock that are guarded by shepherds and dogs. This study leveraged data from 30 wolves in the warm season and 25 wolves in the cold season over ten years to look at how environmental factors and human presence shape the habitats selected for by wolves, both in the forests and on the open landscape, using resource selection functions. In both seasons, wolves selected forested sites with lower south-facing slopes closer to roads and settlements. While the forest type was not a significant predictor in the summer months, wolves were choosing coniferous over mixed forests in the winter. Within forests, wolves have chosen locations closer to the forest edge and forest roads. This supports findings that wolves regularly use forest roads to travel around their home ranges, as already found in other parts of the world. As the interface between humans and wolves increases globally, understanding how wolves react to anthropogenic inputs is vital to successful planning and management. This research adds to the limited number of studies that show how wolves may integrate into anthropogenic environment.

How much is enough? Effort optimization for wolf population size estimation at a regional scale

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The ongoing expansion of wolf populations (*Canis lupus*) in many parts of its range has led to a growing demand for up-to-date abundance estimates. However, effective monitoring of the wolf is resource-intensive, because of the species' elusive behavior and wide range. Despite attempts to find more cost-effective methodologies, non-invasive genetic sampling (NGS) is still a mainstay of wolf monitoring, and essential to identify wolf individuals and subsequently apply capture-recapture methods to estimate population size. Here, we took advantage of the intensive NGS data collected by the Italian Alpine Wolf Monitoring program which has already been used in spatial capture-recapture (SCR) models in 2020-2021 to estimate wolf population size at the alpine scale. In the present study, we subsample the existing data to evaluate the robustness of SCR population size estimates and determine the role of: (i) the minimum number of non-invasive genetic samples (ii) the spatial extent of search transects (iii) the number of search transect repetitions needed to obtain reliable abundance estimates at the regional scale. Our study shows that by carefully planning monitoring, it is possible to substantially reduce search effort while still obtaining robust abundance estimates. Our work is an attempt to provide guidelines on how to optimize sampling effort to obtain robust estimates of wolf densities when using SCRs in monitoring programs.

Wolf activity patterns revealed by camera traps and accelerometers: What are we missing?

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How animals divide their time between rest and activity is an essential aspect of their adaptation to the environment. The decision when to be active involves a trade-off between the optimization of foraging and risk avoidance. Therefore, activity patterns may vary depending on local conditions and individual traits. Nowadays, humans act as the main risk factor for many species; for far-ranging terrestrial mammals, complete spatial segregation from human activity is rarely possible. Therefore, temporal shifts in activity patterns may become an effective strategy to avoid humans while sharing the landscape. The methods of remote measurements of wildlife behavior involve mainly animal-attached devices but, recently, camera traps, have become increasingly popular in studies on wildlife activity due to low disturbance, simple use, and reduced costs. However, the data collected by camera traps are associated with certain biases, and how these affect the activity estimates is not well understood. Our goals were (1) to investigate how wolf (*Canis lupus*) activity patterns are related to anthropogenic variables and the primary prey type (domestic animals or wild ungulates), and (2) to compare the activity estimates obtained via camera traps and collar-attached accelerometers. We used camera-trap data from several areas in Turkey, Croatia, Poland, and Germany. The results of generalized mixed models showed that wolves in all study areas were predominantly active at night and twilight. The activity patterns were associated with anthropogenic variables, both at the local (human presence) and landscape (human footprint) level. Wolves were more nocturnal in areas where they consumed more domestic animals. Next, we used generalized additive mixed models to compare the camera-trap activity estimates with accelerometer-derived data from collared individuals in Croatia (n=19) and Turkey (n=17). The activity patterns, as predicted by camera-trap and accelerometer data, were positively correlated, but the correlations were weak, and stronger in Croatia than in Turkey. In Croatia, accelerator-based estimates indicated higher activity during summer twilight, and camera-trap estimates were higher during spring evenings and winter nights. In Turkey, camera-trap data indicated higher activity during autumn evenings and winter days. Finally, we discuss the implications for camera trap use for studying wildlife activity.

From relatives to enemies: Evenki reindeer herders and hunters agreement with wolves in the changing environment of East Siberia and the Russian Far East

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In this presentation, by exploring Evenki reindeer-herders and hunters' mutual interactions with wolves, I aim to reveal how the wolf features in the daily lives of Evenki people and vice versa in the dynamically changing socio-environmental contexts of Siberia and the Russian Far East. I demonstrate that the wolf has been one of the most important animals in Evenki social life, morality, economy, and land use. Hence, wolves tend to be perceived by Evenki as non-human persons with their own individualities, potentialities for partnerships, and, often, distinctive characteristics that can be learned by humans through an active process of socialization and rivalry as well as from experiences of sharing the landscapes they inhabit. Thereby I show how Evenki form partnerships with their neighbours the wolves based on interpersonal relations, mutual learning and attunement, and acknowledgment of certain established social norms contributing to the creation of joint domestic living-places. Finally, I describe the contemporary ambiguity Evenki have to deal with in the context of their shifting economic and ecological environment as well as the changing behaviour of wolves. My presentation is based on my participant observation that I conducted in Siberia over the two decades.

Wolf personalities, ecosystem impacts, and the possibility of wolf cultures

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Animal personalities can modulate ecosystems, but can wolf personalities alter ecosystems? Previous work has demonstrated that wolves alter the creation and recolonization of wetlands by killing beavers, and that wolves who kill more beavers likely alter more wetlands. To assess how wolf personalities can alter ecosystems, we compared kill rates (beavers killed per day) and ambushing rates of beavers (ambushing attempts per day) from adult wolves in the same pack operating under identical or similar ecological conditions in Minnesota, USA. This approach allowed us to assess individual variation in predation behavior -which is likely reflective of personality- by reducing the effect of many confounding factors (e.g., prey density, environmental conditions, age-class). We found substantial variation in pack member kill rates and ambushing rates, with some wolves exhibiting kill rates and ambushing rates that were 229% and 263% higher than other pack members. All evidence indicates that wolves with "beaver-killing" personalities alter the creation or recolonization of more wetlands. Thus, this wolf-beaver-wetland provides an example of how wolf personalities, manifested through differences in kill rates of beavers, can alter ecosystem services. Hence a fraction of wolves in a population with strong 'beaver-hunting' personalities can be disproportionately responsible (relative to the entire wolf population) for the outsized ecological effects that result from preying upon beavers. Furthermore, the presence of wolf personalities suggests wolf cultures may exist because personalities are a necessary precursor for cultural formation. We examine what wolf cultures might look like and their potential importance for conservation.

Wolves & Gen. Z: How to communicate to the next generation about wolves

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Gray wolves once roamed the western landscape in droves, and were extirpated from the Colorado landscape in the late 1920's. In November 2020 Colorado citizens voted to reintroduce wolves into the state, via the first ever citizen voted reintroduction effort. Attitudes, beliefs and knowledge of wolves has been regularly studied across North America, but never before in youth populations. This research aims to answer the following questions: 1) What attitudes, beliefs and values do youth populations hold about wolves? 2) Does that differ from the previous populations studied? 3) Can an online educational platform affect youths' attitudes, beliefs, and values regarding wolves? To assess these questions a multi-disciplinary approach has been implemented by gathering data through an on-line survey attached to an online informal science education platform called Wolf Quest. This research will contribute to conservation efforts by examining youth populations, cross comparing those to adult populations and considering demographics as part of the sampling process.

Media mayhem! Wolf reintroduction and the impact of media

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Reintroduction and conservation of native carnivores requires an understanding of stakeholder and public perspectives, as people's attitudes and actions can influence where carnivores can live and how they are managed. One example of the power of public action is the ballot initiative to reintroduce wolves to Colorado, proposition 114, which passed in the November 2020 election, because of the efforts of citizen groups. Surveys conducted prior to the vote suggested that a majority of Coloradans intended to vote for wolf reintroduction yet proposition 114 passed with a 1.82% margin. Given the importance of media coverage in both representing and persuading public opinion, examining media coverage can lend insight into nuances surrounding public discourse and potential attitude change in advance of the passing of proposition 114. We conducted a thematic content analysis that examined (1) the most common arguments used in support of and opposition to wolf reintroduction (2) the prevalence of negative versus positive arguments represented in the media. Commonly reported arguments in support of wolf reintroduction included statements highlighting wolves' contribution to a more balanced ecosystem while commonly reported arguments against wolf reintroduction suggested the vote was indicative of urban populations imposing their beliefs on rural communities. Our findings indicate that arguments against reintroduction, were mentioned at a rate of almost 3x that of arguments in favor of reintroduction and those arguments addressed double the number of possible concerns. Our results also support prior studies of media coverage on large carnivores, which have suggested that local news sources focus on negative impacts of carnivores to livelihoods, particularly when carnivores are new or anticipated in an area. This talk will go over the arguments used from both sides and discuss takeaway tools for organizations to consider when implementing conservation initiatives.

Genetic consequences of differing management regimes in a cooperatively breeding carnivore: A case study of wolves from two regions in Alaska

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Differing management strategies can affect the social composition of groups and underlying population genetics of cooperatively breeding carnivores. The gray wolf (*Canis lupus*) is a widely distributed Holarctic species of cooperatively breeding carnivore that has been subject to varying levels of management including protection, harvest, and active control efforts throughout its range. We are evaluating the effects of differing harvest and management regimes on the population genetics of wolves in two study areas in Alaska, USA. Subsistence and sport hunting can occur on both state and federal lands as established by the Alaska National Interest Lands Conservation Act. In addition, the Alaska State Intensive Management law allows for state-sponsored wolf control efforts targeted at increasing ungulate populations. Wolf hunting and trapping is permitted only in portions of Denali National Park and Preserve (DNPP), while hunting and trapping is permitted throughout Yukon-Charley Rivers National Preserve (YCRNP). However, wolf management by Alaska Department of Fish and Game on lands adjacent to park units has varied, including periods of predator control and liberalized bag limits. From 2000-2010, a buffer zone was established to prohibit wolf hunting and trapping on the border of DNPP. Along the border of YCRNP, a non-lethal sterilization program was implemented from 1997-2001 and lethal control occurred between 2005-2017. In this study, we are comparing the genetic structure, diversity, and relatedness of wolf groups between two study areas and evaluating gene flow during different management periods using microsatellite genotype data spanning 29 years. Even though separated by > 400 km, preliminary results indicate high genetic connectivity suggesting the wolves in both study areas belong to the same population. We are currently identifying private alleles and calculating observed heterozygosity of individuals, average allelic richness, F-statistics, and inbreeding coefficients across different management periods for future comparisons. These analyses will fill in a gap of knowledge regarding the genetic composition of wolves in DNPP and YCRNP across differing management and harvest regimes, providing valuable information for the continued management and monitoring of this population. Additionally, we will generate inferences for wolf populations elsewhere that are managed with public harvest and agency control.

Patterns of distribution, habitat use and seasonal diet of Himalayan wolf (*Canis lupus chanco*) in the central Himalayas, Nepal

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The Himalayan wolf (*Canis lupus chanco*) is a flagship species of the Himalayas in Nepal. The conservation of this species is challenging as they are associated with human used landscape where livestock farming is an integral part of the economy. Limited information is available on the ecology of this species. The main objectives of this research were to identify habitat use patterns, assess seasonal diets, and conservation threats of the species. Distribution and habitat use patterns were assessed based on sign – scats, kills and scrape marking as well as from direct sightings from long-term biodiversity monitoring surveys data (12 years, 2003-2014). Both random sightings and signs encountered during transect surveys were also compiled. Seasonal variation in diet was assessed based on scat 236 samples (57 genotype scats, 179 non-genotype scats) collected during the 2013-2014 field session. The sighting of wolves is very rare in the region probably due to low abundance. The majority of the sightings were of single animals; pack sightings were rare. The largest pack size was of 4 individuals recorded in the upper Mustang of Annapurna Conservation Area. They were mostly distributed at an altitude ranging from 3600 to 5800m. Wolves preferred open landscapes with undulating terrain. Marking and defecation was most frequently recorded in mountain passes where human signpost (raised rock for trail marking, locally known as manhe) were present. Junctions of trails located along mountain passes was used more frequently compared to valley bottoms and dry riverbeds. Wolves are opportunistic predators and their diet ranges from small mammal, birds to larger mammals. They were also observed visiting carcass sites. Seasonal diet shifts were evident, i.e., small rodents (pikas, marmots) were preferred in summer compared to other seasons. The ongoing community-based conservation efforts are helping wolf recovery and the expansion of its range in this landscape. As most of the areas of wolf distribution and habitats adjoin border areas in the north, establishing transboundary conservation and research initiatives is essential for the long-term conservation of this rare species.

Impact assessment on wolves: Can we do it better?

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The continuous rise of human population globally results in a heavy use of landscapes and natural resources. New human infrastructures, like transportation or energy facilities, are a particular risk to large carnivores, especially if they are built within their ecological strongholds. Environmental Impact Assessments (EIA) are the most widespread planning and management tool ensuring that a comprehensive evaluation is undertaken anytime a new development is projected, leading decision-makers to well-informed choices. In Portugal, with an estimated population size of around 300 individuals, wolves are an endangered species with full legal protection. They occupy mountainous areas, where there has been a big overlap with wind energy development for the last 20 years. Consequently, dozens of wolf monitoring plans under EIA procedures were established to evaluate population status and specify adequate mitigation or compensation measures. Here, we review these monitoring programs to answer four key questions: 1) do wolf programs examine the adequate biological parameters to reach objectives? 2) are the study design and resulting data sufficient for measuring impact? 3) does statistical analysis of the data lead to robust conclusions? and 4) do the assessments achieve stated objectives? Overall, we found a mismatch between the stated aim of wolf monitoring and actual results reported, and it is often the case that neither aligns with national wolf monitoring guidelines. Despite the vast field effort and methodologies employed, data analysis makes almost exclusive use of relative indexes or absolute survey numbers, with little to no consideration for the (imperfect) observational process. This makes comparisons across space and time difficult. We suggest the development of standardised monitoring protocols and advocate for the use of statistical methods that account for imperfect detection on the observational process. Impact assessments make use of time-series of ecological state variables to infer cause-consequence relationships with the development of some infrastructure. We need to step forward in data analysis and make use of robust and meaningful values to drive sound conclusions, so that EIA measures can really contribute to this large carnivore conservation.

Carnivore depredation on cattle, and measures to prevent this: Comparing experiences across Europe and North America

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Across the western world cattle is farmed, varying from small farms with a handful of animals to hundreds of cattle, kept intensively in small holdings or extensively across large areas. Mortality of cattle is a key issue for producers, resulting in loss of income, genetic material and a waste of investment. The causes of cattle mortality can be plentiful, and cattle grazing outside are particularly at risk given additional threats such as parasites/insects, traffic collisions, and carnivore depredation. The recent recolonization of large carnivores in many areas in Europe, Canada and the United States has made carnivore depredation a particular concern, and a range of measures to prevent carnivore depredation are used. The purpose of this study is to examine the importance of carnivore depredation as a mortality factor relative to other mortality factors, and the importance of preventive measures to reduce cattle depredation in Europe and North America. It is based on two international surveys with 66 agricultural or wildlife experts, one from 1999 and the other from 2020. In particular, the study analyses differences in importance between Europe and North America, and between 1999 and 2020, using statistical tests. The study found that carnivore depredation has significantly increased in importance as a mortality factor between 1999 and 2020 in North America, while only marginally increased in Europe. In 2020 it had the first and third highest average importance score in North America and Europe, respectively. In both 1999 and 2020 carnivore depredation was rated as significantly more important in North America than in Europe. We found that lethal control was the overall most important preventive measure to reduce carnivore depredation, however this was significantly more important in North America than in Europe, and it significantly reduced in importance in North America between 1999 and 2020. In Europe measures related to guarding or safe keeping of cattle were important measures in 1999, however these significantly dropped in importance between 1999 and 2020. Possible explanations for these results are growth in carnivore populations, and changes in cattle grazing systems and management practices.

Linking wolf feeding behavior to individual predator traits

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The investigation of carnivore feeding behavior helps to increase knowledge on carnivores' ecology and their role in affecting prey populations. Among the physical, behavioral, and environmental drivers of carnivore feeding patterns, those associated to individual traits of predators are among the most difficult to study. Alongside cluster checks of GPS-collared carnivores, the growing field of faecal DNA-based diet analysis in combination with individual genotyping has the potential to increase the feasibility of large-scale analyses of prey use related to individual predator traits. We analyzed the effect of intrinsic and extrinsic factors on the feeding ecology of wolves in Scandinavia by i) investigating the use of the two main prey species, moose and roe deer, analyzing wolf scat samples ($n = 1478$) with a molecular method developed for prey identification using multiple species-specific markers, and ii) examining the proportion of time spent scavenging ($n = 14,205$ locations) with data from GPS-collared wolves ($n = 39$). Overall, the results supported our predictions of more scavenging and higher use of roe deer while lower use of moose for individual wolves that were expectedly less skilled hunters. Solitary females showed a lower consumption of moose compared to females living in pairs or packs, while more inbred wolves showed a higher consumption of roe deer. Solitary and more inbred wolves were characterized by a higher extent of scavenging. Moreover, we observed variability at the landscape level in use of moose and roe deer, indicating a dietary response by wolves to changes in wild ungulate abundance in a prey system with multiple ungulates. GPS-collared wolves spent most time on wolf-killed ungulates and showed a low extent of scavenging (6-15%), which was related to season, social affiliation, inbreeding, and densities of moose, the intra-guild competitor brown bear, and humans. The observed patterns underline the opportunistic nature of wolves' behavior and show support for variation at the individual level in relation to intrinsic traits. Adding to a small body of literature, our study advocates a line of research looking into the range of environmental and behavioral traits related to the individual condition and experience, which can influence feeding behavior.

Coexistence between wolves and extensive livestock farming in northern Spain

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Grey wolves (*Canis lupus*) often prey on livestock. This situation generates economic losses and social conflict, with potential negative effects on wolf populations. Illegal retaliatory killings are one of the most common responses to livestock depredation, affecting long-term carnivore conservation. In an attempt to reduce conflict and enable coexistence between carnivores and humans compensatory schemes have been developed, but these schemes are often limited by inadequate compensation levels and slow compensation refunds, which mean that conflict is not fully mitigated. Identifying the drivers of wolf attacks on livestock and the vulnerability of farms, together with assessing the economic impact and the effectiveness of compensatory payments on the livestock industry, could help reduce conflict and foster coexistence between wolves and humans worldwide. We propose a multiscale approach to identify vulnerable areas and farms in a 10,000 km² region in northern Spain, where each year around 4,000 livestock deaths are attributed to wolf attacks. We developed landscape analysis for bovine, equine, ovine and caprine livestock in a 10 x 10 km scale trained on landscape features, wolf population dynamics and livestock management. We then used beef cattle data to analyse the vulnerability of farms based on livestock management variables. We quantified the economic losses due to wolves in beef cattle and assessed whether compensatory payments fully compensated for the losses, offering recommendations to improve compensation schemes. We found that variables related to landscape (e.g. roughness), wolves (e.g. distance to packs) and livestock management (e.g. density in pastures) described risky areas. Moreover, in the case of beef cattle, farms with larger numbers of animals and calves were more vulnerable to attacks, and compensatory payments did not compensate for the market value of the animals for 80 % of farmers. Attaining coexistence between large carnivores and people remains an important aspiration, particularly due to the new areas of conflict expected to appear due to the expansion of wolves in Europe. Counting with the relevant information yielded by the proposed approach will help identify in advance vulnerable areas and farms, so that preventive measures may be implemented to avoid unnecessary conflict.

Resource exploitation efficiency collapses the home range of an apex predator

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Optimizing energy acquisition and expenditure is a fundamental trade-off for consumers, strikingly reflected in how mobile organisms use space. Several studies have established that home range size decreases as resource density increases, but the balance of costs and benefits associated with exploiting a given resource density is unclear. We evaluate how the ability of consumers to exploit their resources through movement (termed “resource exploitation”) interacts with resource density to influence home range size. We then contrast two hypotheses to evaluate how resource exploitation influences home range size across a vast gradient of productivity and density of human-created linear features (roads and seismic lines) that are known to facilitate animal movements. Under the Diffusion Facilitation Hypothesis, linear features are predicted to lead to more diffuse space use and larger home ranges. Under the Exploitation Efficiency Hypothesis, linear features are predicted to increase foraging efficiency, resulting in less space being required to meet energetic demands and therefore smaller home ranges. Using GPS telemetry data from 142 wolves (*Canis lupus*) distributed over more than 500,000 km², we found that wolf home range size was influenced by the interaction between resource density and exploitation efficiency. Home range size decreased as linear feature density increased, supporting the Exploitation Efficiency Hypothesis. However, the effect of linear features on home range size diminished in more productive areas, suggesting that exploitation efficiency is of greater importance when resource density is low. These results suggest that smaller home ranges will occur where both linear feature density and primary productivity are higher, thereby increasing regional wolf density.

The impact of wolves on mesocarnivore denning and foraging behaviour in Białowieża Forest

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The ongoing wolf recolonisation of Europe could restore ecological functionality in the form of risk effects that suppress the behaviour of mesocarnivores. Yet recent studies show that mesocarnivore responses to risks can be varied, ranging from risk averse to risk tolerant. Due to the context and species dependent nature of predator-prey relationships, we are still unable to accurately predict how these species will interact in Europe using the existing knowledge. In three studies we investigated the effect of wolf risk at various spatio-temporal scales on mesocarnivore denning and foraging behaviour in Białowieża Forest, Poland. In the first, we studied whether badger sett use varies with landscape level patterns of wolf presence. We found that in parts of the landscape with highest wolf presence badger setts were used 60% less often than in areas with lower wolf presence. In the second, we investigated behavioural responses of badgers at their setts after experimentally increasing perceived wolf risk using wolf playbacks. We found that neither badger emergence time nor sett use varied with wolf risk. In the third, we quantified raccoon dog and fox foraging costs using Giving Up Densities after exposure to wolf body odour across the landscape level gradient in wolf presence. Wolf risk increased raccoon dog foraging costs only at plots exposed to wolf body odour in areas with the highest wolf presence. Neither wolf body odour nor landscape level wolf risk increased fox foraging costs. These studies indicate that in this landscape where mesocarnivores have lived sympatrically with wolves for centuries and intensively consume carrion left by them, fossorial species can adapt their use of burrows to the prevailing wolf risk landscape, while wolf suppression seems to play a subordinate role to facilitation in determining mesocarnivore foraging behaviour. These results highlight the importance of testing the effects of risk at multiple spatio-temporal scales, and demonstrate the context-dependence of mesocarnivore-large carnivore interactions. We suggest that to more accurately predict the impacts of large carnivores on mesocarnivores, future studies should focus on exploring how context, and species traits such as fossoriality and carrion consumption mediate the interaction between large and mesocarnivores.

Transcending problematic dualisms in managing wolf-dog hybridisation

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The issue of hybridisation has a long-troubled history in Western conservation. Hybrids have generally been considered a conservation problem to mitigate and eliminate. At the turning of the 21st century, Allendorf et al. (2001; *TREE*. 16:613-622) advanced a new and highly influential framework for managing hybridisation, drawing a distinction between natural and anthropogenic hybrids and including only the former among the wildlife to protect and conserve. In this talk, which is based on Donfrancesco & Luque-Lora (2022; *Conserv Biol*. 36:e13816), I will discuss how the natural-anthropogenic framework for managing hybridisation does not go far enough in recognising and realising the full conservation potential of hybrids. I will present the following four arguments in support of managing and conserving hybrids beyond the natural-anthropogenic dichotomy: (i) the notion of 'naturalness' is paradoxically anthropocentric, generally centring attention on humans and how to erase their impacts to create or preserve pristine nature, rather than focusing on the vibrant non-human life that is to be protected; (ii) the natural-anthropogenic distinction is based on Western-centric dualisms between humans and the rest of nature, which if transcended could open the door to a more holistic management of hybrids based on their relations with the broader socioecological systems in which they are embedded. This would also allow for more pluralistic approaches in conservation; (iii) the categorisation of certain hybridisation phenomena as 'anthropogenic' often fails to recognise the agency of non-humans in shaping and co-producing the world we live in, and further reinforces the problematic paradigm of human exceptionalism; and (iv) conservation management focused on promoting biodiversity and ecological functions instead of 'pristine nature' better aligns with the values of most conservationists, as shown by the latest global surveys conducted in the conservation social sciences. I will conclude by relating these considerations to the specific issue of wolf-dog hybridisation, reflecting on possible implications for its present conceptualisation and management in Europe.

Landscape-level patterns in wolf home range size revealed by non-invasive spatial capture-recapture

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The concept of home range is fundamental in wildlife ecology as it determines how members of a species will interact with each other and their environment. It is for example crucial when trying to mitigate human-wildlife conflicts involving large carnivores. To date, most insight about home range size and its drivers comes from telemetry studies where only a handful of animals are equipped with GPS collars or other telemetry devices. While these studies can inform about individual home range space use in great detail, instrumented individuals usually constitute a very small proportion of the number of individuals and spatial range of the population under study. Such studies are thus bound to miss sources of variation in home range size that occur at larger scale. Non-invasive monitoring, in combination with spatial capture-recapture methods, have been recently implemented at large scale (including entire population ranges), and offer new opportunities to obtain information about animal space use and its variation at the scale of populations and landscapes. In this study, we developed a spatial capture-recapture model able to estimate the spatial determinants, including population density, of wolf home-range size at the landscape level. We applied these models to a large-scale non-invasive genetic monitoring dataset of wolf (*Canis lupus*) to uncover the spatial variation in wolf home range size across the western Italian Alps.

DNA metabarcoding reveals extensive marine resource utilization by coastal wolves in Southwest Alaska

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Gray wolves (*Canis lupus*) throughout most of their range are assumed to be obligate ungulate predators, but wolf populations with access to marine resources may demonstrate incredible dietary flexibility. Wolves are seen frequently on the coast of Katmai National Park & Preserve in Southwest Alaska, but their role in the nearshore system has not been characterized. The objective of our study was to reconstruct Katmai coastal wolf diet using non-invasive genetic methods. On the Katmai coast, black bears are completely excluded by brown bears, and beavers and moose occur at very low densities. We hypothesized that these circumstances drive coastal wolves to forage extensively on marine mammals, fish, and consume intertidal invertebrates. In the summer of 2021 we collected approximately 800 wolf scat samples from six distinct sites along Katmai's coastline. We conducted fecal DNA metabarcoding of both vertebrates and invertebrates to characterize relative contribution of terrestrial and marine species to coastal wolf summer diet. Sea otters (*Enhydra lutris*) were an important food source for wolves across all sites, and in several instances constituted the primary diet item for a pack of wolves. A diversity of marine species were identified in Katmai coastal wolf diets, including flounder, salmon, harbor seal, sea lion, three species of whale, razor clam, blue mussel, and feather worm. Our findings demonstrate the extensive variation in the diet of wolves living in maritime environments and the importance of sea otters as a major food source for wolves on the Katmai coast.

A step closer towards enriching and unifying the methodology of grey wolf genetic studies

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Over the past two decades, numerous genetic studies of the grey wolf (*Canis lupus*) have been conducted in Europe. The use of diverse molecular markers has provided valuable insights into the subject. However, not all the results of such important studies are suitable for comparison between regions or laboratories, and some of them focus on small fragments of the genome. The reason for this is the specific features of the molecular markers implemented (e.g., microsatellites). There has been a need to standardise and unify such results, and this is a topic addressed in recent reviews of research in this area. The presentation briefly introduces the problem and covers my PhD project, which aims to bring us closer to the point where methodologies that meet this requirement will be readily available and implemented in broad studies of the grey wolf. Single nucleotide polymorphisms (SNPs) are markers that meet these requirements because they can be distributed throughout the genome, and the results of studies using SNPs are comparable. In recent years, thanks to advances in Next Generation Sequencing and our knowledge of genomics, the number of studies implementing SNPs as molecular markers has increased. Unfortunately, not so much in the case of the grey wolf. What's more, the widely available SNP kits implemented in wolf research are two commercial arrays that were made based on the genomes of dogs (*Canis lupus familiaris*) and smaller kits designed for specific purposes. Therefore, as part of my PhD, I have started a project to provide a complete list of SNPs discovered in the genomes of wolves from Poland and a few additional individuals from abroad. Such a list is a first step that in the future will facilitate the design of a list or array of the most informative SNPs in all wolf genomes. Such an approach not only allows standardisation of the methodology, but also increases the reliability of the results, since despite the high similarity of the wolf and dog genomes, they are diverse and SNPs for wolves can give us deeper insights into the subject. An additional advantage of the project is the provision of short reads of wolves from Polish (and perhaps Italian) populations and their publication in the NCBI SRA database. Such data could be useful for many further studies, and at the moment the availability of whole genome data for these populations is very low.

Wolf conflicts in Denmark: Management between a rock and a hard place

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After 200 years with no big wild predators living in Denmark, the first free ranging wolf was discovered at the peninsula of Jutland in 2012. Since 2012 more than 20 wolves have immigrated from Germany to Denmark and at least 25 wolves have been born in Denmark. In the wake of wolves re-settling in Denmark the same type of increased political conflicts seen in other countries, have followed, with systematically distorted communication, the confirmed illegal killing of one wolf and the total disappearance of 16 wolves. Conflicts are driven by myths, misinformation, public anxiety and wolves killing husbandry and wildlife on the one hand side, and by interests of nature conservationists and Denmark`s legal and international obligations to protect the wolves on the other hand side. Political conflicts regarding wildlife management are often handled by the Danish Wildlife Management Council (WMC). The WMC was established in 1979 and currently have nine members from NGOs representing Danish agriculture, forestry, hunters, nature conservation, ornithologist, animal protection and outdoor activities. The WMC holds an advisory role to the minister of the environment regarding hunting regulation, species for hunting, `conflict species` (species causing various conflict between humans such as beaver, red deer geese and many other, including wolves). Recommendations to the minister unanimously agreed upon by WMC are normally accepted and implemented by the minister regardless of political color. In this presentation the chair of the Danish WMC will offer an inside perspective, including some of the trials and errors, of the two years long process finally concluded in 2021 by the WMC unanimously recommending an adaptive management approach to the minister, including 41 specific proposals.

Sea otter recovery affects feeding ecology and population demography of an isolated wolf pack

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Energetic resources transferred between distinct habitats or ecosystems can greatly subsidize consumers in the recipient habitat, and thus influence food web structure and dynamics. Such subsidies may allow the growth of the consumer population to be decoupled from in situ productivity with effects on consumer abundance and behavior as well as on resident prey populations. The gray wolf (*Canis lupus*) is considered an ungulate specialist throughout its distribution but also consumes marine resources such as salmon and marine mammals in coastal bioregions. We have recently discovered a wolf pack on Pleasant Island in southeast Alaska that is feeding almost exclusively on marine resources after depleting the local ungulate population. As deer on the island declined wolves were able to persist by prey switching to sea otters (*Enhydra lutris*), which had become abundant after recovering from historical lows. Such an unusual species interaction, where a keystone marine apex predator is a critical resource for a terrestrial apex predator, has the potential to influence both terrestrial and marine ecosystem dynamics. For wolves, what remains unclear is whether they thrive on a nearly complete marine resource base or if they are under nutritional stress such that reproduction, recruitment, and survival are compromised. To address this, we analyzed over 900 scats and 27 tissue samples collected from 2016-2021 to explore how elements of foraging, population dynamics, and human induced mortality affect the persistence of wolves on Pleasant Island in comparison to an adjacent mainland wolf pack that still had access to ungulate prey. We used DNA metabarcoding to compare the diets of both packs and genotyping by amplicon sequencing to identify individuals. These data were used to quantify movement between the mainland and Pleasant Island and to estimate apparent annual survival, abundance, and recruitment. Our findings provide new insights into wolf ecology and suggest that sea otters may fundamentally change terrestrial predator-prey dynamics such that wolf populations are not dependent on ungulate resources.

Reversible immobilization of free-ranging wolves by helicopter darting: Advantages and challenges

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Some of the biggest challenges with wildlife capture are to enable safe drug administration, limit stress and minimize negative physiological effects related to capture and immobilization, and to ensure that the animals recover safely. Various capture methods and drug protocols for wolves have historically been used based on efficacy and survival rate with only minor or no in-depth evaluation of physiological effects. Physiological monitoring is crucial for safe handling of immobilised wolves and to evaluate the effects of capture. Prolonged and rough recoveries may jeopardise the safety of the wolf if it cannot respond to potential danger, such as open water and vehicles. There is a need to develop reversible drug combinations suitable for helicopter darting of wolves. Data will be presented from reversible immobilisation of free-ranging wolves in Scandinavia and Alaska with a new drug combination; medetomidine-ketamine-zolazepam-tiletamine (MKZT). Induction and recovery times and physiological monitoring, including lung function and acid-base status, will be presented. Recovery (time to standing and walking) from MKZT immobilisation, after reversal with atipamezole, was significantly faster and smoother in comparison with the prolonged recoveries seen after immobilisation with only ZT. Challenges with wolf capture by helicopter darting, advantages of reversible drug combinations, and practical considerations to ensure animal welfare when handling immobilised wolves will be discussed. Acknowledgements We thank the Scandinavian Wolf Project and Alaska Department of Fish and Game for invaluable collaboration. Many thanks to Marie-Claire Cronstedt's Foundation, the Swedish Environmental Protection Agency, the Norwegian Directorate for Nature Management, Michael Forsgren Foundation, and the Animal Welfare Association in Växjö (Djurskyddet Kronoberg) for generous support.

Rescue, rehabilitation, and post-release monitoring of wolves injured in snares and traffic accidents

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Wildlife rehabilitation and treatment is a challenge for intervention groups, veterinarians, rehabilitation centers and wildlife researchers. The basis for developing good practices is their monitoring after returning to the natural environment. Free-ranging wolves injured in human accidents are often rehabilitated and they have been released, but their survival and behavior after release remain insufficiently researched. That is why we analyzed the cases of 13 wolves (*Canis lupus*) that suffered in a car collision in 2014-2022, were caught in snares or were found sick. These cases concerned adults, of whom a female and seven males were found in the snares, another four males suffered in road collisions, and one was sick. Most of the wolves caught in snares, after the examination, could be released and only one had to undergo longer treatment and rehabilitation, while all collisions and sick wolves were sent to wildlife rehabilitation centers. Before being released into the environment, the animals were provided with telemetry collars with GPS / GSM and VHF transmitters, which enabled their careful monitoring. The results show that adult wolves, after rehabilitation lasting up to three months, successfully return to the natural environment, and their behavior is no different from other wild wolves.

Freshwater fish as a more common prey for wolves than originally thought: Annual observations from a boreal ecosystem

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Gray wolves (*Canis lupus*) are generalist predators that capitalize on newly available food within days, however, the short nature of many food pulses makes documenting their responses to these foods a challenge. In 2017, we documented wolves hunting freshwater fish in the Greater Voyageurs Ecosystem (GVE), Minnesota, USA for the first time in Western science. Since 2017, we recorded several wolves hunting and killing fish in the GVE, using GPS-collar locations, remote cameras, GPS-collars equipped with cameras, and field observations, providing evidence that wolves are adept at quickly responding to fish as an alternate prey. Wolves primarily hunted white suckers (*Catostomus commersonii*) at night during April and May, coinciding with sucker spawning activity. Wolves likely exploited spawning freshwater fish in the spring given their abundance, availability, and the low energy expenditure needed to catch fish. Additionally, wolves targeted shallow sections of rivers often below beaver dams where spawning fish congregate, suggesting that beavers may indirectly facilitate wolf fishing behavior. Wolves caught suckers by waiting-in-ambush on creek banks and launching an attack after detecting fish, adding to growing evidence that wolf hunting strategies are more flexible than cursorial behaviors used to hunt ungulates. We observed these behavioral patterns across unrelated members from five different packs at four different creeks, suggesting that wolf 'fishing' behavior is widespread across similar boreal ecosystems but has likely remained undocumented given the ephemeral nature of the behavior.

Effects of wolf return on red deer movement behaviour and habitat selection in a cultural landscape: Insights from a long-term telemetry study

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With the presence of predators, prey is facing a trade-off between maximising resource intake and avoiding predation. Thus, the return of large predators after a long absence can induce changes in prey activity, movements, and habitat use. The recolonisation of grey wolves (*Canis lupus*) in Europe offers the perfect opportunity to study how their presence affects prey behaviour. Here, we compare movement behaviour of red deer (*Cervus elaphus*) before and after wolf recolonisation. We use high-resolution GPS data from 35 adult female red deer on a military training area in Germany from 2015-2021. We found limited evidence for changes in home range selection, movement rates, or daily activity patterns in response to wolf presence with a slightly increased movement rates in summer and early mornings. When considering habitat selection within the home ranges, we found changes in the use of open vs. closed habitat in the course of the day. After wolves established in the region, red deer increased the use of open habitat at night, which is when wolf activity is the highest. These results are contradicting expectations based on findings from large North American National Parks, where deer have been shown to increase forest use in the presence of wolves. Thus, we stress the context-dependence of behavioural effects of predators on their prey. We provide the first evidence of changes in red deer movement behaviour in the same region before and after the recolonisation by wolves in Europe. Such insights on prey behaviour in response to predator presence can inform wildlife management and conservation and contribute to understanding effects of the return of wolves on the ecosystem.

When a wolf meets a group of wild boars: An anthropologist's critical reflection on the term 'hunting strategy'

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In wolf research, one of the most prominent questions regarding hunting behaviour is whether wolves act 'on instinct', without a plan, without a pattern or structure and thus without intelligence or with a 'strategy', i.e., based on intelligence and rational thinking, based on a cost-benefit analysis, coming up with an intentional plan of how to hunt best which later is executed accordingly. While the search for a 'strategy' and intelligence has been a welcome move towards a more complex view of what animals are and how animal behaviour can be understood, I argue that it also misconstrues wolves as thinking animals that is reminiscent of certain (heavily disputed) theories of human action in the social sciences. In particular, biologists' use of the term 'strategy' seems to take up implicit assumptions stemming from rational choice theory and action theory. Both theories emphasize that humans think before they act, that they weigh up options and design a plan to be executed in order to reach the goal of action. As a theory of human action, it might hold for some yet not all circumstances. Translated into a theory of animal behaviour, it is more than dubious. By looking closely at one particular hunt of one wolf of the Knappenrode/Seenland Pack in Germany, this paper offers an alternative, qualitative approach to understanding what happens. Instead of interpreting the encounter as a 'competition of minds', it shows both wolf and wild boar first of all as corporeal beings testing their body, bodily skills and bodily intelligence against each other. While the seemingly chaotic dynamics of this hunt suggests that there was no strategy at play, it will be shown that the success of the wolf depended on its 'embodied knowledge' of how its own body and those of the wild boar affects and is affected by the other.

Better understanding the links between wolf depredation behavior, culling, and depredations levels with an individual-based model

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Contrary to many predators, solitary hunting is not the only option for wolves. One of the remarkable features of this species is the social organization of the individuals in packs. This organization makes the study of the predation behavior more complex, as there are many possibilities regarding hunting strategies for wolves. Individual-based models (IBMs) have been widely used to model population dynamics and to represent species with complex social structure like wolves. IBMs are bottom-up models that simulate the fate of individuals interacting with each other and/or their environment. They can include many mechanisms at the individual-level and/or group-level (such as pack-level) and therefore are a great tool to explore complex individual interactions as exhibited by these social species. We built an IBM simulating a wolf population under culling management (Bauduin, Grente, et al. 2020). The point was to explore the effects of culling on depredations according to different scenarios of wolf depredation behavior, in which some wolves were more prone than others to attack livestock, depending on individual characteristics such as age, social status or pack size. In turn, these scenarios influenced the culling risk for each wolf. We tested different scenarios of wolf depredation behavior because this behavior may depend on the habitat, or the wild prey diversity but also on the level of protection of livestock. Moreover, there is no clear consensus about some aspects of individual wolf depredation behavior, if solitary individuals are more prone to depredation than wolves in pack for example. We showed that for some depredation behavior scenarios, lethal removals were efficient to reduce depredations, essentially through population reduction, despite pack disruptions. For other scenarios, lethal removals had no substantial effects. Therefore, the understanding of this behavior is fundamental when studying the effects of culling management on depredation levels.

The role of wolf predation on wild boar to control African Swine Fever: Insights from a multi-prey system in central Europe

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Wolf selective predation has been recognized to have an important sanitation effect on wild prey populations, by limiting the risk of spread or prevalence of lethal wildlife diseases. In this context, wolf predation on wild boar may have the potential to eradicate infected individuals and limit the spread of African Swine Fever (ASF), a highly contagious and deadly viruses affecting both domestic and wild pigs, with strong socio-economic implications in central Europe. Although no previous studies addressed this hypothesis, it was suggested during the latest outbreak of Classical Swine Fever in Slovakia during 1994–2003, when the vast majority of positive cases were identified outside wolf range. By focusing Slovakia (central Europe), this study aims to: 1) evaluate the importance of wild boar as a wolf prey by addressing diet and prey selection in a multi-prey system; and 2) model the association between wolves' spatial use as a proxy for predation risk and the prevalence of ASF spreading throughout Slovakia since 2019. We analysed wolf diet composition and prey selection based on 321 scat samples from four different areas in central Slovakia during 2015–2017, showing a wide variation in wild boar consumption (F.O. = 8.7% to 47.9%) and a selection for wild boar, especially in areas with higher altitudinal range. Next, we evaluated wolf habitat selection using resource selection functions based on 1300 presence records obtained in central Slovakia during 2014–2017 and extrapolated it to the entire wolf range in Slovakia as a proxy for wolf predation risk. Finally, to analyse whether wolf predation can be effective to control ASF, we used Generalized Additive Models, considering spatial and temporal processes of disease spread, based on the probability that a wild boar is ASF positive ($n > 4000$ cases), and depending on covariates of both the infected individual (sex and age) and the environmental conditions (e.g., wolf predation risk) within a spatial unit (municipality) in which infected wild boars were found dead. Overall, our results highlight the role of wolves in providing a key ecosystem service as a disease control agent, which should be properly recognised when considering human-carnivore conflicts.

Near humans: How wolves acclimatize to the anthropogenic landscapes of Poland

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Wolves are known for their flexible behavior. They can adapt to a wide range of climatic conditions, habitats, and prey, but also can thrive in human-dominated landscapes. Over the last 40 years, wolf population recovered in Poland, a country with an average density of 123 inhabitants/km² and 0.87 km/km² of paved public roads. Wolves occupy over 60 000 km², i.e. 20% of Poland. We used telemetry and snow tracking to study wolves in four areas with various levels of human impact, from semi-natural lowland and mountain forests, intensely managed pine monocultures, to densely populated mosaics of small woods and settlements. In general, wolves avoided humans and infrastructure spatio-temporally, i.e. they use areas of high human activity at moments when humans were absent or less active. For example, wolves chose midnight hours to cross busy roads. When crossing fenced highways, wolves easily accepted wildlife passages, but were also able to take advantage of road infrastructure, like viaducts constructed for local traffic and railway crossings. Wolves avoided forest roads, which were used by loggers and foresters, during business hours, but used them as principal travel routes within their territory at night. For den and rendezvous sites, wolves selected areas relatively difficult to access for people, far from infrastructure and settlements. In addition, the selection of resting sites by wolves depended on the time of day – during daylight, wolves rested at sites that were more concealed and further from forest roads. Wolves were also able to take advantage of forestry enclosures protecting young forest plantations to hunt roe deer. Although wolves took the opportunity to prey on livestock if available, even packs with easy access to livestock predominantly preyed on wild ungulates. We conclude that wolves can acclimatize to variations in human presence. The temporal dynamics in both human activity and wolf behavioral responses are crucial to understand this process. Behavioral plasticity allows wolves not only to survive in anthropogenic habitats by minimizing the risk associated with humans and infrastructure but also to take advantage of some aspects of human activity.

Competition between sympatric wolf taxa: An example involving African and Ethiopian wolves

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Carnivore populations are declining globally due to range contraction, persecution and prey depletion. One consequence of these patterns is increased range and niche overlap with other carnivores, and thus an elevated potential for competitive exclusion. Here, we document competition between an endangered canid, the Ethiopian wolf (EW), and the newly discovered African wolf (AW) in central Ethiopia. The diet of the ecological specialist EW was dominated by rodents, whereas the AW consumed a more diverse diet also including insects and non-rodent mammals. EWs used predominantly intact habitat, whereas AWs used mostly areas disturbed by humans and their livestock. We observed 82 encounters between the two species, of which 94% were agonistic. The outcomes of agonistic encounters followed a territory-specific dominance pattern, with EWs dominating in intact habitat and AWs in human-disturbed areas. For AWs, the likelihood of winning encounters also increased with group size. Rodent species consumed by EWs were also available in the human-disturbed areas, suggesting that these areas could be suitable habitat for EWs if AWs were not present. Increasing human encroachment not only affects the prey base of EWs, but also may impact their survival by intensifying competition with sympatric AWs.

Determining favourable reference population for wolves in Finland: What did we do and learn?

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The European Union's Habitats Directive aims at achieving and maintaining the favourable conservation status (FCS) of species and habitats of Community interest. Viability and long-term persistence are the key concepts when assessing FCS of a species or a population. Favourable reference population (FRP), the number of individuals likely to ensure long-term persistence of the population, can be used to evaluate whether FCS has been attained. To support the assessment of FCS of the wolf population in Finland, the Natural Resources Institute Finland (Luke) ran a two-year project (2021-2022) with the main aim of developing tools for resolving FRP. In the project, we developed new methods to uncover the demographic and genetic viability of the wolf population, to assess ecological carrying capacity, and to determine FRP based on these factors. In our approach, the determination of FRP has several steps. First, we define genetic and demographic minimum viable population (MVP) sizes. Both MVPs depend on choices reflecting the decision-makers' precaution towards negative outcome (e.g., the acceptable risk of extinction). The larger one of these can be regarded viable both in genetic and demographic terms and is taken as the final MVP. In the second step, the chosen MVP is scaled to FRP. Since there is no single way to do this, we developed several approaches applicable either to demographic or genetic MVP or both. In the last step, the FRP is contrasted to the ecological carrying capacity to ensure that the FRP can be maintained by the environment. The developed approach is transparent and emphasizes the fact that, despite its factual biological and ecological basis, the determination of FRP is not purely a scientific question but requires decision-makers to express their precautionary attitudes in each step of the process. The project also highlights the need to develop approaches for species like wolf in Finland, with populations simultaneously expanding over national borders and showing genetic structuring (i.e., subpopulations) within a single country.

Behavioural interpretation of bold wolves: If I can't see you, I can't fear you!

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During the end of 20th and the beginning of 21st century, gray wolf (*Canis lupus*), increased its distribution range and manage to re-colonize human-dominated landscapes in Europe and North America. Wolves get close to settlements on a regular basis, particularly if food resources are available. The adaptation to these conditions increases the number of wolf-human interactions. Fear of wolves is a widespread reality and shapes human attitudes toward wolves. This scenario raises concerns on what can be considered by local communities as a normal behavior, then if and what should be done in each situation. The interpretation of what is bold behavior might vary across its range based on different levels of coexistence. Therefore, our goal was to evaluate wolf space and temporal use patterns of settlements and its surroundings in two different countries with different levels of coexistence with humans. The GPS data from 21 and 36 wolves, from Croatia and Turkey, was used respectively. Period of the day, season and gender were considered when identifying patterns across a range of distance buffers around settlements. The proportion of locations within 1 km to settlements was higher in Croatia. However, a higher proportion of locations inside or close to settlements was documented in Turkey. The highest proportion of locations in both countries, occurs within 1km during the night and dawn periods. Wolves avoided areas close to settlements in Turkey during day and dusk. In Croatia, wolves used areas in surroundings of settlements more often during the cold season and male wolves were more often around and in settlements than were females, whereas the wolves in Turkey did not differ in their proximity to settlements either by gender or by season. This study illustrates the differences in space and temporal use pattern of wolves in the surroundings of settlements in two countries. It also contributes to our understanding of the human perception of wolf bold behavior that may not be linked with the regularity of presence close to settlements, but with the period of the day and probability of direct human-wolf interaction combined with the intrinsic fear of wolves by humans.

Afraid of the unknown: The role of humans on range limit wolf population activity

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Despite the current upsurge of European wolf (*Canis lupus*), populations inhabiting range-limit distribution areas face different ecological and coexistence (wolf-human) challenges which are different from the ones inhabiting core areas of same populations. In these range-limit distribution areas, wolves need to cope with higher persecution and less acceptance and tolerance levels from local communities. Contrarily, in core distribution areas, local communities have learned how to cope with wolves. Thereafter, coexistence is pivotal for wolves to thrive in human-dominated landscapes. Our goal was to evaluate the activity patterns in different range-limit distribution areas and core distribution areas and identify the main drivers underlying. We used 1-year simultaneous camera trap data from two different range-limit distribution areas, Dalmatia (Croatia) and Central Portugal, and one core area, Plitvice Lakes NP (Croatia). Our results show that despite a common nocturnal activity, there are significant differences between range-limit and core distribution areas. In range-limit areas wolves, are more active during dusk and early night period avoiding day period. On the other hand, wolves in core distribution areas, despite being also more active during night, do not avoid dawn and day periods. Seasonal activity shows a more pronounced yearly pattern during warm season possibly when humans usually widen their activity period and wolves restrict theirs. These patterns might not only be linked with direct human activity but also with human food resources such as livestock and husbandry practices. Even though this is a 1-year study, our results suggest that human activity might have distinct influence on wolves in range-limit and core distribution areas. Further analysis should focus on exploring this as we believe that range-limit distribution areas should be studied distinctively consequently with different conservation actions implemented from core distribution areas. Knowledge exchange between different areas is crucial for improved research and management.

Feeling like a wolf: Quantifying and classifying the complexities of facial communication in wolves and domestic dogs to determine if dogs can convey 'emotions' via facial expressions like their wolf ancestors?

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Communication within wolf packs reduces aggression among pack members, thus maintaining pack cohesion and stability. Wolves produce a wealth of facial expressions that convey affective states; forms of motivation such as emotions, moods, attitudes, desires, preferences, intentions and dislikes. The relative shape and position of the eyes, ears, forehead, muzzle, nose and lips (the main conveyers of facial expressiveness) are the same for all wolves throughout the world. Domestic dogs are the selectively bred descendants of wolves. However, selective breeding has resulted in the main conveyers of facial expressiveness of dogs greatly diverging from those of their wolf ancestors, although, it is still thought that dogs use facial expressions to convey affective states. This research quantifies and classifies the facial expressions of wolves and domestic dogs. Using the Dog Facial Action Coding System (DogFACS) and cluster analyses, this research identifies an extended range of wolf and dog facial expressions and demonstrates their relationships with affective states, including anger, anxiety, curiosity, fear, friendliness, happiness, joy, interest, and surprise. These analyses reveal that wolves can produce a variety of 'emotional' responses and are more communicatively complex than domestic dogs. Furthermore, the comparison between wolves and dogs clearly demonstrates how domestication has altered the social communicative behaviour of dogs. In addition, the methods used here to identify and classify patterns of canid visual communication have the potential to provide a non-invasive tool to assess the 'emotional' states of canids, or indeed other mammals, with potentially wide-ranging applications in monitoring animal-welfare.

Applying human-wildlife-conflict-research in practical management

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Lately there has been a lot of research going on within the field of human-wildlife conflicts (HWC). In this oral presentation I will share my experience working with the wolf management in Sweden and how we can apply the results from recent research into practise. The presentation will start in the research of Madden & McQuinn 2014 (<http://dx.doi.org/10.1016/j.biocon.2014.07.015>), and Zimmermann et al. 2020 (DOI: 10.1111/csp2.259) and from there explore how we can rethink management actions in wolf management. I will also give an overview of the conflict management system of large carnivores in Sweden and how it may be developed in the future.

The role of wolves in regulating a chronic non-communicable disease, osteoarthritis, in prey populations

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It is widely accepted that many predators disproportionately prey on individuals that are old, weak, sick or injured. By selectively removing "less-abled" individuals, wolves may play an important role in regulating the overall health of prey populations. However, that idea is rarely tested empirically. Here we assess the extent that grey wolves select adult moose (*Alces alces*) in Isle Royale National Park on the basis of age-class and osteoarthritis, a chronic, non-communicable disease. We also assess how temporal variation in kill rates (on moose by wolves) were associated with the subsequent incidence of osteoarthritis in the moose population over a 33-year period (1975-2007). Wolves showed strong selection for senescent moose and tended to avoid prime-aged adults. However, the presence of severe osteoarthritis, but not mild or moderate osteoarthritis, appeared to increase the vulnerability of prime-aged moose to predation. There was weak evidence to suggest that senescent moose with osteoarthritis maybe more vulnerable to wolves, compared to senescent moose without the disease. The incidence of osteoarthritis declined following years with higher kill rates – which is plausibly due to the selective removal of individuals with osteoarthritis. Together those results suggest that selective predation plays an important role in regulating the "health" of prey populations. Additionally, because osteoarthritis is influenced by genetic factors, these results highlight how wolf predation may act as a selective force against genes associated with developing severe osteoarthritis as a prime-aged adult. Our findings support giving priority for allowing predation to regulate the health of prey populations. The evidence we present for predation's influence on the health of prey populations is also relevant for policy-related arguments about refraining from intensively hunting wolf populations.

Wolf ecology in agricultural areas at the Axios-reiver basin national park in northern Greece

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Wolves have been expanded rapidly during the last decades following legal protection and restoration of their habitats. However, this expansion does also include areas close to human infrastructure, peri-urban areas and agricultural land with few, if not at all-natural prey. We studied ecology of wolves in the Axios river basin National Park (2000 km²) in northern Greece, in a highly humanized agricultural landscape during autumn 2021 and winter 2021-2022. Aims of the study included estimation of the wolf density in marginal wolf habitat, recording events of habituated wolves and related conservation problems linked to the presence of wolves in a highly humanized region. Presence of wolf packs was located, and their size estimated with the use of sign surveys, simulated howling surveys and camera trapping. Possible wolf habituation events were recorded using a semi structured questionnaire to interview local farmers in the same areas where field methods were also employed. Reports on perceived bold-habituated wolves were classified according to their severity by using several criteria, including distance of wolves from humans, behavior of wolves in relation to human reaction, time of the day, presence of attractants and frequency of the events, and analyzed with categorical principal components analysis (CATPCA) and spatial-explicit habitat suitability models (MAXENT) to relate their location with landscape features. Wolves were found to breed and reproduce successfully even in peri-urban and agricultural areas with minimal forest cover, utilizing small streams, forest patches and riverbanks to establish den and rendezvous sites, with a wolf density estimated to approximately 3 wolves/100 km². From the perceived wolf habituation records reported from local inhabitants, approximately only one third of those could be classified as true cases of habituation according to criteria set. Areas with higher density of human settlements, livestock farms and water streams and lower density of protected areas were found to be related with higher frequency of wolf habituation events. Severe indications of increased rates of wolf-dog hybridization in the study area were also found including highly abnormal wolf coat patterns in almost one third of the wolf packs located in the study area.

Wolves in The Netherlands: How to reach coexistence in a highly urbanized landscape

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The Netherlands is one of the most densely populated countries by humans and livestock in Europe. Never in the history of wolves and man have they been together in such a composition. Therefore, it is a new experience whether humans and wolves will find a way of coexistence in such a human dominated landscape. Public attitudes in The Netherlands regarding wolves range from mutualism (humans are part of nature, wolves deserve a place in our country & we need to invest in coexistence) to dominance (humans consider themselves superior to nature & wolves don't belong in our urbanized human society). Since 2015 wolves frequently visit The Netherlands. In 2018 the first wolves started to settle themselves and in 2019 the first pack with offspring was a fact. In 2022 there were 4 packs with offspring and the population is still growing. For now, it seems that territorial wolves in large nature reserves cause little conflict in our society since they are hardly ever seen and primarily feed on wild ungulates. However, the ones settling in more fragmented and agricultural habitat do frequently prey on livestock. By doing so public acceptance is negatively influenced and the protected status of wolves is debated. In this presentation we will explain the developments in The Netherlands regarding wolves, public awareness, monitoring, policy, mitigation, compensation and communication. But important as well at this conference, we come to ask for your advice how to coexist with wolves in our country.

Finnish wolves: The population genetic perspective

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Since 2015 Finland's Natural Resource Institute (LUKE) has utilized genetic data, 17 microsatellite loci, for individual identification, to monitor of the size of the wolf population. During the preparation of the 2022 FRP report for Finnish wolves this data was analysed for the first time in the context of population genetics. We first analysed Finnish data together with recent Scandinavian and Russian genotype data to understand substructure and migration between these three connected populations. Then Finnish data was analysed alone for temporal trends in genetic diversity, inbreeding and effective population size, as well as for genetic patterns, substructure and gene flow across time and space. Short and long-term genetic viability of the Finnish wolf population was modelled based on current population size, levels of inbreeding and migrations. Long-term viability was modelled in the same way among the connected wolf populations in Finland, Russia and Scandinavia. Our results suggested genetic connectivity among Finnish, Russian and Scandinavian populations. The Finnish wolf population is relatively genetically diverse, without high levels of inbreeding, and with quite stable effective population sizes. However, the population substructure and patterns of gene flow within Finland are somewhat complex. The long-term genetic viability of the Finnish wolf population is contingent on good connectivity and migration to and from the wolf populations residing in neighbouring Scandinavia and Russia.

Understanding the patterns of livestock depredation by wolf (*Canis lupus*) in northern Pakistan

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Carnivores have always been considered a serious threat for livestock. Understanding the socio-ecological factors that contribute to this threat is crucial for carnivore conservation. We interviewed 2,317 shepherds to quantify livestock losses due to wolf (*Canis lupus*) predation in northern Pakistan. A total of 7,583 livestock animals were killed by the wolves during the years from 2011 to 2015. Our results showed that the small ruminants, as goats and sheep, were more likely killed than large livestock animals as for example the cow and yak. The extent of livestock losses changed between seasons, with maximum of wolf depredation events occurring in summer. Wolves preferred to attack small ruminants in open pastures and large livestock animals in the corrals. A number of factors were positively correlated with livestock predation, including herd size, disease caused mortality, and occupation. The data also suggested less predation with increases in the education levels of respondents. Livestock disease was a stronger cause of loss per herd with an average of 3.5 animals dying annually. The increasing number of livestock in Pakistan is fostering conflict and undermining support for wolf conservation. This conflict needs to be addressed in order to promote wolf acceptance in the rural communities of Pakistan. Better guarding could prevent wolf attacks, particularly in the summer. Our study suggests that establishing veterinary centers to support the reduction in livestock mortality due to disease will also help reduce conflict. This study suggests that various mitigation techniques should be trialed to sustain the co-existence of wolf populations in rural communities.

Social understandings of categorizing biodiversity: Using wolves and tigers as a case study

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Conservation programs often prioritize their efforts by focusing on threatened species and, use their conservation status as proxies for indicating ecosystem conditions. Some of these surrogates or proxy types include classifying species as keystone or charismatic species. Keystone is more an ecological term, which means a top-order species regulating other organisms in an ecosystem, whereas, charismatic is more a socio-political term, meaning those species that have attractive qualities such as intelligence, beauty, or strong symbolic values. Wolves are a keystone and charismatic species in North America and Europe, and the same holds true for tigers (*Panthera tigris*) in India. Ironically, wolves (*Canis lupus pallipes*) are neither regarded as keystone nor charismatic species in India. Rather, it is recognized as a secondary-level carnivore species, quite like coyotes in North America. This paper looks at biodiversity categories through a social-class lens and shares how conservation proxies (like keystone or charismatic) have implications on the lesser-keystone or lesser charismatic species, like wolves in India. Using triangulation methods in its analyses, this study shares how such categories transform our understanding of whether people see landscapes as worth conserving or not. The paper suggests there is a need to understand the social construction of biological categories and see how it makes some species vulnerable and creates conservation inequalities. This research can facilitate coexistence between wolves, tigers, and people in India and promote equitable conservation in South Asia and beyond in the long run.

Human activity drives diel activity patterns of wolves in Denmark

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Nocturnal activity in wolves is widely recognised as a behavioural strategy to minimise human encounters but may also be driven by other biological factors such as prey activity. If wolf diel activity is mainly driven by avoidance of humans, may the magnitude of negative correlation between diel activity in wolves and humans (adjusted for biological drivers) be used as an indicator of local investment in human avoidance by wolves. If so, temporal avoidance of humans may potentially also be used to monitor tolerance to humans over time. Based on >2000 date and time stamped wildlife camera trap observations of adult wolves from eight Danish wolf territories, we analysed to which extent variation in diel wolf activity patterns was best explained by light conditions (daylight vs. dark), variation in human activity (assessed from >7000 observations) or deer activity (>7000 observations) or a combination of several of the aforementioned factors. Across seasons and territories, the activity of adult wolves peaked between 8 PM and 5 AM and dipped between 10 AM and 4 PM where the number of images per hour were 10 times lower. The models with greatest support in data predicted wolf activity primarily as a negative function of human activity, independent of deer activity. Our results suggest that even in this legally protected wolf population in Denmark, human activity is the main driver of diel activity patterns. The incidence that similar diel activity pattern was found in habitats with no public access may suggest that this diel activity pattern, which minimised encounters with humans is at least partly inherited.

Do wolves living in highly human dominated landscapes inevitably become bold?

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In the last decades wolves were recolonizing large parts of Europe, returning into areas where they were absent for decades or even centuries. The landscapes where wolves return to are often heavily modified by human infrastructures and activity. The wolf population in Germany is one of the fastest growing in Europe. They mainly occur in the German lowlands, a highly fragmented and completely accessible landscape. With the fast spreading of the wolf population wolf sightings become more frequent. Although such observations are usually singular events, in the public perception they tend to be interpreted as wolves living in Germany lose their natural wariness of humans. We discuss if the proximity between people and wolves in the absence of hunting will lead to wolves becoming increasingly bold. We explain what kind of behaviour can be interpreted as bold and what not by referring to the actual terminology used by the LCIE. We give examples of unusual wolf behaviour that is of no concern for human safety, but attracted a lot of media interest and present examples of actual bold behaviour. To date we have no indication that wolves living in Germany become increasingly bold. However, everywhere where wildlife and people are living in close proximity there is a risk that animals become strongly habituated and / or positively conditioned due to human misbehaviour. The key for keeping the level of wolf – human conflicts in cultivated landscapes low comes with prevention. Wolves should by no means be approached or fed. Within the framework of monitoring, all wolf sightings should be recorded and evaluated in order to detect conspicuous behaviour as early as possible to be able to counteract it quickly.

Regional differences in reproductive success of wolves in Finland: Potential causes and consequences

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In recent years, the number of wolf family packs in eastern Finland near the Russian source population has been decreasing substantially while the recently established western segment of the population has been rapidly increasing. Reproductive success of wolves (the likelihood of late winter family pack in year $t+1$) that occupied western territories was remarkably higher than in eastern territories. A wide area between eastern and western packs has remained unoccupied, opposite to the predictions based on analyses on habitat suitability for wolves. Reproductive success is positively related to prey abundance that is considerably higher in western, particularly in southwestern, territories than in eastern territories where wolves are dependent on low-density moose population. The reason behind the lower reproductive success in eastern territories might also be due to a higher poaching rate that is supposedly motivated by the higher risk of wolves' attacks on hunting dogs: attacks are rare in western and especially southwestern territories with a high-density deer population. A weak connectivity between eastern and western parts of the population appears to increase genetic differentiation and compromise the genetic viability of Finland's wolf population.

Modeling roads and railways mortality hotspots of gray wolf (*Canis lupus*) in Poland

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The subject of the research was to determine the factors influencing the mortality rate of the gray wolf *Canis lupus* as a result of collisions with vehicles in Poland. Based on the available data on the mortality of wolves on roads and railways in Poland, an analysis was carried out to determine the so-called hot spots, i.e. sensitive places where the risk of collision is highest. For this purpose GIS (Geographic Information System) modeling techniques were used utilizing the MaxEnt program, based on positive occurrences (in this case, places of confirmed death of individuals) and using variables (predictors), that determine the key factors influencing the probability of animal death on roads or railways. This allowed us to pinpoint places of particular importance regarding the collisions. Additionally, the cases of collisions with regards to the season of the year and the age of wolves were analyzed and the case-by-case analysis of communication solutions has been compared to the model's results. One of the goals of the analyzes was to determine "good practices" involving the application of measures to minimize collisions with vehicles, i.e. recommendations on methods of determining and securing vulnerable places, which could be recommended in the species protection plans and taken into account at the stage of planning of the expansion or modernization of the national and local communication network. Our work emphasizes the importance of protecting ecological corridors.

Reconstructing 20 years of wolf comeback in Germany with individual-based models

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The return of the grey wolf (*Canis lupus*) to the human dominated landscape of Germany since the year 2000 is a success story for wildlife conservation on the one hand; however, on the other hand this creates a huge potential for conflicts with farmers and hunters. Despite full protection status of the species under the Berne Convention, cries for lethal regulation of the expanding wolf population in Germany are getting louder. This situation calls for a thorough assessment of population viability under different demographic scenarios prior to any management decision, which requires a well-calibrated model that captures the intricacies of the landscape as well as decisive biological processes of the species. For large carnivores, spatially-explicit, individual-based models (SE-IBMs) are highly useful tools, as such models allow exploring dynamics at the population level that emerge from behaviour and decision-making at the individual level. Integrating such dynamic processes as dispersal and demography requires the combination of an adequate biological model, detailed long-term data on demography and social structure, and knowledge on how prey density and feeding ecology influence demography. By confronting the model with field data, models can be calibrated with the combination of most plausible parameters and processes that reflect 'reality' and reduce complexity and uncertainty in model processes. Then, they can be used to assess the potential impacts of diverse scenarios on the population. Here, we use a two-step approach of two individual-based models developed using two different tools, rangeshiftR and a custom-programmed own model, to reconstruct the population development of the past 20 years in space and time. We based both models on a habitat suitability model developed with telemetry and demographic data from the German wolf population. We then run several demographic scenarios to assess population viability under additional mortality varying in intensity and spatial resolution and discuss discrepancies in the outcomes.

The role of social drivers in shaping attitudes towards wolves and the spatial prediction of human-wolf conflicts in Sweden and Italy

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Due to their protection status under European law, wolves have been able to expand their range within Europe in recent decades. At the same time, we see wolves returning into human-dominated areas leading to increasing occurrence of conflicts. This is observed both, in Sweden and Italy, thus, we expect similar social aspects to drive conflict occurrence. Recently, the impact of social drivers has been increasingly investigated, however, very few studies exist on the geospatial patterns across carnivores, hunters and livestock farmer interactions evolving from societal and social differences in a landscape. With a study stretching over Italy, Sweden and Tanzania we expect to create knowledge about highly valuable general correlations and patterns that contribute to the prediction of conflict hotspots. In autumn 2022, we interviewed representatives of administrative bodies, researchers, rangers, livestock farmers, representatives of NGOs and hunting associations about the human-wolf interactions in and around Stelvio National Park, Italy. Managed by three different provinces, the national park provides for a diverse cultural setting, based on their different politics and history. Our preliminary results highlight the importance of the social variables and the spatial context in which they are embedded: attitudes towards wolves were more negative when land users were said to have a higher sense of autonomy as being seen in Suedtirool. This high resentment towards wolves also appeared mostly amongst those people that despite not having a lot of depredation incidences felt a strong ownership over the landscape and were emotionally attached to their livestock. Furthermore, willingness to apply prevention measures strongly depends on the level of pressure emerging from the respective local community. Surprisingly, however, the debate about wolves was not predominantly driven by local land users but by the media and animal rights activists which will be further examined in a media content analysis. With a follow-up in-person survey with hunters, livestock breeders and herders, we will quantitatively investigate the influence of different cultural environments, since social drivers like values, belief and emotions apparently are stronger spatial predictors for negative attitudes towards wolves and conflict hotspots than the previous occurrence of livestock depredation.

Walking on the dark side: Anthropogenic factors limit suitable habitat for the wolf in Polesia

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Due to successful conservation initiatives and European legislation, the grey wolf (*Canis lupus*) has gradually re-colonized the cultural landscapes of its historic range in Europe. Additionally wolves never have been extirpated across large areas in Eastern Europe but are often constrained to remote and inaccessible areas. This study aimed to identify the potentially suitable wolf habitats in Polesia, a cross-border region extending over southern Belarus and northern Ukraine. and to determine the driving factors for habitat suitability. We hypothesize that wolf habitat use is primarily controlled by anthropogenic rather than environmental factors.. We used a dataset of 4,130 wolf observations covering the period 2014-2020, and applied maximum entropy distribution modeling (presence-only data) to model wolf distribution in Polesia. Natural factors (NDVI, tree cover) contributed poorly to predict habitat suitability for wolves. Proportion of cropland, human density and artificial light pollution were the most important factors delineating habitat potentially suitable for wolf. In Polesia, wolf selected habitats with low values of artificial light pollution, human density and avoided croplands. We identified priority areas for wolf conservation in Polesia and emphasize the need to protect highly suitable habitats between source populations in the Chernobyl Exclusion Zone in the east and the Belavezhskaya Pushcha National Park in the west. Effective long-term wolf monitoring programs in both Belarus and Ukraine are needed for sustainable conservation; however, national and transboundary wolf management in Polesia has been extremely challenging since 2022 due to the ongoing war in this part of Europe.

Paws without claws? Ecological effects of large carnivores in human-dominated landscapes

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Large carnivores are frequently presented as saviours of biodiversity and ecosystem functioning through their creation of trophic cascades, an idea largely based on studies from relatively natural landscapes. However, in large parts of the world, particularly in Europe, wolves live in and are returning to strongly human-modified ecosystems. At present, we lack knowledge to predict the effects of large carnivores in these human-dominated landscapes. Our studies from the Białowieża Forest (Poland), illustrate that wolves can create trophic cascading impacts on ecosystem functioning but also humans modify their impacts even here in one of the least disturbed forest complexes in Europe. By means of intensive camera trapping, we showed that wolves affect landscape-scale distribution of their main prey (red deer), unlike secondary prey species (wild boar, roe deer) and non-prey species (European bison, moose). At fine spatial scales, red deer change their behaviour by increasing vigilance levels in response to cues indicating predator presence (wolf scats) or objects that block view and escape routes (large tree logs). Both these large- and fine-scale behavioural responses of red deer, create spatial variation in browsing intensity and affect tree regeneration success. As wolves avoid human activity, these trophic cascading impacts of wolves are most pronounced far from human settlements. This 'human shadow' on predator-prey interactions is therefore an important component that should be taken into account in even more human-dominated landscapes in Europe. Human presence, forestry and hunting potentially modify predator-prey interactions largely, which is in line with case studies we carried out in Sweden and Germany. We conclude that predator-prey interactions in human-modified landscapes will be highly context-dependent and human actions will often attenuate the ecological effects of large carnivores. We suggest that future studies should focus on how context modifies the ecological impacts of wolves to understand under which conditions they can exert ecosystem impacts.

Wolf territory sizes and winter densities of wolves in Croatia and Turkey

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Wolf territory sizes and their variations are one of the main parameters showing the status of wolf populations. Wolf territory sizes depend on latitudes, prey biomass, abundance of vulnerable prey, the size of prey species, wolf population density, season, and the degree of human domination over the landscape. Winter wolf densities are often used as a convenient indicator of population status and trend in areas where snow-tracking is possible. The diet of wolves in study areas of Croatia consist predominantly of wild ungulates and of livestock in studied part of Türkiye. A total of 38 and 39 wolves from Croatia and Türkiye were captured and tracked respectively. Of these, resident individuals constituted 81% in Croatia and 59% in Türkiye. We calculated 95% Kernel Density for the individuals that were tacked for minimum of six winter months, i.e. 13 wolves belonging to six packs in Croatia and 14 wolves belonging to five packs in Türkiye. The average territory sizes were 333.8 km² (range 149.5- 652.7 km²) and 273.3 km², (range 40.9- 600.8 km²) for Croatian and Turkish packs, respectively. The average winter pack sizes were 6.5 individuals (range 5-9) in Croatia and 7.0 (range 5-10) wolves in Türkiye. The respective densities of wolves in tracked packs were 2.2 wolves/100 km² (range 1.1 – 4.0) and 3.0 (range 1.2 to 6.4) wolves/100 km². The difference in territory sizes and wolf densities in winter were not significant between Croatia and Türkiye, but the smaller territory sizes, higher densities, and higher proportion of dispersers all together indicate higher saturation with wolves of the study area in Eastern Türkiye. Highly anthropogenic landscape in Eastern Türkiye seems not to be detrimental for the local wolf population, but on a contrary, the combination of human tolerance and high abundance of food for both preying and scavenging, resulted in thriving wolf population. The Eastern Türkiye wolf population showed that wolves may not always be the symbol of wilderness, may not be used as umbrella species, and probably are not the keystone species in this ecosystem. However, wolves in both countries are used to paint flags with a mix of colors from nature conservation, but also patriotism.

A non-invasive assessment of density, diet, and distribution of Himalayan wolves in Nepal

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The Himalayan wolf (also called Tibetan wolf) *Canis lupus chanco* is uniquely adapted to life at high altitudes of the Himalayas and the Qinghai-Tibetan Plateau of Asia and comprises a genetically distinct lineage from the Holarctic grey wolves. These wolves are currently known to occur only in the high altitudes of Nepal, India and China. Wolves are currently assessed as 'Critically Endangered' in Nepal and are a protected priority species under the National Park and Wildlife Conservation Act of the country. However, the species is neglected by research and conservation projects. For this ongoing doctorate research, we conduct field work in Upper Humla (Western Himalayas), Upper Mustang (Central Himalayas) and Sagarmatha (Mount Everest) National Park (Eastern Himalayas) in Nepal to i) estimate their population density ii) reveal their dietary habits and iii) investigate their current distribution in the country. We use faecal DNA sampling of putative wolf scats collected within the survey grids and use maximum likelihood-based spatially explicit capture-recapture models to estimate Himalayan wolf population density. We employ DNA meta-barcoding techniques to investigate their foraging ecology. Likewise, we use the Himalayan wolf presence points (genetically verified scats, camera trap images, and direct sightings) to generate species distribution models and use the habitat suitability map to model potential movement corridors. Information on the population density will make way for reassessing the conservation status of the Himalayan wolves in Nepal while also providing useful data for an IUCN red-list assessment of the species that is currently pending. Application of DNA meta-barcoding to study foraging ecology will provide a clearer picture of their dietary diversity as earlier studies based on microscopic dietary analysis of genetically verified wolf scats have limitations. Similarly, identification of movement corridors will facilitate the designation of priority landscapes for their conservation. This in turn will provide crucial information to design and implement conservation action plans for the species in Nepal.

"How do I look?" Changes in phenotype in wolf-dog hybrids

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Hybridisation is a natural part of evolution that can lead to speciation and increased fitness of species. However, when it occurs between wild species and those artificially selected by humans, population-threatening introgression can occur. During intensive monitoring of hybridisation incidents between wolf and dog in Poland, we recorded a number of changes incompatible with known wolf traits that were a dog legacy. Through monitoring with camera traps, we have recorded the changes that occur in the next generation of the hybrids, e.g. different tail lengths and fur colours within the group. These changes can cause serious survival problems to the wolf population if they spread, reducing hunting efficiency, which can be threatening to the wolf population, but could be also used as indicators of hybridisation if observed. We would like to highlight the importance of population monitoring using camera traps in areas where wolves are present, as the first warning signal of the occurrence of hybridisation, which should be combined with genetic identification for confirmation.

Wolf monitoring in the Netherlands

Glenn Lelieveld (1)

1) Dutch Mammal Society, Netherlands

Wolves first returned to the Netherlands in March 2015, after an absence of over 200 years. In this presentation, we will share our lessons learned of this highly adaptable species in an human-dominant environment. The wolves are monitored by (active) field study, but also by (passively) validating thousands of sightings per year reported by the public (citizen science). Field study is performed by trained volunteers and foresters and focusses mostly on wolf scats and the use of trap cameras. Also, wolf predation on livestock is intensively studied. Even though the Netherlands are highly populated (17,5m people in 41.543 km²), wolf territories have formed from 2018 onward, with first reproduction in 2019 (5 pups) and 2020 (4 pups) in one wolf pack. In six years' time, 10 out of the 12 provinces of the Netherlands have had sightings of wolves. In total more than 30 individual wolves have been genetically identified in the Netherlands, excluding many wolf pups that have not yet been genetically identified. So far, four wolves have been found dead in the Netherlands. All four are killed by traffic, of which two were born in the Netherlands. One female wolf that was born on the northern part of the Veluwe (largest forest in central part of the Netherlands) was killed on the southern part of the Veluwe and had eight embryos in the uterus.

Interactive mapping of wolves across borders

Glenn Lelieveld (1) and Ellen van Norren (1)

1) Dutch Mammal Society, Netherlands

Animals have no boundaries but maps do. Most of the maps stop at national borders, thus creating a narrow view of the range of species. This is why EuroLargeCarnivoresProject and WWF Germany commissioned the Dutch Mammal Society to create a web-based interactive map of territorial wolves across the Benelux and Germany. In cooperation with the governments of these countries. This map is available in four languages and has approximately 10,000 unique visitors per month. The map shows information of each wolf territory (represented as a dot) and background information. The technical solutions behind the map are built in a way that it is easy to add any other language and make a web-based interactive map of the range of wolves in Europe. The map is hosted and maintained by the Dutch Mammal Society, but can be incorporated in any other website by use of an iframe. In our presentation we will demonstrate the map and invite you to join our initiative by sharing your language and the bare minimum of your countries monitoring data.

Web address to the map: wolvesmap.zoogdiervereniging.nl

Origin and dispersal distances for individual wolves establishing territories on the Scandinavian Peninsula 1999 -2020

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The Scandinavian wolf population has been intensively monitored since the early 1980's. The monitoring has been based on extensive tracking and registration of scent-marking territorial individuals on snow, from 1999 combined with DNA-analyses of non-invasive samples (scats, urine) collected during the monitoring season. An almost complete pedigree with known individual genetic profiles of almost all territorial individuals have been constructed. We made a detailed analysis of origin, dispersal distances and relatedness among all individuals establishing in territorial pairs during the study period 1999 – 2020. We recorded territory establishment of 468 different wolf pairs. In 258 cases (56%) both partners had a distant origin, in 181 cases (39%) one of the partners was local (widow/widower or offspring from the same territory), and in 23 cases (5%) both partners were locally recruited, i.e. through different forms of incestuous mating. It was more common for a female offspring to take over the parental territory together with a foreign male (10%) as compared to a male offspring taking over together with a foreign female (4%). Excluding locally recruited territorial wolves (widow/widowers and offspring), average dispersal distance from natal territory to established new territory was 131 (10-553, min-max) km for males and 90 (6-424 min-max) km for females. Dispersal distances decreased with population size for males, but not for females. Dispersal distance however decreased with local density of territories (number of territories within a radius of 108 km from the centre point of the natal territory), both for males and females, but the amount of variation explained by the local density was relatively small (male: $r^2 = 0.12$, female: $r^2 = 0.11$) in relation to the total variation. A multi-factorial model confirmed that higher local density of territories resulted in reduced dispersal distances, but also showed that dispersal distance increased with the distance from natal territory to the estimated population centre, i.e., wolves born in more peripheral territories had longer dispersal distances.

Livestock depredation in Portugal: Is the wolf guilty, innocent, or simply co-responsible?

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Livestock is a major component of Iberian wolf (*Canis lupus signatus*) diet, in central Portugal. There is also a large population of free-ranging dogs overlapping wolf territories in this area, with evidence of livestock depredation. Despite this, no published information on dog patterns of prey consumption is currently available. The negative perception of wolves coupled with scepticism about dogs' role as predators, often leads to bias against the former in cases of livestock damages. Thus, our goal was to assess and compare the diet composition of Iberian wolves and free-ranging dogs in central Portugal, to raise awareness on the predatory role of dogs on livestock and its implications for the conservation of an endangered wolf population. We used data from 40 attacks on livestock, occurring between 2019 and 2021, from which genetic species assignment from saliva swab samples was successful. We also assessed diet composition from 107 and 95 genetically confirmed wolf and dog scats, respectively, collected between 2014 and 2022. Results showed that dogs were the sole predators detected in most attacks on livestock (62%). Scat analyses confirmed goats as the most consumed dog prey in all analysed regions, followed by lagomorphs, small mammals, and wild boars, indicating potential wild prey depredation. Wolf diet varied between regions, with goats and wild boars being the most consumed prey in the western region, and birds and goats in the central. Thus, the dietary overlap between both canids was very high (Pianka's index $O = 0.93$). Our findings raise awareness on dogs' role as predators of livestock and possibly also wild species, supporting the need for a stronger enforcement of the legislation on dog ownership and an effective management of the stray population, to help reduce human-wolf conflict in the area.

Wolf territory cooperation: Local platforms for joint management and knowledge sharing

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The management of the Finnish wolf population is steered by a management plan, which assigns tasks to various organisations governed by the state. Its main aim is to reconcile the needs of citizens living in wolf territories with the protection needs of the wolf population. To that end, the administration hosts multiple stakeholder platforms on national, regional and local level. The LIFE BOREALWOLF project (2019–2025) provides essential support for implementing the management plan. It develops tools for facilitating the coexistence of people and wolves, thus aiming to increase the acceptability of wolves in the Finnish society. Among other things, this includes promoting interaction and collaboration with and between those stakeholders, that are involved in the management of wolves. On local level, wolf territory cooperation groups are one of the most important Finnish platforms. Their operations were launched in 2016 by the Finnish Wildlife Agency, which currently coordinates some 35 groups. These cooperation groups consist of stakeholder representatives, who convene to discuss the wolf situation and plan for useful local actions. There are various interest groups involved: associations for hunting, conservation, livestock production, community, recreation and kennels, as well as municipal administration and law enforcement. The key aspect is to include members, who are familiar with the residents, their livelihoods and any challenges faced with wolves within the local communities. LIFE BOREALWOLF supports the groups e.g., by producing updated guidelines of operation, information materials and templates for stakeholder communication. It also hosts national webinars for disseminating wolf-related information and organises regional seminars to promote dialogue and networking. Territory cooperation groups have been a welcomed operating model especially in areas, where wolves have previously been absent for a long time. Well-functioning cooperation groups act as hubs between territory residents and relevant authorities: they help to ensure that people have access to information about wolves and opportunities to engage and to be heard. This is crucial to successful management of wolves. Despite the efforts required to establish and maintain territory cooperation groups, forming such networks can be recommended for other regions, where conflicts arise from wolf presence.

Identifying the presence of pups in a chorus to monitor wolf populations

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The number of reproductive packs is often the basis of wolf monitoring schemes, which with conversion factors based on pack size estimates can generate study area (or larger area) population estimates. Different field methods and analytical approaches have been used to estimate the number of reproductive packs at a regional scale, including the use of acoustic methods to identify the presence of pups in wolf chorus. Wolves, particularly pups, respond to simulated howls, and this behaviour is used in wolf monitoring programs to help identify successful reproduction events. Furthermore, recent developments in the use of automated recording units have facilitated the use of these devices to record spontaneous chorus howls, which may have logistical and budgetary advantages, and may contribute to increased acoustic data available to help determine the presence of pups in an area. On the other hand, when listening a wolf chorus, observers have wrongly determined the presence of pups in a remarkable number of cases when, in fact, there were no pups vocalizing. Quantitative analysis of wolf choruses has been proposed as a method to reduce potential human bias in determining the presence of pup vocalizations in a chorus. Previous research has shown that specific acoustic parameters are linked to the presence of pups. Hereby analysing a large dataset of wolf choruses ($n = 150$), we discuss the pros and cons of this approach, with the aim to optimize monitoring of successful wolf reproduction and the overall use of the acoustic monitoring in wolves, including the identification of the main acoustic parameters to be used when analysing wolf choruses for reproduction detection using open software (i.e., R). The application of non-invasive acoustic wolf monitoring methods such as this will contribute to increased understanding and conservation of wolf populations in the wild.

Flexibility or free-riding? Challenges of transboundary management of a wolf population

Siri Martinsen (1) and Katrin Vels (1)

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NOAH – For Animal Rights will present on the theme “Policy” on the legal challenges of managing a transboundary (Southern Scandinavian) wolf population in a situation where there is no political transboundary agreement on the common management. On what legal grounds can the Norwegian government argue that it is only obligated to ensure a small fraction of the South Scandinavian population? Can the strict protection of the wolf in the wolf zone established by law in Norway be set aside on the ground that a bigger part of the population is to be found across the border? How to solve the legal challenges related to biologically transboundary wolf populations if there is no political agreement on the division of responsibilities? The ongoing legal battle around the culling of wolves in the wolf zone between NOAH and the government of Norway is referred to as an example of how problematic the management of a transboundary population can become when political cooperation is lacking.

Wolf population size estimation: An integrated approach for long term conservation practice

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(10) Regione Autonoma Valle d'Aosta - Flora e fauna - Ufficio per la fauna selvatica e ittica, Italy

(11) MUSE - Museo delle Scienze di Trento, Conservation Biology Section, Italy

(12) ERSAF - Direzione Parco Nazionale dello Stelvio, Italy

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The wolf is among the most controversial wildlife species. Abundance estimates are required to inform public debate and policy decisions. Obtaining such estimates at biologically relevant scales has proven challenging. We developed a system for a comprehensive wolf population estimation across the Italian alpine region (100000 km²). The system involved an extensive network of 1513 trained operators representing 160 institutions. This network allowed for a coordinated genetic sample collection for landscape-level spatial-capture-recapture analysis that transcended administrative boundaries. This effort resulted in the first estimate of key parameters for wolf population status assessment: wolf abundance (946 individuals, 95%CrI:822-1099), number of reproductive units (134 packs, 95%CrI:112-161), and the proportion of mature individuals (32-45%). The system also provided reliable information about monitoring effort, thereby overcoming a limitation of citizen-science data. This is an effective approach for wolf-human coexistence based on wolf monitoring, and a tool for conservation practice in the long-term.

Mapping population-level mortality risks of an emblematic and controversial large carnivore, the wolf

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The dynamics of wildlife populations arise from individual life histories, which in turn are influenced by the spatial and temporal dynamics of resources and pressures, often shaped by humans. Quantifying spatial variation in vital rates, particularly survival, is therefore a central topic in ecology and has direct relevance for wildlife management and conservation. Yet, population-level inferences about spatial variation in survival remain elusive. We applied an open-population spatial capture-recapture model (OPSCR) to an extensive dataset from a decade of range-wide non-invasive genetic sampling of wolves (*Canis lupus*) in Scandinavia. Using this approach, we were able to estimate and map spatial variation in multiple sources of mortality, while accounting for imperfect detection. Our results revealed substantial variation in wolf mortality across space and time. Importantly, spatial variation in cause specific mortality seemed to be driven by wolf density. Management and conservation - like wildlife population dynamics - are spatially explicit and require information at the scale at which interventions are typically implemented. Our study provides a way to do so, by mapping cause-specific mortality and offering a better understanding of the factors driving spatial variation in survival.

The effect of wolves on the exit and voicing exit of Swiss mountain farmers

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Wolves are perceived as a threat by small ruminant farmers in Switzerland. In this study, we examined whether there is an association between exit from small ruminant farming and wolf prevalence. We drew on Hirshman's "exit, voice, and loyalty" theory to shed light on (1) farmers' exit strategies in the past and (2) farmers' voice on future intentions of exiting ("voicing exit"), when dealing with wolves. Using farm panel data from Swiss small ruminant farmers (13,954 regular farms and 3758 Alpine summer farms), we first applied a mixed-effect logistic regression model to estimate farmers' exit rate from small ruminant farming. We then conducted a survey among farmers (n = 928) to show correlations between the farmers' burden caused by wolves and intention of how long to continue farming and keeping small ruminants. We differentiated between regular "all-year" farms and Alpine summer farms. We were able to show that wolves, among other important factors, played a small but significant role in the exit from small ruminant farming, mainly on farms with small herds. The survey results also revealed that farmers exposed to greater wolf pressure were more likely to voice potential exit from small ruminant farming. In general, there is a real threat that farmers will exit small ruminant farming because of wolves. We highlight that farmers' exit from small ruminant farming should be seriously taken into account for further wolf management decisions.

Humans and wolves together create a landscape of fear for deer in a human-dominated landscape

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Due to rapid global land use change, large predators are recolonizing human-dominated landscapes. Managing the (perceived) risk created by both carnivores and humans requires novel behavioral adaptations in their prey species such as red deer. Thus the question remains what ecological effects recolonizing carnivores have on the landscape. Therefore, we measured the spatial behavior, vigilance and foraging behavior of ungulates in a recreational area in The Netherlands where wolves recently established. We installed wildlife cameras across a gradient of wolf space use, close to (20m) and further from (100m) from hiking trails used for recreation. On the same locations, we measured recreation intensity, browsing and carbon stocks (biomass, litter, soil organic matter) to assess effects of humans and wolves on deer browsing impact. Deer spatially avoided locations closer to the core of the wolf territory, yet this did not translate into effects on the vegetation or beyond. Closer to trails, ungulates visited our plots less compared to further away from trails, yet only during the day. When trails were more intensely used for recreation, visitation frequency was lower, visit duration was shorter, and the proportion of time spent on browsing was lower. This reduced deer browsing intensity and impact on the vegetation and carbon stocks near trails. We found no effects of neither wolves nor humans on vigilance levels, indicating that deer in our study area mainly navigate the risk landscape through adaptations in spatial behavior rather than vigilance. Our study indicates that recolonizing wolves affect deer behavior, but effects on the landscape may be overruled by human activities.

Complacent wolves: Human-caused local mortality and high turn-over of territories may explain the lack of wolf expansion in the Iberian Peninsula

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The conservation of wolf populations in human-dominated landscapes is challenging because of conflicts with human activities, along with small effective population sizes and fragmented habitats. Disentangling the contribution of these different factors to the stability of wolf populations is critical for conservation planning. In particular, wolves need to move frequently across human-dominated landscapes in fragmented habitats, but how much human-caused mortality of resident and dispersing individuals affect wolf dynamics is little understood. To close this research gap, we built a spatially-explicit individual based model (SE-IBM) to simulate the dynamics and dispersal of the wolf population in the Iberian Peninsula (shared between Portugal and Spain). Unlike other populations in Europe, its distribution range (approx. 120,000 km²) and the number of packs (approx. 350 packs) have not changed substantially over the past 40 years. Using the IBM, we show how human-caused mortality of residents and during dispersal can explain shifts in the distribution range and connectivity between subpopulations. Mean distance travelled by dispersers was substantially lower under high human-caused mortality levels than in the absence of human impacts. Such increases in local mortality created vacant territories and social openings in existing packs, which led to short dispersal events and high turnover of territories. This may have partially prevented wolf expansion in the Iberian Peninsula. Our study enables a better understanding of the dispersal process and local dynamics in wolves and its role in the recolonization processes, thus allowing prioritization of management actions for wolf conservation.

Management and ecology of wolf-dog hybrids in Poland

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While hybridization between wolves (*Canis lupus*) and domestic dogs (*C. l. familiaris*) is considered a threat to the genomic integrity of wolf populations worldwide, this phenomenon appears to occur particularly often in areas currently recolonised by wolves. Despite its importance assessments of optimal management strategies for wolf-dog hybrids as well as research regarding hybrid ecology have been widely neglected so far. Here we report intense research on wolf-dog hybrids in Poland since 2014, when the first such incident was reported. We applied 13 autosomal microsatellites, 93 SNPs optimized for hybrid identification, as well as camera trapping to address the frequency and distribution of wolf-dog hybridization. We analysed external features, reproduction, and diet of hybrids, as well as outcomes of management interventions undertaken by responsible governmental agencies. Wolf-dog hybridization was recorded in all wolf management units in Poland: Baltic, Carpathian and Central European. Our study revealed substantial differences in morphological appearance and reproduction parameters between hybrids and pure wolves, but close similarities in prey composition. Management interventions, which included lethal elimination of both adults and pups, showed largely positive results but were heavily affected by various socio-political factors.

Predicting the potential distribution of grey wolves in Turkey under climate change scenarios

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Due to the continuous increases in greenhouse gas emissions, and a potential increase in planet earth's global surface temperature, considerable changes in the bioclimatic state of the planet are projected. Climate change is expected to shift the current distribution range of thousands of species and impact the overall status of biodiversity. Knowledge of species' range shifts under future climatic conditions is critical, especially for preemptive conservation action. Grey wolves (*Canis lupus*) range over a wide geographic area to fulfill their ecological requirements and serve as important keystone species. Their response to climate change can be a useful model for general conservation actions. From May to October 2020, we recorded 89 presence points of grey wolves throughout Türkiye. We then produced the possible distribution range and suitable habitats of the species in the 2070s under selected General Circulation Models (GSMs) and three representative concentration pathways (RCPs) and compared it with the current situation. We found that some parts of the currently suitable range may be lost in the future, accounting for 27% of the current range. Our models indicate that the most significant factor which affects the species distribution is the mean temperature of the driest month followed by annual precipitation and distance to protected areas. Most of the suitable habitats for future climatic scenarios are in northeastern Türkiye. Those areas that show high suitability both current time and in the next five decades comprise climatic refugia and need more urgent consideration by the decision-makers and conservation agencies.

Dynamic occupancy models predict wolf spatial use in human-dominated landscapes

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Among large carnivores, wolves show a remarkable capability to persist in human-dominated landscapes. However, the dynamics of variation in spatial use in these landscapes over time remains poorly understood. Considering the relevance of spatio-temporal variations of territorial marking on wolf behaviour, either to defend territory boundaries and core areas or to expand into new areas, it is expected that the location of wolf signs would reflect the dynamics of spatial use. Taking advantage from a long-term wolf monitoring dataset (spanning from 2005 to 2020), based on transects of sign survey (faeces), and the persistence of wolves in several highly human-dominated landscapes of Iberia, here, we fit a multi-season occupancy model, in a Bayesian framework, to investigate the effects of environmental and anthropogenic factors on the dynamics of wolf spatial use in human-dominated landscapes. We explore occupancy dynamics, accounting for detection probability, at a scale of 5x5km. We focused on two dynamic parameters of spatial use: colonization and extinction. Furthermore, we used these results to develop a wolf habitat suitability map for Iberia. Wolf detectability increased with higher survey effort, the density of unpaved roads, and topographic complexity. In our context, the density of local roads showed a marginal influence on the dynamic parameters of spatial use. Colonization probability increased with the increase of livestock density and proportion of open areas, and with the decrease of ruggedness and national-regional road density. Extinction probability increased with the increase of highway density. The strong influence of livestock on the dynamics of wolf occupancy highlights the need for conflict management associated with livestock depredation. At the scale considered, the strength of anthropogenic disturbance may constrain the use of the landscape which, together with intraspecific competition, may restrict wolves into using less suitable and riskier habitats. Our results contribute to a sound understanding of wolf spatial use in human-dominated landscapes, and their ability to adapt to these dynamic environments.

Beware or be aware? Temporal foraging strategies of wolverines and wolves at wolf-kills

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Facultative scavengers face tradeoffs between scavenging or predation that do not only depend on prey availability versus scavenging opportunities, but also on the risk versus reward associated with the utilization of carcasses, specifically interference competition and intra-guild aggression. As resource availability and intra-guild interactions change in space and time, scavengers need to adapt their foraging behavior to these changes. We present wolverine (*Gulo gulo*) and wolf (*Canis lupus*) use of wolf-killed ungulates (n = 29) during three seasons: summer, fall, and winter in Norway. We deployed remote cameras at fresh wolf-kills to examine carcass use and activity patterns of wolverines and wolves as either single individuals or in groups. We found that both wolverine and wolf use of wolf-kills reflected seasonality of biomass availability at ungulate carcasses. We observed little evidence of wolves limiting wolverine scavenging behavior, apart from delayed carcass use by wolverines in avoidance of wolves that visited carcasses in groups. Wolves and wolverines showed little temporal segregation in activity patterns. Our results suggest that, rather than representing a substantial risk to wolverines, wolves facilitate wolverine scavenging through carcass provisioning. We suggest that seasonal biomass availability is an important factor influencing the risk-reward balance of utilization of carcasses killed or used by a smaller predator and thus perhaps the facultative nature of wolverine foraging behavior. The behavioral responses of intra-guild interactions are important for understanding drivers of sympatry and dynamics offsetting facilitation or suppression in sympatric carnivore species.

CEwolf: Harmonized genetic monitoring allows to reconstruct wolf recolonization of Central Europe's human-dominated landscapes

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Wolves are currently recolonizing parts of their former Holarctic range. The western part of Central Europe is a striking example of rapid range expansion after long-term absence of territorial wolves. We present the genetic reconstruction of wolf recolonization in the area since the year 2000, with several hundreds of wolf packs that inhabit the area between the Benelux countries, Denmark, Germany, Austria, the Czech Republic and Western Poland. To allow for cross-border genetic monitoring on the population level, we founded the CEwolf consortium between 9 laboratories in 8 countries. Use of a common genetic marker panel and regular exchange of data and information ensure a harmonized assessment across the range of the Central European wolf population (CEP). To this date, coordinated wolf monitoring has established that, despite a lack of spatial separation, the CEP is genetically distinct from its Baltic source population - suggesting a separate management unit. While genetic diversity is somewhat reduced compared with Baltic wolves and other populations, it shows an increasing trend and inbreeding is low overall. Despite ongoing range expansion within human-dominated landscapes, we find low hybridization rates with domestic dogs and no substantial introgression of dog alleles into the CEP. We show how cross-border wolf monitoring is facilitated by efficient scientific cooperation, resulting in relevant insights for wolf management and conservation.

From forest dweller to suburb tenant: Wolf territories and food habits in human-dominated landscapes of central Europe

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Humans drastically reduced and changed natural habitats, therefore nowadays many wild species have to adapt to human-dominated landscapes. An understanding of how wild animals function in a mosaic of natural and modified by humans areas as well as how they adapt to human-caused disturbance and how they take advantage of the opportunities created by human activity is crucial to the proper allocation of resources for their conservation. This problem is especially crucial for protection of large carnivores such as wolves (*Canis lupus*) due to potential conflicts with humans. We applied GPS/GSM telemetry on 19 wolves inhabiting forests with different degree of fragmentation and proximity to human settlements within both Baltic and Central European wolf populations in lowland Poland. We also studied composition of wolf diet across over 20 locations based on analysis of scat content. Our study revealed that wolves are not exclusive forest dwellers and may live in landscapes significantly changed by humans, e.g. on outskirts of large towns, but still rely largely on wild ungulates to sustain their food requirements. We recorded no substantial differences in the home-range size of wolves inhabiting exclusively forests and those living in areas with a high share of farmlands. We hypothesize that it is largely caused by the increase of wild ungulates number and their persistence in agricultural lands along with a long-lasting cover provided by corn crops.

Recolonization and population patterns of wolves in Schleswig-Holstein and Denmark, 2007-2022

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With 12% forest cover, the Jutland Peninsula (470 km length, 46,208 km²) of Denmark and Schleswig-Holstein (Germany) represent one of Europe's most intensively cultivated regions, connected to the Central European mainland by a 60-km wide stretch of urban-dominated land between Hamburg (1.83 mill people) and the Baltic Sea. The first immigrating wolf in recent time in the region was registered (traffic victim) near Hamburg in 2007. After the second verified wolf in 2012, immigrants (predominantly males) have been registered annually at rate proportional to the number of packs in Germany. In 2021, eleven new immigrants were registered in the region of which four reached Denmark. Genetic monitoring demonstrate that most wolves spend few weeks in the densely humanly populated and forest deprived Schleswig-Holstein before dispersing to the lesser densely populated and slightly more forested Denmark, wherefrom no immigrants have returned upon arrival 2012-2022. First reproduction occurred in 2017, the year after the arrival of first female in Denmark. As of 2022, the population numbered about 15 adult wolves, including two reproducing and one newly established pair, all located in the Danish part. Until 2020 the annual mortality rate was unsustainably high in both states mainly due to cryptic mortality in Denmark and traffic in Schleswig-Holstein, creating a population sink maintained by increasing immigration from the south. The future prospects of the population development will depend on whether increasing local recruitment (at least 14 pups born in 2022) may compensate for the high human-caused mortality rates. While immigrants from the south seem to disperse smoothly through Schleswig-Holstein to Denmark, Danish born wolves have more difficulties finding way through Schleswig-Holstein as the North Sea coastline often guides them. This leads them to a dispersal dead end in the deforested marshland north of the Elbe estuary and west of Hamburg, where they may cause much trouble as predators on sheep that grazes this cultural landscape. As the number of reproducing pairs in Denmark are likely to grow in the coming years, so may also the number of dispersers from Denmark that are upheld by dispersal barriers in the pastoral landscape in western Schleswig-Holstein.

Spatial and dietary consequences of apex carnivore competition following gray wolf recolonization in the Pacific Northwest

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Expanding gray wolf (*Canis lupus*) populations have reestablished elements of interspecific competition with sympatric cougars (*Puma concolor*) in Pacific Northwest landscapes, which can affect cougar behavioral ecology and population dynamics. We evaluated diet composition, ungulate kill rates, daily activity patterns, and habitat selection for cougars before wolf recolonization occurred (2009-2012), and for wolves and cougars after wolf establishment (2014-2018) in Oregon, USA. We used GPS relocations to identify and search predation sites, calculate movement rates (km/hr), and evaluate habitat selection for cougars across pre- and post-wolf periods. We compared patterns for cougars with concurrent wolf predation and activity patterns. In the post-wolf period, cougars had lower ungulate biomass intake (14-61%; 12% less deer) and lower summer kill rates (17-50%) without shifting large prey diet composition. Cougars spent more time searching for prey but moved shorter distances with wolves on the landscape (mean pre = 0.60 km, 90%CI = 0.49-0.70; mean post = 0.43 km, 90%CI = 0.38-0.47) and their diel activity shifted to offset periods of high wolf activity. We also found female cougars selected for less open habitats in winter after wolf recolonization. The patterns we documented reflect behavioral strategies cougars could use to balance fitness costs of competition with wolves in areas of sympatry. Our results demonstrated that competition could counter-intuitively influence top-down effects by reducing kill rates and altering movement, activity, and habitat selection patterns of subordinate carnivores. As wolf populations continue to expand, behavioral and system-specific population responses of shared ungulate prey subjected to predation by dynamic, coexisting carnivore populations needs to be clarified.

Detection of howling activity around rendezvous sites using automatic recorders and its usefulness for wolf monitoring

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We studied spontaneous vocal behaviour of wild wolves around rendezvous sites in Yellowstone National Park and Superior National Forest (USA), Maharashtra (India), and Tierra de Campos, Cordillera Cantábrica, and Sierra de la Culebra (Spain) using automatic recording devices. We recorded 605 wolf chorus howls and 224 solo howl series emitted spontaneously by 25 wolf packs. The percentage of days with spontaneous vocal activity ranged from 12.5% in Cordillera Cantábrica to 94.12% in Yellowstone National Park. Daily solo rates ranged from 0 to 3.47 solo howls/day, obtained in Yellowstone National Park; daily chorus rates from 0.13 chorus/day (Cordillera Cantábrica) to 5.29 chorus/day (Yellowstone); and hourly distribution of chorus howls showed two peaks in most of the packs, being a common pattern a peak after sunset and the other before sunrise. We obtained higher vocal rates for larger packs living in less humanized areas. Using automatic recorders within 500-1000 m of known rendezvous sites (1-6 recorders per site) needed 4-15 days to detect the pack (average 9.5 days) and 5-21 days (average 11.3 days) to detect pups, both with a probability of 95%. We discuss the pros and cons of using automatic recorders compared with howling surveys to detect wolf reproduction, especially in human-dominated landscapes. Our results may help guide future wolf monitoring programs using automatic sound recorders.

Effectiveness of husbandry practices in reducing wolf depredation in free-ranging livestock in Greece

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Livestock depredation is a prime wolf-human conflict issue worldwide, threatening wolf conservation and impacting human livelihoods. Our analysis of nationwide compensation data in Greece showed a dramatic shift in compensation costs paid for cattle mounting from less than 30% of total costs to over 55% in recent years (period 2006-2021), and an inverse trend for sheep/goats. To disentangle factors influencing wolf predation on livestock, we collected data on the husbandry practices and depredation levels for 70 sheep/goat and 68 cattle herds through semi-structured interviews with livestock farmers along a livestock damage gradient in a mountainous area of NW Greece. Sheep/goat herds were significantly better protected than cattle herds with respect to seven preventive measures and had three times fewer annual losses than cattle herds in terms of Livestock Units. Generalized Linear Modeling pinpointed three core preventive measures significantly reducing wolf depredation risk for both herd types, namely increased shepherd surveillance, systematic night confinement, and an adequate number of livestock guardian dogs. Our work suggests the optimal ratios are 3 Greek guardian dogs per 100 sheep/goats and 7 guardian dogs per 100 cattle. Keeping young livestock in enclosures and not abandoning livestock carcasses at pastures were additional important preventive measures for cattle herds. In the applied context, our study provides evidence for the subsidizing policy to be adopted by the forthcoming Common Agricultural Policy in the European Union and can inform the development and implementation of national wolf-livestock conflict mitigation policies in conflict hotspots, such as Greece.

Key insights for proactive wolf governance in the Anthropocene

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Wolves are expanding across Europe, while popular support for the process continues to grow. Despite this trend, there are significant research gaps on what fosters and perpetuates durable coexistence, or how to work proactively with communities that are facing the return of this controversial animal, as well as various other socio-ecological challenges. This presentation will delve into these issues by summarising the findings of a four-year research project on human-wolf interactions in pastoral areas of Spain. The project constitutes a cross-case synthesis of communities at different states of wolf expansion: one known for long-established coexistence, one where wolves have returned in recent decades and one where they are expected to return imminently, using qualitative methods to explore the social and ecological conditions which help or hinder co-adaptation. In particular, the presentation will discuss procedural considerations of legitimate wolf governance, and the barriers which prevent just transformation to positive and durable coexistence.

Spatial heterogeneity in wolf disappearance rates in Scandinavia

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The return of large carnivores is frequently followed by deep-rooted conflicts between parts of the society that often results in illegal killing of the species. After three decades of positive population growth, the wolf population in Scandinavia has fluctuated in size since 2016. While the true cause of the population development is unknown, there has been a simultaneous increase in disappearance rates of wolves in Sweden since 2010. The recent distribution of wolf territories is characterized by large gaps that are not explained by habitat suitability or management decisions. Previous research shows an association of higher disappearance rate with higher population size and lower disappearance rate with higher legal culling rate. We make use of an updated dataset (up to 2022) on the fate of monitored wolves to explore additional hypotheses for wolf disappearance heterogeneity across Scandinavia. Namely, we use the correlation between wolf disappearance rate and proxy variables to look at the potential role of poaching (e.g., terrain ruggedness and human density), resource limitation (e.g., moose density), intraspecific interaction (i.e., wolf density) and inbreeding (e.g., inbreeding coefficient). Predictions will be done using a Generalized linear model (GLM). Our results have the potential to be of importance for wolf management in Scandinavia for example in relation to the minimum number of individuals required for being considered a population with favourable conservation status.

Spatio-temporal and demographic dynamics in German recolonizing wolf population

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After being completely eradicated in the 19th century, wolves are now recolonizing the human-dominated landscape of Germany. This represents a major challenge for wildlife management and conservation, including increasing human-wildlife conflicts. Limited data and non-stationarity responses to habitat selection in expanding populations pose significant challenges to reliably predict wolves' range expansion and suitable areas for conservation. We used the natural experiment of the recent wolf expansion into Germany from the past 20 years, combining telemetry with territory monitoring data, to analyze the habitat selection of individuals along time. We compared predictions from models representing spatio-temporal colonization steps with a global ensemble model to check for non-stationarity in habitat selection. Furthermore, we analysed survival and reproduction from capture-recapture data to investigate density-dependent effects in the population. Our results showed that individuals in newly colonized areas select for areas with lower human disturbance than those in previously colonized areas. This cautions against extrapolating habitat models in space based on data from initial colonization phases, when species are out of equilibrium with their environment. Furthermore, habitat suitability as well as wolf density -estimated as the number of wolf territories around each territory each year-, affected both survival and reproduction. Habitat suitability of the natal territory was positively associated with juvenile survival. Local wolf density was negatively associated with annual juvenile survival, but positively associated with number of pups per reproduction event. The combined result of both parameters is key to understand wolf population expansion in Germany.

Getting ready for the wolves: Lessons learned in anticipating its return to central France and the case for 'wolf-smart communities'

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Wolves are expanding from the Alps into other parts of France, including the Massif Central, generating a recurring pattern of local ignorance, discovery and disbelief, widespread inaction and posturing, trauma, and then conflict-ridden adaptation of livestock operations while predation on livestock spikes as protection measures are only slowly generalized. This takes several years to unfold before normalization can be envisaged. Meanwhile, predation levels on largely unprotected livestock spike. Government support, in the form of compensation for livestock losses and subsidies for protection measures, is enabled and expanded as this pattern unfolds, only once wolf attacks on livestock have been officially recognized. Breaking this pattern to achieve less traumatic adaptation and reduce livestock losses requires proactive anticipation, including awareness-raising and empowerment of local communities to detect early wolf presence, prepare mentally and materially for significant changes to livestock operations (including the purchase of guard dog puppies which take 2-3 years to be operational), and self-organise to decrease livestock losses and support human victims of successful attacks on livestock. We illustrate this challenge from initiatives aimed at anticipating wolf comeback in the Limousin (2018-2020) and Dordogne regions (since 2020) of the Massif Central, and discuss how this can be done. Key lessons learned include the importance of negotiating a neutral position from State authorities (e.g. concerning detection), avoiding political interference (given high stakeholder pressure towards ineffective posturing) and the importance of having willing farmers (not environmentalists) taking the lead and involving non-farmers (e.g. hunters, naturalists, and other users of the landscape) in establishing predator-smart communities that enable a collective response to living with wolves. We also discuss how this approach can be replicated to coexistence in other regions and with other species such (e.g. lynx in NE Germany, bears in the Apennines, and European Bison in Romania's Carpathians).

Fencing against African Swine Fever poses barriers for wolves

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African Swine Fever (ASF) is on the rise in Europe and hit Germany in 2020. Other than the single case incidents that occurred in the Czech Republic and Belgium a few years ago Germany was flooded by a disease wave coming from Poland and stretching over more than 100 km. The response of the German authorities to this epidemic, in addition to trying to eradicate wild boar in the affected areas, was to build fences. The border between Poland and Germany is now completely fenced. In addition, fence lines are built in the interior of the country. The federal state Brandenburg alone built 1800 km of ASF-fences. In the federal state Saxony, eight fence routes cut through the country in a north-south direction. Green bridges built to mitigate the barrier effect of highways were closed. This extremely long linear barrier in an already highly fragmented landscape was built without any form of systematic monitoring of its effect on wildlife (state autumn 2022). Telemetry data of single radio collared wolves underline the barrier effect of ASF-fences on individual wolves. Genetic data indicate that the fence lines may have an effect of the spatial location of wolf territories, influencing the spatial organization of the affected wolf population. Other detrimental side effects may be increases in wolf – human and wolf – livestock conflicts: The ASF-fences are interrupted and are permeable for wolves in areas of human settlements. Wolves and other wildlife could therefore show up more often in settlements in search of crossing opportunities. Individual wolves have learned to overcome ASF-fences by jumping. These individuals will likely use this ability on livestock protection fences too. While the goal is to protect domestic pig farms from ASF, the measures have significant effects on wildlife beyond wild boars, including strictly protected species. We therefore suggest to (1) evaluate the effectiveness of ASF-fences in preventing the spread of ASF to domestic pig farms, (2) to consider alternative measures for preventing the spread of ASF to domestic pig farms and (3) to monitor the detrimental side effects of ASF-fences for other mammalian species and develop appropriate mitigation measures.

Long-term use of livestock guarding dogs in Portugal: Overall results and future challenges

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The Livestock Guarding Dog Program, continuously developed by Grupo Lobo since 1996, has been successfully promoting the use of livestock guarding dogs (LGDs) as an efficient tool to prevent wolf damages and mitigate conflicts with livestock breeders. Since it began, more than 680 dogs of local breeds have been placed with sheep and/or goat flocks and cow herds throughout the wolf range, in different landscapes and husbandry systems. Selected pups are donated to livestock breeders, with food and veterinary care being provided, are monitored until adulthood, and finally assessed in terms of their efficacy and performance. Overall results of this long-term program will be presented, focusing on damage reduction, dog behaviour and owner satisfaction, in relation to livestock management and dog characteristics. Data on dog efficacy over time, the long-term use of this tool, the reasons for abandoning it and the requirements for continuing using it, the cost-effectiveness of using LGDs, and the advantages and constraints of using LGDs in modern contexts will also be discussed.

Island biogeography and demographic history influences genetic structure of Alexander Archipelago wolves

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Alexander Archipelago wolves (*Canis lupus ligoni*) are a subspecies of grey wolf that occupy coastal areas of Southeast Alaska and British Columbia, USA. On the Alaskan side of the border, these wolves have been the focus of conservation efforts for 4 decades due to localized high levels of mortality from harvest and logging of old-growth forest which reduces the carrying capacity of their primary prey, Sitka black-tailed deer (*Odocoileus hemionus sitkensis*). The landscape is characterized by islands, long fjords and mountain ranges and this natural fragmentation shapes the population genetic structure of these wolves. We designed a hybridization capture and generated ~30,000 genome-wide single nucleotide polymorphism (SNP) genotypes. Using a subset of the genotyped Southeast Alaskan wolves (n = 59) we estimated the proportion of the genome in runs of homozygosity (FROH) and found 2 populations of inbred wolves: 1) the southern mainland and inside islands, and 2) Prince of Wales Island (POW). POW wolves had a higher proportion of long FROH, indicating more frequent mating between relatives recently (1-10 generations ago) and a smaller population size. Genetic structure analyses of a larger set of hundreds of individual wolves revealed 4 population clusters that aligned with major geographic features – wolves on POW formed a distinct cluster, as did wolves in the southern inside islands. Two other wolf populations occurred mostly on the mainland and displayed a higher degree of genetic admixture among regions reflecting greater landscape connectivity. We detected recent immigrants from the Yukon Territory, Canada across the Coast Mountain Range. Although it was previously assumed that POW was a genetic sink due to high levels of wolf harvest, our results indicate higher levels of migration off the island than immigration to it. Our results show that in Alexander Archipelago wolves island biogeography and demographic history influences genetic structure and has implications for managing wolf populations to maintain genetic diversity and population viability.

Status of wolf introductions in Isle Royale National Park, USA

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After declining to two related individuals, the United States (US) National Park Service (NPS) made a determination to augment the number of gray wolves (*Canis lupus*) on Isle Royale National Park. Our primary goals were to re-establish a viable population of this apex carnivore and facilitate the restoration of ecosystem processes. Isle Royale National Park is a remote, wilderness archipelago and International Biosphere Reserve renowned for wolf/moose (*Alces alces*)-predator/prey relationships. During September 2018–2019, the NPS and its partners translocated 19 wolves from nearby Ontario, Canada and Minnesota and Michigan of the US. Our research and monitoring evaluating the success of this restoration program includes assessing wolf abundance, social organization, reproduction, survival and cause-specific mortality, population genomics, prey acquisition, and movements; prey (moose and American beaver [*Castor canadensis*]) abundance and distribution, wolf-mesocarnivore interactions, disease ecology, moose browse, and impacts of recreational human use.

Livestock Protection in the German speaking Alps: First results of the only livestock protection LIFE project “LIFEstockProtect”

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Livestock protection has been part of human culture since the first settlers needed to protect their livestock against predators. The Mediterranean cultures developed coexistence strategies and adapted their practices to minimize losses while hunting aggressive predators. One of the results of this coexistence strategy has been the breeding of Livestock Guarding Dogs (LGDs) to keep predators at a distance. Looking at the LCIE map of the areas where the wolves survived centuries of eradication and overlapping these areas with a map of the LGD breeds, it is obvious that LGDs played a major role in the survival of wolves. The Alps differ from the Mediterranean nations not only because of their climate. While ancient Italian cultures worshipped the wolf, it became one of the most controversial animals in Central Europe, resulting in a total eradication of the local wolf populations. This resulted in agricultural communities in parts of Europe living in coexistence with the wolf, but others unable to image this. Traveling through southern Italy, a tourist will encounter in almost every village a shepherd with their Cane de Pastore Maremmano Abruzzese, while in the Alps one encounters sheep and goats but not a single shepherd. The return of the wolf after the fall of the Iron Curtain is now forcing the Alpine farmers to change their techniques to the Southern European model. This change is complicated by the fact that, while in Southern Europe, shepherds are following a commercial model, livestock owners in the Alps hold sheep mainly as a hobby and are financially supported by the European Union’s Rural Development Policy (RDP) and national subsidies. In Germany, many sheep and goats are funded as a valuable nature conservation tool to keep landscapes open by grazing. These differences are key to understanding the high resistance in Central Europe to coexistence strategies. The pivotal solution is a differentiated financing mechanism for new herding strategies, as well as the return of the shepherds with their herding dogs.

What big skulls you have! Cranial morphometry of grey wolf (*Canis lupus*) in Eurasia

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The grey wolf (*Canis lupus*) is one of the best known and studied canids worldwide. This species once had a distribution that covered nearly all Eurasia and North America. The wide distribution offered the species great morphological variability. However, studies on the cranial morphometry of wolves in a large geographical range are still limited. While body size has already been studied, it is not stated if wolves from northern latitudes have larger skulls than individuals from southern geographical regions or whether there is sexual dimorphism in skull size. Thus, the objective of the study was to analyse and compare wolf skulls using a unique set of craniometric measurements taken across Eurasian museums' collections. In total, 1056 mature specimens were measured in 13 countries from 10 climatic regions. Three-fourths of the samples (n=800) were identified by sex and then analysed using general linear models (GLM) and principal component analysis (PCA). Among the 17 different skull measurements, PCA showed that 6 were dominant: condylobasal length, zygomatic breadth, breadth between upper carnassials, neurocranium length, minimum breadth of skull and maximum frontal breadth. Wolf skulls differed significantly between the 10 climatic regions ($p < 0.001$). Individuals from northern latitudes (Scandinavia, northern parts of former USSR) had larger skull measurements than wolves from the Mediterranean countries, Caucasus, Arabian Peninsula and the Far East. The index of sexual dimorphism – Storer's index as well as the GLM confirmed that there were significant differences ($p < 0.001$) between the sexes and that males had larger skulls than females, both in length (mean \pm SD: for males 238.9 ± 10.7 mm and females 227.2 ± 10.4 mm) and width (142.3 ± 8.2 mm and 133.9 ± 7.2 mm, males and females respectively). These differences in skull size and morphology can be attributed to adaptation to trophic and climatic conditions. This study is valuable in imparting knowledge on the craniometry of grey wolf across Eurasia.

Out of the woods? Decline of genomic diversity in a demographically stable gray wolf population in Western Europe

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The gray wolf population in the Iberian Peninsula has been one of the remaining wolf populations in Europe after human persecution during the last century. After reaching its minimum in the 1970s, both in size and distribution, the northwestern population has increased until being considered the largest wolf population in Western Europe, while the southern population in Sierra Morena has followed the road to extinction. After a severe population bottleneck, genetic diversity can be lost even in stable or expanding populations, especially in those isolated. Here, we used ancient DNA methodology to analyze the genomes of historic and modern Iberian wolves from across their historic, and different modern range in order to look at changes in the genomic diversity through time in the population as a whole, with a special focus on the southern Sierra Morena population, where the most important changes in distribution have taken place in the last decades. We identified lost genomic variation associated with local extirpation, but also loss of variation on a larger scale. This illustrates that the long-term survival of the Iberian wolf population might be compromised despite its recent increase, suggesting that this population may still be of conservation concern.

Himalayan wolf occupancy is determined by elevation

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Little is known about basic key conservation information on Himalayan wolves (*Canis lupus chanco*), such as range and population size estimates. Himalayan wolves present unique adaptations to low oxygen levels at high altitude, but how altitude affects its range remains unexplored. Previous studies based on genetic identification of Himalayan wolves using non-invasive fecal samples established that Himalayan wolves range between 4,000 and 6,000 m.a.s.l. Here, we used a dataset of 106 photographs/images of Himalayan wolves obtained in Upper Humla, north-western Nepal, in 2021, where 52 camera traps were deployed during a total of 2384 trap nights, and applied maximum likelihood, single-season occupancy approaches, to assess how different factors influence Himalayan wolf occupancy. Wolves in Upper Humla have been genetically identified as Himalayan wolves in previous studies, therefore this is the first study on Himalayan wolf occupancy and detection probability without taxon identification bias. Our results suggest that Himalayan wolf occupancy is strongly determined by altitude. Elevation determined occupancy in this area, modulated by the distance to human settlements, with wolves selecting places at higher altitudes, even at the narrow altitudinal range covered by our data, possibly because height reduces risky exposure to humans. Detection probability was influenced by distance from water-bodies (positive effect), and slope (negative effect). The combined effect of elevation selection for occupancy and the preference of a longer distance to water-bodies also support the idea that humans have a role influencing wolves' occupancy, even in highly remote mountainous areas. Wolves tend to occupy high-altitude areas at a longer distance to water-bodies. At this altitude, human activity might be less frequent, as domestic yaks have shown a bigger detection probability closer to water sources. Further studies on the potential range and range selection of Himalayan wolves and the influence of human activities on the space use by these wolves are required to evaluate the relationship between high-altitude niche occupancy, facilitated by their adaptation to hypoxia, and the potential avoidance of human exposure risk at lower altitudes.

High turnover rates of territories in the Scandinavian wolf population: Causes and consequences

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Animal populations commonly show changes in individual behaviour and demography as they change in size and density. For wolves, this process is strongly affected by their territorial behaviour, making them defending exclusive areas (territories) towards conspecifics suggesting that wolf distribution may be better defined by a presence-absence of territories rather than a continuously changing distribution of individuals. This territorial behaviour also has important consequences for the conservation and management of wolf populations because culling or other mortality of adult territorial individuals may result in complex spatial dynamics similar to a chess-board of areas successively changing between being vacant or occupied. We investigated how fast territories were re-occupied after being terminated by culling or due to other reasons, and what factors that may affect this and examined the probability of re-occupation of terminated territories. During 1999-2017 we recorded territory establishment of 468 different wolf pairs. Of these 159 wolf territories were terminated during the study period with 21 (13%) not being re-occupied by 2020. Of the 138 territories that were re-occupied, the number of years from termination to re-occupation was on average 1.1 years and ranged from 0 to 11 years. The average number of years from termination to re-occupation decreased with both time and total population size ranging between one and three years during the 2002-2009 period but was reduced to less than one year for the 2015-2017 period. Territories with packs was on average re-occupied 1.2 years faster than territories inhabited by a territorial pair. Faster re-occupation occurred after legal culling of both individuals as compared to territories where both individuals disappeared for unknown reasons. This study shows that the Scandinavian population now has reached a size where most terminated territories in the main wolf distribution area rapidly are re-occupied. This provides conditions for high rates of population growth or resilience of population size in years with high rates of mortality. Actively terminating territories, i.e. through directed culling, to remove "problem wolves" will in most cases only have a temporary effect, as new occupants will rapidly re-colonize the area.

Can physiology inform management? Extrinsic determinants of hair cortisol concentration in Iberian wolves

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The mechanisms by which the degradation of natural habitats influences wild animals can require an understanding of their physiological responses to stressors. The quantification of cortisol, the major glucocorticoid in wolves, in hair is an emerging biomarker of chronic stress in wildlife. We hypothesized that hair cortisol concentration (HCC) can highlight the environmental determinants that affect wolves' stress physiology and thus inform the management of the species. Wolves inhabit the Iberian Peninsula across a range of population density, human disturbance, and prey availability, which makes this an appropriate model to address the hypothesis. Hair samples were collected from the lumbar region of 207 wolves in the Iberian Peninsula from 1996 to 2021 and the HCC was determined using enzyme immune assays. The HCC was modelled based on potential extrinsic determinants extracted from a 400km² buffer around the location of each sample. Intrinsic determinants of HCC were also included in the model to correct for their influence. Mean HCC was 8.9 ± 12.1 pg/mg of lumbar guard hair. The most supported model included extrinsic determinants deemed proxies of social stressors, human disturbance, prey, and refuge availability. The strongest effect size was that of wolf pack density being positively related to HCC, supporting the relevance of intra-specific stressors in a social species. The proportion of protected areas showed a positive relation with HCC. Livestock density was positively related with HCC, while species richness of wild ungulates was negatively related with HCC. Prey type and availability affects chronic stress of wolves, potentially mediated by the conflict arising from livestock depredation. The density of primary roads showed a negative relation with HCC, while the inverse was found for secondary roads. Road density influences the chronic stress of wolves, while the other factors related to human disturbance (human and tertiary road density, and size of livestock herds) were not included in the most supported model. This study highlights the complex and sometimes unexpected relations between extrinsic factors influencing the chronic stress of a social large carnivore in human-modified landscapes. The HCC shows promise as one more tool to inform the large-scale management of wolves.

Space use patterns of recolonizing wolves (*Canis lupus*) and co-occurring cougars (*Puma concolor*) in a human-impacted forest landscape (Washington, USA)

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Ecological relationships between wolves (*Canis lupus*) and their prey have been studied in both single- and multi-prey systems globally. However, few studies have also considered the effects of co-occurring top predators in these wolf-prey relationships. Here we examine the spatial interactions between naturally recolonizing wolves and an existing top felid, the cougar (*Puma concolor*), in a montane forest ecosystem of Washington State, USA. Previous studies have indicated that wolves are dominant over cougars, with cougars sometimes changing their habitat selection as a result. However, these previous studies focused on wolf-cougar populations in protected areas such as national parks where native ecosystems are relatively intact and human impacts are low. We sought to understand how wolves and cougars would navigate a forested montane landscape where native ecosystems have been altered and where human impacts are moderate to high. Furthermore, most previous wolf-cougar studies occurred in systems where wolf populations exceeded cougar populations. Our study system is unique in that cougars far outnumber the co-occurring wolf population. Under the hypothesis that wolves are situationally dominate over cougars, we predicted that cougars would increase their avoidance of wolves in areas of high wolf pack density. We further predicted that wolves would be more avoidant than cougars of areas with greater human exposure, which cougars are better able to exploit. To test these predictions, we used global positioning system (GPS) collars to identify habitat use of 60 cougars and 19 wolves (five packs) within two study areas in eastern Washington State, USA totaling 10,000 km². We used resource selection functions (RSFs) to examine drivers of wolf space use, in particular environmental resources, anthropogenic influences, and prey availability. We then use RSFs to examine cougar space use in relation to all the same variables, plus wolf pack density. Results demonstrated that cougars and wolves do overlap heavily within both study areas, with cougars making greater use of human-developed areas than wolves. However, spatial relationships of wolves and cougars in response to specific habitat and anthropogenic factors varies widely.

Acceptance of wolf presence through effective preventive measures: Livestock protection with volunteer support

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After being extirpated for over one hundred and fifty years, wolves migrated back to Lower Saxony, Germany since 2008. Their reappearance found mostly sheep farmers (but also cattle farmers and horse owners) unprepared and quickly led to an increase of lethal wolf attacks on unprotected livestock. Securing the grazing of grassland, nature reserves, dikes, etc. in the presence of wolves is important in many aspects such as biodiversity, climate protection or marketing of regional (organic) products. The presence of wolves led to highly emotional debates about wolves and their right to live in densely populated areas such as Lower Saxony. In order to support livestock owners adapting to the new situation, Lower Saxony's Nature and Biodiversity Conservation Union (NABU) implemented its novel livestock protection project "Herdenschutz Niedersachsen" in 2017. As additional support to the state funding opportunities, the main focus of the project is the implementation of livestock protection measures. Specific project activities are (a) consulting of livestock farmers (on-site), (b) networking between farmers, authorities, companies, associations, science, (c) practical support with trained volunteers (setup of wolf-deterrent fences, night watch, monitoring, etc.) as well as (d) training, knowledge and technology transfer for professional setup of wolf-deterrent fencing and the use of Livestock Guarding Dogs. Thus, the project, minimizes the amount of work for the supported livestock owners, helps finding possibilities and solutions, enhances knowledge, spreads the word and reduces (initial) reservations against wolves and protection measures. As a result, more grazing animals are well protected which leads to a higher acceptance of the presence of wolves and enables a coexistence of livestock and wolves by the project activities.

Conservation with hard borders: Wolves and people in the highlands of Ethiopia.

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While most canids are versatile and often more than capable of navigating vast landscapes, rare Ethiopian wolves (*Canis simensis*) are endemic to an archipelago of Afroalpine islands, surrounded by hard agriculture borders, people and dogs. Human encroachment continues to erode their shrinking ranges, locking them into further isolation. Small populations become vulnerable to stochastic effects, with competition with domestic dogs – fundamentally disease transmission - posing the most clear and immediate threat to their survival. Habitat loss and human disturbance, and the ensuing extinction risks, vary among extant populations. We have identified lower habitat thresholds for population extinctions over the past three decades, with a small population eradicated in a brushstroke by concomitant rabies and canine distemper epizootics. With current levels of fragmentation and isolation opportunities for recolonisation are few. However, recent evidence of successful dispersal within and across patches has unveiled prospective mechanisms for conservation translocations as a tool to avert new extinctions. The future of the Afroalpine ecosystem and the wolves that live there is ultimately linked to suitable land use and governance models, including habitat restoration. While most Afroalpine ranges harbouring Ethiopian wolves are under some form of protection, community conservation areas necessitate supporting more sustainable livelihoods, and traditional protected areas need better management and funding. The future of Africa's most threatened carnivore is conservation dependent, requiring a softening of these hard borders through better habitat protection, fostering coexistence, active management of disease, and eventually a metapopulation approach to manage several small, isolated populations as one.

Demographics of gray wolf (*Canis lupus*) packs recolonizing variable habitat types in Central Wisconsin

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Most gray wolves in the United States live in a series of disjunct populations. Management of these isolated populations is important in sustaining the species. The Central Forest Region (CFR) of Wisconsin has been home to one such disjunct population since the early 1990's. Using 18 years of CFR wolf monitoring data, we divided this gray wolf recolonization into three distinct time periods: Early (1994-1999), Mid (2000-2005), and Late (2006-2012). With GIS we defined habitat classes of individual pack territories as Optimal, Mixed, and Marginal, based on features known to influence wolf habitat selection or avoidance. These were: (1) percent public land, (2) percent agriculture, and (3) road density (km/km²). We analyzed the influence of time periods and habitat classes on pack territory size, mid-winter pack size, pup production, wolf-human conflicts, human-caused wolf mortalities, territory persistence, and sustained reproductive performance. Pack demographics were similar across time periods, except for pup production that was slightly lower during the Mid Time Period. Wolf-human conflicts increased significantly over time, but when wolf population size was accounted for, the time effect disappeared. In contrast to the weak effects of time period, packs existing in Marginal Habitat had smaller mid-winter pack sizes and lower reproductive performance, and experienced greater conflicts with humans, and six-time greater human-caused mortalities than the other habitat classes. This study demonstrates that wolves can tolerate human-altered landscapes up to a point, provides management with possible habitat parameter thresholds, and identifies which wolf demographic parameters most impact wolves in human-dominated environments.

Acoustic localisation as a tool for non-invasive monitoring of wolf movement and behaviour

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Tracking the locations of wolf packs allows us to better understand and predict wolf movement behaviour, and can facilitate proactive non-lethal management of human-wolf conflict rather than reactive culling and illegal kills. Currently, wildlife researchers and managers predominantly employ camera traps or radio-collars for monitoring. Whilst these can be effective for tracking animals, camera traps can only survey a small area directly in front of the camera and radio-collaring is a highly invasive process that can cause distress and injury. Thus, we are developing non-invasive acoustic localisation methods, whereby the time differences in arrival of howls to GPS-synchronised acoustic recorders are used to locate vocalising wolves. We first tested our system in Yellowstone National Park, USA with Wildlife Acoustics Song Meter (SM) recorders and found that wolf howls could be localised to within approximately 20m and at ranges up to 7 km. We further tested our system in Wisconsin, USA in December 2019 where we compared the efficacy of SM recorders with customised, low-cost devices called CARACALS. We found that the CARACALS were less sensitive, detecting only 50% of the wolf howls detected by the paired SMs. Although acoustic localisation could not be performed for wolves due to a low sample size, we found that acoustic localisation of coyote howls, which have similar acoustic properties to wolf howls, was possible from the CARACAL recordings with no difference in precision or maximum detection range to when using the SM recordings. Acoustic localisation with low-cost recorders could, therefore, offer a way to track dispersal events and cross-border movements over large scales. In addition, we have been testing acoustic localisation for discerning habitat preferences and inter-species interactions between wolves, coyotes, and domestic dogs, which could offer insights into predictive wolf pack behaviours in relation to other co-occurring canids that are more vocal and easier to monitor. We will conclude with an overview of how we are developing acoustic equipment alongside automatic detection of wolf howls to find solutions for non-invasive, real-time, automated monitoring of wolf movements.

Ecological effects of using livestock guarding dogs as large carnivore deterrents

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Livestock guarding dogs (LGDs) are considered effective at preventing livestock losses and reducing persecution of large carnivores so are often suggested as a tool to help facilitate coexistence with wolves around the world. However, little is known about the ecological impacts of LGDs on target predators and other non-target wildlife (e.g. herbivores and mesopredators not responsible for livestock losses). Our study, conducted in collaboration with Fauna & Flora International, aimed to characterise and quantify LGD-wildlife interactions and their outcomes in the southern Carpathian Mountains of Romania; an area which hosts some of Europe's largest populations of grey wolves, brown bears, and Eurasian lynx. In the summer of 2021 we visited 13 shepherds across three counties where we interviewed them, GPS-tracked their sheep and 40 LGDs for three weeks each, and collected 130 LGD scats for dietary analysis. For 12 months we deployed camera traps across a 315 km² area covering pastures and surrounding forest roads to monitor LGD and wildlife activity. The GPS tracking data revealed that LGDs mostly remained with the sheep, but with some excursions of up to 2.5 km. Travelling away from the sheep could be instances of LGDs chasing wildlife as shepherds reported their LGDs chased away bears and wolves and sometimes chased other animals such as deer, wild boar, foxes, and hares. Shepherds also reported their LGDs occasionally killed foxes, wildcats and boar, or fed on wildlife carcasses. Wildlife remains, including wild boar, red fox, and small mammals, were found in 14% of the LGD scats. Although our data cannot confirm whether these remains originated from hunting or scavenging, both activities have ecological impacts on prey, competing predators, and co-occurring scavengers. The >100,000 photos (including >2,000 photos of wolves) captured on the camera traps will be used to determine the spatiotemporal responses of wildlife to seasonal LGD presence (analysis ongoing but will be complete by May 2023). By acknowledging and quantifying the unintended ecological effects of LGDs, stakeholders can work together to mitigate unwanted consequences, thereby improving the use of LGDs for facilitating human-wildlife coexistence and aiding large carnivore conservation.

Population genetics of unique and ancient wolf lineages in India

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The ancient and divergent wolves of the Indian subcontinent are threatened by hybridization with free ranging dogs that are sympatric with the Indian peninsular (*Canis lupus pallipes*) and Himalayan wolf (*Canis lupus himalyensis*). With samples collected across the range of these species and sympatric dogs, we use a combination of maternal (mtDNA CR and Cyt b) and bi-parental (nuclear microsatellites) markers to assess phylogenetic and phylogeographic patterns, current genetic diversity, genetic connectivity, demographic histories of wolf populations and the extent of their hybridization with dogs. Indian wolves showed moderate levels of genetic variability, comparable to other grey wolves. High level of genetic differentiation was observed between the two Indian wolves as well as each wolf had unique haplotypes indicating absence of gene flow between them. Low levels of genetic differentiation were observed within both the Indian peninsular and Himalayan wolves indicating high levels of gene flow within their populations. Both the wolves showed genetic patterns indicative of population declines in the recent past (25-50 generations) and evidence of genetic bottlenecks. Hybridization analysis suggest relatively low levels of hybridization between Indian peninsular and dogs and no detected hybrids between Himalayan wolves and dogs. Phylogenetic analysis clustered all the Himalayan and Indian peninsular wolves into a separate single clades that were basal to all other Holarctic wolves further supporting the uniqueness of Indian wolves. Based on distinctiveness and uniqueness of both Indian wolves and evidence of no admixture between them, our results are supportive of awarding a full species conservation status as *Canis pallipes* and *Canis himalayensis*. Such a taxonomic status would also ensure allocation of required investments for their conservation management.

Communication between wolf and domesticated dog revealed from experimental scent marking

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The European grey wolf (*Canis lupus*) and the domestic dog (*Canis lupus familiaris*) share not only a common origin, but also many similarities in their behavior. Because of their improved protection, wolf populations have increased in Poland and across Europe. The increasing presence of wolves in human-dominated landscapes brings them increasingly into contact with their domesticated relatives, dogs. However, the potential for and ways of interactions between the wild and domesticated form of the wolf are still poorly understood. Scent marking is one of the major forms of communication for canids. It entails among others information essential for marking territories, synchronization of reproduction, establishment of hierarchies in groups, and formation of new pairs. As scent-marking plays an important role in communication for both wolf and dog, the presence of dogs in wolf territories could potentially impact the behavior of wolves. To test this, we experimentally scent-marked locations to simulate the presence of "unknown wolves" (wolf urine from outside the area) and "unknown dogs" (dog urine from outside the area), as well as water as a control. By means of camera traps we studied the behavioral response of wolf families living in Kampinos National Park while exposed simultaneously to all scent stimuli. Our study showed that wolves responded to scent marking from the dog by overmarking it. Wolves spend significantly more time exploring and sniffing "unknown wolves" scents marks compared to "unknown dogs" scent marks. However, time spent by breeding pair on reaction to both scent marks (by overmarking and ground scratching) were on similar level. This result indicates that wolves can distinguish between wolf & dog scent marks, but especially juveniles spend much time exploring dog scent marks. Dog scent marks did trigger a behavioral response in wolves showing that it does affect their behavior. This suggests that the increasing co-occurrence of dogs inside wolf territories, could affect (potentially disturb) scent marking behavior of wolves which deserved more attention in future studies.

Wolves in fenced nature areas: Scientific opportunities and management headaches

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In highly cultivated regions, fencing ungulate populations within nature areas, surrounded by farmland and urban areas is increasingly used as conservation tool to restore natural processes and preserve wildlife populations and natural habitats. After wolves have recolonized heavily cultivated countries like Denmark and the Netherlands, at least three cases exist of wolves naturally establishing permanent territories inside fenced nature areas. From an ecological viewpoint, establishment of wolves in fenced areas create the same situation as when wolves colonize islands with limited geographical space and prey population sizes. Scientifically, cases of wolves colonizing fenced nature areas create a unique opportunity to study predator-prey interactions in semi-closed ecological systems, disconnected from the human drivers that dominates ecological processes every else. From a management point-of-view, wolves within fenced nature areas of limited size may create management dilemmas if they depredate prey populations as described for islands in North America. In this presentation, we present the results from ecological monitoring of wolves and prey in two Danish fenced nature areas with permanent wolf presence since 2020 (Klelund Plantage: reproducing wolves with four pups in 2021 and six pups in 2022) and 2021 (Tofte Skov: single resident male), respectively. Both areas are semi-permeable for wolves, but red deer (initial population size 350-400 in both areas), roe deer and wild boar are effectively enclosed. In at least one of the fenced areas (Klelund), wildlife camera and drone census data suggest substantially higher juvenile mortality of red deer compared to unfenced populations, at a magnitude that most likely will result in long-term population reduction. From a management perspective, one may ease local depredation effects by enhancing the wolves' access to cross the fences, enabling their opportunity to forage outside the fenced area when prey supply and foraging opportunities starts falling inside the fenced areas.

Interactions between wolves and cattle: Reviewing global experience, analysing encounter rates and depredation patterns in Switzerland and factors affecting cattle depredation by wolves

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Since the return of wolves to Switzerland in the 1990ies, human-wolf interactions have focused mainly on predation on free-grazing sheep and goats. In recent years, however, attacks on cattle have been increasingly registered in Switzerland, including attacks on adult cows. The keeping of cattle, especially dairy cows, is characteristic of Swiss agriculture, of high economic importance and a central part of Swiss identity. Thus, a low-conflict coexistence between cattle breeders and wolves is central to the wolf's future in Switzerland. In parts of the Swiss Jura Mountains, it is also traditional to keep free-ranging horses. Wolf attacks on horses have not yet been recorded in Switzerland, but attacks on donkeys have occurred, and there is the potential for future conflicts. This project aims to address the challenges arising for the coexistence between cattle and equid breeders and wolves in Switzerland and identify factors that facilitate attacks on bovids and equids and thus, to develop the scientific basis for management solutions in Switzerland. We will present the current challenges for a low-conflict coexistence between humans and wolves in Switzerland and show the current situation in Switzerland and present first results of a literature review of wolf-cattle interactions.

Spatial organization and population dynamics of a recolonizing wolf population are affected by the presence of an introduced ungulate species, the fallow deer *Dama dama*

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The gray wolf *Canis lupus* was extirpated from western Poland, but since enforcement of strict protection in 1998 recolonized most of the suitable habitats. One of such recently recolonized areas is Tuchola Forest, a large forest complex in north-western Poland, where an alien medium-sized ungulate species, fallow deer *Dama dama*, was introduced for hunting purposes. Highest fallow deer density (on average 30-40% of the ungulate community, locally up to 60%) occurs in the south-eastern part of the study area (where cumulative ungulate biomass is also the highest) and it gradually decreases towards the north-west. Using a combined approach involving (i) non-invasive genetics, (ii) identification of wolf core areas and reproduction sites by camera trap surveys and tracking, and (iii) camera trap-based occupancy analyses, we studied demographic dynamics and spatial organization of the local wolf population and investigated if they are shaped by the fallow deer density. The wolf population in the study area increased from one family group in 2011/12 to 14-15 groups in 2022. Interestingly, the breeding pair from the pioneer pack (that settled in the high fallow deer abundance zone) survived until 2021, producing at least ten litters of pups and in consequence contributing to a local founder effect revealed by genetic analyses. The nearest neighbor distance between core areas of wolf territories was the lowest (10.1 km) in the south eastern part of the study area. Moreover, we found a positive correlation between the fallow deer abundance and the rate of the predicted territory overlap between adjacent packs. Importantly, the high density of wolf family groups in the south-eastern region could not be explained by other factors such as lower anthropopressure, as road density and share of urbanized areas are in this area higher, while forest cover percentage is lower, than in the north-western part. On the other hand, we found no significant relationship between fallow deer abundance and wolf family group size in winter or number of pups per pack in summer. Thus, we suggest that the main effect of high abundance of the introduced fallow deer is the increase of the number of family groups.

Seasonal drivers of competition between wolves and bears

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Competition between apex predators can alter the strength of top-down forcing, yet we know little about the behavioral mechanisms that drive competition in multipredator ecosystems. Interactions between predators can be synergistic (facilitative) or antagonistic (inhibitive), both of which are widespread in nature, vary in strength between species and across space and time, and affect predation patterns and predator-prey dynamics. Recent research suggests gray wolf (*Canis lupus*) kill rates decrease where they are sympatric with brown bears (*Ursus arctos*), however, the mechanisms behind this pattern remain unknown. We used data from two long-term research projects in Scandinavia (Europe) and Yellowstone National Park (North America) to test the role of interference and exploitation competition from bears on wolf predatory behavior, where altered wolf handling and search time of prey in the presence of bears are indicative of interference and exploitation competition, respectively. Our results suggest the mechanisms driving competition between bears and wolves were dependent on season and study system. During spring in Scandinavia, interference competition was the primary mechanism driving decreased kill rates for wolves sympatric with bears; handling time increased, but search time did not. In summer, however, when both bear and wolf predation focused on neonate moose, the behavioral mechanism switched to exploitation competition; search time increased, but handling time did not. Interference competition, however, did affect wolf predation dynamics in Yellowstone, where wolves prey more evenly on neonate and adult ungulates, during summer. Here, bear presence at a carcass increased the amount of time wolves spent at carcasses of all sizes and wolf handling time for small prey, but decreased handling time for large prey. Wolves facilitate scavenging opportunities to bears, however, bears alter wolf predatory behavior via multiple pathways and are primarily antagonistic to wolves. Our study helps clarify the behavioral mechanisms driving competition between apex predators, illustrating how interspecific interactions can manifest into population-level predation patterns.

Wolf attacks on dogs in Finland and a potential solution to mitigate the conflict

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Wolf attacks on dogs is a major driver of wolf-human conflict in many countries of Europe and Northern America. In Finland the wolf population started to increase in the 90's. As the population increased, so did the conflict between humans and wolves. The Finnish hunting culture developed in times when wolves were almost extinct. Since then, the use of solitary working dogs has become the most popular way to hunt the moose. Unleashed hunting dogs run over wide areas away from their owners, and therefore it is almost impossible to protect them from wolves. Wolves attack approximately 30–50 dogs annually. Even the dogs are compensated, the value of the dog is not only monetary. For better understanding the nature of depredation on dogs we studied locations of wolves' attacks in territories and described how knowing of wolf locations in hunting area affected the number of attacks. Wolves attacked dogs more near territory boundaries than expected compared to the time they spent there. This result suggests that wolves see hunting dogs more as competitors than a prey. Wolves see dogs as unknown wolves not belonging to the pack intruding their territories and exclude them as soon as they are perceived. Hunters usually search for wolf signs from the hunting area before they free their dogs, but this is difficult before snow cover. Between years 2013–2020 locations of GPS-collared wolves were shown public during the hunting season. In territories where there was at least one collared wolf there were less attacks on dogs than in territories without collared wolves between hunting seasons 2013/2014–2017/2018. As there is not the collaring of wolves anymore in Finland, it is crucial to develop other ways to see the presence of wolves in hunting areas to decrease attacks.

Validation of a recent method for identification of hybrids in the Finnish wolf population

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Hybridization between wolves and dogs has been found to occur to some extent in many European countries. The topic has been raised in public discussion also in Finland, calling attention to the need for more thorough monitoring regarding the “purity” of the Finnish wolf population. However, detecting wolf-dog hybridization events can be challenging, especially when backcrossing to wolf has occurred more than once. Therefore, to detect possible hybridization in the Finnish wolf population, we adopted a recently published method based on 93 SNP markers and further validated it for use in the Finnish wolf population. We used DNA samples already collected for the Finnish wolf monitoring program and included all individuals in the current population and their parents, where possible, going back to 2014. Our SNP panel results suggest reliable results from the panel, when used together with marker-based kinship information and territory knowledge collected from the field. The incidence of hybrids and hybridization is low in the Finnish wolf population, and the 93-SNP panel was demonstrated to be a valuable tool for monitoring the situation going forward.

Numerical top-down effects on red-deer (*Cervus elaphus*) in human-dominated landscapes

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Terrestrial ecosystems are shaped by interactions between top-down and bottom-up processes, with the magnitude of top-down control by large predators largely depending on environmental productivity. While carnivore-induced effects on ungulate prey populations have been demonstrated in large, relatively undisturbed ecosystems, the role of large carnivores in human-dominated systems is less clear. Human activities may change the ecological impacts of large carnivores, either directly or through behaviourally mediated effects on large carnivores and on ungulate populations or through their impact on the resource landscape. The aim of this study was to quantify the interactive effects of human activities, large carnivore presence and environmental productivity on the population density of red deer (*Cervus elaphus*). Data on red deer density were collected in a literature survey encompassing 481 study sites across 28 European countries. Variations in density were analysed using a generalised additive model in which productivity, carnivore presence, human activities, site protection status and climatic variables served as predictors. Within the upcoming presentation I will present our results and will provide evidence of the role played by humans and large carnivores on red deer density across European human-dominated landscapes

Towards a shared forest: Studying the compatibility of free-ranging cattle and carnivores in boreal forests

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Norway has a long tradition with unattended free-ranging livestock, with sheep and cattle released into summer ranging areas annually. However, the recent return of large carnivores creates conflicts between the political goals to conserve carnivores and the agrarian goals to utilize forests and mountains for livestock production. In response, a policy was developed to create separate zones for large carnivores and free-ranging livestock – a policy strategy employed in other countries also. In the carnivore zone, free-ranging sheep grazing has ceased and free-ranging cattle stocks are reduced. Cattle have a hundred times lower depredation rate than sheep, indicating that cattle are likely a good alternative for sheep in carnivore areas. Despite this pattern, farmers report negative effects such as increased stress and shyness in cattle because of carnivore presence. This can potentially lead to more work, anxiety, and income loss for the farmer. Thus, there is a need to study the effect of carnivore presence on cattle, yet the difficulty of observing cattle in remote areas constrains such research. Additionally, large carnivores are elusive and difficult to monitor. Therefore, we use GPS collars with accelerometers to study these cattle and potentiality wolves. Our primary aim is to understand if and how cattle are affected by carnivore presence. In order to understand and interpret behavior and habitat selection we assess the precision and accuracy of commercially available GPS collars for virtual fencing and calibrate accelerometry data for cattle behaviors by using tri-axial accelerometry sensors. Furthermore, we study the effect of carnivore presence on habitat selection, grazing behavior, and body condition of free-ranging cattle. Additionally, we assess spatial cohesion between individual cattle in the same herd and the effect of carnivore presence on those herd dynamics, as less cohesive herds might be more vulnerable for depredation. We will present the results of the GPS collars functioning and the calibration of cattle behavior on tri-axial accelerometry data. Additionally, we present the first results of cattle habitat selection, and the potential influence of carnivore presence. Our results will inform novel insights about the compatibility of free-ranging cattle with carnivores and potential effects on animal welfare.

Formation of wolves' territorial system during the colonization process

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The return of wolves in many countries within the European continent is bringing the option to study their spatial frames in human-altered landscapes. While here they still trying to occupy quiet places far from human intense interests (eg. military areas, forests in border zones), then on the other side such habitats are significantly different from habitats where were the spatial frames described in the pioneer telemetry studies in Europe (Poland, Ukraine, Scandinavia). The social order is asking for the scientists to answer if the spatial and time-spatial frames of wolves' territorial behaviour are some or are somehow affected by the recent habituation of wolves in human-dominated agriculture landscapes. We will provide the first outputs from telemetry studies from Middle Europe, where wolves have begun to form their territorial structure. Our aim is to show (based on telemetry data) how the wolf territories are formed on the so-called colonization front during their spreading. Further, we intend to show in the example of a similar landscapes mosaic how main spatial parameters vary in the population newly established and in the population which has been already saturated.

Wolf management challenges across an international border: Predation on domestic sheep in Norway are dominated by Swedish-born, crossborder dispersers

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For decades, the reestablished Scandinavian wolf population has shared a joint crossborder distribution between the two countries Sweden and Norway, and on both sides mainly on private property. After functional extinction, and when breeding wolves started to recolonize the south-central parts of the Scandinavian peninsula during the 1980's, there were continuous wolf-human conflicts, mostly caused by loss of livestock, semi-domestic reindeer or unleashed hunting dogs, in addition to people's fear, and competition with hunters for moose. Our study is the first quantitative assessment of the history and future wolf predation on livestock in Norway. Concerning wolves and livestock in Norway, predation on free-ranging domestic sheep has been the major conflict. During 1986-2022, investigations at site by professional field crew found a total of 8323 domestic sheep to be confirmed or classified as most likely killed by wolves in Norway. We analyzed the dispersal patterns of Scandinavian wolves born in 1) Norwegian territories, 2) Swedish territories and 3) crossborder territories, respectively. Based on the established dispersal patterns, we analyzed wolf occurrence and potential for livestock predation in all Norway and split on different regions. Except for two municipalities west of Oslo, free-ranging sheep are no longer found within the Norwegian established wolf zone, located in SE-Norway. Young, solitary wolves, which disperse and immigrate crossborder into regions outside the Norwegian wolf zone, pose the greatest potential damage to free-ranging sheep. The vast majority of wolves dispersing to potential conflict areas in Norway were born in Sweden. Wolves born in Norwegian territories most often dispersed eastwards into neighboring Sweden, or further northeast into Finland and/or Russia. For the extent of wolf predation on free-ranging sheep in Norway, the number of litters born in Norwegian wolf territories seemed to be of minimal importance, as long as the reproductions happened within the Norwegian wolf zone.

Phylogeny, ecology, and conservation status of the Himalayan/Tibetan Wolf

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The Himalayan wolf (also called Tibetan wolf) is a genetically distinct wolf lineage uniquely adapted to the Asian high-altitude ecosystems of the Himalayas and the Tibetan Plateau. The conclusive taxonomic classification of the Himalayan wolf is pending. The current expert recommendation for its nomenclature is *Canis lupus chanco* with taxonomic level at least at subspecies and possibly species level being justified by the data. Its distribution range lies in the Himalaya, Transhimalayas and Tibetan Plateau region spanning across northern Nepal, northern India, western China, and possibly northern Bhutan. The specific distribution boundaries remain to be understood in detail, but where investigated a genetic admixture belt was found between the Himalayan wolf and the Holarctic grey wolf that inhabits surrounding lower lying habitats. Population size and trends remain unknown for the Himalayan wolf. We present insights into Himalayan wolf social life and dietary ecology based on six summer seasons of field research. We have found wolf pack sizes between 5 to 11 animals, with an adult pair leading a pack with offspring of the current and at times the previous year. The high-altitude scrublands used by the wolf packs for denning are also used as pastureland by local people to graze livestock in late spring and summer. This is a time when the wolf pups are a few weeks old and are restricted in their mobility. These circumstances facilitate depredation conflict as wild prey species are partly displaced by the suddenly appearing livestock. To understand the dietary habits of the Himalayan wolf we compared wild and domestic prey species consumed to the relative availability of the respective species in the landscape. We found that Himalayan wolves tend to select wild over domestic prey, smaller-sized over larger-sized wild ungulates, and plains-dwelling over cliff-dwelling ungulates. Smaller mammals such as marmots, hare, and pikas were important supplementary food resources. The finding that wild prey was preferred over domestic prey can direct conservation by, for example, ensuring intact prey populations. We discuss the most pressing knowledge gaps and next steps to advance science and conservation around the Himalayan wolf lineage.

POSTER PRESENTATIONS

1 Wolf-human interactions: Behavioral responses of wolves in human encounters

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The wolf population recovered the French alpine range since the early 90's thanks to its natural expanding process from Italy. At first restricted in the wild mountainous areas far from the humans, wolves are getting closer from human settlements because of its range expansion and densification in some places in the Alps. Along with that arise more wolf-human encounters as well as a legitimate debate on public safety issues. Thanks to a network of experts in charge of documenting and reporting wolf observations since the wolf return, more than 3000 wolf-human encounters were gathered since the early 90's to document the wolf behavior as well as the encounters' context. Negatively-perceived behaviors (i.e., aggressive, approaching or non-afraid) were rare reactions of wolves when meeting humans (5%), and they mostly had neutral (18%) or withdrawal reactions (77%). Aggressive and non-afraid reactions also seemed to decrease in proportion over time. The approaching behavior seemed to have increased at first but decreased lately. Some encounter conditions appeared determinant, the closer the observer was, the more likely the wolf showed a negatively-perceived behavior. However, most of the recorded observations were made at more than 50 m or 100 m. Provoking (e.g., yelling, throwing rocks, gunfire, etc.) or approaching humans are more likely to trigger a negatively-perceived behavior from the animal but the probability (10%) still remains low. In France, there are only 10 encounters over more than 3000 where the wolf was perceived as "aggressive" by the observer(s). In these 10 particular cases, the observer(s) always had a provoking or approaching behavior toward the wolf, triggering a defense behavior from the animal. However, no accident, injury or bite attempt happened during these encounters. While the wolf may look bolder with time in France because of an increase in sighting numbers, accident or injury appears very unlikely, especially if the observer does not seek a direct interaction.

2 Growth rates, sexual dimorphism, and morphometric differences between two wolf populations

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Gray wolves (*Canis lupus*) have the broadest geographic range of any land mammal, inhabiting a large majority of the northern hemisphere. Across their range, wolves adapted both behaviorally and physically to wide variety of habitat conditions. In many cases, physical changes are thought to be driven by habitat, prey species, and hunting strategy. Therefore, understanding morphometric differences between wolf populations can shed light on how relatively close populations have adapted to survive in their unique situation. This study looks at growth rates, sexual dimorphism, morphometric differences, and how sexual dimorphism and morphometrics differ between two populations of wolves in Croatia and Turkey. The two populations are the Croatian part of the Dinaric-Balkan population of wolves of southeastern Europe and the part of Turkish population in northeastern Turkey. Morphometric measurements have been collected from individuals captured for GPS collars and from dead wolves found in the period 1995-2022 and 2011-2021 in Croatia and in Turkey, respectively. Measurements have been taken from 359 individuals from the Dinaric-Balkan population and 28 from the Turkish population. Growth rates were derived for wolves less than two years of age in their juvenile period from the Dinaric-Balkan population and were created by fitting a linear regression from mass, body length, and shoulder height. Males grew faster than females, but in all measurements, growth slowed or stopped by age of two years. Sexual dimorphism was documented in both populations but was more distinct in the Dinaric-Balkan population with a larger sample size. Finally, the adult individuals from Dinaric-Balkan population of wolves were larger in several body measures compared to the Turkish population. Physical differences between wolf populations can appear even in locations that are geographically close to each other. By investigating these changes, we can start to explore the drivers of these physical differences and how wolves may be adapting to each ecosystem.

3 Could wolves come back to the UK? Trophic rewilding and biodiversity recovery versus landscape fragmentation and negative attitudes towards an apex predator

Katarzyna Breska (1)

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The subject of my presentation is directly connected to the subject of my MSc dissertation and the research I am currently conducting. I am interested in the conservation of gray wolf and the impact of this predator on the top-down trophic cascade, and landscape recovery. There is an increasing amount of research conducted on the wolf reintroduction and the positive impact on the recolonised environment, to suggest that bringing wolf back to UK (specifically to Scotland) could have a multidimensional positive effect on the land and its inhabitants. I believe that the presence of wolf would benefit not only agriculturally devastated land, but would also significantly improve the local economy and create a range of opportunities for the communities located within or near the hypothetical wolf range. Scotland has a number of potential areas that could be taken under the programme of landscape recovery, and rewilding. Wolf as a keystone species has an incredible potential of shaping the landscape towards self sufficient ecosystem, with an increase of biodiversity and therefore an increase of value of the area they inhabit. Ecologically and economically, reintroducing wolf to UK has an immense potential. Moreover, in the context of many remote areas in Scotland falling into disrepair due to depopulation, the concept of reintroducing wolf appears less radical. Within this research I would also like to focus on the significance of landscape connectivity in species reintroduction, especially the wildlife crossing structures and how they may play role in re visualising the coexistence of wolf and people. Finally, I would like to present the range of attitudes within the public and in the agricultural environment towards wolf reintroduction in UK (Scotland).

4 Wolves are what they eat: An interactive visualization of wolf diets spring through fall in the Greater Voyageurs Ecosystem

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Seasonal diet shifts are a fundamental focus of the natural history of wolves and are often presented in uncreative tables and figures. Here we present a creative visualization that depicts typical wolf diets during spring through fall in the Greater Voyageurs Ecosystem, Minnesota. Adult wolf diets during this period include foods such as beaver, deer, black bear, snowshoe hare, fish, and berries. The diet visualization is accompanied by a caption that blends a creative and interactive interpretation of the poster image with accurate information based upon peer-reviewed publications. The aim of this work is to explore novel, accurate, and effective ways to communicate the natural history of wolves to diverse audiences of all ages. We hope this visualization stimulates wolf biologists, managers, and researchers to consider different and creative approaches for sharing data with the public and scientists alike.

5 Snare poaching of Apennine wolf (*Canis lupus italicus*): Prognostic indicators of rehabilitation outcomes and conservation connotations

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Snare poaching is a relatively simple, inexpensive and effective technique that involves laying wire snares on the ground to capture animals. In some cases, snares cause the animal's immediate death, but more often may determine amputation of body parts, lead to dehydration, infection or starvation. Due to their unselective nature, snares also capture non-target species, including predators attracted to carcasses in snare lines. This is the case of Maiella National Park (MNP) and surrounding areas of central Apennines, where illegal snaring is usually linked to wild boar persecution, but often are the wolves victims of these criminal practices. As is well known, mortality investigations of wildlife based on telemetry data are important for understanding underlying causes of protected population dynamics: out of 20 GPS radiocollared wolves in MNP, from 2010 to 2022, 3 have fallen into the snares. This indicates not only that this type of mortality can be widely underestimated on protected wolf population in Italy, but also stimulates to plan prevention actions and, where possible, recovery and rehabilitation strategies. In this work we evaluate the type of injuries found in recovered wolf individuals accidentally trapped in illegal snare traps, correlate the severity of these injuries to the timeliness of intervention, and propose guidelines for a correct therapeutic and rehabilitative procedure, based on the analysis of 7 snared Apennine wolf (*Canis lupus italicus*) case studies. In order to define prognostic indicators of rehabilitation outcomes of wolves freed from snares still alive, we propose: - Timeliness of finding the animal and localization of lesions as key prognostic factors; - An injuries identification and scores assignment based on a Trauma Scale; - A therapeutic path in relation to the type and gravity of the lesions found; - Antibiofilms as crucial guides for antibiotic therapy during convalescence and rehabilitation period; - Serial hematobiochemical analysis during the recovery and rehabilitation period as tool to recognize critical issues that are not possible to assess with the clinical examination; In addition, a preliminary evaluation of fecal microbioma and resistome was attempted from one individual rescued alive and kept in MNP isolation shelters.

6 Wolf monitoring with camera traps: The view into an ecosystem

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The Wolve-Monitoring in Saxony-Anhalt, Germany is organized by technical authorities of regional environmental Protection Agency, named "Wolfskompetenzzentrum Iden". Beside classical methods of animal monitoring like searching tracks, scats, collecting genetical information and recording observation we use more than 200 camera traps in occurrence area and territories of wolve in our federal state. The Aim is to recognize the Status of these Territories (Pack, Pair or single Wolve), to count Familymembers and to see what else live inthere. Focused on endangered species, like polecat, marten, wildcat, lynx or beaver. These Presentation shows results of wolvemontioring, recording of endangered species and chance finding of extraordinary observation.

7 Scalar and hierarchical processes enhance our understanding of rendezvous site selection by wolves in human-modified landscapes

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Habitat selection is a process whose hierarchical and scalar components, both in space and time, are fundamental to consider for understanding habitat choices by animals, especially territorial ones such as wolves. Similar to other large carnivores, most European wolves live in human-modified landscapes and adopt habitat-mediated strategies to co-habit with humans while minimizing the associated risks. Despite wolves are generally considered habitat generalists, some critical behavior and life cycles, such as pup nurturing and rearing, are clearly habitat-dependent, especially in human-modified landscapes. By means of GPS telemetry, complemented by wolf-howling and camera trapping during summer, we investigated habitat selection by wolves in the Abruzzo Lazio and Molise National Park (PNALM, central Italy), where wolves have historically coexisted with humans (14.6 inhabitants/km²). Specifically, using a set of anthropogenic, topographic, and land-cover variables, we developed multigrain resource selection functions (MRSFs) both at the landscape and territory extents (i.e., 2nd and 3rd order of selection, respectively). To implement MRSFs, we used generalized linear mixed models and model selection procedures (R packages lme4 and MuMin, respectively). We hypothesized that habitat responses by wolves would vary based on both the extent and the grain, and that changes in the ecological domain of wolves would become apparent contrasting different orders of selection (i.e., selection of the territory vs selection of the rendezvous sites, RVs, within the territory). From 2006–2010, we detected 31 RVs in 8 wolf packs. Habitat selection at the territory level showed avoidance of human presence and positive selection of forest cover, as well as proximity to unpaved roads and trails, likely to enhance hunting and traveling efficiency. Habitat choices at RVs also accounted for forest cover but relaxed avoidance of anthropogenic features, with the exception of low-use, linear features, possibly revealing a trade-off between safety and traveling efficiency. In addition to clarifying which habitat features are relevant to wolves when establishing their territory and the RVs within it, our findings also warn against designing such studies irrespective of the hierarchical and scalar nature of habitat selection by wolves.

8 Wolves and tourists on an Italian beach: Avoidance or attraction?

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The Italian wolf population has experienced a significant increase in the last decades, including the expansion of its distribution range, with an increase of wolf presence in areas where it was not recorded for the last 50 years. One such area is Duna Feniglia Natural State Reserve, on the Tyrrhenian coast of southern Tuscany. The area (478 ha) is a sandy bank with old pinewood, stretching for 6 km, between the coastline and Orbetello marshy lagoon. The Reserve is heavily frequented by mass tourism, which uses the beach for bathing activities during the summer period, while during wintertime is mainly used for leisure activities by locals. One reproductive wolf pack was detected in summer 2017 and its presence, noticed by inhabitants, created social alarm. Sightings were reported in social media and to local carabinieri forestry police, and camera traps were set up to systematically monitor the spatial movements of the nucleus members. All sightings were verified and recorded in a database, coding the observed behaviour. The Carabinieri Biodiversity Department, that manages the Reserve, engaged in a communication process with the local community, using a supportive and transparent approach to ensure that people maintained a proper behaviour. We analysed the activity patterns of wolves using data from 14 camera-trapping active 24h from December 2017 to December 2018 (over 150 wolf records in more than 700 camera days), and we collected 82 wolf scats from April-October 2018 to assess the food habits. We detected, through the camera-trapping data, a significant shift in the wolf activity patterns during the high touristic season compared to low touristic season (Watson's Two-Sample Test of Homogeneity: 0.492; $p < 0.001$). The preliminary rough excrements analyses underlined a wolf prevalence use of fallow deer (36.5%) and wild boar (24%) as well as a 4% bird and 29% vegetable. Although preliminary and site-specific, related to a small portion of the wolf home range including the rendez-vous sites, the results suggest that wolves in the high touristic season seemed to avoid humans, showing mostly crepuscular and nocturnal peaks of activity, while they tended to be more diurnal during low touristic season, when human presence is scarce and mainly concentrated at weekends. Preliminary data from scat contents also suggest that, although available from rubbish and food remains, human sources of food were marginal, and natural trophic resources represented the main diet of wolves in the area rich of wild preys.

9 Recolonization vs colonization: Is the wolf recolonization affecting the golden jackal colonization? The case study of Friuli Venezia Giulia Region (North East of Italy)

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After being absent for over 100 years, the wolf has recently started to recolonize the Friuli Venezia Giulia Region (North East of Italy). In this area, the presence of the golden jackal dates back to the mid 80's, following the expansion of the Balkan population. This process poses important ecological and management issues. To better understand the relationships between these two carnivores, we studied their dynamics of presence/absence, behaviour, habitat use, and the degree of occupation and disappearance in the area. To do so, we combined the results obtained from different monitoring methods: snow-tracking, acoustic stimulation, camera-trapping and opportunistic data, collected within 18 quadrants of 100 Km² and during three different periods: 2010-2013, 2014-2017, 2018-2022. Specifically, we evaluated this trend especially in the last period (i.e., 2022) by increasing the number of monitored quadrants ($n = 31$). To investigate how the presence of the wolf affects the one of the jackal, we explored the habitat selection of the two predators considering the period pre- and post wolf re-appearance in the sampling areas. During the three periods, the presence of the jackal increased, with a percentage of occupied quadrants (even for a single year) varying from 39% ($n = 7$, first period) to 67% ($n = 12$, third period). The same was observed for the wolf where it was absent or occasionally present in the first two periods, up to recording its presence in 61% ($n = 11$) of the monitored quadrants in the third period. In 2022, the presence of the wolf was reported in 58% ($n = 18$) of the quadrants ($n = 31$), while the one of the jackal in 32% ($n = 10$) of them. Only five quadrants of copresence were observed. The jackal has been showing specific dynamics, with areas of permanent occupation and other occupied for shorter periods. Some areas recolonized by the wolf were abandoned by the jackal, which in turn started to colonize new areas, in particular lowlands characterized by low-middle level of naturalness. The wolf, particularly in those natural areas in which stable packs are present, seems to be the dominant competitor, thus influencing the behaviour of the jackal, its habitat use as well as the dynamics of colonization.

10 Overcoming (in-)visible borders in regional management of wolves

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Today, the federale state of Baden-Württemberg may be at the bottom of acceptance towards the current return of wolfs. An everyday normality with regard to large carnivores therefore seems to be a long way off: carnivore damage on cattle, the first resident wolves and the establishment of herd protection areas trigger uncertainties and mistrust in management institutions. In the coming years not only single males, but packs will establish themselves in south-west Germany. Until then, one question is crucial: How to overcome the lack of trust in management? While management is currently focused on improving preventive herd protection and monitoring single male wolves, complex structures in communication and networking become visible. Especially at the regional level, management and science are looking at a profound alienation between agriculture and nature conservation and at highly emotional conflicts in which the wolf sometimes acts as a magnifying glass and brings to light any deficit in unbalanced communication. In order to establish a functional, trustworthy management of wolves we see that overcoming visible and at least identifying invisible borders is crucial for a sustainable and adaptive management of this species. We aim to: (a) Consider borders in mind sets, attitudes, lobbyism and administration as an every day normality to deal with. (b) Identify stakeholders, networks and group dynamics that hinder appreciative communication and create measures to deal with it. (c) Differentiate challenges on multi-layered scales in management of different stakeholder-groups, specify needs and measures to formulate realistic goals in acceptance. (d) Create measures to approach complex management systems in regional administration and local challenges in herd protection regardless of the current political situation within the federal state. (e) Use transparency in monitoring as a tool for trust building, especially on an regional scale. (f) Improve transfer of knowledge by differentiation of target groups. (g) Learn from other federale states and neighbouring countries and improve cooperations without regard of administrative borders, just like the wolf does.

11 Factors that affect the genetic diversity and distribution of coastal wolves in northern British Columbia

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Wolves in coastal British Columbia and southeast Alaska are considered genetically, morphologically, and functionally distinct from their mainland conspecifics. They inhabit temperate rainforests that occur on off-shore islands and along the mainland coast; a range that is naturally fragmented by mountain ranges, steep terrain, and expanses of ocean. Given the subspecies' unique ecological and genetic characteristics, coastal wolves warrant direct conservation. A recent petition to list coastal wolves in southeast Alaska under the Endangered Species Act has sparked an urgency to gain a more refined understanding of the spatial extent and genetic connectivity among subpopulations in southeast Alaska and northwest British Columbia. Thus, the objectives of this study are to examine landscape connectivity between coastal wolf subpopulations in northern British Columbia and identify corridors and geographical features that may influence genetic continuity between subpopulations. To accomplish this, genetic data will be collected from wolves using non-invasive hair snag boards and scat. DNA extraction and genotyping will use a vetted 24 microsatellite loci and will be conducted at Wildlife Genetics International. I will then use Omniscape to model connectivity using habitat data to inform different resistance surfaces and examine variability among predicted corridors. Then, with the program STRUCTURE, use genotype data to identify subpopulation differentiation for the study area. I will then establish geocenters for each subpopulation, rebuild the Omniscape model to best fit subpopulation differentiation, and identify critical geographical corridors for connectivity among coastal wolf populations. The results of this study will inform the petition for listing in Alaska which has management implications for the subspecies as a whole. The Province of British Columbia should be proactive in addressing the conservation concern of coastal wolves and use this opportunity to collate data being collected in Alaska to produce a transboundary understanding of this subspecies to enhance the management and conservation of the subspecies as a whole.

12 Livestock predation by wolves in Saxony-Anhalt, Germany

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Since the natural recolonization of wolves to the federate state Saxony-Anhalt in Germany started with the first settlement of wolves in 2008 and the first reproduction in 2009, their numbers have increased up to 37 territories in the monitoring year 2021/2022. Accompanied by this increase, human-wolf-conflicts, especially in the form of livestock predation, rose as well. Several measures and a funding programme were established by authorities to support livestock owners in protecting their livestock from wolf attacks. Although wolf attacks on livestock increased with rising wolf numbers, the increase was not equivalent and there was no causation visible. During the majority of wolf attacks, livestock was not properly protected. In Saxony-Anhalt, wolf attacks peaked in February and March while the fewest attacks happened in summer from May to July. The geographical distribution of wolf kills in Saxony-Anhalt also showed regional differences. Although, for the last years, most wolf territories were found in the administrative district Wittenberg, the most attacks on livestock occurred in the administrative district Jerichower Land. This again showed that there is no direct causal relation between wolf numbers and attacks on livestock. Some wolves were repeatedly identified at different livestock kills. However, there was no evidence of any specialisation in killing livestock. It was more likely that those wolves took their chance when fences showed weak spots. 14 years of assessing livestock kills in Saxony-Anhalt have shown that the most effective method to protect livestock is the establishment of livestock protection measures such as electric fences. Wolf attacks on cattle, for example, are decreasing in Saxony-Anhalt since the establishment of a funding programme for electric five-strand cattle fences.

13 Are wolves losing their fear of humans in human-dominated landscapes?

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Wolves have expanded their range throughout Europe in recent decades, increasingly occupying human-dominated landscapes. Successful management of the resulting challenges of wolves living in close proximity to humans can only be based on sound scientific knowledge. Existing studies show that the avoidance of human activities is a major factor affecting wolf behavior and limiting wolf space-use. This seems to contrast with the increasing number of wolf observations in densely human-populated areas as well as close human-wolf encounters, suggesting behavioral changes in wolves towards humans. These observations have prompted much discussion as to whether wolves are losing their fear of humans as a consequence of less fearful behavior being favored by the combination of: 1) the benefits resulting from accessing anthropogenic food resources in human-dominated areas (e.g., livestock and garbage); and 2) the reduced risk of being killed by humans attributable to increasing species protection legislation and hunting bans. What impact does human presence have on wolf behavior? We tested the behavioral response of wild wolves towards simulated human presence in the Tuchola Forest, Poland. In this area wolves share the landscape with tourists, mushroom pickers, hunters and foresters, which creates clear spatiotemporal gradients of human pressure. We used automated camera trap-speaker systems to video-record wolf responses to playbacks of humans (speaking calmly), dogs (barking) and non-predator controls (birds calling). We expect that wolves will react strongest to human vocalizations and mostly display a flight response. Moreover, we predict that hearing dogs may trigger a mixed response, with wolves sometimes being repelled and at other times attracted. We will present our preliminary results during the Wolves Across Borders conference. The insights from this study will not only contribute to predicting future wolf population dynamics and the possible ecological consequences, but also help to develop management strategies for human-wolf coexistence.

14 Approach and exploration behavior of wolves (*Canis lupus*) towards selected livestock fences

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This study shed light on approaching and exploration behavior of wolves (*Canis lupus*) towards a selection of livestock protection fences to evaluate possible deterrent effects of color, shape, height and electrification of the fences, as well as wolf strategies to cross them. In 2017, three enclosed wolf packs were filmed in a french wildlife parc under comparable conditions. Neither the tested blue-white two-strand fence (upper strand: 65 cm, lower strand: 25 cm), nor the three flock nets (black-white u. 106 cm; white u. 90 cm; blue-white u. 90 cm height) showed a significant deterrent effect. The wolves got used to the fences' presence within 96 h and were daring to approach closely. Nevertheless any electrified fence was respected as boundary. The surveys showed that the wolves, while exploring, focused the ground area of all fence types. Moreover, a non-electrified two-strand fence was undermined and thus passed by one pack. These results support benefits of electrified fences with near-ground (< 20 cm height) or ground-guiding strands, or alternative means of securing the ground area against undermining, for practical application in livestock management. Wolves did not attempt to jump the two-strand fence, nor the flock nets, but comparisons between the packs indicated that lower fence systems (≤ 90 cm) could be explored more frequently above than in the ground area. To optimize the efficiency of electric fences and to minimize the possibility of jumping over small fences, it is reasonable to recommend either higher fences (≥ 105 cm) or additional over-climbing protection. There was no evidence that a blue-white flock net was more deterrent to wolves than a white flock net, although wolves can probably see in the blue wavelength range. Instead, a strong light-dark contrast, a high number of horizontal strands, and an overall narrower mesh width combined with an overall height of approximately 105 cm might be more relevant. The results also provide evidence that wolves may lose interest in a fence if they fail to cross. For a stronger validity of the results, further behavioural research in the field would be preferable to assess herd protection fences.

15 Accounting for individual animal variability in habitat suitability models for the wolf in Croatia

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Identifying areas characterized by suitable habitat for the wolf at the landscape level is pivotal for guiding effective conservation and management actions for the species. The increased availability of wolf GPS-locations in regions of Europe where they were scarce, gives the opportunity to improve habitat models previously based on expert opinion or developed from opportunistic species occurrence data. Although GPS points provide accurate information on animal locations, predicting habitat suitability from GPS data pose the challenge to account for individual animal variability in habitat preferences, which is especially important when dealing with behaviorally complex and opportunistic species. Our goal was to map habitat suitability for the wolf in Croatia using GPS locations collected from 32 individuals. We analyzed wolf habitat preferences on a seasonal basis, using hierarchical generalized additive models (HGAMs) to account for wolf individual responses to topographic, land cover and anthropogenic variables. We validated maps of predicted seasonal habitat suitability using the continuous Boyce index on an independent dataset of verified wolf observations. Across all seasons, wolves showed preferences for areas with higher coverage of conifer and mixed forests as compared to availability in the study area, whereas settled areas negatively influenced wolf occurrence during summer. During fall and winter, wolves selected areas at intermediate altitudes, whereas there was higher variability in selected altitudes during summer. The continuous Boyce index showed that models performed well in predicting wolf occurrences ($CBI=0.89\pm 0.14$). Our case study illustrates how HGAMs can provide a desirable framework to model habitat suitability for the wolf, accounting for individual variability. Furthermore, the maps produced in our study can be a useful tool to indicate areas with higher habitat suitability for the wolf in Croatia and assist in the assessment of the impact of infrastructure planning and development.

16 Developing Management Strategy Evaluation (MSE) tools for wolf population management in Finland

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In Finland, the wolf (*Canis lupus*) has recolonized many areas, which has resulted in urgent need to provide transparent information on various wolf-related topics to different stakeholder groups. To meet this need, new modelling efforts have been launched. Here we present one of these efforts, the management strategy evaluation (MSE) modelling framework, which aims at comparing alternative wolf management strategies in the light of management objectives identified by different stakeholder groups. The work is part of LIFE BOREALWOLF project (2019–2025). The focus is especially on multispecies management, i.e., the model aims at combining wolf population dynamics to ungulate (e.g., moose (*Alces alces*) and white-tailed deer (*Odocoileus virginianus*) and other large carnivore (e.g., brown bear (*Ursus arctos*) and lynx (*Lynx lynx*) population dynamics. This part of the work forms the ecological core of the model. Further, the model will include several socio-economic factors. Stakeholder involvement plays a major role in the process, which started by arranging a webinar, a web survey, and a workshop to relevant stakeholders, i.e., all stakeholder groups that had participated in updating the national management plan for the wolf population in 2019. Here, the aim was to identify relevant outcomes to be included in the model together with different management actions that can potentially affect the outcomes. The outcomes identified by stakeholders included factors like the status of wolf and moose populations, the number of killed or injured hunting dogs and domestic animals, and the number of moose accidents. The management actions brought up by stakeholders were related to, e.g., moose hunting practises and prevention of losses of domestic animals by using protective fences. When completed, the MSE tool gives the game administration a possibility to compare different wolf population management measures efficiently and transparently.

17 The natural resettlement of wolves in Normandy, France

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After an absence of over a century, the return of the wolf to Normandy took place on lands of Pays de Bray from November 2019 to February 2021, then in Pays d'Ouche in the spring and summer of 2021. Today, its presence has once again been confirmed in Pays de Bray. The specimen staying in the area is a wolf of Italian-Alpine lineage, looking for territories that remain unoccupied and a female mate. Between these lupine episodes, observations and signs of its presence is generating doubts in all five departments in the Normandy region. The predation of wildlife and domestic stock have been found, creating an unprecedented situation for stakeholders of the land, including professional breeders and owners of sheep, judicial authorities amongst others. For now, DNA analysis can confirm the presence of one specimen but it cannot determine whether any other counterparts roam within the region. In the course of a Geography Master degree, research was carried out to study the impact of the predator's arrival in Normandy. We met with different stakeholders in order to identify issues and address questions following the return of the wolf. Our exploratory proposal culminated in a thesis which highlighted the apprehensive difficulties associated with the presence of the wolf in lowlands zones. Indeed, the legal framework and mechanisms to protection domestic stock are adapted for mountain areas and their agricultural contexts. In Normandy, sheep and goat farming are extensive and predation is primarily an issue concerning hobby breeders (who keep small ruminants for leisure, yard maintenance or personal consumption) and few professional breeders who often breeds sheep or goat as a secondary activity. Facing new environmental, ecological and social issues induced by the presence of wolves, our research continues in the framework of a PhD thesis. We examine questions relating to space and territorial mixed-use. This geographical work is part of a research-action initiative, the operational aim of which is to produce a tool to assist recommendations and decision-making that can contribute to the public management of the species in Normandy.

18 Dancing with wolves: Behavioral responses of moose to close proximity of wolves in Scandinavia

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Carnivores have been recolonizing Scandinavia, and the consequences of their presence on prey species remain unclear. With the return of wolves (*Canis lupus*), it has become increasingly interesting to test if and to what extent prey species still exhibit some anti-predator behaviors. Contrary to studies in North America, Scandinavian moose (*Alces alces*) have been found to exhibit little to no anti-predator behaviors when confronted with wolves. The present study tests whether this dynamic has changed. We studied the movement behavior of 28 moose and 8 wolves with GPS-collars over three years in Scandinavia from 2018 to 2020 and used linear mixed models and generalized mixed effect models to identify factors associated with a change in behavioral pattern before, during or after close proximity. We used rate of movement (speed), linearity of movement, daily range sizes and overlap as well as habitat use as response variables. We hypothesized that (i) moose would move faster after close proximity than before, (ii) that they would move less linearly after than before, (iii) moose would have larger daily ranges after close proximity than before, (iiii) daily ranges would overlap before and after but not before and during and event, and (v) moose would exhibit spatial displacement by using different habitats after a close proximity event. Results confirmed four out of five of our hypotheses; contrary to what we expected, moose daily ranges were larger before a close proximity event than after. Our results suggest that Scandinavian moose exhibit different behavioral changes when in close proximity with wolves. However, further studies should investigate how human impacts through hunting can affect the slow re-adaptation of moose to wolf presence, as well as how it affects wolf predation efficiency.

19 Let's work together: Volunteers promote wolf and livestock coexistence gaining a higher tolerance of wolf presence

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After being extirpated for over one hundred and fifty years, wolves migrated back to Lower Saxony, Germany since 2008. Their reappearance found mostly sheep farmers (but also cattle farmers and horse owners) unprepared and quickly led to an increase of lethal wolf attacks on unprotected livestock. Grazing by sheep is an essential part of conserving high-value extensive grasslands in Lower Saxony's cultural landscapes. Wolves were in general welcomed by nature conservationists, but strongly opposed by livestock farmers. This situation led to highly emotional debates about wolves and their right to live in densely populated areas as Lower Saxony. To support livestock farmers adopting to the new situation, safeguard grassland grazing for nature conservation and bringing nature conservationists, often with pro-wolf attitudes in exchange with livestock farmers, Lower Saxony's Nature and Biodiversity Conservation Union (NABU) implemented its novel livestock protection project in 2017. Farmers could ask for assistance by volunteers specially trained in fencing and then jointly build electric fences according to highly wolf-deterrent standards. We conducted 50 semistructured interviews with volunteers and participating farmers before and after the project period. Main motivations for participation of volunteers were i) practical work and positive group experiences outdoors, ii) personally helping to lessen the perceived hardship of livestock farmers and iii) positive attitudes towards wolves. Main motivations for farmers were i) economic, ii) a perceived lack of support by the state, iii) lacking technical knowledge in wolf-deterrent fencing and iv) the growing professional reputation of the volunteer project team. Both groups emphasize a deeper understanding of the other side's arguments, all livestock farmers in the post-project sample praise the project's support. Several farmers mentioned a lasting relief from severe negative stress that they experienced before fencing their animals. Overall, a higher tolerance for wolves is apparent.

20 Use of passages across a high-speed railway by Iberian wolves

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The barrier effect of linear transport infrastructures on wolves has raised increasing conservation concerns, such as in human-dominated landscapes of Europe, with a high development of transport infrastructure networks. Most attention has been focused on road networks, with the potential impact of infrastructures, such as High-Speed Railways being less evaluated so far. During 2021 and 2022 we collared three Iberian wolves in Tierra de Campos, an agricultural human-dominated landscape in NW Iberian Peninsula, to assess the use of passages across the Palencia-León High-Speed Railway. The wolves belonged to two adjacent wolf packs. The averaged home range of the wolves was 1007 km² and all home ranges were traversed by the High-Speed Railway. All wolves often crossed this infrastructure, with a ratio of 0.17, 0.27, and 0.51 crossings/day. The highest crossing rate was observed during September 2022, when the pups of one of the packs were located in a rendezvous site 750 m away from the High-Speed Railway. During this period, a non-reproductive female crossed the railway 1.9 times/day. The wolves used different passages, mainly high non-adapted overpasses, cross drainage culverts, and viaducts. Wolves also used passages to cross regularly the double fenced, four lane A-231 highway, which runs in parallel to the high-speed railway. Our results suggest that wolves are able to cope with these infrastructures as soon as there is enough availability of passages.

21 Diet of wolves in the Holy Cross (Świętokrzyskie) region of central Poland

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We study the composition of the wolf (*Canis lupus*) diet in the northern foreland of the Holy Cross (Kielce upland 20°33'34" E - 21°23'39"E, 51°19'12" N - 50°41'35" N) region in central Poland, as a part of the wolf population monitoring program. As is in most of Poland wolves in the region were exterminated in 1950. They started to recolonize the region in 1980 and now the area holds 10-12 packs of wolves, 60-80 individuals. The area is a mosaic of forest, small-scale agriculture, villages, and towns, with a dense network of public roads, including major highway S7. It is to our knowledge the most densely populated (127 people/km²) area in Europe that holds substantial numbers of wolves. The potential wolf prey are ungulates (red and roe deer, wild boars, moose) hares, and beavers. Between September and December 2021, we collected wolf scats (n=252) in 7 forest complexes, home to 7 wolf packs. After being collected, the samples were stored frozen, rinsed to isolate hairs and bones, and then dried. These were then subjected to microscopic analysis to determine the species of prey. Ungulates predominated the diet of wolves (88.6% of occurrence, 97.7% of total biomass). The most important prey of wolves in the region were wild boars. We found their remains in 25% of samples, which accounted for as much as 55.1% of the total biomass. Wild boars are especially common in the renaturalized agriculture areas, which constitute up to 25% of wolf habitat in the study area. The roe deer were the most frequent (49.7% samples), but they accounted only for 19.9% of the total biomass. Red deer, occurring in 12.9% of the samples, accounted for 24.5% of the total biomass. Noteworthy, we recorded a relatively large percentage of aquatic rodents. Beavers, nutria, and muskrats accounted for nearly 10% of the samples examined, but beavers were the most frequent (6% of samples, 1.9% of total biomass). Surprisingly, we did not identify moose remains in the samples, although moose are quite common in the study area. We also did not find a single sample that indicated the presence of domestic animals, which is explained by limited animal husbandry in the region.

22 Wolves in Germany: Return and management

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In 2000 the first wolf pack after 150 years of absence was confirmed in Germany close to the Polish border. This was the starting point for a rapid population growth and spreading. In 2021 more than 200 wolf territories were confirmed in Germany, most of them in the North-Eastern part of the country. The price for living in such a densely populated and fragmented landscape is a high anthropogenic mortality. The annual number of wolves found dead mimics the population growth and traffic fatalities are by far the most common cause of death. Although the wolf is strictly protected by federal law, the implementation and enforcement of nature conservation is the responsibility of the federal states. In consequence, wolf management is regulated on federal state level. The main conflicts related to the return of wolves are wolf-livestock conflicts. All federal states have a system for financing damage prevention and compensation measures. However, the details for funding and compensation are differing from state to state. This is partly also true in respect to wolf monitoring. Wolf surveillance is conducted annually with the goal of obtaining reliable area of occurrence and population size estimates at the national level. The data collection is funded, organized, and conducted on federal state level. Uniform data evaluation and interpretation across administrative borders is ensured by the national monitoring standards. The backbone of the current monitoring system is the genetic identification of wolf family groups. Nearly 4000 genetic samples are analysed annually in the national reference centre for genetic analyses. The genetic centre is together with other scientific institutions part of the scientific consortium “Federal documentation and consultation centre on wolves” (DBBW) that was funded in 2016 and advises federal and state conservation agencies on all wolf-related issues upon request. The DBBW among other compiles the wolf monitoring data annually on a national level. The results are published on the DBBW-Website <https://www.dbb-wolf.de> where also current data on wolf monitoring can be found.

23 Smelling fear, can we create a landscape of fear for large ungulates by applying wolf scent only?

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Local overabundances of ungulates can often lead to increasing human-wildlife conflicts. Traditionally, wildlife management aims at lethal population control, but inducing fear in prey by applying risk cues over the landscape could be a more sensible solution. Redistributing ungulates over the landscape and prevent them from coming in conflict-prone areas could quicker reduce conflicts than aiming at population control in an entire area. We studied the efficacy of using a gradient of grey wolf (*Canis lupus*) urine scent at landscape-scale to induce fear in red deer (*Cervus elaphus*). A grid of 50 camera traps was homogenously distributed throughout a 3,300 ha enclosure in the Belarusian part of the Białowieża Forest to assess red deer behaviour, space use and group size, 1 month before and 1 month during applying wolf urine at 105 locations. We expected that red deer would spatially avoid areas with high wolf urine concentrations. Moreover, we expected red deer to express more induced vigilance, less foraging, move more and form larger groups during the treatment than during the control period. Our results showed that red deer did not spatially avoid locations with high urine concentration and their visitation rate remained unaffected by the urine gradient. During the treatment period, red deer spent unexpectedly less time on induced vigilance than during the control period, but they spent significantly more time running. Female adults decreased nocturnal foraging levels and weaned juveniles increased overall vigilance levels with increasing urine density in the landscape. In conclusion, an artificially created landscape of fear based on wolf urine markings alone, does not evoke a spatial response in red deer. Moreover, the actual distribution of predation risk (i.e. induced by human presence) throughout the landscape might be different than we predicted, and other confounding factors might mediate the perceived predation risk of red deer. Wildlife management should not rely on repellent effects of predator scent alone and consider a mixture of predator cues.

24 Field observations of high tolerance between wolves and jackals in an arid grassland of Maharashtra, India

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(3) Oviedo University, Spain

(4) RESQ Charitable Trust, India

Wolves (*Canis lupus*) coexist with several “subordinate” carnivores across its range, and are known to show low tolerance, and even predate on other canids, including golden jackals (*Canis aureus*). In such scenarios, niche partitioning (particularly spatio-temporal segregation), has attracted most attention as a coexistence mechanism. Accordingly, it would be expected that jackals exhibit a strong spatio-temporal avoidance toward wolves at small scales. In this regard, we describe two unexpected and complementary field observations of high tolerance between wolves and jackals in Maharashtra, India. In the first observation, jackals and wolves were observed feeding simultaneously on a cow carcass in Shingave (Pune District). In one hour and a half of carcass monitoring, the number of wolves observed at the carcass varied from one to four and that of jackals from one to seven. During this time both species were observed feeding simultaneously for twelve minutes. The number of jackals feeding along with wolves ranged from one to five while that of wolves ranged from one to three. The most frequent jackal/wolf ratio feeding simultaneously at the carcass was 1:2 (35% of time), followed by 3:1 (13%), 1:1 (12%), 2:2 (10%). Some short, agonistic interactions (without physical contact) occurred during this time, sparked by wolves but also by jackals. Around two years later, we observed in the same area an adult wolf female integrated in a group of jackals. During these observations (n=8 in four months) up to seven jackals, including pups, were observed together with the wolf. In one occasion, the wolf responded agonistically to four dogs approaching the jackal pups. To our knowledge, these observations illustrate the highest degree of tolerance between wolves and jackals described to date. In this regard, jackals had been previously observed tracking wolves in order to access kill remains, but not feeding simultaneously. We discuss the potential role of food availability and other context particularities (e.g. disintegration of a wolf pack) that may play a role in relaxing the niche partitioning assumptions for asymmetrically competing species.

25 Current status of the wolf (*Canis lupus*) in Austria

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About 15 years ago wolves started to recolonize Austria after their extermination in the 1840's. Scattered earlier evidence was collected since 2002 in Upper Austria, Lower Austria and Styria. Towards the end of 2015 the first pair of wolves in Austria was recorded in the Allentsteig military training area. From 2016 on this pair has produced 6-8 pups nearly every year. In 2018 two additional packs were confirmed in the same region. In 2022 the first pack in the Alps of Austria was established and the number of packs in the whole country rose to four at the minimum. Apart from the Allentsteig pack all packs were instable and did not exist at least with the same parents from one year to the next. The number of single wolves dispersing from the surrounding countries into Austria is growing from year to year. Wolves from Austrian packs are also dispersing out of the country. In two cases, we recorded the journey of wolves with GPS Collars. One female travelled to the Check Republic and one male to Poland. Both of them reproduced in the following years. In Austria, we expect more single individuals and packs in the following years. This prospect resulted in an agreement of states in Austria to better organize Wolf monitoring in 2023 by better involving the local population in the opportunistic monitoring all over the country and installing a systematic monitoring within pack areas.. Austrian hunting association agreed to be a substantial part of monitoring contributing with resources and data. Additionally, a consolidation of methods used by the genetic labs in the alpine area is necessary in order to effectively share genetic information about wolves crossing borders.

26 Ungulates navigate the risk landscape mainly through adaptations in space use rather than vigilance

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Due to rapid global change, large predators are recolonizing human-dominated landscapes. Managing the (perceived) risk created by both carnivores and humans requires novel behavioral adaptations in their prey species. Thus the question remains how ungulates respond to novel wolf presence. Therefore, we measured the space use and vigilant behavior of ungulates in a recreational area in The Netherlands where wolves recently established. We installed wildlife cameras across a gradient of wolf space use, close to (20m) and further from (100m) from hiking trails used for recreation. Deer spatially avoided locations closer to the core of the wolf territory and avoided plots closer to trails during the day. We found no effects of the wolf risk gradient nor of the distance to trails on vigilance levels, contrasting a variety of research in other systems. Our results indicate that deer in our study area mainly navigate the risk landscape through adaptations in space use rather than vigilance. Hereby, our study indicates that effects of recolonizing wolves on ungulate behavior, and thereby on the landscape, are ambiguous and may be system and context dependent.

27 Phylogeography of wolves in the Caucasus, Carpathian, and Dinaric-Balkan regions

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(5) University of Belgrade, Serbia

(6) Stefan cel Mare University of Suceava, Romania

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(9) Milvus Group Bird and Nature Protection Association, Romania

(10) Civil Society for the Protection and Management of Wildlife and the Natural Environment, Greece

(11) Norwegian University of Life Sciences, Norway

(12) University of Zagreb, Croatia

(13) Russian Academy of Sciences, Russian Federation

(14) BALKANI Wildlife Society, Sofia, Bulgaria

The Balkan Peninsula played an important role in maintaining biodiversity during the glacial periods and subsequent post-glacial recolonization of Central and Northern Europe. Several studies have shown that refugia further north and east, such as the Carpathians and the Caucasus, were also vital for the postglacial dispersal of several species and contributed to their complex phylogeographic patterns. These areas are important reservoirs of genetic diversity for highly mobile species such as the Eurasian lynx (*Lynx lynx*), brown bear (*Ursus arctos*), roe deer (*Capreolus capreolus*), and many others. Understanding the historical relationships among populations could help reveal species phylogeography on a continental scale. We examined the grey wolf (*Canis lupus*), a species where substantial populations have persisted in the predominantly mountainous Caucasus, Carpathian, and Dinaric-Balkan regions. We combined previously published haplotypes of mitochondrial DNA (mtDNA) control region with new haplotypes from Croatia, Bosnia and Herzegovina (B&H), Serbia, North Macedonia, Greece, Bulgaria, Romania, Ukraine, Russia (the Greater Caucasus mountain range), Georgia, and Armenia, to better elucidate the role of these regions in contemporary wolf phylogeography. In the final dataset of 926 sequences (529 new) with a total length of 223 bp, we detected 26 haplotypes including five new unique haplotypes identified in single individuals from Serbia, B&H, Croatia, Ukraine, and Russia. The highest number of haplotypes was detected in Bulgaria ($N_a = 10$) and the lowest in B&H, Montenegro, and Armenia ($N_a = 5$). The highest haplotype (H_d) and B diversities were detected in the Caucasus (Russia and Georgia) ($H_d = 0.76$, $B = 3.77$), whereas the lowest in Serbia ($H_d = 0.51$, $B = 2.01$). We detected two main haplogroups H1 and H2, already described in the literature. Three sub-haplogroups were defined in haplogroup H1: H1A, H1B, and H1C. Haplogroups H1A and H1B overlapped throughout the study area, whereas H1C occurred only in the southern Caucasus, in Armenia. Haplogroup H2 was detected throughout the study area, with the greatest dominance in the Balkans and Carpathians. Spatial analyses with SAMOVA and Geneland identified four ($K=4$) clusters. Further research with genome-wide nuclear markers, complete mitgenomes and data on environmental and ecological variables could help clarify past and current genetic structuring.

28 Many hands make light work: Involving citizen science volunteers contributes significantly to wolf monitoring efforts in Lower Saxony

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After an absence of 150 years, the wolf returned to the German federal state of Lower Saxony in 2008. By the end of 2017, 17 wolf packs had been confirmed through standardised wolf sign monitoring methodology (SCALP), conducted through passive sign collection via the state hunting association. In 2017, NGO Biosphere Expeditions and the state wolf bureau began a cooperation to provide international citizen scientist volunteers for active wolf sign monitoring to augment passive monitoring and supplement the SCALP database. They organised five citizen science monitoring expeditions between 2017 and 2022. Partly as a result of this increased monitoring effort, the number of confirmed wolf packs rose to 48 by 2022. Between 2017-2022, a total of 136 citizen scientists actively monitored designated study areas for wolf signs in June/July each year. 10-12 citizen scientists and two to four staff were on site for seven days (2017: four groups, 2018: two, 2019: two, 2020: one (Corona), 2021: none (Corona), 2022: three). The first two days of each group were used for intensive methodology training, followed by four days of field work in small groups of two to four people. Groups covered a total of 3,720 km on public footpaths and tracks only - to comply with access regulations and maximise sign detection probability. All signs found were recorded following the SCALP protocol. 1052 wolf scats and 245 other wolf signs were found. After quality assessment, 647 wolf scats were entered into the official wolf monitoring database, of which (a) 108 were analysed genetically, (b) 611 were searched for prey animal remains, (c) 78 (12%) were classed as sign quality C1, 157 (24.5%) as C2, 407 (63%) as C3 and 5 (0.5%) as false (originating from fox). The quantity and quality of samples collected by citizen science efforts is remarkable, boosting official wolf sign records by an average of 19,1 % over five years of monitoring (2017: 30,4%, 2018: 33,2%, 2019: 20,3%, 2020: 6,2%, 2022: 25,5%). The project serves as a showcase of how international citizen scientists can make a significant contribution to regional wildlife monitoring and concomitant conservation efforts.

29 The effect of grey wolf (*Canis lupus*) and human disturbance on the activity of big game species in the Bükk Hills, Hungary

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(2) Directorate of Bükk National Park, Hungary

(3) WWF Hungary, Hungary

(4) University of Lisbon, Portugal

The recent return of wolves to the Hungarian forests escalates conflicts among stakeholders. Hunting management agencies communicate that the presence of wolves may change the behaviour of big game species leading to difficulties for hunting organization and logistics. Here, we take a data driven approach to explore the activity of wolves and big game species. For this purpose we analysed camera trap data, collected in the Bükk National Park, Hungary. To estimate avoidance among wolves, humans and games we calculated a non-parametric activity overlap coefficient ($\Delta 4$) and used a machine learning (XGBoost) model. Our results show that game species have higher overlap coefficient with wolf ($\Delta 4 = 0.83-0.89$) than with human activity ($\Delta 4 = 0.26-0.52$), because predators and games are active in the same periods of the day, mainly night and dawn, and human activity mainly takes place during daytime. We classified site locations as low human density (LHD) and high human density (HHD) areas. HHD results in higher overlap between wolves and games which might indicate that games accept a higher overlap with wolves to decrease the overlap with humans. Our XGBoost analyses only found a moderate negative effect of wolf on red deer occurrence, while human activity had higher importance value and lowered the occurrence of all three game species investigated. Our results may thus indicate that human disturbance might be more important in shaping game activity than the presence of the grey wolf in Hungary.

30 Helping farmers to prevent depredation on livestock mitigates the wolf-human conflict

Mari Tikkunen (1), Mikko Jokinen (1), Jenni Pirinen (1), Mari Lyly (1), and Mikael Luoma (1)

(1) Finnish Wildlife Agency, Finland

The wolf population in Finland has expanded its range during the 21st century. As a result, the conflict between wolves and livestock farmers has increased. The biggest losses have occurred on sheep. For example, in 2021 the state paid almost 95 000 euros in compensations for a total of 235 depredated sheep. As wolves might kill dozens of sheep in one attack, economic consequences for the farmer concerned can be severe and may even lead to the farm being closed down. To increase the farmers' tolerance towards wolves, it is crucial to improve the husbandry practises and offer effective tools to prevent attacks. The LIFE BOREALWOLF project aims to reduce damages during 2019–2025 with a wide range of methods, which have not been extensively used in Finland before. The key approach is face-to-face collaboration; when visiting farmers on site, we share information about wolves and help to plan suitable damage prevention methods. Predator fences are usually the most effective way of preventing attacks. LIFE BOREALWOLF offers farmers temporary, movable electric fences for acute situations to protect remaining animals, and permanent electric fences for farms of high depredation risk. As maintenance is often laborious and typically the biggest drawback of using permanent electric fences, the project also searches for applicable ways of limiting vegetation growth. LIFE BOREALWOLF has acquired several types of light and sound deterrents. Project also lends out transmitting trail cameras, which can be used for monitoring of the well-being of livestock or to observe predators nearby. Project has offered GPS-collars on semi-natural biotopes, where predator fences are not possible. Collars help to identify deviant movements and to locate sheep from large pastures. According to our survey, farmers experience both cameras and collars very useful. Project has now reached over 100 farmers, and during this time they have learned to trust the field workers of the project. This could not be taken for granted in the beginning of the project. As the operating model developed in the project has been found functional and beneficial, we aspire to continue it also after the project.

31 First data on home ranges, movements and activity of wolves *Canis lupus* in Southwest Bulgaria (Pirin Mts., Maleshevska Mts. and Ograzhden Mts.) based on VHF telemetry

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(2) BALKANI Wildlife Society, Bulgaria

(3) Fund for Wild Flora & Fauna, Bulgaria

(4) South-West University Neofit Rilski, Bulgaria

(5) Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences, Bulgaria

(6) University of California, Davis, United States

Three wolves *Canis lupus* L. 1758, two males and one female were equipped with VHF collars and radio-tracked in Pirin Mts., South-west Bulgaria, in 2005 - 2009. Radio-tracking in high-mountainous, rugged and rocky terrain is a challenge because of difficult access to convenient locations for signal registration and appropriate triangulations. The overall locations are in altitudes between 200 and 2090 m a.s.l. The first trapped male (WM1), estimated as 8-9 y old, was tracked for 1.5 months before he was found dead. His home-range (100% MCP) was 16.2 km². The female (WF1), estimated as a yearling, had a home-range of 93.1 km² (100% MCP) and core area of 33.97 km² (50% KDE) while with her natal pack. The second male (WM2) was estimated as 2 y old. His home-range, while with the pack was 139.7 km² (100% MCP) and the core area was 59.9 km² (50% KDE). Both wolves dispersed from their packs. WF1 dispersed in November and traveled from West to South Pirin, where she was killed. For the whole period of radio-tracking (9.5 months) WF1 covered an area of 456 km² (100% MCP). The longest distance traveled by WF1 away from the core area of the natal pack (50% KDE) was 34.2 km. During dispersal WF1 was never recorded crossing main roads or other urbanized areas. WF1 was active in 46% of the time recorded. WM2 traveled several times away from the pack's territory in different directions and back. His intensive dispersal attempts started in March. In May, WM2 finally stayed in the neighboring mountains to the West (Maleshevska and Ograzhden Mts.). During his dispersal WM2 crossed an international road to Greece (E79) in the area of Kresna gorge, at least 11 times. For the whole period of radio-tracking WF1 covered an area of 712.4 km² (100% MCP). The longest distance traveled by WM2 from the core area of the natal pack (50% KDE) was 31.9 km. WM2 was active in 40% of the time recorded. The present data provide the first direct observation of wolf dispersal and crossing of busy road infrastructures in Bulgaria.

32 Interactive mapping of wolves across borders

Ellen van Norren (1) and Glenn Lelieveld (1)

(1) Dutch Mammal Society, Netherlands

Animals have no boundaries but maps do. Most of the maps stop at national borders, thus creating a narrow view of the range of species. This is why EuroLargeCarnivoresProject and WWF Germany commissioned the Dutch Mammal Society to create a web-based interactive map of territorial wolves across the Benelux and Germany. In cooperation with the governments of these countries. This map is available in four languages and has approximately 10.000 unique visitors per month. The map shows information of each wolf territory (represented as a dot) and background information. The technical solutions behind the map are built in a way that it is easy to add any other language and make a web-based interactive map of the range of wolves in Europe. The map is hosted and maintained by the Dutch Mammal Society, but can be incorporated in any other website by use of an iframe. In our presentation we will demonstrate the map and invite you to join our initiative by sharing your language and the bare minimum of your countries monitoring data.

In the poster presentation we show the map online (no poster) and we can discuss how to join the map.

Web address for the map: wolvesmap.zoogdiervereniging.nl

33 Testing different depredation mitigation schemes for wolf conservation in the Nepalese Himalayas

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(1) Himalayan Wolves Project, Nepal

We present conservation work in progress that works to facilitate coexistence with carnivores in the high Himalayas. We are developing a carnivore conflict mitigation toolkit specific to this high mountain setting with special attention to wolves. Any conservation activity needs to help the local Buddhist communities continuing their traditional way of life despite modern pressures, while at the same time ensuring the protection of the unique high-altitude wildlife community. The aspired toolkit must create conservation solutions that benefit the traditional human and wildlife communities by mitigating depredation conflict, relieving the costs of coexistence, and increasing awareness and education that a healthy and intact wildlife community is an asset. We test different livestock depredation mitigation schemes in Upper Humla, north-western Nepal, after almost a decade of wolf research in the area that also included many formal and informal discussions with the local communities about their conservation needs with regards to wolves and other predators. Specifically we test the efficiency and usability of foxlights, livestock corrals, and electric fences to increase livestock safety. We further implement conservation education programs, formed and continue to train community conservation groups, and hold various group discussions. We find that wolves hold a lower cultural status compared to snow leopards in these communities and that wolves receive a more negative attitude despite them causing less conflict compared to snow leopards. This may be caused by generally dog-type animals holding a lower status compared to cat-type animals in their culture and religion but likely also reflects decades of conservation work in the region with a narrow focus on snow leopards. Local communities need conservation support for depredation conflict by wolves, snow leopards, and other carnivores through infrastructure provision and functioning and practical financial compensation schemes. We learn that the villagers currently need support especially to deal with the conflict with the wild yaks. Conservation on the ground needs rapid adaption to changing conditions through material and non-material support of local communities while ensuring their self-governance and traditional lifestyles. We recommend the implementation of financial incentives and conservation education programs targeting all conflict-causing mammals across the Nepalese Himalayas.

34 High abundance of an introduced prey species, fallow deer *Dama dama*, abolishes wolf preference towards red deer

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(1) University of Gdańsk, Poland

(2) Forest Research Institute, Poland

(3) Bory Tucholskie National Park, Poland

(4) University of Warsaw, Poland

The gray wolf (*Canis lupus*) is dynamically recolonizing western Poland. One of such recently recolonized areas is Tuchola Forest, a large forest characterized by high density of an artificially introduced, medium-sized ungulate species, fallow deer (*Dama dama*). We investigated how fallow deer density affects diet composition and prey preference patterns of the local wolf population. Across the study area the niche breadth B (Levins index) of the wolf diet was very narrow (mean 1.21) indicating clear specialisation on a single food category – wild ungulates, which constituted 91% of the consumed biomass. However, inter-pack diet variety was relatively high (B range 1.00 -1.67 for the 13 analyzed wolf family groups), reflecting significant share of beaver (up to 19%) and anthropogenic food (mostly domestic dog; up to 12%) in the diet of some packs. Fallow deer was in general the preferred wolf prey. In regions of its highest density, fallow deer constituted ca. 35-40% of ungulate biomass consumed by wolves. Unsurprisingly, the share of other ungulates in the wolf diet decreased with the increase of fallow deer in the ungulates community. However, the size of this effect differed between the prey species: while the biomass of consumed roe deer (*Capreolus capreolus*) decreased only slightly, which may result from specialization towards the smaller size of the prey of wolves recolonizing new areas, the decrease of red deer (*Cervus elaphus*) consumption was significant. Concordantly, the Jacobs' D selectivity index indicated that red deer was avoided by wolves in the high fallow deer density zone, while when fallow deer was absent or present at very low density, red deer was the preferred prey species, similarly as in the other wolf diet studies from central Europe. Thus, it indicates that the introduction of fallow deer significantly alters the grey wolf's dietary preferences and may affect the gray wolf – red deer ecological relationship. Interestingly, wolves in high fallow deer abundance zone consumed better quality food than the wolves in other packs, which may indicate the presence of easier prey, such as the fallow deer, results in decreased need to feed on less indigestible material like bones.

INFORMATION FOR PRESENTERS

ORAL PRESENTATIONS

You will have 15 minutes for your oral presentation. Your talk should last approximately 12 minutes, which will allow 3 minutes for questions. There will be a 5 minute break between each talk to allow participants to move between rooms.

POSTER PRESENTATIONS

The poster session will take place on Tuesday, May 9 from 1700 - 1900 in the main hall. You may set up your poster between 1630 and 1700.

Poster Format

Simple and interactive is best! What we don't want is the typical 'scientific poster'. Please, no posters with more than 200 words (and feel free to use less!). We offer the following guidelines on how to best structure your poster:

- Maximum 65 cm wide and 100 cm tall
- Provide co-author information and logos for affiliations
- Maximum 200 words (but feel free to use less!)
- Use large font and short and effective sentences
- Highly recommend using photos and graphs
- Do not be afraid to be creative
- Think outside of the box

You may also have other supporting interactive material on site (e.g., ipad, computer, books, etc), although note we will not have the ability to provide tables. Please print your poster before you arrive at the venue, as there will be no services for this on-site.

Slide Format

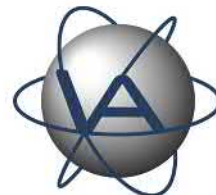
All poster presenters are required to prepare a one powerpoint presentation slide about themselves and the work they are going to present. The format is loose, but again think few words and simple. This is meant to be an advertisement for people to join you at your poster. Please use the Standard 4:3 aspect ratio.

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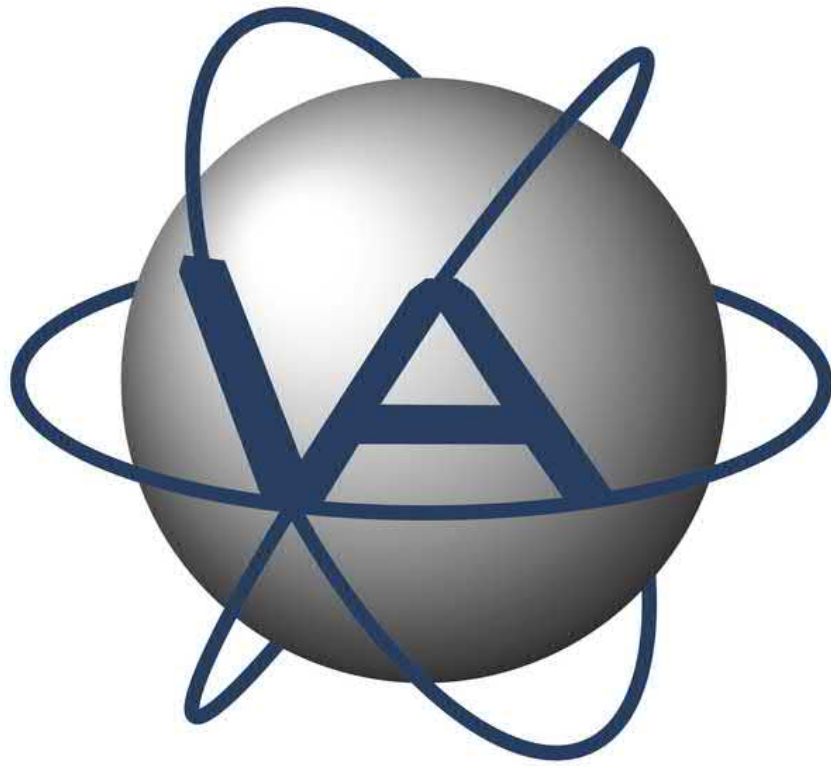
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Center for Natural Resource Dialogue

The Centre for Natural Resource Dialogue - CNRD

CNRD is a network of expert facilitators, mediators, negotiators and researchers. Its primary purpose is to be a neutral platform for dialogue on conflicts and issues involving natural resources. These involve wildlife management, conservation, protected areas, forestry, wind farms and water. We also offer courses and seminars to increase competence in natural resource issues and conflicts.

We recognise that most, if not all, environmental and natural resource conflicts are complex in nature and need to be managed in a way suited to the level of complexity and conflict each contains. We firmly believe dialogue and collaboration are the basis for constructively and sustainably managing these issues.

Membership is open to professionals working with or researching natural resource issues and conflicts. We also welcome associate members interested in participating in events, training courses and information the centre produces.

CNRD recently co-hosted a unique multi-level meeting on large carnivore conflicts in Sweden involving stakeholders from the European Commission, the Swedish Parliament, Counties, European and Swedish organisations and local inhabitants. It is instrumental in arranging a multi-stakeholder conversation on establishing wind farms. It hosts training courses and material for the Swedish EPA, Forestry Service and counties through its members. It offers a range of training courses on dialogue, collaboration and conflict management for practitioners.

www.cnrld.se

THANKS TO OUR VOLUNTEERS

STUDENT VOLUNTEERS

Serena Carpentari
Maria Petridou
Isabel Salado

Szofia Szabo
Thaana Van Dessel
Loan Zumbach

OTHER VOLUNTEERS

Giorgia Ausilio
Cecilia Di Bernardi
Sara Droghei

Nuno Guimaraes
Kristoffer Nordli

ABSTRACT REVIEWERS

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Erik Versluijs

ABOUT US



SKANDULV

The Scandinavian Wolf Research Group (SKANDULV) conducts research on the Scandinavian wolf population, working on scientific questions regarding basic and applied wolf ecology and management. SKANDULV has managed an effective cross-border collaboration between Sweden and Norway for over two decades, and has previous and ongoing collaborations with wolf researchers and managers from multiple countries in Europe, North America, and Asia.



**Inland Norway
University of
Applied Sciences**

ORGANIZING COMMITTEE



AIMEE TALLIAN

Aimee Tallian is the primary conference organizer for Wolves Across Borders and researcher with Scandinavian Wolf Research Group (SKANDULV). She received a PhD in Ecology from Utah State University in 2017, after which she worked as a postdoctoral researcher for the Norwegian Institute of Nature Research and the Scandinavian Brown Bear Project. Her work focuses on predator-prey dynamics, competition, and behavioral interactions between predators, prey, and humans. She was recently awarded a Fulbright Fellowship to study predator-prey interactions with lynx and snow leopard in Scandinavia and Mongolia, respectively.



CAMILLA
WIKENROS

Camilla Wikenros is the Project Coordinator for SKANDULV and an Associate Professor at the Swedish University of Agricultural Sciences, where she received her PhD. Camilla's research is focused on trophic interactions between mammalian apex predators and their prey species, how the results from those interactions propagate through to lower trophic levels, and in turn affect other mammals, bird species as well as human use of natural resources. She is interested in both basic ecology and behavior, and applied scientific research questions. Her work aims to inform the conservation of threatened species and their effects on biodiversity in relation to wildlife management and sustainable use of natural resources.



BARBARA
ZIMMERMANN

Barbara Zimmermann is a Senior Researcher with SKANDULV and a Professor at the Inland Norway University of Applied Sciences (INN), where she received her PhD. Barbara is a project leader for Grensevilt, a cross-border collaboration between Norway and Sweden that works to provide a solid base for a better transnational, inclusive, conflict-reducing multispecies management of moose, wolves and wolverines in Inner Scandinavia. She is also the head of INN's research group LARGE, a group committed to knowledge generation to meet common goals for a sustainable management of large-bodied species and dampening wildlife-human conflicts, and a member of Skogsjerv, which studies Scandinavian large carnivores and their interactions with wild and domestic herbivores.



HÅKAN SAND

Håkan Sand is the Project Leader for SKANDULV (Sweden) and an Associate Professor at the Grimsö Wildlife Research Station, at the Swedish University of Agricultural Sciences. Håkan obtained his Ph.D. in wildlife science in 1996 at the Swedish University of Agricultural Sciences. His research is focused on population ecology and management of large mammals, with a special emphasis on population dynamics and life-history variation in moose and wolves. Håkan has collaborated with researchers from various systems around the world to explore the role of wolves in their trophic interactions.



PETTER
WABAKKEN

Peter Wabakken is the Project Leader for SKANDULV (Norway), an Associate Professor at the Inland Norway University of Applied Sciences, and director for Nature Management based in Norway. His research interests and expertise lie in large carnivore ecology and management, human-carnivore interactions and wolf social behaviour in particular. He is a current member of the IUCN Wolf Specialist group and conducts several large-carnivore research projects. He has also worked on brown bears (founder of the Scandinavian Brown Bear Research Project), eagle owls and baleen whales. Research interests include population structure & dynamics, molecular ecology, behavioural ecology, multiple predator communities.

INFORMATION ABOUT DJURÖNÄSET



HOTEL CHECK IN

SUNDAY: 15:00 and after

MONDAY: 18:00 - 19:00

HOTEL CHECK OUT

THURSDAY: 11:00

HOTEL INFORMATION

Spa Hours (6:00 - 11:00)

Massages available on-site, but they must be pre-booked.

Drink tickets are available for purchase to be used anywhere on-site, or you can use your credit card. No room charges will be allowed.



DJURÖNÄSSET

- 1-7 Konferenslokaler & hotellrum/Conference & Hotel rooms/ Konferenz & Hotelzimmer
- 8 Seregården
- 9 Restaurang/Restaurant, Bar & Vinloket
- 10 Restaurang/Terrass/The Terrace/Die Terrasse
- 11 Vedeldad bastu/Firewood sauna/Holzofensauna
- 12 Skåtgårdskrogn/Sjöboden/Restaurant
- 13 Svlt, "Längan"/Suite, "The Row"
- A Tennisbana/Tennis court/Tennisplatz
- B Folkpark/Outdoor events/
- C Boulebanan/Boule court/Boule-Platz
- D Kanoter, Båtar/Canoes, Boats/Kanus, Boote
- E Motionsringa/Running track/Trimmichjfad
- F Bastulandskap med pool/Sauna Landscape with pool/Schwimmbad
- G Ångbåtsrygga/Steamboat jetty/Anlegsteg
- H Badstrand/Beach/Badstrand
- I Varm källa/Hot spring
- J Hällar/Campfire/Grillplatz
- K Cyklar/Bicycles/Fahrräder
- L Bussstallplats/Bus stop/Bushaltestelle
- M Mötesplats/Group meeting place/Gruppentreffpunkt
- N Naturstig/Nature trail/Naturpfad
- R Gästbygga/Guest jetty/Gästtraten
- S Skåtgårdspaviljongen/Archipelago Pavillion
- T Heilikopparplatån/Reliefpad/Hubschrauberplatz
- U Utegym/Outdoor gym/Fitness im freien
- P1 Parkering/Parking/Parkplatz
- P2 Parkering/Parking/Parkplatz Seregården

DJURÖNÄSETS BEVERAGE PACKAGES

TIP
Upgrade your predrinks
to Gin & Tonics
+50 SEK excl. VAT
+63 SEK incl. VAT
Max. 100 p.

small scale - exclusive - carefully selected

The drinks are selected and adjusted to the season suitable for your menu.

The Big Wine Package

- Aperitif 1 glass of sparkling wine
- Wine with starter 1 glass of selected wine
- Wine with main 1 glass with refill
- Dessert wine 1 glass

420 SEK excl. VAT / 525 SEK incl. VAT
Non-alcoholic alt: 240 SEK excl. VAT / 269 SEK incl. VAT

The Small Wine Package

- Aperitif 1 glass of sparkling wine
- Wine with starter 1 glass of selected wine
- Wine with main 1 glass with refill

365 SEK excl. VAT / 456 SEK incl. VAT
Non-alcoholic alt: 221 SEK excl. VAT / 247 SEK incl. VAT

We work with organic wines and products as much as possible.

Prices may be subject to change.

The Exclusive Wine Package

Snacks are served with the predrink

- Aperitif 1 glass of sparkling wine
- Wine for the starter 1 glass of selected wine
- Wine for the main 1 glass with refill
- Dessert wine 1 glass
- Digestif 3 cl

796 SEK excl. VAT / 995 SEK incl. VAT
Non-alcoholic alt: 380 SEK excl. VAT / 425 SEK incl. VAT

Värmdö Bryggeri Package

Beer instead of wine? Our range of organic beer from Värmdö Bryggeri, a local microbrewery, includes tasty seasonal beers. Even the pre-drink apple cider comes from the local distillery on Värmdö.

- Aperitif Värmdö apple cider 4,5%
- Beer for the starter Djurönäsets light lager
- Beer for the main Värmdö Lager/IPA

214 SEK excl. VAT / 267 SEK incl. VAT
Non-alcoholic alt: 221 SEK excl. VAT / 247 SEK incl. VAT

