World Wolf Congress 2003 Bridging Science and Community



September 25 - 28, 2003 The Banff Centre Banff, Alberta, Canada

hosted by



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Objectives

Hosted by the Central Rockies Wolf Project

o provide a forum for scientists to share contemporary scientific information on wolf ecology, behaviour, and management.

- To provide a forum for managers to assess the current state of wolf management.
- To assess the role of science in wolf management and policy formation and identify needs for future research.
- To assess the socio-political realm of human-wolf coexistence.
- To provide a forum for a diversity of people with varying values, attitudes, expertise to interact and share information and viewpoints on coexisting with wolves.
- To share viewpoints of wolves from a variety of alternative traditions including artistic and storytelling with conference participants and the broader community.

The goal of World Wolf Congress 2003 will be to provide information and constructive discussion on the following general themes:

The Science of Wolf Ecology and Management

The Congress will offer a medium for learning about the leading edge of science in ecology that is being conducted on wolves around the world. We will also explore the role of science in policy formation and wolf management.

The Role of Management in Coexisting with Wolves

Wildlife managers are faced with several issues in working with wolves. Managing wolves in the ranching communities of a rural area provides one set of challenges; managing for the persistence of wolves in protected areas provides another set of challenges. In rural areas, wolves tend to kill livestock, whereas managers, ranchers and farmers tend to kill wolves to reduce depredation on livestock. In protected areas, wolf persistence will depend on availability of habitat and wild prey, but the needs of wolves will conflict with those of car and truck drivers. The Congress will provide a forum for analyzing the socio-economical variables that influence wolf management.

Wolves continue to be one of the most controversial and popular carnivores in the public eye. The reintroduction of wolves to Yellowstone in 1995 has received global attention on the subject of coexisting with wolves. As a consequence, many people are aware of wolf management issues, and are seeking more knowledge on ways that humans may coexist with wolves. Our Congress will provide such people with much food for thought on the scientific and socio-political realms of living with wolves, and has the potential for reframing the way society responds to conflicts between wolves and humans in the 21st Century.

Science and Community Approaches to Wolf Conservation for the 21st Century

Although centralized wolf management has often been the norm across the globe, effective wolf conservation strategies may be developed with valuable contributions of many different individuals and organizations. Scientists, government agencies, aboriginal people, conservation groups, corporations, ranchers, herders, hunters, trappers, and the general public collectively can contribute to wolf conservation. This shift of power, which started during the last 30 years of the 20th Century, might become a must for 21st-Century wolf management. During the Congress, various collaborative initiatives on wolf management will be discussed.

When wolves live close to human settlements, human – wolf cultural relationships profoundly influence wolf management. Many people around the world view wolves as an integral component of natural ecosystems and a wilderness icon. Many other people and groups fear wolves or conflict with them because wolves impact their interests. Congress contributions dedicated to the "human dimension" and collaborative initiatives in wolf management will also explore viewpoints of wolves from a variety of alternative traditions and stakeholders.

Welcome to the World Wolf Congress 2003

olves and humans have had a turbulent relationship over the millennia. Prior to domestication of ungulates by people, wolves enjoyed a place in cultural mythology that depicted a multifaceted but strong relationship between wolves and humans. After the introduction of domestic livestock, wolves were often perceived to be an enemy to taming the land. Wide-scale and intensive efforts were made to eradicate wolves throughout much of its range in the world. Such efforts were frequently endorsed and funded by governments with the blessing of the public. The days of widescale eradication are over, however, and today most of the public have a positive attitude toward wolves. Indeed, many people view wolves as a symbol of wilderness worthy of preservation for all time.

Many individuals maintain that our attachment to nature and wilderness is related to the industrialization and urbanization processes that alienated us from wild animals such as wolves. The change in public attitudes toward wolves has been attributed to science and education. Since the 1940s, hundreds of scientists have studied wolves around the world. Subsequent documentary films, books, magazine articles, and school curriculum on wolves have disseminated scientific knowledge among vast numbers of the public and coincidentally the public's knowledge of wolves is much higher today than it was in 1940.

Despite the overwhelming shift in the public's attitude toward wolves and despite the wealth of scientific investigations on wolves, there continues to be controversy over wolf management issues. Perhaps this is because wolves are our original competitor for wild and domestic ungulates. Moreover, wolves are controversial because they demand a lot of us. They require relatively large tracts of land that support adequate prey populations and they sometimes kill the wild and domesticated prey that humans raise to make a living or prize as game. In the public arena where wildlife management issues play out, protectionist attitudes toward wolves are pitted against utilitarian attitudes. This polarization has served to fuel the philosophical discussion of whether humans and wolves can coexist.

Managing wolves on the landscape is evidently much more than ensuring that adequate prey exists or that scientific investigation on wolves occurs. The broader community of people holding various values toward wolves is pivotal to ensuring that places for wolves will be maintained in perpetuity around the world. Consumptive users of wolves such as trappers and hunters have a special interest in wolf management. Wolf pelts are sold commercially in many regions and wolf trapping constitutes an ongoing source of income for some communities. Some sectors of the hunting community kill wolves to reduce their impact on prey populations. Livestock producers that occupy wolf range also have a special interest in wolf management because wolf depredation can impact the economics of farmers and ranchers. More recently, people in the tourism industry have developed an economic interest in wolves. Wildlife belongs to all members of the public, however, and many people who do not have an economic interest in wolves also raise a powerful voice for wolf conservation. These socioeconomic, ethical, and political components exemplify the multi-faceted and challenging nature of managing wolves in human-dominated systems.

In organizing this conference, we had four primary objectives: to provide a forum for disseminating current scientific information on wolf ecology, behaviour, and management; to assess the role of science in wolf management and policy formation and identify needs for future research; to provide a forum for a diversity of people with varying values, attitudes, and expertise to interact and share viewpoints on coexisting with wolves, and finally; to share viewpoints on wolves from a variety of alternative traditions including artistic and storytelling.

On behalf of the Central Rockies Wolf Project (CRWP), we are pleased to bring you the World Wolf Congress 2003. The CRWP is a non-profit science and education organization. We are a small group of

scientists and educators who, since 1988, have studied a wolf population in 28,600 km2 of spectacular Rocky Mountains and rolling foothills. Parks Canada and Dr. Paul Paquet initiated the wolf research here in the Bow Valley of Banff National Park that continues today throughout the region.

The international community of wolf biologists is familiar with Alberta, largely due to the efforts of Dr. Lu Carbyn and others in organizing two successful wolf symposiums in the province - in 1981 and in 1992. Because these conferences suggested a pattern of every 11 years, we decided to try for a third successive conference in Alberta. We hope that this congress lives up to the expectations that the last two Alberta conferences left in their wake. It is our wish that the vision of bringing multi-interest groups together to discuss wolf science, management, and conservation continues well into the future. We would be delighted if an ambitious group of people were to continue the tradition by organizing the next World Wolf Congress in another location in the world. Wolf conservation gains immensely from a diversity of ideas and knowledge.

We are honoured you can attend this event.

Sincerely,

Mark BarkerPatti MayerSteve WadloCarolyn CallaqhanMarco MusianiKelly WoodHolly HolbrookBob SandfordSue Wood

Steve Wadlow

In Memory of Erik Zimen

nternationally prominent behavioral ecologist and ethologist, Dr. Erik Zimen, died at his home in Gemany on May 19, 2003 from a malignant brain tumor. He was with his beloved wife, Mona, their three children, and a menagerie of farm animals. His legacy will remain forever embossed on all those who knew or were influenced by his infectious pursuit of knowledge and love of life. Erik was an academic, a hunter, a pilot, a sailor, an ecological farmer, and acclaimed documentary filmmaker. The complex relationship between humans and wolves engaged him throughout his life. His original contributions to our current understanding of human and wolf social behavior were seminal. In recent seminars and lectures, he discussed the social, ecological, and economic reasons for humans driving wolves to near extinction and the return of wolves in recent times. He always maintained that problems are usually with humans and not wolves, although he clearly recognized that conflicts existed.

Born in Sweden in 1941, he had lived in Germany since 1971. He studied with Wolf Herre at the Institute for Domesticated Animals at the University in Kiel and with Konrad Lorenz in Seewiesen. His comparative studies about the behavior of wolves and Königspudel (standard poodle) and their genetic crossing are to this day important basics of ethology. Numerous academic publications, popular articles, and documentary films contributed to his widely spread international renown. Among his many classic contributions are: "The wolf, myths and behavior (German title: "Der Wolf, Mythos und Verhalten") and "The dog, origins, behavior, man-dog relationship" (German title: "Der Hund, Abstammung, Verhalten, Mensch-Hund Beziehung"), as well as TV documentary films such as "Wild routes" (German title: "Wildwege") and "Wolves' Traits" (German title: "Wolfsspuren").

Erik was a dear friend and we will miss him.

- Rolf Jaeger and Paul Paquet

Acknowledgements

he World Wolf Congress 2003 began as a simple discussion three or four years ago. The idea took shape as we further discussed the merits of hosting such an event. At a certain point we became committed and the idea became a reality. The World Wolf Congress 2003 has been a tremendous learning experience for us.

Events of this magnitude are only possible through the efforts of many people who willingly provide their time and energy and through 'rolling up their sleeves' to assist in many different ways. Organizing the World Wolf Congress 2003 has been a true honour because it has allowed us to work with many talented individuals and organizations. We are therefore indebted and we would like to show our sincere appreciation as follows.

Hosting an international conference is a costly endeavour. We would like to express our heartfelt appreciation to all of our funding partners who helped make this event a reality. We received financial support from six non-profit organizations, 16 businesses and corporations, two government agencies, and three individuals.

Our congress steering committee spent many hours over the past twenty months to ensure the event was well organized and that 'no stone was left unturned'. We lost track of the number of meetings we sat through. Each committee member took on many tasks throughout the organizing period. We would like to extend a very warm and sincere thank you to Mark Barker, Holly Holbrook, Patti Mayer, Bob Sandford, Kelly Wood, and Sue Wood for their incredible efforts. They went above and beyond the call of duty to assist in organizing this event. It has been a long twenty months for them, yet they persevered and came out truly shining and smiling!

We were fortunate to be able to rely on several people who have had considerable experience in organizing events of this size. A warm thank you is extended to Dr. Lu Carbyn, Dean Cluff, Nina Fascione, Sean Flynn, Joseph Fontaine, and Mary Ortiz. Dr. Rolf Jaeger and Barry Worbets provided valuable comments during the initial organizing period. A thank you is also extended to Patrick (the Czar) Valentino for his encouragement and excellent sense of humour that kept us grounded over the past year and a half.

Bernadette MacDonald and the Centre for Mountain Culture provided the initial enthusiasm for the congress and provided ongoing support and a connection to the artistic community. Yvonne Dixon, Cameron Dyck, Michiko Ellis, Shirley Kayama, and Leslie Vanderzwet, our friends at the Banff Centre, provided many hours of advice and suggestions to help make the event run smoothly. Kurt Bagnell and the Theatre Arts Department at the Banff Centre provided critical support for the use of the Eric Harvie Theatre and the partnership for the Ian Tyson concert. Colleen Campbell, our Artist in Residence, provided creative ideas and energy to the Congress.

We are grateful to two Canadian icons who showed enthusiasm and support for the congress and gave of their time to help to broaden the scope of the event to the artistic and musical community. Robert Bateman, a world renown artist, brings a passion for the conservation of all things wild. His contribution to the congress will help to remind us that conserving species such as wolves is not simply an intellectual exercise. Robert is a person whose time is in high demand – and we are grateful for his time and energy. Ian Tyson, Canadian folk and country music hero, has a passion for the wide open spaces of his beloved southern Alberta ranch country. We share his interest in preserving the open landscapes of the Rocky Mountain foothills. When we initially contacted Ian to ask if he would consider giving a concert during the congress, without hesitation he replied, "Wolves – I love wolves. I would love to give a concert!" When the date for the concert coincided with his busy schedule, he still enthusiastically agreed to show his support by performing the concert. We were delighted!

The world wide response to the Call for Papers was overwhelming. Consequently, the review of the abstracts was an enormous job. A sincere thank you is extended to all members of the Scientific Advisory Committee and the Education Advisory Committee for their professional approach to reviewing the abstracts. In addition, we would like to thank all the presenters who dedicated their time and energy to share their research at the World Wolf Congress 2003. We would also like to express our appreciation to all attendees for participating in this event. A special thank you is extended to Eric Butters for providing the thread throughout the congress as our Master of Ceremonies.

When the idea came up about holding a conference for youth during the congress, we thought of three competent educators to organize the event. Sue Arlidge, Jamie Honderich and Pam Carnochan willingly accepted the task at hand and organized a memorable program. We are grateful to Cathy Gill, Garland Jonker, Carol McTavish, Lori Nunn and Kevin Strauss for adding their efforts to the youth event. We also thank Robert Bateman and the scientists contributing their time to the participants of the Youth Wolf Congress. They are fantastic role models for these young conservationists. Additionally, we would like to thank Pam Carnochan for her beautiful creation of the Youth Wolf Congress logo and Jeff Williams Log and Timber Frame Structures for making the identification badges for our young conservationists. Also, thank you to Gordie Miskow, at Lafarge Canada, for believing in the idea and supporting it so 80 youth would have the opportunity to participate in this international event.

The organizing of several special sessions merits appreciation. For assisting in the organizing of the Livestock Depredation Summit, we thank Tim Clark, Dave Lavigne, Marty Smith, Nina Fascione, Melissa Mauro, John Shivik, and Tyler Muhly. For helping to organize the Central Rockies Forum, we thank Bob Jamieson, Cormack Gates, and Mark Hebblewhite. For the Wolf Control Forum, we thank Steve Herrero and Elisabetta Tosoni. We also wish to acknowledge all concurrent session chairpersons: Layne Adams, Luigi Boitani, Lu Carbyn, Dean Cluff, Ray Coppinger, Francisco Petrucci-Fonseca, Joe Fontaine, Cormack Gates, Hank Halliday, Yadvendradev Jhala, Dave Lavigne, Olof Liberg, David Mech, Paul Paquet, Mike Quinn, Doug Smith, Martin Smith, John Vucetich, and Robert Wayne.

We were also fortunate to have many other people help in a variety of different ways. John Wentworth created a wonderful congress web site and continued to provide web updates. Melanie Weinbender provided important help in congress registration. Tyler Muhly and Elisabetta Tosoni provided precious help during various stages of the congress planning, including logistical aspects of the abstract review and session planning and scheduling. Kate Currey assisted in initial registration ideas. Paul Paquet provided valuable input at various and key times throughout the organizing period. Gloria Remington, Bob Remington, and Mark Barker were our media relations team and worked hard to ensure that the event was well publicized. Dave Garrow and Michelle Jansen rolled up their sleeves last winter to help publicize the event. Carol Engstrom, Wendy Coons, and our friends at Husky Energy assisted immeasurably in the area of audio visual equipment loans and ideas. Joseph Potts also provided much advice, expertise and time as our head audio visual technical person. Julian Norris provided assistance in liaising with the First Nations community. Jim Kievit assisted in liaising with the hunting and trapping community. Further, the Alberta Trappers Association assisted in advertising the event and encouraging its members to attend. Cynthia MacKenzie helped to organize the banquet. Shawn Biggings worked hard to organize the silent auction event. In addition, we would also like to thank the following donors for the silent auction: Ellie Archer, Robert Bateman, Tony Bloom, Gordie Miskow, Robin and Linda Read, as well as other local businesses.

The creation and printing of this Book of Abstracts was due to the generous support of Jill Branson and Glenn Jackson at Xerox Canada – Communication First Inc., as well as Joe Fontaine and the folks at the U.S. Fish and Wildlife Service. Linda Petras did a wonderful job on layout. In addition, Tyler Muhly provided excellent leadership skills and cracked a firm but diplomatic whip in orchestrating the creation of the Book of Abstracts.

Very importantly, we had many volunteers during the actual event who contributed immensely their time and positive energy: Janice Barnes, Bev Berteau, Julie Budgen, JP Canet, Judy Candy, Sydney Candy, Kate Currey, Karen Deatherage, Ed Engstrom, Jackie Engstrom, Sheila Forbes, Dave Garrow, Jennifer Grant, Ronni Ishaky, Betty Leask, Cynthia Mackenzie, Lois McCulloch, Tyler Muhly, Gudrun Pflueger, Don Pickard, Valerie Pissot, Linda Read, Robin Read, Danielle Robertson, Bart Robinson, Betsy Rossell, Shannon Rossell, Anna Sangster, Steve Taylor, Elisabetta Tosoni, Suzanne Walsh, Jennifer Wasylyk, Linda Wiggins, Sherry Willetts, Judy Wiltse, and Tom Wood.

Again, we would like to express our appreciation to Tyler Muhly and Elisabetta Tosoni for their energy, ideas and dedication in many aspects of the organizing of this event. Also, Jim Pissot, a dedicated man of integrity for 'all things wild', requires special mention. Jim contributed immensely by acting as a sounding board for many ideas and patiently provided critical advice and solutions to issues as they arose. Thank you Jim. You are fantastic.

A special note of appreciation is extended to Kelly Wood, for her incredible positive energy throughout the past 20 months. There never was a job too big or difficult for Kelly. Thank you Kelly for the creative ideas and ongoing efforts.

In closing, thank you to Mimosa Arienzo, Eileen Callaghan, and George and Sheila Wadlow for providing that very necessary family support during the organizing period. Thank you also to Madeline Wadlow for keeping us grounded and reminding us that it is also necessary to play, even when you are at your busiest.

Thank you again!

Carolyn Callaghan, Marco Musiani, Steve Wadlow

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LIST OF EXHIBITORS

LOCATION	EXHIBITOR
Max Bell Lounge	Riverbend Publishing
Max Bell Lounge	The Wildbird General Store
Max Bell Lounge	Lotek Wireless Inc.
Max Bell Lounge	Christine Selbstaedt - artisan
Max Bell Lounge	National Wildlife Federation
Max Bell Room 253	Caribou Range Restoration Project
Max Bell Room 253	International Wolf Center
Max Bell Room 253	Defenders of Wildlife
Max Bell Room 253	Mountain Magic - A Wilderness Series
Max Bell Room 253	Spirit in Stone
Max Bell Room 253	Cynthia MacKenzie - artisan
Max Bell Room 253	California Wolf Center
Max Bell Room 253	Ukiyo Flutes

Congress At A Glance

THURSDAY, SEPTEMBER 25

TIME	EVENT	DESCRIPTION	LOCATION
08:00 - 17:00	Invitation Only	Depredation Research and Management Summit	Max Bell Complex Max Bell Auditorium
13:00 - 19:00	All WWC2003 attendees welcome	Registration for Attendees (A Registration Booth will always be available during the Congress)	Max Bell Complex
17:30 – 19:30	All WWC2003 attendees welcome	 Social Reception & Cash Bar Exhibitor Display Films: (a) Livestock Guarding Dogs Protecting Sheep from Wolves –B. Lequette; (b) Fladry and Electric Fences Bamboozling Wolves –G. Volpi & M. Musiani 	Max Bell Complex
20:00 -	All Welcome – Tickets purchased at Box Office, Eric Harvie Theatre	An Evening with Ian Tyson	Eric Harvie Theatre

FRIDAY, SEPTEMBER 26

TIME	EVENT	DESCRIPTION	LOCATION
08:30 - 09:15	Plenary	Welcome and Opening Remarks: Eric Butters, Carolyn Callaghan, Marco Musiani, Steve Wadlow, Mike Mears	Eric Harvie Theatre
0915-10:00	Plenary	Keynote Address: Luigi Boitani	Eric Harvie Theatre
10:00 - 10:30		COFFEE BREAK	Eric Harvie Theatre
10:30 - 12:15	Plenary	Panel Discussion: Should wolf populations be controlled to enhance prey populations?	Eric Harvie Theatre
12:15 - 13:30		LUNCH (not arranged for attendees)	Donald Cameron Hall
13:30 - 15:20	Concurrent 1-I	Conservation Policy and Planning	Max Bell Auditorium
13:30 - 15:20	Concurrent 1-II	Wolf and Human Culture: Co-existence or Conflict	Max Bell Rm. 252
13:30 - 15:20	Concurrent 1-III	Population Biology and Habitat Relations for Wolf Conservation	Donald Cameron Hall Rm. 300
15:20 - 15:45		COFFEE BREAK	Max Bell Complex
15:45 – 17:35	Concurrent 2-I	Status, demography, territory and prey impact in remnant, re-established, or exploited wolf populations	Max Bell Auditorium
15:45 - 17:35	Concurrent 2-II	Approaches to Wolf Management	Max Bell Rm. 252
15:45 – 17:35	Concurrent 2-III	Wolf Management Techniques	Donald Cameron Hall Rm. 300
17:35 – 18:30	Poster Session	 All WWC2003 attendees welcome Exhibitor Display Cash Bar Book Signing 	Max Bell Complex
18:00 - 19:30		SUPPER (not arranged for attendees)	Donald Cameron Hall
20:00 - 23:00	All WWC2003 attendees welcome \$10 for non-attendees	An Evening of Film • Doors Open 19:30 • Cash Bar	Max Bell Complex Max Bell Auditorium

SATURDAY, SEPTEMBER 27

TIME	EVENT	DESCRIPTION	LOCATION
08:30 - 10:20	Concurrent 3-I	Wolves and Protected Area Management	Max Bell Auditorium
08:30 - 10:20	Concurrent 3-II	Education to Foster Co-existence	Max Bell Rm. 252
08:30 – 10:20	Concurrent 3-III	Understanding and predicting wolf and depredation occurrences, and managing wolves lethally and non-lethally	Donald Cameron Hall Rm. 300
08:30 – 13:00	YOUTH EVENT	YOUTH WOLF CONGRESS	Eric Harvie Lobby/Wings and Donald Cameron Hall South Wing Rm. 17
10:20 - 10:45		COFFEE BREAK	Max Bell Complex
10:45 - 12:35	Concurrent 4-I	When Wolves Meet Dogs	Max Bell Auditorium
10:45 - 12:35	Concurrent 4-II	Wolf Physiology	Max Bell Rm. 252
10:45 – 12:35	Concurrent 4-III	Wolf-Human Interactions	Donald Cameron Hall Rm. 300
12:35 - 13:35		LUNCH (not arranged for attendees)	Donald Cameron Hall
13:35 – 15:00	Plenary Address	Olof LibergRobert WayneLevi Holt	Eric Harvie Theatre
15:00 - 15:25		COFFEE BREAK	Max Bell Complex
15:25 - 17:25	Concurrent 5-I	Wolf Population Dynamics	Max Bell Auditorium
15:25 - 17:25	Concurrent 5-II	Wolf Conservation Genetics	Max Bell Rm. 252
15:25 – 17:05	Concurrent 5-III	Trophic ecology of wolves: diet, ecology and research techniques	Donald Cameron Hall Rm. 300
15:25 – 17:05	Concurrent 5-IV	Central Rockies Special Session Panel Discussion	Donald Cameron Hall South Wing Rm. 30
17:25 – 17:45	Poster Session	 All WWC2003 attendees welcome Exhibitor Display Cash Bar open at 16:45 	Max Bell Complex Max Bell Rm. 251
17:45 -	Dinner Banquet	 An Evening with Robert Bateman Silent Auction, Gala Banquet and Awards Celebration (ticket required) 	Donald Cameron Hall

SUNDAY, SEPTEMBER 28

TIME	EVENT	DESCRIPTION	LOCATION
08:30 - 10:20	Concurrent 6-I	Wolf Community (Ecological Interactions)	Max Bell Auditorium
08:30 - 10:20	Concurrent 6-II	Wolf Behavioural Ecology	Donald Cameron Hall Rm. 300
08:30 - 10:20	Concurrent 6-III	Livestock Depredation	Donald Cameron Hall South Wing Rm. 30
08:30 - 10:20	Concurrent 6-IV	Management strategies for small and recovering wolf populations	Max Bell Rm. 252
10:20 - 10:50		COFFEE BREAK	Eric Harvie Theatre
10:50 - 11:30	Plenary Address	• L. David Mech	Eric Harvie Theatre
11:30 – 12:50	Plenary	 Paul Paquet Dave Lavigne Closing Remarks by Carolyn Callaghan and Marco Musiani 	Eric Harvie Theatre



Full Congress Session Schedule

FRIDAY, SEPTEMBER 26-MORNING

Starting@	ERIC HARVIE THEATRE	
08:30	Welcome and Opening Remarks: Master of Ceremonies: Eric Butters; Carolyn Callaghan; Marco Musiani; Steve Wadlow; Mike Mears: CEO and President, The Calgary Foundation.	
09:15	Plenary Session : Luigi Boitani - Keynote address - How many wolves are enough? The wolf-human interface and the role of biology, ethics and politics.	
10:00	COFFEE	
10:30	Plenary Session : Should wolf populations be controlled to enhance prey populations?; Chair: Steve Herrero; Tentative Panellists: Wlodzimierz Jedrzejewski, Bob Jickling, Mark McNay, L. David Mech, Rick Page, Paul Paquet, and Greg Roczicka.	
12:15	LUNCH at attendees discretion.	

FRIDAY, SEPTEMBER 26—AFTERNOON

Starting @ 13:30	MAX BELL AUDITORIUM	MAX BELL BUILDING ROOM 252	DONALD CAMERON HALL ROOM 300
	Concurrent Session 1 - I; Conservation Policy and Planning; Chair: Lu Carbyn	Concurrent Session 1 - II; Wolf and Human Culture: Co-existence or Conflict; Chair: Paul Paquet	Concurrent Session 1 - III; Population Biology and Habitat Relations for Wolf Conservation; Chair: John Vucetich
13:30	Darimont - Succession debt: Effects of logging on wolf- deer dynamics in coastal British Columbia and southeast Alaska	Atkinson-Berg - Exploring history to change negative sentiments and influence sound wolf management	Carroll - Transboundary assessment of mexican wolf recovery needs using a dynamic population model
13:50	Fascione - Wolf recovery in the lower 48 states: what next?	Lynn - Sound science is never enough: Ethics, science and values in wolf recovery	Duke - Wolf use of corridors in the central Canadian Rockies: multivariate use of habitat characteristics
14:10	Oakleaf or Stark - Relative success of the reintroduction of Mexican wolves to other wolves in the United States	Mertig - Here comes the wolf: Public attitudes toward wolf recovery in Michigan	Etherington - Framing bias and resource selection models for gray wolves (Canis lupus) in Canada
14:30	Palacios - Improving of wolf habitat in SW European countries	Petersen - The group to which people belong	Hurford - Predicting the recolonization rate of wolves using mathematical models
14:50	Philips - Wolf Recovery in the U.S. Southern Rocky Mountains		Oakleaf - Habitat selection by recolonizing wolves in the northwestern United States
15:20	COFFEE		

Session schedule continued on next page ...

Starting @ 15:45	MAX BELL AUDITORIUM	MAX BELL BUILDING ROOM 252	DONALD CAMERON HALL ROOM 300
	Concurrent Session 2 - I; Status, demography, territory and prey impact in remnant, re-established, or exploited wolf populations; Chair: Olof Liberg	Concurrent Session 2 - II; Approaches to Wolf Management; Chair: Joe Fontaine	Concurrent Session 2 - III; Wolf Management Techniques; Chair: Carolyn Callaghan
15:45	Can - Current status of Gray Wolf, its prey and human- wolf Interaction in Turkey	Bath - Integrating a human dimensions approach to addressing wolf management issues in Europe	Beck - Adaptive management to reduce coyote introgression into the red wolf genome
16:05	Pedersen - Wolf territories in Scandinavia: sizes, variability, and their relation to prey density.	Duchamp - Wolf status in the French Alps: from monitoring to damage management	Beyer - Translocation of wolves associated with livestock depredation in a recovering population
16:25	Varley - Assessment of the WOLF5 model: Eight years after wolf recovery in Yellowstone	Espirito-Santo - Human dimensions in Iberian wolf management in Portugal	Bradley - Evaluating wolf control in response to livestock depredation in the northwestern U.S.
16:45	D. Murray - An analysis of factors affecting wolf mortality across three recovery areas in the Western United States	Naughton - Paying for tolerance? The impact of depredation and compensation payments on rural citizens' attitudes toward wolves	Meier - How should we count wolves?
17:05	Wydeven - Growth, survival, and productivity of a colonizing wolf population in Wisconsin		Stahler - Yellowstone wolves and GPS collars: New insights from new technology
17:25	McNay - Reproductive characteristics of an exploited wolf population		
17:35-18:30	Poster Session at Max Bell Complex. All WWC2003 attendees welcome - poster display, exhibitor display, cash bar and book signing.		
18:00-19:30	SUPPER at attendees discretion		

FRIDAY, SEPTEMBER 26—AFTERNOON (... continued)

FRIDAY, SEPTEMBER 26—EVENING

Starting@	MAX BELL AUDITORIUM
20:00-23:00	An Evening of Film - All WWC2003 attendees welcome, Non-attendees \$10.00. Doors Open 19:30 - Cash Bar Available.

SATURDAY, SEPTEMBER 27—MORNING

Starting @	ERIC HARVIE LOBBY/WINGS AND DONALD CAMERON HALL SOUTH WING ROOM 17
09:00-13:00	Lafarge Youth Wolf Congress The Lafarge Youth Wolf Congress, sponsored by Lafarge Canada Inc and the Central Rockies Wolf Project, will provide a dynamic opportunity for young people to become actively involved in learning about wolves and wolf conservation. They will learn more about what the word 'conservation' means, how they can become involved in conservation, and how they can plan career choices in the exciting field of conservation. Further, they will learn about the importance of working with many different stakeholders in solving complex conservation issues.

Session schedule continued on next page ...

Starting @ 08:30	MAX BELL AUDITORIUM	MAX BELL BUILDING ROOM 252	DONALD CAMERON HALL ROOM 300
	Concurrent Session 3 - I; Wolves and Protected Area Management; Chair: Luigi Boitani	Concurrent Session 3 - II; Education to Foster Co-existence; Chair: Hank Halliday	Concurrent Session 3 - III; Understanding and predicting wolf and depredation occur- ences, and managing wolves lethally and non-lethally; Chair: Marco Musiani
08:30	Callaghan - Linking social behaviour to a population viability analysis for wolves	Gangaas - Can an educational program change attitude towards wolf from fear to curiousity?	Bangs - Restoration of the gray wolf in the northwestern United States
08:50	Carbyn - Wolf predation and the exotic disease debate in Wood Buffalo National Park, Canada	Jickling - Wolf stories: Reflections on science, ethics, and epistemology	Jedrzejewski - Factors affecting wolf distribution, numbers, and livestock depredation in Poland
09:10	Patterson - Estimating wolf densities in central Ontario using the Sampling Unit Probability Estimator	Ortiz - Techniques and tools for educating the world about wolves	Muhly - Predicting risk of livestock depredation by wolves in southwestern Alberta
09:30	Pisapio - Validating measures of ecological integrity for wolves in protected areas	Thiel - Wolf-deer field study by high school students in Wisconsin	Shivik - The future of non- lethal methods of wolf predation management
09:50	Villemure - Large predators in small parks: wolves in La Mauricie National Park	Whitteker - Interactive and innovative programs using captive wolves as the educational cornerstone	Treves - Characteristics of wolf packs depredating on doemestic animals in Wisconsin, USA
10:20	COFFEE		
Starting @ 10:45	Concurrent Session 4 - I; When Wolves Meet Dogs Chair: Francisco Petrucci- Fonseca	Concurrent Session 4 - II; Wolf Physiology; Chair: Layne Adams	Concurrent Session 4 - III; Wolf-Human Interactions; Chair: Yadvendradev Jhala
10:45	Bologov - Wolf depredation on domestic dogs in central part of European Russia	Asa - Semen quality in generic <i>(Canis lupus</i> sp.) and Mexican gray wolves <i>(C .l. baileyi)</i>	Alexander - Wolves (Canis lupus) and roads: Barrier effects and scale dependent habitat associations
11:05	Karlsson - Interactions between wolves and dogs in Scandinavia	Frame - Use of rubber-padded foot-hold traps for research capture of wolves	Cluff - The NWT Rennie Lake area wolf kill: commercial hunt and predator control?
11:25	Ribeiro - Recovery of traditional techniques of livestock protection from wolf predation in Portugal	Hillis - Comparison of bite forces in wolves (Canis lupus sp.) along a geographical cline	K. Murray - Analysis of wolf- human interactions in Denali National Park and Preserve, Alaska
11:45	Rigg - Livestock guarding dogs and their modern role in large carnivore conservation initiatives	Schultz - Sarcoptic mange impact on gray wolves <i>(Canis lupus)</i> in Wisconsin	Percy - Daily movement patterns of gray wolves in the Bow Valley of Banff National Park, Alberta
12:05	Coppinger - The use of guardian dogs for controlling predation in peasant and pastoral economies		Haber - Persistence and social organization of wolf family lineages, Denali National Park, Alaska
12:35	LUNCH at attendees discretion		

SATURDAY, SEPTEMBER 27—MORNING (... continued)

SATURDAY, SEPTEMBER 27—AFTERNOON

Starting @	ERIC HARVIE THEATRE					
13:35	Plenary Sessions: Olof Liberg - Outcomes of Depredation Research and Management Summit held Thursday September 25 Robert Wayne - Evolutionary and conservation genetics of the wolves Levi Holt - Sacred Connection					
15:00	COFFEE					
Starting @ 15:25	MAX BELL AUDITORIUM	MAX BELL BUILDING ROOM 252	DONALD CAMERON HALL ROOM 300	DONALD CAMERON HALL SOUTH WING ROOM 30		
	Concurrent Session 5 - I; Wolf Population Dynamics; Chair: Doug Smith	Concurrent Session 5 - II; Wolf Conservation Genetics; Chair: Bob Wayne	Concurrent Session 5 - III; Trophic ecology of wolves: diet, ecology and research techniques; Chair: Dean Cluff	Concurrent Session 5 - IV; Maintaining viable wolf populations in protected and managed landscapes in the Central Rocky Mountains.; Chair: C. Cormack Gates Participants: Cliff White, Parks Canada; Glenn Brown, Alberta Guide Outfitter; Bob Jamieson, BC Rancher, ecologist and former hunting outfitter; Ken Schroderus, Alberta Trappers Association; Jim Pissot, Defenders of Wildlife Canada; Mark Hebblewhite, University of Alberta; Carolyn Callaghan, University of Calgary, Central Rockies Wolf Project		
15:25	Jozwiak - Response of wolves to changing harvest levels on the Kenai NWR, Alaska	Arndt - Genetic analysis of Manitoba and Saskatchewan wolf populations	Sand - Summer predation patterns of Scandinavian wolves			
15:45	Kojola - Wolf population ecology in Finland	Carmichael - Genetics of Arctic Island and Barren- Ground wolves	Reed - Diets of free- ranging Mexican gray wolves in Arizona and New Mexico			
16:05	Scandura - Structure and micro-scale differentiation in a wolf population of Italian Apennines	Jhala - Extant ancient lineages of wolves in the Indian subcontinent	Marucco - Winter diet selection of wolves in the Western Alps			
16:25	Vila - Two hundred years in the history of Scandinavian wolves: decline and recovery	Leonard - Impact of management regime on genetic diversity	Adams - Evaluating interior Alaska wolf diets via stable isotope analyses			
16:45	Vucetich - The population ecology of Isle Royale wolves	Liberg - A complete pedigree and loss of genetic variation in the Scandinavian wolf population	Wilmers - Meals on wheels: wolf subsidies to scavengers in Yellowstone			
17:05	Wabakken - Wolf population recovery and pair formation patterns among successful breeders in Scandinavia	Pilot - Mitochondrial DNA variability of grey wolves in Eastern Europe				
17:25	Poster Session at Max Bell Complex - All WWC2003 attendees welcome - Poster display, exhibitor display and cash bar (open at 16:45)					
17:45	An Evening with Robert Bateman at Donald Cameron Hall Silent Auction, Gala Banquet and Awards Celebration (with purchased ticket)					

SUNDAY, SEPTEMBER 28-MORNING

Starting @ 08:30	MAX BELL AUDITORIUM	DONALD CAMERON HALL ROOM 300	DONALD CAMERON HALL SOUTH WING ROOM 30	MAX BELL BUILDING ROOM 252	
	Concurrent Session 6 - I; Wolf Community (Ecological Interactions); Chair: L. David Mech	Concurrent Session 6 - II; Behavioral Ecology of Wolves; Chair: Ray Coppinger	Concurrent Session 6 - III; Livestock Depredation; Chair: Mike Quinn	Concurrent Session 6 - IV; Management strategies for small and recovereing wolf populations; Chair: Martin Smith	
08:30	Akenson - Wolves and cougars: Large carnivore competition in Idaho following wolf reintroduction	Blanco - Impact of two kinds of barriers on wolves in Spain	Fontaine - Non-lethal efforts to enhance wolf recovery and deter wolf/human/ livestock conflicts in Montana	Jhala - Foraging ecology, economics, and conservation of Indian wolves	
08:50	Hebblewhite - Wolf recolonization triggers trophic cascade in Banff National Park	Brainerd - The effects of alpha wolf loss on reproductive success and pack dynamics	Stone - Incentive strategies and collaborative conflict management for wolf conservation	Nowak - To prevent conflicts: A program of wolf conservation in the western Carpa- thians (S Poland)	
09:10	Mao - Elk habitat selection before and after wolf reintroduction in Yellowstone National Park	Jimenez - Wolf/elk interactions on state managed elk feed grounds in Wyoming	Tsingarska- Sedefcheva - Wolf diet and activity towards livestock in condi- tions of decreased natural prey	Roque - Conservation problems and solutions for an isolated Iberian wolf population in Portugal	
09:30	Musiani - Maintain- ing differentiation without geographic isolation in the North American gray wolf	MacNulty - Group hunting behaviour in wolves	Weber - Wolf depredation on livestock in the Swiss Alps, 1998-2002	Sime - Linking wolf ecology, people, place, and planning: Moving from restor- ation to maintenance	
9:50	Smith - Wolf-prey interactions in Yellowstone National Park	Wikenros - Hunting behaviour of Scandinavian wolves on moose and roe deer	Wilson - Nomads, sheep, and wolves: The conservation of cultural landscapes in eastern Mongolia	Wiedenhoeft - Counting wolves: Integrating data from volunteers	
10:20	COFFEE				
Starting @	ERIC HARVIE THEATRE				
10:50	Plenary Session: L. David Mech - Future of Wolf Research and Mangement - Examining some common claims about wolf ecology and behavior				
11:30-12:50	Plenary Sessions: Paul Paquet and David Lavigne - Important issues discussed throughout the conference and insights into the future direction of wolf research Closing Remarks: Carolyn Callaghan and Marco Musiani				



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Oral Abstracts and Films

(in Order of Session Schedule)

Thursday, September 25, 08:00, Max Bell Complex

- Special Session, By Invitation Only -

World Wolf Congress 2003 Livestock Depredation Summit

One of the primary challenges to humans coexisting with wolves is addressing conflicts between wolves and livestock producers successfully. The World Wolf Congress 2003 Livestock Depredation Summit is a full day meeting in which representatives from fourteen countries will share information on livestock depredation management. The Summit will result in a comprehensive summary of the size and nature of the depredation problem and the current depredation management practices in different contexts around the world. This summit is designed to determine what practices are working to reduce or manage conflicts. We also want to learn why certain management techniques have been successful and under what conditions they have been successful. This background will permit us to make recommendations to improve depredation management systems.

We have a very ambitious agenda for the Summit and only one day to fulfill our objectives. Consequently, we have restricted the meeting to invitees only. The findings of the Summit will be shared with congress attendees during the Saturday plenary session, and a report on the Summit will be made available to the public on www.graywolf.ca shortly after the congress.

The Livestock Depredation Summit was sponsored by Defenders of Wildlife, USDA—Wildlife Services, and the Central Rockies Wolf Project.

Thursday, September 25, 17:30, Max Bell Complex

BENOÎT LEQUETTE

Livestock Guarding Dogs Protecting Sheep from Wolves

The film shows two wolves attacking a flock of sheep and Livestock Guarding Dogs defending the flock. The 5 to 6 dogs worked all night and only two sheep were killed. Benoît Lequette will describe the film during the presentation.

Giulia Volpi and Musiani, Marco (presented by Musiani) Fladry and Electric Fences Bamboozling Wolves

This film shows behaviour of captive wolves. We tested anti-wolf barriers made of flags hanging from ropes (fladry) to impede access by wolves to food. During experiments, fladry prevented wolves from accessing food for a limited time period. Electric fences also worked, but shocked wolves could panic thus ending up on the wrong side of the fence.



Plenary Keynote Address: Friday, September 26, 09:15, Eric Harvie Theatre

How many wolves are enough ? The wolf-human interface and the role of biology, ethics and politics.

BOITANI, LUIGI

Department of Animal and Human Biology, University of Rome, Viale Università 32, 00185 Roma, Italy (l.boitani@pan.bio.uniroma1.it)

Wolves are often deeply hated or loved, rarely indifferent to human societies. The reasons for their high conflicts with human interests are well known as well as the motivations of those who want wolves to be fully protected or eradicated. The outcome of confrontation on wolf management is always dependent on the mutual strengths of biological, ethical and socio-economic factors. All have wide ranges of variations: wolf populations are remarkably resilient under a broad range of environmental variation, ethics and policies are as diverse as human societies can be. Their wide variations allows a great variety of solutions for wolf management; however, these factors often interact in complex and confused patterns and keeping them clearly distinct would greatly improve the speed and efficiency of finding solutions to the many facets of the wolf-human interface. In this presentation I examine how these factors interact and the extent of their flexibility in some recurrent questions in wolf management such as a) wolf management in protected areas vs. external areas, b) wolf control to increase ungulate populations, c) the limits to wolf recovery and distribution, d) wolf and livestock coexistence. I compare the main differences in management strategies adopted in Eurasia and North America to show that many potential and viable answers are possible to the same management question.

Plenary Panel Discussion: Friday, September 26, 10:30, Eric Harvie Theatre

Should wolf populations be controlled to enhance prey populations?

Chair: Steve Herrero

Tentative panelists include: Wlodzimierz Jedrzejewski, Bob Jickling, Mark McNay, L. David Mech, Rick Page, Paul Paquet, and Greg Roczicka.

The complex relationship between predators and prey is a contemporary object of current research efforts that also has management implications. As the human population grows and ecosystems are inevitably affected by humans, people are increasingly concerned with "how" to manage ecosystems, more so than "if" to manage them. With regard to wolf issues, some topical questions may arise: In ecosystems where humans play a pivotal role, is wolf predation the ultimate and causative factor for prey population declines? What are the implications of "human effects" on the natural system, such as those caused by habitat loss and alteration and wildlife mortalities? How do multiple predators on the landscape affect an ecosystem? Overall, we might ask with what degree of accuracy can we predict how ecosystems respond if managers manipulate its components?

The question "Should wolf populations be controlled to enhance prey populations?" is a current topic of debate among scientists, wildlife managers, politicians, and the public. The topic is debated from both a scientific efficacy position, as well as an ethical position. Wolf control is commonly applied where wolves prey on livestock (please note that this is discussed in other sessions). In some areas, wolves may threaten other vital human interests such as wild prey populations that are also economic commodities for humans. Given the complexities described above, is it scientifically-sound and cost-effective to control wolves with the objective to increase people's access to prey? Yet another component of the wolf control debate involves instances in which wolves can threaten an endangered species (for example, in Canada, the Vancouver Island Marmot).

Published literature provides information on the efficacy of wolf control that has often been characterized as "controversial" and/or "equivocal": in some instances wolf control was considered effective in enhancing prey populations, and in some case it was not. In addition, the costs, benefits and overall feasibility of wolf control programs have often been re-evaluated and criticized. Moreover, some sectors of the public maintain that any wolf control is unethical. Some argue that wolves play an important role in natural ecosystems and that humans should

not interfere with any such ecosystem functioning. Conflicts are intense among people with different interests. In instances where public opinion is polarized, non-lethal methods have been proposed to counteract the perceived effects on wolves' prey. However, the question remains: What is the cost-effectiveness and biological or social feasibility of lethal and non-lethal wolf control methods?

This session is designed to discuss the biological and ethical implications of wolf control to enhance prey populations. Representatives with various expertise and perspectives have been invited to discuss and debate the topic. Public involvement in management decisions regarding controversial issues such as wolf control is important and inevitable. This plenary session will offer the opportunity for the audience to intervene in the discussion.

Friday, September 26, 13:30, Max Bell Auditorium

Succession Debt: Effects of Logging on Wolf-deer Dynamics in Coastal British Columbia and Southeast Alaska

DARIMONT, CHRIS T.; Person, David K.; Paul C. Paquet & R. Terry Bowyer

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Logging in the temperate rainforests of coastal British Columbia initiates a pattern of forest succession and road access by humans that has long-term adverse consequences for wolves and their deer prey. We call this "succession debt". Twenty-five to 40 years after clear-cutting, regenerating stands of even-aged conifers grow into a "stem exclusion" stage characterized by a dense canopy and depauperate under-story, which substantially reduces carrying capacity for deer. Once initiated, changes are irreversible and cannot be mitigated by adjustments to future forest management. Moreover, logging roads facilitate access to wolf and deer habitat. Long-term effects include declines in populations of deer and wolves, increased exploitation of deer and wolves by humans, greater probability that wolves will suppress deer numbers, and increased likelihood of conflicts between hunters and wolves for deer. Moreover, island populations in this archipelago are more vulnerable to disturbance from logging and less likely to be readily recolonized. We compare wolf-deer systems from adjacent areas of coastal British Columbia and southeast Alaska. In sparsely populated and nearly pristine coastal northern British Columbia, human-caused mortality of wolves is low, and prey populations are likely at historical levels. In contrast, Prince of Wales Island in southeast Alaska has undergone extensive timber removal. Killing of 30-40% of the wolf population annually is common and we predict substantial declines in deer populations over the next 50 years. Resource managers need to consider long-term consequences of forest management on predator-prey systems and recognize that mitigation of those consequences may not be possible.

Wolf Recovery in the Lower 48 States: What next?

FASCIONE, NINA

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As a result of the successful expansion of gray wolf *(Canis lupus)* populations and active restoration programs under the Endangered Species Act, the U.S. Fish and Wildlife Service has lessened protections for this species throughout the lower 48-states. A federal rule, released on April 1st, 2003, reclassifies wolves from endangered to threatened in much of their range and removes federal protections entirely in 16 states. Defenders applauds the U.S. Fish and Wildlife Service for the work done to date restoring wolves. Nonetheless, these changes set less ambitious goals for continued restoration than are essential to long-term recovery and would fail to complete the job of saving wolves. Equally important, they would fall short of realizing significant opportunities to restore ecological integrity to important ecosystems and of maximizing the many cultural values of this species to the American people.

Achieving true long-term recovery of the gray wolf requires not just protection and expansion of current populations, but also active restoration of *Canis lupus* to additional areas, including the southern Rockies, the Pacific Northwest and the northeastern United States.

Relative success of the reintroduction of Mexican wolves to other wolves in the United States

KELLY, BRIAN T., Colleen Buchanan, John Oakleaf, Mike Phillips, Dan Stark

U.S. Fish and Wildlife Service, P.O. Box 1306, Albuquerque, NM, 87103, USA; phone 505-248-6656; Brian_t_Kelly@fws.gov (BTK and CB); U.S. Fish and Wildlife Service P.O. Box 856, Alpine, AZ, 85920, USA; phone 928-339-4329 (JO and DS); Turner Endangered Species Fund, 1123 Research Drive, Bozeman, MT, 59718, USA; phone 406-556-8500 (MP);

During the past 16 years, 3 wolf recovery programs were initiated using the reintroduction of wolves as the mechanism to achieve recovery. The Mexican wolf recovery program is the most recent of these efforts and provides a significant point of comparison and contrast to the similar yet different efforts undertaken with red wolves in North Carolina and gray wolves in Yellowstone National Park and Idaho. The Mexican wolf program combines the unique challenges of each program into one. Like red wolf recovery, captive born and raised Mexican gray wolves were the release stock for reintroduction, and like gray wolf recovery in Idaho and Wyoming, but unlike the red wolf program, opportunities for wolf-livestock conflict are numerous in the current Mexican wolf reintroduction effort. Despite this unique combination of challenges, the current Mexican wolf reintroduction is succeeding. This success provides us an opportunity to evaluate the relative success of the Mexican wolf recovery program to date to the other wolf reintroduction efforts in the U.S. at this point in time. Many have characterized the Mexican gray wolf reintroduction as not successful but when compared to similar efforts the Mexican wolf program is found to be very successful biologically. At 5 years after the first wolves were reintroduced, second generation wild conceived and born offspring were documented within a normal generation time of 4 years, established packs are surviving and reproducing, and new packs are forming. Administratively this success has been achieved by a collaborative management approach with State, Federal, Tribal and private participation in the reintroduction's day to day activities.

Improving of wolf habitat in SW European countries

PALACIOS, FERNANDO

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The present conditions of wolf habitats in Western European countries, which have been created by humans bent on uncurtailed development and the use of natural resources to maximize benefits, are a trap for this wild species. The domestication and the development of free-grazing livestock raising practices have created the circumstance in which the wolf has become a livestock predator. This trait serves to justify those who obtain a profit from the wolf conflict (public authorities, hunters, consultants) to authorize or support wolf hunting, thus leading to a chaotic management scheme that sanctions persecution by any method. Those who are satisfied with managing wolves in humanized environments in Western European countries and those who benefit economically from the wolf conflict should understand that it is necessary to contribute politically and economically to improving wolf habitats. The necessary improvements in habitat include prohibiting free-grazing practices (extensive grazing) in open areas, promoting semi-extensive grazing practices supervised by professional shepherds and dogs who rotate and watch livestock by day and guard them at night, measures to ensure that livestock carrion remains out of the reach of wolves, promoting wild ungulates and restoring their habitat, prohibiting big game fences, and prohibiting the persecution of wolves that feed on wild prey. The most viable option for the continued existence of the wolf in Western European nations, which have wealthy, modern, democratic and civilized citizens who are supposedly concerned about the conservation of biological diversity, is to guarantee that wolves and their natural functions can be integrated into natural settings and that the species can cease to live traumatically.

Wolf Recovery in the U.S. Southern Rocky Mountains

PHILLIPS, MICHAEL K.

Turner Endangered Species Fund, 1123 Research Drive, Bozeman, Montana 59718 (tesf@montana.net)

Since the mid-1990s there has been considerable interest in restoring wolves to the U.S. Southern Rockies Ecoregion. Wolf recovery there is probably a requisite for delisting the species throughout much of the western United States and would serve as a capstone for wildlife conservation. This study was undertaken to document the biological and social aspects of restoring wolves to the Ecoregion. The Ecoregion extends from south-central Wyoming, western Colorado, and north-central New Mexico and includes much public land (about 10 million hectares) and much wild prey (e.g., an estimated 300,000 elk and 500,000 deer inhabit Colorado) that could support a self-sustaining population of 1,000 or more wolves. There is considerable public support for restoring wolves to the area and significant citizen-based efforts have risen in support. Since the Ecoregion is nearly equidistant from the population of wolves in the U.S. Northern Rocky Mountains and the population of a metapopulation of wolves from the arctic to Mexico. Nowhere else in the world does such an opportunity exist to effect large carnivore restoration over an area of continental proportions. Moreover, the southern portion of the Southern Rockies may offer the only hope for recovering the Mexican wolf.

Friday, September 26, 13:30, Donald Cameron Hall, Room 300

Transboundary assessment of Mexican wolf recovery needs using a dynamic population model

CARROLL, CARLOS, and Michael K. Phillips

Klamath Center for Conservation Research, PO Box 104, Orleans, CA 95556 (carlos@sisqtel.net) (CC) Turner Endangered Species Fund, 1123 Research Drive, Bozeman, MT 59718 (MP)

Long-term conservation of the Mexican wolf *(Canis lupus baileyi)* likely depends on establishment of a viable metapopulation spanning a larger portion of its historic range in the U.S./Mexico transboundary region. We performed a regional-scale population viability analysis for the subspecies across its entire historic range using a dynamic, individual-based model (PATCH) that assessed potential habitat and the effects on viability of projected landscape change associated with human population growth and development of rural lands. We faced challenges in gathering consistent habitat data over such a large region spanning two nations, and in linking population dynamics to mapped habitat data at these scales. The complexity of the population model, and its sensitivity to poorly-known parameters such as dispersal distance, also added uncertainty to model results. Despite this uncertainty, our results allowed us to prioritize areas for conservation management and wolf reintroduction and compare the efficacy of alternative conservation management strategies. Comprehensive analyses such as this one can be key factors in strengthening recovery efforts in the many regions of the world where threatened wolf populations span national, state, and provincial boundaries.

Wolf Use of Corridors in the Central Canadian Rockies: multivariate use of habitat characteristics

DUKE, DANAH and Suzanne Bayley

Miistakis Institute for the Rockies, c/o Environmental Design, 2500 University Drive, NW (DD); University of Alberta Department of Biological Sciences, CW 405, Biological Sciences Centre (SB)

Wildlife corridors are recognized as important features allowing the persistence of large mammals in humandominated environments. Using snow-tracked wolf *(Canis lupus)* travel routes within corridors (collected from 1993-2000 in Banff National Park and Yoho National Park), We compared available habitat characteristics to those of wolf travel routes to determine the characteristics most important for wolves as they utilize corridors. Slope, distance to cover, relative prey abundance, distance to trails, and corridor width were important predictor of wolf travel routes. I found that wolves prefer flat to gentle slopes, areas <50m from trails, high relative prey abundance and in close proximity to forest cover (<25m), the latter being particularly important in corridors adjacent to high levels of human activity. These results can be used to assist wildlife and land managers to maintain, restore and design wildlife corridors to enhance connectivity for wolves in the Rocky Mountains.

Framing Bias and Resource Selection Models for Gray Wolves (Canis lupus) in Canada

ETHERINGTON, THOMAS R. and Shelley M. Alexander

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The effect of scale in GIS-based habitat analysis is a key research area. The results from resource selection models, based on one wildlife dataset and developed using Geographic Information Systems (GIS), can vary with subtle changes in the definition of available habitat. We investigated the effect of varying the analytical frame on predictive models developed using logistic regression and information theory. Data were collected on road, right-of-ways, and transects in Banff National Park and Kananaskis Country, Alberta, between November and March, 1997-2000. Winter resource selection models were developed using wolf *(Canus lupus)* presence, indicated by track data. Dependant variables used in the model included slope, aspect (eastness and northness), elevation, greenness, distance to high greenness, terrain ruggedness, distance to high terrain ruggedness, stand-age, prey density, distance to cover. Pseudo-absence points were identified using random sample point generation algorithms for five successively larger analytical frames. Predictive spatial models were constructed for each frame and compared using image-differencing techniques. We concluded that sampling design plays a key role in the effects of framing bias, particularly in mountainous environments. In addition, the designation of available habitat can alter significantly the output of predictive models. Changes observed between the models can highlight limitations in the sampling regime and aid in the identification of additional landscape metrics critical to analysis.

Predicting the recolonization rate of wolves using mathematical models

HURFORD, AMY, Mark Hebblewhite, Mark Lewis

 AH - Centre for Mathematical Biology, Department of Biological Sciences, University of Alberta, MH – Department of Biological, University of Alberta,
 ML - Centre for Mathematical Biology, Department of Biological Sciences & Department of Mathematics and Statistics, University of Alberta

Wolf reintroduction to Yellowstone National Park (YNP) has been a remarkable biological success with wolf populations expanding from about 30 reintroduced wolves to 250 wolves in 2002. Of more than 20 established wolf packs, approximately 14 packs have established home ranges entirely outside the boundary of YNP. As the wolf population in the Greater Yellowstone Area continues to grow and expand, wolves are expected to recolonize areas of high prey abundance and low human use. Previous efforts have focused on predicting where new wolves might recolonize using resource selection function based approaches. However, few have explicitly addressed the temporal element of recolonization. The objective of our paper is to examine this neglected temporal element of wolf recolonization. Mathematical biology has had a long history using diffusion-based models and derivations to predict the rate of spread of invading organisms in novel environments. To address the temporal element of recolonization for wolves in Yellowstone National Park, we consider a variety of approaches including differential and integrodifference models, combined with wolf dispersal data from the Northern Rockies Ecosystem and published wolf demography data. Preliminary results suggest differential and integrodifference are able to predict the rate of spread (km/year) of Yellowstone wolves. We believe our approach shows great promise to model wolf dispersal. Furthermore, the addition of a temporal element to spatially explicit dispersal models will aid wildlife managers in anticipating wolf recolonization with appropriate legislation and policy.

Habitat Selection by Recolonizing wolves in the Northwestern United States

OAKLEAF, JOHN K., Dennis L. Murray, Edward E. Bangs, Curt M. Mack, Douglas W. Smith, Joseph A. Fontaine, James R. Oakleaf, Michael D. Jimenez, Thomas J. Meier and Carter C. Niemeyer

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Gray wolf populations have persisted and expanded in the northern Rocky Mountains since 1986, while reintroduction efforts in Idaho and Yellowstone have further bolstered the population. However, rigorous analysis of either the availability of wolf habitat in the region, or the specific habitat requirements of local wolves, has yet to be conducted. We examined wolf-habitat relationships in the western U.S. by relating landscape/habitat features found within wolf pack home ranges (n = 56) to those found in adjacent non-occupied areas. Logistic regression of

occupied versus unoccupied areas revealed that a higher degree of forest cover, lower human population density, higher elk density, and lower sheep density were the primary factors related to wolf occupation. Further, our analysis indicated that relatively large tracks of suitable habitat remains unoccupied, suggesting that wolf populations likely will continue to increase in the region. Analysis of the habitat linkage between the 3 main wolf sub-populations indicates that populations in central Idaho and northwest Montana have higher connectivity, and thus greater potential for exchange of individuals, than does either subpopulation to the Greater Yellowstone Area subpopulation. Thus, for the northern Rocky Mountains to function as a metapopulation for wolves and other carnivores (e.g. lynx, wolverine, and grizzly bears), it will be necessary that dispersal corridors to the Yellowstone ecosystem be established and conserved.

Friday, September 26, 13:30, Max Bell Building, Room 252

Exploring history to change negative sentiments and influence sound wolf management?

ATKINSON BERG, KARLYN

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In 1968 I began to collect, record and document historic perceptions about the wolf, including complex cultural images and international perspectives and compare old beliefs with current attitudes. I have continued to address the relationship between humans and wolves and explore how historic images influence in our interactions with the wolf. Interest in wolf increased dramatically and recovery and reintroduction efforts have been initiated, however, the future survival of the wolf remains controversial and uncertain. I will examine if has there been a resurgence of negative attitudes, or if these attitudes have persisted and are now becoming unmasked as the movement to remove wolf protection escalates. This program will also provide a historic and visual review of wolf conflict, past and present animal damage control methods, and wolf protection. Historically the slaughter of predators was not an incidental by product of taming the land or an accidental destruction, but an organized, efficient, well financed efforts to return to extensive lethal wolf control? Can understanding the historic source of these negative ideas help change these negative sentiments and influence ecologically sound wolf legislation and management? People mistakenly assume the wolf's survival is secure in a more environmentally aware world. I suggest that there is a need to investigate history in order to change negative attitudes so the wolf does not continue to be a symbol of the failure of humans to co-exist with predators.

Sound Science Is Never Enough: Ethics, Science and Values in Wolf Recovery

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Biologists note that the restoration of wolves is primarily a social as opposed to an ecological issue. Wolves will thrive wherever there is sufficient prey, habitat and freedom from human persecution. This is an insightful point, and becomes more powerful when we recall how ethical norms condition our willingness to live with wolves. Even so, there is a mismatch between the science and ethics of wolf recovery. Both scientific and policy discussions of wolf recovery tend to emphasize 'sound science'. Sound science is supposed to be the evidence-based, theory-rich baseline for managing wolves in both wild and humanized landscapes. Yet as previously noted, humanity's trouble with wolves is deeply informed by conflicting values, which have little or nothing to do with empirical data, quantitative models, or management techniques. Instead, they are deeply rooted ethical conflicts over our coexistence with large predators. Society needs, therefore, a 'sound ethics' to complement our science, as well as to guide our efforts in wolf recovery. A sound ethics should, at a minimum, recognize the *moral standing* of wolves, highlight the *moral significance* of the science-based management of wolves, and emphasize the *practical value* of ethics in the restoration of wolves.

Here Comes the Wolf: Public Attitudes Toward Wolf Recovery in Michigan

MERTIG, ANGELA G., Rik Scarce and Pat Lederle

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Although native to Michigan, wolves no longer existed in most of Michigan by the mid 1900s. Since the late 1980s, however, the wolf population has been recovering naturally in Michigan's Upper Peninsula (UP), as wolves from other areas have moved there. Many observers believe it is possible that wolves may move south over the frozen Lake Michigan into Michigan's Northern Lower Peninsula (NLP) sometime soon. A public opinion survey in 1990, prior to the establishment of a viable wolf population in Michigan, indicated that the public was relatively supportive of wolf recovery in Michigan. This paper reports on a public opinion survey of Michigan residents conducted in spring/summer of 2002 (final n=556; response rate=59.4%). The survey was conducted via mail, using disproportionate stratified sampling to ensure adequate representation from the less populated portions of the state (which are also those areas more likely to have wolves now and in the future). Half of the sample received a survey specific to the presence of wolves already in the UP; the other half received a survey specific to the possibility of wolves moving southward into the NLP. Each survey repeated several of the questions that had been included in the prior survey (1990) and included information about people's interactions with, interest in, attitudes toward and knowledge of wolves. This paper reports on results of this survey and analyzes differences in public attitudes and knowledge by key background variables, such as

The Group to Which People Belong

PETERSEN, THOMAS R.

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The story I would like to present, *The Group to Which People Belong*, is a synthesis of my graduate work (and was my dissertation) at the University of Montana in 1994. The story is a creative nonfiction essay that attempts to pick up where Barry Lopez' *Of Wolves and Men* left off when it was published in 1978. The essay is an exploration of attitudes towards wolves in the midst of the historic reintroduction in the U.S. in the mid 1990's. The story weaves interviews with ranchers in Cody, Wyoming during the wolf reintroduction hearings in 1993; conversations with key wolf biologists Mike Jimenez and Ed Bangs; and culminates in a trip to Pincher Creek, Alberta with wolf biologist Diane Boyd, to find the killer of one of the first wolves to bear pups in Glacier National Park in over sixty years: a creamy-white wolf named Phyllis. The story is ostensibly about Phyllis, but the real story is about people's values towards wolves, and why we still feel so passionately, hating or loving them; it is about whether attitudes have changed since the reintroduction, or if they have even changed since the Middle Ages, where Lopez took his readers to find one of the sources of wolf history and wolf mythology. E.O. Wilson coined the term "biophilia" to describe "...the innately emotional affiliation of human beings to other living organisms." I write to say we are not just *like* animals, we are animals; they are the group to which people belong.

Friday, September 26, 15:45, Max Bell Auditorium

Current status of the gray wolf, its prey and human-wolf interaction in Turkey

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The lack of information on wolf population hinders planning of wolf management in Turkey. The exact distribution of wolves is not known in Turkey and the authorities think that wolves cause significant damage to livestock industry. Therefore, wolves are listed as pest species in Turkish legislation. To gather baseline data about

wolves in Turkey, we have studied the distribution of wolves in Bolu in Central Anatolia by snow tracking from January to April 1999. We have conducted a questionnaire study and distributed 450 questionnaires in an area of 73.863 km2 in southeastern Turkey to reveal the presence of wolves and wolf-human conflict in 2001. We have also interviewed key local authorities and locals (N=110 from 19 provinces) about wolf presence in different regions of Turkey between 1999-2002. Our results indicated that the presence of wolves was highly determined by the presence of wild boar and brown hare with a significant (p<0.01) association. We estimated the density of wolves as 2.2 to 2.8 wolves per 100 km2 in Bolu. The wolf caused mortality for the wild boar was estimated to be more than 16 % and human caused mortality for the study population was 29-36% in Bolu. The initial analysis of the questionnaires showed that the perception of the wolf differs among local people and eradication of wolves by all possible means has been ongoing in Turkey. The future of wolves depends on limiting the conflict between wolves and humans, recovery of declining prey populations and planning wolf management in Turkey.

Wolf territories in Scandinavia; sizes, variability and their relation to prey density

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The Scandinavian Wolf Research Project SKANDULV has been studying the re-established wolf population since 1998. In this paper we report on annual territory size in relation to social organization and prey density. Nineteen annual wolf territories were estimated for 12 different territories in south-central Scandinavia during 1998-2002. The wolves were followed from ground or by aircraft using either conventional VHF radio-telemetry or GPS-technology. Wolf territory sizes were estimated using the Minimum Convex Polygon (MCP) and the Adaptive Kernel Method (AKM). So far a preliminary analysis of the data (8 annual territories for 6 different wolves during 1998-2000), has shown that MCP on average is 1259 km2 (range 405-2221 km2), whereas AKM is 1057 km2 (range 484-1849 km2). In stable territories, with a reproducing pair, the MCP-method gave 90% territory cover estimates with 100-150 positions evenly distributed over the year. In unstable territories, with one adult animal, 150-200 positions were needed to cover the same proportion of the total area used by the wolves. Scandinavian wolf territory sizes were generally larger than was North-American territories at comparable prey densities and at similar latitude. They were generally smaller than North Alaskan territories but larger than wolf territories further south in North America or in Europe. Wolf territory sizes in North America, but not in Scandinavia, were related to ungulate densities with larger territories at low values of relative ungulate biomass.

Assessment of the WOLF5 Model: 8 Years After Wolf Recovery in Yellowstone

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Recovery of gray wolves *(Canis lupus)* in the Yellowstone National Park ecosystem has provided the opportunity to evaluate predictions made prior to recovery. Eight years after wolves were transported from Canada to Yellowstone a thriving population has been established. Efforts to forecast the ecological ramifications of restoring wolves to the Yellowstone ecosystem were made prior to reintroduction while intensive field studies have focused on

predator/prey relationships after wolf recovery. The Boyce WOLF5 model simulated the consequences for ungulate populations after wolf reintroduction under varying levels of population density, management action and winter severity. This model was evaluated using empirically based parameters from the post-wolf era. Functional and Numerical Response terms were modified to reflect observed relationships in wolf/prey dynamics. Elk (*Cervus elaphus*) and wolf population age structure was added and harvest levels were varied. As with the original model, prey populations were expected to be reduced 10-30%, with elk as the principal species. Consequences of wolf predation on ungulate populations are influenced significantly by climate and management practices. Overall, the WOLF5 model was a useful tool for forecasting and has proven adequate for describing current wolf/prey relationships in Yellowstone.

An analysis of factors affecting wolf mortality across three recovery areas in the Western United States

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Wolves were extirpated from the northwestern U.S. in the early 1900's, and recent transplants to Yellowstone and central Idaho, along with natural recolonization in northwestern Montana, have allowed the species to become reestablished in the area. We used multivariate regression models to analyze factors associated with mortality and cause of death for radio-collared wolves (n>400) across the three recovery areas (1982-2002). Wolves had similar annual mortality rates in Yellowstone and Idaho (approx. 0.20) whereas mortality in Montana was considerably more common (>0.40). Across recovery areas, mortality rates varied annually and were lower for resident than dispersing animals. Males had slightly higher mortality rates than did females, and prime-aged wolves (3-6 years) had the lowest mortality rates of all age classes. Factors such as season, transplant status, social status, breeding status, and pack size, failed to correlate to wolf mortality rates, whereas the importance of prey density and private versus public land ownership in the wolf pack's home range differed between recovery areas. Overall, the principal cause of wolf death was of anthropogenic origin (illegal killing, control actions by wildlife damage personnel), and when considered in the context of the above results illustrates the need for adequate space, habitat, and protection status, for effective wolf population recovery.

Growth, Survival, and Productivity of a Colonizing Wolf Population in Wisconsin

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Wolves recolonized the state of Wisconsin in the mid-1970s after being extirpated for about 15 years. Between 1979 and 2002, the Wisconsin Department of Natural Resources (WDNR) maintained constant monitoring of the state wolf population through live-trapping and radio tracking, winter track surveys, summer wolf howls, and public reports. The wolf population in Wisconsin ranged from a low of 15 (1985) to 327+ in 2002, and ranged from 4 to 83 packs. Mean estimated pup survival from late gestation to about 9 to 11 months was 0.30 (range 0.16 to 0.57). During periods of disease outbreak of Parvovirus (mid 1980's), and initial outbreak of Sarcoptic mange (early 1990s), pup survival declined to <0.20. Mean pack size was 3.7 (SD + 0.64) wolves, but declined to < 3.0 during periods of severe disease outbreak. A mean of 36% (SD + 16.4%) of packs had no surviving pups in late winter. Survival of older wolves (1+yr) was 0.61 during the early 1980s when wolves declined, but increased to 0.82 in the late 1980s and early 1990s, and has remained high in recent years. Since 1985 the wolf population increased an average of 20% annually, and experienced a slight decline during only one year. Areas occupied by wolf packs expanded from about 1500km 2 in the early 1980s to about 13,000km 2 in 2002. The wolf population continues to increase, but growth may decline or stabilize soon as most suitable habitat is occupied, and more liberal lethal controls are enacted.

Reproductive Characteristics of an Exploited Wolf Population

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In most wolf packs a single reproductively dominant female produces pups. However, examination of reproductive tracts collected from heavily hunted and trapped wolf populations in Alaska suggested higher pregnancy rates occurred in exploited populations. To assess the role of exploitation in stimulating high pregnancy rates and to estimate the contribution of secondary females to net productivity we captured, radio marked and closely monitored female wolves from an exploited wolf population in interior Alaska. We darted wolves from a helicopter, and performed 68 ultrasound scans for pregnancy over a 4-year period (1996-1999). Ninety four percent of primary (i.e. alpha) females (n=31) were pregnant. Annual pregnancy among secondary females ranged from 40%-80% and was highest following intensive trapping. An estimated 61% of secondary female pregnancies contributed pups to summer wolf populations. Nine of 36 annual wolf packs contained more than one pregnant female; in each of 2 packs at least 4 females were pregnant. At least 5 of the 9 multiple pregnancy packs produced surviving, multiple litters. Overall, estimated pup survival among 18 *in utero* litters of primary females averaged 60% to autumn, but survival varied with pack social structure. In utero through early autumn pup survival appeared to be lower in pairs with no previous offspring than in larger packs with offspring from previous years (0.48 vs. 0.65, p=0.13). Exploitation contributed to initial high pregnancy rates and multiple littering, but some packs produced multiple litters by reproductively co-dominant females in the absence of exploitation.

Friday, September 26, 15:45, Max Bell Building, Room 252

Integrating a human dimensions approach to addressing wolf management issues in Europe

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Human dimensions in wolf management have long been recognized as an essential tool given that most of the challenges faced today in managing wolves tend to be more socio-political in nature than biological. Human dimension studies focused as "research tools" are useful in identifying: (1) the nature of conflicts between groups (e.g., cognitive, value, cost/benefits and behavioral) (2) support or opposition for types of wolf management options (3) weaknesses in knowledge that are most directly linked to attitude thus enabling the focusing of educational messages (4) to evaluate the effectiveness of educational programs. While human dimensions work in these directions offers managers useful insights into the nature of the issue, to actively resolve types of conflicts and build partnerships between diverse interest groups human dimensions must go beyond its traditional role as an academic research tool and move into a much more applied "human dimensions conservation (HDC) approach". Such a facilitated HDC approach is currently being applied in Croatia to enable a variety of interest groups to work together through consensus toward the design of a national wolf management plan. While the characteristics and steps of such a HDC approach are not fully understood and tested, the approach of getting groups to initially come and work together, managing the dynamics of the first meeting, building on common ground, encouraging discussion on visions and goals first, and focusing on principles rather than positions, holds considerable promise for a new way for managers to create wolf management plans that have wider public acceptance.

Wolf status in the French Alps: from monitoring to damage management

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The wolf disappeared from France in the 1930's. After more than sixty years it returned to the French Alps where it was first observed in 1992 in the Mercantour national Park (southeastern France), expanding from Italy where their population is in numerical and geographical increase since the 1970's. Since then, the species kept expanding; and permanent wolf presence is now observed throughout most of the French Alps. A large scale monitoring of the species has been established using both field observations and genetic methods. More than ten years after the first sighting an overview of the species status and its management can be given. The field monitoring network is coordinated by the Office National de la Chasse et de la Faune Sauvage and is based on more than 450 field workers. During the winter 2002/2003 ten different areas were occupied by wolves, 6 of them having packs that already reproduced at least once in previous years. Non-invasive genetic sampling methods are used to confirm wolf presence in newly colonized areas. Several hundreds of scats have thus been analysed allowing a good control of data obtained from field observations of wolf signs (scats, tracks and prey carcasses). As damage to livestock frequently occurs within areas occupied by the wolf, this control facilitates the settlement of prevention systems in order to reduce damage to livestock and also facilitates damage compensation.

Human Dimensions in Iberian Wolf Management in Portugal

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The goals of this first human dimension in wolf study in Portugal are: understanding attitudes and beliefs toward wolves and wolf management, exploring how they differ between interest groups and across space, and identifying factors affecting those attitudes. The study is focused south of the Douro River where 23-34 wolves exist, seemingly fragmented from the main population located to the north. Quantitative data on people's attitudes and beliefs toward wolves and wolf management was collected through 1753 personal interviews with the general public (n=1209), livestock owners (n=111), hunters (n=105), and high school students (n=328), in three different zones, Aveiro/Viseu (n=573), Guarda (n=590), and Castelo Branco (n=590). Interviews were conducted using a questionnaire with 68 items covering attitudes, beliefs, experiences with wolves, importance of wolf issues, and socio-demographic data. Unstructured qualitative interviews with 31 interest groups (e.g., livestock owner and hunter associations) allowed the identification of issues and solutions. Attitudes toward wolves do not differ across zones but differ between interest groups, with hunters and students showing more positive attitudes than the general public and the livestock owners. Livestock owners strongly support a compensation system for livestock damages caused by wolves, but are not in favour of receiving money for living in zones where wolves exist. Most interest groups are neutral to moderately positive toward having livestock owners required to buy insurance for their flocks, and not receiving financial support from the Government. Such results have implications to European Union discussions regarding agricultural subsidies and the common agricultural policy.

Paying for Tolerance? The impact of depredation and compensation payments on rural citizens.

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As wolf populations recover in Wisconsin, U.S.A., their depredations on livestock, pets and hunting dogs have increased. We used a mail-back survey to assess 535 rural citizens' tolerance for wolves and their preferences regarding 'problem wolf' management. Specifically, we tested whether people who had lost domestic animals to wolves or other predators were less tolerant of wolves than neighbouring residents who had not, and whether compensation payments improved tolerance for Wisconsin and the likelihood s/he would shoot a wolf. We also measured individuals' approval of lethal control and other wolf management tactics under five conflict scenarios. Multivariate analysis revealed that the strongest predictor of tolerance was cohort: bear hunters were concerned about losing valuable hounds to wolves and were more likely to approve of lethal control and reducing the wolf population than were livestock producers, followed by general residents. To a lesser degree, education level, experience of loss, and gender were also significant. Livestock producers and bear hunters who had been compensation. Yet all respondents approved of compensation payments as a management strategy. Our results indicate that deep-rooted social identity and occupation are more powerful predictors of tolerance to wolves than individual encounters with these large carnivores.

Friday, September 26, 15:45, Donald Cameron Hall, Room 300

Adaptive Management to Reduce Coyote Introgression into the Red Wolf Genome

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A population and habitat viability assessment conducted in 1999 identified the major obstacle to recovery of the red wolf *(Canis rufus)* in the wild as introgression of coyote *(Canis latrans)* genes into the red wolf genome. An adaptive management plan using sterilized animals as a buffer to introgression and geographic zones of gradated management intensity was developed to mitigate the impact of coyote/red wolf interactions. The objective for the most intensively managed zone (zone 1) was to maintain the zone free of coyotes or hybrids through active removal. All terrestrial access to this core zone would require transit through a research zone (zone 2) where tubally ligated or vasectomized non-wolf canids served as space holding buffers in areas not occupied by red wolves. The outer most zone (zone 3) represented territory beyond the capacity of intensive management. Active trapping, radio collars to support land based and aerial telemetry, and genetic analysis of scat surveys were among the tools used to assess the genomic integrity of the zones from 1999 to 2003. Intensive data management using advanced GIS technology has allowed timely adaptation of management, contributing to success. Since implementation of the adaptive management plan, it has been possible to manage zone 1 as a coyote free zone. It has also been possible to increase the size of zone 1 and expand zone 2 management practices to a larger area. The use of sterile, hormonally intact non-wolf canids is proving to be a useful management tool.

Translocation of wolves associated with livestock depredation in a recovering population

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Gray wolves (*Canis lupus*) have become reestablished in the Upper Peninsula of Michigan, through immigration of animals from the neighboring states of Minnesota and Wisconsin and the Canadian province of Ontario. The wolf population has increased from 3 animals in 1989 to 278 animals in 2002. Wolves in Michigan are currently listed as a federally endangered species. In 1998, the first case of wolf depredation on livestock was verified. The only management response to wolf depredation allowed under the federal endangered status is live-capture and relocation of nuisance animals. To date, we have verified 16 cases of wolf depredation on livestock. We have trapped and relocated 24 wolves at 5 farms that experienced wolf depredation. Translocated wolves were released with radiocollars an average of 124 km from the trapping location. None of the translocated wolves remained in the vicinity of their release site. Three wolves returned to their territories and 4 wolves settled into territories in new areas. Translocated wolves often moved long distances in short periods of time. Radio contact was lost with 8 wolves after an average of 58 days, although 3 of these animals were later recovered. Four wolves died before settling into a territory. The fate of 6 wolves trapped and translocated in 2002 is still being assessed. Regardless of their movements or fate, none of the translocated wolves were associated with livestock depredation after they had been moved. Survival of translocated wolves did not differ from wolves that were not moved (P = 0.82).

Evaluating Wolf Control in Response to Livestock Depredation in the Northwestern U.S.

BRADLEY, ELIZABETH H., Daniel H. Pletscher, Edward E. Bangs, Kyran E. Kunkel, Douglas W. Smith, Curt M. Mack, Carter C. Niemeyer, Joseph A. Fontaine, Thomas J. Meier, Michael D. Jimenez

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Wolf depredation of livestock in the recovery areas of Montana, Idaho, and Wyoming has been a challenging management issue. Effectively mitigating livestock damage without impeding wolf population growth has been important in attempts to improve local tolerance while working towards recovery goals. The U.S. Fish and Wildlife Service, with the assistance of Wildlife Services, translocated 107 wolves and lethally controlled 141 wolves in response to livestock conflicts from 1987-2002. We evaluated these two wolf control methods to determine their effectiveness in reducing livestock conflicts. First, we looked at all cases of removal from established packs, either from lethal control or translocation, where only part of the pack was removed. To determine whether livestock killing behaviour decreased in the remaining pack, we compared depredation intervals pre- and post-removal. We considered control actions successful if packs were not implicated in any confirmed depredations for > 1 year. We looked at effects of remaining pack size and alpha removal in this regard. Wolf removal helped to decrease the rate of livestock depredations, but 2/3 of packs depredated again within 1 year. Second, we assessed the fate of translocated wolves to determine whether they survived, established or joined reproductive packs, and/or resumed livestock depredations. We looked at effects of age, social status, and cohesiveness of relocated wolves, as well as release method (hard or soft), release location, and distance of translocation. For both control methods, we assessed whether wolves reproduced and contributed to recovery goals. Our findings may be useful for future management decisions.

How should we count wolves?

MEIER, THOMAS J. Carolyn A. Sime and Edward E. Bangs

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Wolf populations can be monitored by counting wolves or packs, or by measuring wolf movements, reproduction or mortality. In the U.S. Northern Rocky Mountains, wolf recovery is evaluated by counting breeding pairs (BP), defined as a male and female wolf raising at least two pups through December 31. Enumerating wolves by age and sex in winter can be difficult. If total wolf numbers or numbers of packs can substitute for more detailed criteria, it might allow significant savings in money, effort and intrusiveness. We show that the number of BP is highly correlated with total wolf numbers and with numbers of wolf packs. In Montana, we predict 8.3 BP per 100 wolves (r2 = 0.94, 95% CI: 7.7-9.0), 6.6 BP per 10 packs of 4 or more wolves (r2 = 0.93, 95% CI: 6.0-7.1), and 7.9 BP per 10 packs of 5 or more wolves (r2 = 0.96, 95% CI: 7.4-8.4). We review survey methods, and present results of a survey of wolf and conservation biologists, on population viability standards. For precise monitoring of populations in most habitats, radio telemetry is probably needed. If we manage wolves close to some threshold number, or need to document dispersal, or if we believe that wolves are so inherently dangerous or vulnerable that we must keep close track of them, then such precision is warranted. If we are willing to tolerate more wolves or more ambiguity, then less intrusive and expensive, but less precise and repeatable methods, like track surveys, may be acceptable.

Yellowstone wolves and GPS collars: New insights from new technology.

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We describe techniques in applying Global Positioning System (GPS) technology to investigate a variety of ecological and behavioural topics involving wolves (*Canis lupus*) in Yellowstone National Park (YNP), Wyoming. Because GPS collars provide more accurate and numerous data compared to traditional radiotelemetry collars, we have added this technology to our monitoring program to enhance our understanding of 1) seasonal predation patterns; 2) spatial and temporal interactions with other wolf packs, GPS collared cougars (*Puma concolor*) and grizzly bears (*Ursus arctos*); 3) movements with respect to dens during pup rearing season; and 4) territory size, use, and overlap. Specifically, we tested the use of remotely downloadable GPS collars on Yellowstone wolves and their ability to periodically retrieve data on movements to identify location clusters. We have applied this relatively new technology to aid in determining predation patterns and prey selectivity of wolves during summer, a season from which such information is lacking. Preliminary results suggest that plotted GPS location data regularly downloaded from the collars can provide biologists with information fine scaled enough to determine kill sites from ground searching clustered locations, especially for large ungulates. Combining field observations on wolves with downloadable GPS location data can substantially improve our understanding of year round predator-prey relationships, multi-carnivore interactions, and wolf habitat use and activity patterns.

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Friday, September 26, 20:00, Max Bell Auditorium

Join host Bob Sandford for a fun, entertaining and informative evening of film in the Max Bell Auditorium. The event is free for congress attendees. For non-congress attendees, a fee of \$10.00 will be charged. Each of the 5 films will be introduced by the filmmaker or a representative of the filmmaker, followed by 20 minutes of footage. Each film session will then conclude with a 5 minute question and answer period. An intermission will be included after the third film.

The Good, The Bad, and The Ugly of Filmmaking

Dr. Lu Carbyn

Join Dr. Lu Carbyn in this exploration of filmmaking and his long standing research on wolf-bison interactions in Wood Buffalo National Park, Canada.

It's Not Just About Wolves

Producer and Filmmaker: Joseph Potts

Starting with the question, "Why are wolves so important?", people [stakeholders] seem to either love or hate wolves. The answer to the original question is unambiguous. However, this answer raises complex and difficult questions about values, process, and commitment to wildlife management on the eastern slopes and the central Rockies of Canada. Join Joseph Potts in this exploration of the central Rockies region of Canada as a microcosm of the issues surrounding wolves around the world.

Rain Wolves

Raincoast Conservation Society and Rainshadow Media Director: Twyla Roscovich. Executive Producer: Ian McAllister.

Rain Wolves profiles one of Canada's greatest icons of wilderness, the gray wolf, in a coastal rainforest setting that is unparalleled in beauty and rarity. Join scientists, conservationists, and the Heiltsuk First Nation as they track the elusive coastal wolf through the Great Bear Rainforest. Witness the breathtaking videography of Raincoast's Ian McAllister and experience these magnificent creatures completely in the wild. This film premiered August 28, 2003 on the Discovery Channel.

— Intermission —

A cash bar will be available in the Max Bell Lobby.

The Wolves of Yellowstone

Robert Landis, Filmmaker

Join narrator Douglas Smith in this exploration of wolves as they interact with one another, other carnivores and elk. Robert Landis has spent many waking hours in Yellowstone trying to capture the essence of wolves in nature. Considered one of the best filmmakers of wolves, Robert Landis' film explores the Druid Peak pack as well as other packs that were visible this last winter.

Wolves, Bears, and Bison in a Restored Mountain Valley

Dan MacNulty, Ph.D. Candidate, University of Minnesota

Wolves, grizzly bears, and bison once coexisted in great numbers in North America. This unique assemblage of wild mammals withered under European settlement and was finally brought to bay in Yellowstone National Park's remote Pelican Valley. In 1901 the last 25 wild bison in the United States found refuge in this valley. Wolves found no such haven and were extirpated by the 1930's. Dedicated conservation efforts have since led to the recovery of all three species in Yellowstone, giving wildlife researchers their first chance to study a rare biological system. This film provides an introduction to ongoing efforts to understand the behavioral and ecological interactions between wolves, grizzly bears, and bison in Yellowstone's Pelican Valley.

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Saturday, September 27, 08:30, Max Bell Auditorium

Linking social behaviour to a population viability analysis for wolves

CALLAGHAN, CAROLYN, John Vucetich, Miroslaw Kucz, Paul Paquet.

Carolyn Callaghan, Department of Zoology, University of Guelph, ON Canada N1G 2W1 Carolyn@graywolf.ca John Vucetich Michigan Technological University,

1400 Townsend Dr., School of Forestry and Environmental Science Houghton, MI, USA Miroslaw Kuc; Paul Paquet, Box 150 Meacham SK, Canada S0K 2V0

Small populations of wolves are vulnerable to decline due to stochastic processes and deterministic effects of human-caused mortality may be important for wolves because of their low densities and wide-ranging movements. Dispersal behaviour and social organization also may have important consequences for population persistence of wolves. We developed an individual-based, age-structured, spatially-implicit stochastic simulation model to investigate interaction of social dynamics and population parameters in a population of wolves occupying the Central Rocky Mountains, Canada. Radio-telemetry studies and den site observations in the study area over 14 years provided information on population parameters. Model simulations indicated a relatively low probability (0.14) of extinction under current conditions. Population carrying capacity, number of immigrants, maximum litter size, and severity of catastrophe accounted for the greatest variability in probability of extinction. Simulations in which emigration from and immigration into protected areas did not occur resulted in a high probability (0.82) of population extinction. The ranging behaviour of this wolf population and the topographical complexity of the region increase edge effects by exposing wolves to risks of mortality along the borders of protected reserves. Consequently, protected areas within the region are too small to maintain population persistence without relying on immigrants from outside of protected reserves.

Wolf Predation and the Exotic Disease Debate in Wood Buffalo National Park

CARBYN, LU

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Significant declines in bison have occurred within Wood Buffalo National Park. Numbers declined from about 11,000 in 1971 to about 2,300 in 1998. Prior to 1971, herds had increased from an estimated low of about 500 around the turn of the century to about 15,000 in the mid 1950s.

Exotic bovine diseases were introduced to the park from 1925-1928. This paper evaluates the ramifications of wolf predation and disease in bison declines. The predation hypothesis involves the notion that predators alone have caused the decline. A competing hypothesis is that diseases reduce bison calf production and adult survival, thus shifting bison numbers from food competition equilibrium to low density predator regulated equilibrium. Field studies from 1985 to 1999 indicated low cow:calf ratios at about 30 calves per 100 cows. I have concluded that in the presence of both exotic bovine diseases (tuberculosis and brucellosis) and wolf predation, bison numbers are kept at low levels. In the absence of wolves, it is likely that, even in the presence of diseases, bison numbers will increase. My conclusion is that of the two factors, wolf predation has a greater influence on overall numbers than exotic diseases.

Estimating wolf densities in central Ontario using the Sampling Unit Probability Estimator

PATTERSON, BRENT R., Norman W. S. Quinn, and Earl F. Becker

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Few reliable methods exist for estimating population size of large terrestrial carnivores. This is particularly true for forested areas where sightability is low, and when radio-collared individuals are unavailable. We used stratified network sampling to sample wolf tracks in the snow and estimate density in western Algonquin Park, Ontario in February 2002. We partitioned our 3425 km2 study area into 137 5 * 5 km blocks and a priori assigned 61 and 76, respectively, as having a high or low probability of containing detectable wolf tracks. Stratification was based on the relative amount of watercourses and conifer cover, and the number of road/trails, within each block. We used a Bell
206B helicopter to sample 28 high (46%) and 17 low (22%) blocks. When fresh tracks were found in a block we followed them forward to the wolves themselves and backwards until the tracks were no longer "fresh". We averaged 46 minutes per block (range 23 – 132 minutes). We observed 17 "fresh" track networks within the 45 blocks. The average pack size in the area we surveyed was 4.2 ± 0.4 (SE). These observations result in an estimate of 87 ± 11.4 wolves in the 3425 km2 study area for a density of 2.5 ± 0.3 wolves/ 100 km2. Although we detected no obvious violations of the assumptions of this survey design, several key assumptions (e.g., all fresh tracks in each surveyed block were detected, no double counting of packs) will require the presence of radio-collared wolves within the study area for adequate testing.

Validating measures of ecological integrity for wolves in protected areas

PISAPIO, JOHN and Brent Patterson

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Ecological integrity is the conservation principle underlying the management of ecosystems anchored within large parks and protected areas. The presence of keystone species such as wolves is recognized as a measure or indicator of ecological integrity. However, the occurrence of a species satisfies only one of three fundamental attributes of ecosystems, the other two being structure and function. Structural demographics and non-demographic ecological responses in wolves may reflect relative levels of annual mortality. Despite this, measures of wolf population structure and ecological responses to human exploitation are rarely incorporated into management strategies. Human-caused mortality of park wolves beyond park boundaries is generally considered inconsequential so long as the threshold of compensatory mortality is not exceeded. This reflects a narrow view of population integrity or health based exclusively on whether numbers are increasing, decreasing or are stable. In this paper, we consider whether this view is incongruous with the priority conservation objectives of protected areas. Transboundary movements of wolves from Algonquin Provincial Park, Ontario, and associated human caused mortality are discussed within the context of what defines 'protection' for a portion of a wolf population. This discussion is intended to provide a basis for developing further research on wolves needed to validate measures of ecological integrity.

Large predators in small parks: wolves in La Mauricie National Park

VILLEMURE, MARIO

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The role of small protected areas in the conservation of wolves is unclear. We documented reproduction, survival, dispersal and recruitment inside and outside La Mauricie National Park, Quebec. We examined the consequences for wolf ecology of a patchwork of areas with different wildlife management and land-use practices. We wanted to test if this small Park (536 km2) could be a source of wolves for surrounding areas, where wolves are hunted and trapped. We monitored movements and behavior of wolves using radio telemetry. Since April 2000, we have radiocollared sixteen wolves, of which all but 5 were killed by trappers. Trapping mortality of radiocollared wolves was 33% a year. Of 4 wolves radiocollared in the Park, 3 were killed outside the protected area. The Park area is equivalent to the home range of a single pack, but no pack had its entire home range protected by the Park. Although large protected areas may play a key role in the conservation of large carnivores, it appears that a small protected area like La Mauricie is insufficient to have any impact on wolf populations.

Saturday, September 27, 08:30, Max Bell Building, Room 252

Can an educational program change attitude towards wolves from fear to curiosity?

GANGAAS, KRISTIN EVENSEN

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In 1997 the first wolf pack established in Southern Norway – the first establishment by wolf in Norway in recent years. The establishment resulted in fear and insecurity among the local people, and some of the children no longer walked to school – they wanted to drive by car instead because of fear. In November 2000 the Ministry of the

Environment and the local municipality started an educational program with the objective to provide value-neutral scientific information about large carnivores. By focusing on children and schoolchildren/teachers the objective was to bring people to the areas where wolves live. We arrange outdoor activities like radiotracking, snow tracking, howling etc., and everyone who participated increased their knowledge both in theoretical and practical way. After 2 years and lots of activities, the impression is that it is more acceptable to be curious, and openly show an interest in large carnivores. The local people ask for more information and activities related to the large carnivores, and the conflict related to wolves seems to have both decreased and been replaced by curiosity.

Wolf stories: Reflections on science, ethics, and epistemology

JICKLING, BOB and Paul C. Paquet

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Systematic killing of wolves is not new. Rather, killing wolves to benefit humans is part of our contemporary history. More recently aerial shooting of wolves has been augmented by sterilizations and supported by "science." Biologists responsible for "wildlife management" have been central to the public discourse on killing wolves. While their task is to enact public policy, they too hold assumptions that shape the way policy decisions are presented to the public and subsequently implemented.

Using techniques of analytical philosophy, ethical analysis, and wolf management case studies, this presentation demonstrates how our epistemologies, our systems of knowledge, rest on ethical choices whether these are made consciously or not. Epistemology is value-driven, not the contrary. This being the case, then an a *priori* concern for all scientists is to consider how they ought to approach the world in their pursuit of knowledge; that is, what is an ethical approach to science? This is a radical shift for ethics too. Instead of looking for knowledge claims to frame ethical discourse we argue that ethics are primary; they open the way to knowledge.

Techniques and Tools for Educating the World about Wolves

ORTIZ, MARY and Andrea Lorek Strauss

Marketing and Communications Director, International Wolf Center, 3300 Bass Lake Road, Minneapolis, MN, 55429, USA; phone 763-560-7374; mortiz@wolf.org

Effective Education is just as much about reaching audiences as it is about providing informational materials. The world is changing and so we need to as well. While accurate interesting information and innovative face-to-face education will always be needed, an exciting opportunity to reach people across the world is now available through Web sites and other electronic methods at a fraction of the cost. What is a click-through rate, user profile, flash design, blog? This presentation includes descriptions of cutting edge techniques and tools for web, print and program education used by the International Wolf Center and other wolf educational organizations. It is not a "how-to" program but rather designed to offer insight on what is being done, ideas for the future and to provoke your own creative venues. Educators in the audience will be invited to share their experiences as well. Mary Ortiz is the Communications Director at the International Wolf Center and has worked in environmental education for over 20 years with 13 years specifically at the Center on wolves.

Wolf-deer field study by high school students in Wisconsin

THIEL, RICHARD P.

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In May 1995 a wolf (Canis lupus), kennelled while recuperating from an injury, escaped into Sandhill Wildlife Area (SWA), a 36 km2 deer research facility surrounded by 29.6 km of 3m tall fence. The escape prompted creation of the High School Independent Studies project. Junior and senior high school students with GPA's > 3.0 (on a 4.0 scale) were recruited to participate in this project. Objectives were to provide students an opportunity to conduct wildlife research in the field and analyze data collected at the end of the field season by determining the impact of wolf predation on a deer population. In 7 winter field seasons (January through March), 1995-96 through 2001-02, 154 students participated from 15 public school districts, one parochial school, one home schooled; among these were 2 foreign exchange students. Students walked or drove 1408 km in search of wolf trails in 182 days; trailed the

wolf 116 days totalling 306 km and located 19 wolf-killed deer. Daily consumption rate varied from 2.8 to 7.1 kg/day. Percent utilization was inversely related to winter severity, and consumption rates were related to fall deer densities. The wolf removed a mean of 22 deer per year compared to a mean of 92 harvested annually. The combined removal did not prevent a gradual increase in deer numbers during the 7-year period. Students felt participation increased their knowledge and appreciation for wolves and their effects on deer, and gave them important exposure to the application of scientific methods in the study of wild animal populations.

Interactive and Innovative Programs Using Captive Wolves as the Educational Cornerstone

WHITTEKER, RICK

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Haliburton Forest and Wildlife Reserve Ltd. is a multi-use forest that encompasses 60,000 acres of land supporting two or three wild packs who den on this private property located just south of Algonquin Provincial Park in Ontario. As part of the education component of Haliburton Forest, the Wolf Centre was built in 1996. The centre is a 5,000 square foot interpretive facility which attracts close to 30,000 visitors every year. The Wolf Centre is unique in North America because the resident pack of gray wolves is unsocialized. The 15 acre enclosure allows the pack to live with a large degree of privacy. Public viewing is restricted to inside the centre through one-way glass. A wide variety of groups request wolf education programs. This list includes high school groups, elementary classes, Elderhostel programs, college and university groups, cubs, scouts and the list goes on. How do we use the captive pack to educate, fostering improved wolf/human coexistence? The objective of my oral presentation is to outline how we meet the public's diverse learning needs through a broad spectrum of program formats and presentation ideas using the resident pack as the educational cornerstone. Educational presentations include teaching techniques such as guided imagery, puppet shows, art, storytelling, drama, discussion groups, children's literature reviews, outdoor simulated wolf activities, public wolf howls and using wolf behaviour as a metaphor for team building programs. The Wolf Centre provides a bridge allowing wolf science access to the community through interactive and innovative educational programs.

Saturday, September 27, 08:30, Donald Cameron Hall, Room 300

Restoration of the gray wolf in the northwestern United States

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Gray wolf *(Canis lupus)* populations were eliminated from the western United States by 1930. Naturally dispersing wolves from Canada first denned in Montana in 1986. In 1995 and 1996 wolves from western Canada were reintroduced to central Idaho and Yellowstone National Park, Wyoming. By December 2002, nearly 700 wolves were being managed in those three states under the U.S. federal Endangered Species Act. Wolf restoration has proceeded more quickly, with more benefits (public viewing and restoration of ecological processes), and fewer problems (livestock and pets depredations) than predicted. However, between 1987 and December 2002, a minimum of 244 cattle, 594 sheep, 55 dogs, and 9 llamas were killed by wolves and nearly \$250,000 was paid from a private damage compensation fund. The U.S. Fish and Wildlife Service relocated 117 wolves and killed 149. Management also included non-lethal tools such harassment, barriers, guard animals, altering wolf activity patterns, livestock death but are inordinately controversial. Because over 85% of adult wolf mortality is human-caused, the interagency recovery program focuses its efforts on addressing the concerns of people who live near wolves to increase their tolerance of non-depredating wolves. Wolves were reclassified from endangered to threatened status in spring 2002

to recognize their recovery and to increase options for problem wolf management. The wolf population has achieved its numerical, distribution and temporal recovery goal. This population will be proposed to be removed from the list of endangered species when the states of Montana, Idaho, and Wyoming finalized state wolf management plans that must regulate human-caused mortality so the population is not again jeopardized with extinction.

Factors affecting wolf distribution, numbers, and livestock depredation in Poland

JEDRZEJEWSKI, WLODZIMIERZ; Sabina Nowak; Bogumila Jedrzejewska; Robert Myslajek; Magdalena Rogala; Krzysztof Schmidt

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Mammal Research Institute, Polish Academy of Sciences, 17-230 Bialowieza, Poland (BJ, MR, KS)

In 2001-2002, a census of wolves was conducted by personnel from forestry services and national parks in Poland. The census was co-ordinated by the Mammal Research Institute of the Polish Academy of Sciences, and was based on snow tracking and annual records of wolf observations, tracks, breeding dens, and prey remains. Data were analysed using GIS (MapInfo program). The population of wolves was estimated at about 510 individuals (115 packs), which lived predominantly in eastern Poland. Mean pack size was 5.5 wolves in the Carpathian Mountains, 4 in the lowlands of NE Poland, and 2.4 in the western part of the country. The essential factors determining wolf distribution and numbers were: forest cover, forest fragmentation, human settlements, density of highways, and distance from the continuous range of wolves in Eastern Europe (east or south of Poland). Fragmentation of wolf habitats by newly planned highways and discontinuity of migration corridors are important threats to long-term survival of wolves in Poland. The most common wild prey of wolves were red deer *Cervus elaphus* and roe deer *Capreolus*. Wolf depredation on livestock (about 500 kills per year) was recorded in NE Poland (mainly cattle) and SE Poland (mainly sheep). Most cases of livestock depredation were caused by relatively few packs that settled in outskirts of large woodlands and in the mosaic habitat of small forests and pastures.

Predicting risk of livestock depredation by wolves in southwestern Alberta

MUHLY, TYLER; Carolyn Callaghan; Shelley Alexander; Charles Mamo; C. Cormack Gates; Marco Musiani

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Wolves can potentially prey on all ungulates within their distributional range, including domestic livestock. The potential for conflict between wolves and humans therefore exists especially in rural areas where livestock production is a major economic activity, such as southwestern Alberta. Limited studies have examined factors that predispose livestock to depredation by wolves, and none occurred in southwestern Alberta. The purpose of this study was to determine the spatial relationships between habitat characteristics, human use and wolf depredation on livestock in southwestern Alberta. The goal is to use these characteristics as predictors for areas at risk. We used Geographic Information Systems (GIS) to examine the effects of vegetation productivity, geography, and proximity to roads, rivers, and cover on predicting livestock depredation by wolves. Binary logistic regression analyses, ranked using Akaike Information Criteria (AIC), were used to determine what variables were best at explaining depredation occurrence. On private lands, greenness and elevation were important variables in the best logistic regression model (y = -22.366 + 0.009(elev) + 0.024(green)). These variables were also significantly different between depredated and random sites (elevation (tcrit = 1.97, p = 0.0035), greenness (P tcrit = 1.97, p = 4.40E-08)). Our results indicate that ranches (and land within an 8-km buffer of them) in proximity to the Rocky Mountains and in areas of higher vegetation productivity are at risk of depredation by wolves.

Current development and future directions in non-lethal wolf predation management

SHIVIK, JOHN A., Stewart W. Breck, Adrian Treves, and Peggy Callahan, Wildlife Science Center

USDA Wildlife Services, National Wildlife Research Center and Utah State University. Dept. FRWS Utah State University (john.shivik@aphis.usda.gov) (js); USDA Wildlife Services, National Wildlife Research Center 4101 LaPorte Avenue, (sb); Center for Applied Biodiversity Science, Conservation International (AT); Wildlife Science Center (PC)

We have developed the Radio Activated Guard (RAG) and the Motion Activated Guard (MAG) and tested these and other techniques, such as fladry and electronic training collars, for wolf predation management. In a multipredator study on six wolf territories in Wisconsin, the average weight of carcass consumption was similar on all plots before treatments were applied (P = 0.771); when treatments (MAG, fladry, or control) were applied, however, we found that average daily consumption on MAG protected plots was 68% less than on control plots (P = 0.028), but consumption on the fladry plots was not statistically less than on the control plots (P = 0.583). Our previous study using electronic training collars on wild wolves produced equivocal results, with no clear aversions formed, primarily due to logistical considerations, and in a follow-up study on captive wolves, less food was consumed using MAG devices than in the control treatment (P = 0.011), but effectiveness of the training collar was not evident (P = 0.33) due to behavioral variability in response to collars. The MAG device, although effective in the short term, did not cause a learned aversion. We have developed effective non-lethal methods and continue to promote their appropriate use. Other scientists and managers with limited resources have expressed frustration with the complexity and expense of developing and using non-lethal techniques, but conflicts with wolves are likely to increase, and development of these tools is necessary for wolves and other predators.

Characteristics of wolf packs depredating on domestic animals in Wisconsin, USA

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Not all wolf packs prey on domestic animals despite having the opportunity. Long-term data from Wisconsin show that 40% of wolf packs have been implicated in conflicts with humans. This subset of the population is distinguished by their average pack size and proportion of forest in and around their territory. Wolf packs that preyed on hunting dogs were larger than other packs, while those that preyed on livestock were the smallest of the problem packs. Wolf packs that preyed on domestic animals lived in more forested areas than packs never implicated in depredations. Wolf packs implicated in livestock depredation had smaller territories on average than other packs. About 46% of wolf packs implicated in dog depredation in one year, did so again in subsequent years. Livestock depredations were repeated by the same pack in 33-53% of subsequent years. Our results can help to guide interventions by wolf managers, especially when conflicts with free-roaming dogs and hunters are severe.

Saturday, September 27, 10:45, Max Bell Auditorium

Wolf Depredation on domestic dogs in Central part of European Russia

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Wolf *(canis lupus)* depredation on domestic animals, i.e. livestock and pets, has occurred throughout the world probably ever since and wherever these species have coexisted. The subject has been studied quite intensively since depredation on domestic animals is a major challenge to human tolerance of the wolf and will always influence the relationship between the two where wilderness and agriculture/human settlements meet. Due to importance most studies conducted so far in terms of wolf management and control programs focused on the depredation of

livestock. But wolves also kill considerable numbers of pets, especially dogs *(Canis familiaris)*, though the livestockpet ratio is usually clearly biased towards livestock. In the Central European Russia however depredation is more frequent on dogs than on livestock. By the means of asking people and the information from rangers and hunters we collected data about 123 attacks of wolves on dogs, dating from July 1996 to March 2001. Of these, 117 dogs were killed (95.12%) and 6 (4.88%) survived the attack, three survived because the owner drove the wolves off. One dog was attacked twice in one year. It survived the first assault but was killed the second time. Including livestock, casualties of domestic animals total 146 animals. Besides the 123 attacks on dogs (84.25%), there were 14 sheep (9.6%), 6 cows (4.1%), two goats (1.37%) and one cat (0.68%) killed.

Interactions between wolves and dogs in Scandinavia

KARLSSON, JENS

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Wolf depredation on dogs is one of the most important factors for negative perceptions of wolves in Scandinavia, and thereby also a major issue for wolf management. Dogs are mainly attacked while used for hunting. Compensation is paid for all dogs killed or injured by wolves after field confirmation by trained personnel.

This study presents data on wolf attacks on dogs in Scandinavia and the factors influencing the number of dogs attacked inside and outside wolf territories.

The results presented are based on five different sub-studies carried out between 1999 and 2002: (1) Telephone interviews of 500 hunters with hunting dogs in 5 different wolf territories for 3 consecutive years, aiming at describing the hunting dog population and intensity of hunting dog use in each territory. (2) Selectiveness of wolf depredation. Sex, age, race etc on attacked dogs are compared to corresponding data for the total hunting dog population in each territory. (3) Experimental exposure of radio-collared wolves to barking dogs. (4) Test of dogs interest in following wolf tracks. The number of dogs attacked could not be explained by some wolf individuals being more prone to attack dogs than others. Instead the number of attacks was a function of dog use intensity (hunting) and the number of wolves in the territory. The status of the wolves; dispersing, scent marking or having pups was of less importance. No selectivity for dogs of certain breeds was found, all breeds were attacked in proportion to their use.

Recovery of traditional techniques of livestock protection from wolf predation in Portugal

RIBEIRO, SÍLVIA, Maria Almada & Francisco Petrucci-Fonseca

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Grupo Lobo, Departamento de Biologia Animal, 3º Piso, Ed. C2, Faculdade de Ciências da Universidade de Lisboa (SR, MA, FPF)

Different techniques were traditionally developed by shepherds to reduce wolves' predation on livestock. The most widespread was the use of Livestock Guarding Dogs (LGD). Nevertheless, in the last decades the use of LGDs decreased and the knowledge on their education is being lost. In Portugal, Grupo Lobo initiated a project to recover the use of LGDs and contribute to the conservation of the endangered Iberian wolf by reducing man-wolf conflicts deriving from wolf damages on livestock. Since 1998 forty dogs from two Portuguese breeds of LGDs were placed in flocks in the North and Centre of the country, where the wolf still exists. Their behavioural development was monitored until adulthood and their efficiency evaluated. Since the criteria of the amount of damages is influenced by several factors difficult to assess, for a correct evaluation of LGDs performance a behavioural analysis should be considered. Most of the adult dogs (83%) are trustworthy and attentive to the flock and proved to be efficient in preventing wolf predation. Inquiries to shepherds have revealed the use of other protection methods until 1950, namely different types of light-mobile barriers, similar to fladry, a technique traditionally used in Eastern Europe for hunting wolves. These recent findings increase the trust on the use of fladry as a prevention method for wolf predation. The implementation of traditional methods of livestock protection emerge as a valid contribution to wolf conservation strategies worldwide.

Livestock guarding dogs and their modern role in large carnivore conservation initiatives

RIGG, ROBIN; M. Gorman and C. Sillero-Zubiri

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Livestock guarding dogs (LGDs) have been raised for millennia to protect domesticated animals from wild predators, stray/feral dogs and thieves. We reviewed their use in modern times and found that it has declined in many regions for several reasons. Some LGD breeds are rare, others have been bred for show, crossbred or misused in ways that have weakened their working ability. Nevertheless in parts of Italy and Romania the LGD tradition survives largely intact. Elsewhere, e.g. Slovakia and Poland, systematic efforts are being made to increase use of LGDs to support large carnivore conservation. LGDs have also been tested in countries where they are not traditional, e.g. in Norway, Namibia and the USA. LGDs are especially appropriate when rare, endangered and legally protected carnivores are causing damage to livestock. Many LGD projects therefore operate in conjunction with carnivore conservation initiatives that, when funding and assistance can be provided, help offset farmers' start-up costs. One such initiative is the Protection of Livestock and Conservation of Large Carnivores project, running in Slovakia since 2000. Traditional use of LGDs in Slovakia was mostly abandoned in the first half of the 20th century, at a time when large carnivores had been virtually extirpated. Losses of sheep, goats and cattle to wolves (Canis lupus) and brown bears (Ursus arctos) subsequently increased as their populations naturally recovered. Hostility due to livestock depredation, especially to wolves, is greater than losses, which remain relatively low in Slovakia (<0.3% of all sheep p.a. costing <US\$30,000 for wolf and bear combined) and affect a minority of farms, so effective prevention might reduce conflict and increase acceptance of large carnivores.

The use of guardian dogs for controlling predation in peasant pastoral economies

COPPINGER, RAYMOND, Alessia Ortolani, Kathryn Lord

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Livestock guarding dogs (LGDs) have been a popular choice with international agencies involved in wildlife protection. The advantage of guardian dogs is they are considered non-lethal and they provide a direct link between restoration managers and livestock producers. Numerous projects in the last two decades have attempted to adapt this ancient management system to modern husbandry methods. Initially it was assumed by these researchers that LGDs were represented by breeds that were selected by humans to purposely guard livestock. A more detailed analysis of peasant and transhumance agriculture suggests that the relationship between these dogs and wildlife are more complex. Our work with diverse cultures, such as the recent studies of African pastoralists in the Omo Valley and in the Ethiopian highlands, indicates that the relationship of the dogs to humans and livestock is often "voluntary" by the dog, which is not "consciously" protecting livestock. Ecologically the guardian dogs obey the rules of inter- and intra-specific resource partitioning. These partitioning behaviors have the effect of protecting livestock from wildlife predation, but have an adverse effect on closely related species by limiting resources, transmitting disease, and interfering with reproduction. For these reasons, it may be that fragile populations of canids are not compatible with peasant agriculture.

Saturday, September 27, 10:45, Max Bell Building, Room 252

Semen Quality in Generic (Canis lupus sp.) and Mexican Gray Wolves (C.l. baileyi)

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One of the challenges of managing small populations in captive breeding programs can be problems with fertility, such as those related to inbreeding or founder effects. In the course of evaluating and cryopreserving semen from Mexican wolves (N=37) since 1991, as part of the U.S. Fish and Wildlife Service Mexican Wolf Recovery Program,

we found that Mexican wolf semen quality was generally lower than that from captive generic gray wolves (N=23). The disparity is illustrated by samples from the 8 Mexican wolves with the poorest sperm quality. Only 1% to 45% of the sperm from those males were of normal morphology, which contrasts with the worst sample (59% normal morphology) collected from any of the generic gray wolves. Furthermore, the abnormalities were especially severe in 6 of the Mexican wolves, including high numbers of microcephalic or detached heads, and abnormal acrosomes, characteristics that would render the sperm cells infertile. Mexican wolf sperm quality was not correlated with inbreeding coefficient but was associated with lineage, i.e., 6 of 8 males with the poorest quality semen were from the McBride lineage. The category of abnormality in the other 2 males (1 Aragon, 1 Ghost Ranch lineage) is typically not considered as severe. Poor quality semen may at least partially explain the reproductive failure of some males in the captive population. However, since this sample represents a small percentage of Mexican wolf males, implications for the population may not be of consequence.

Use of rubber-padded foot-hold traps for research capture of wolves

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Foot-hold traps used to capture wolves for research are often modified to minimize injury to the animal. Trap modifications bring fears that new designs will be less effective at holding wolves. We report the foot condition and weight of 54 wolves (35 adults, 19 pups) from Montana, Idaho, Alberta, and Minnesota captured in rubber-padded foot-hold traps (#7 "EZ" Grip Trap, Livestock Protection Company, Alpine Texas). We classified foot injuries following Kuehn et al. (1986); (1) no visible damage, (2) cuts < 2.5 cm long in aggregate, (3) cuts > 2.5 cm long and/or 1 injured phalanx or metacarpal, (4) > 2 injured metacarpals or phalanges and/or radius or ulna. Of 54 captures, 50 (92.6%) were in classes 1 (n=42) and 2 (n=8). Class 3 (n=3) and 4 (n=1) injuries were 1 broken metacarpal (n=2) a ripped heal pad, and a fractured radius or ulna from struggling as researchers approached. Mean weight of adults captured was 36.4 kg (SD 6.4, n=34 [80.5 lb SD 14.1]). Four wolves weighed > 45 kg (100 lb) with 10 additional animals > 38.5 kg (85 lb), demonstrating that these traps do hold large wolves. However, we have anecdotal accounts of 2 wolves pulling free from these traps. In the European Union and Canada where non-rubberized steel jaws are illegal, EZ-grip traps are an effective, acceptable alternative. We suggest that low foot injury from these traps and their ability to catch and hold large wolves make them a preferred alternative for research capture of wolves.

Comparison of Bite Forces in Wolves (Canis lupus sp.) along a Geographical Cline

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In order to determine if differences in bite force reflected primary prey selection, eight skull measurements were taken from individual wolves from three locations along an Arctic cline and two locations in Ontario, and applied to a bite force estimation formula developed by Thomason (1990). Estimations in lower jaw strength (projected moment of area) were also assessed along the same cline and both parameters, bite force and strength, were regressed against skull length to determine if bite forces were independent of size. Results indicated that bite forces were significantly different between Arctic and Ontario groups. Results also indiciated that bite forces were independent of size in Repulse Bay, Baker Lake and the southern Ontario group, however both Arviat and northern Ontario groups were significantly related to size of the skull (R = 0.639, p = 0.05; R = 8.21, p = 0.001, respectively). When correlated with prey size no significant differences were noted for either the lower jaw strength or carnassial strength with the largest prey item in the system, however; when these parameters were assessed with the weight of the secondary prey item a significant relationship was observed for both lower jaw (r = 0.806, p = 0.05; and carnassial bite strength (r = 0.828, p = 0.001). The results support the conclusion that bite force has most likely evolved to handle the smaller prey item in the system, while behavioural changes (increases in pack size) allow wolves to be optimistic in taking down larger prey items.

Sarcoptic Mange Impact on Gray Wolves (Canis lupus) in Wisconsin

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We evaluated the impact sarcoptic mange (*Sarcoptes scabei*) had on gray wolf (*Canis lupus*) packs in Wisconsin during 1989-99. From late April – September a total of 87 wolves (74 adults, 18 pups < 1 year old) in 27 packs, were examined for mange. Of these, 26 wolves (30%) in 17 (63%) different packs showed signs of the disease. Mange reoccurred twice in 3 packs and three times in 1 pack. Mean pack size for three consecutive years, beginning when evidence of mange was first detected in a pack, was used to determine the impact the disease had on packs. The three-year mean pack size of infected packs were; 3.7, 3.5 and 3.2 (overall mean 3.4). Where as non-infected packs were; 4.1, 4.6 and 5.3 (overall mean 4.7). Mange was assumed to be the major factor contributing to the complete demise of 4 packs during the course of this study. The prevalence of the disease peaked in 1992, when 4 out of 10 packs (40%) had the disease and again in 1997, when 4 out of 24 packs (16%) had the disease.

Saturday, September 27, 10:45, Donald Cameron Hall, Room 300

Wolves (Canis lupus) and Roads: Barrier Effects and Scale Dependent Habitat Associations

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Wolf *(Canis lupus)* track data were collected on road right-of-ways and transects in Banff National Park and Kananaskis Country, Alberta between November and March, 1997-2000. The research was designed to determine if traffic volume effects landscape permeability for a suite of focal carnivores. This paper deals specifically with wolves, and compares road of varying traffic volume in Banff and Kananaskis Country, including respectively, Highway 1A and the TransCanada Highway (TCH), Highway 40 and the Smith Dorreint Trail (S-D). To examine the barrier effect, ratios of road crossing track density (number of tracks/km) to (transect track density/km) for each highway section were compared using a Kruskal-Wallis H-test. Habitat Selection was compared for four coarse-scale landscape variables (aspect, slope, toposhape and greenness) at three different spatial scales (local: Banff, Kananskis, and regional: combined local sites) and at four temporal scales (1997, 1998, 1999, 3 years). I found that the TCH reduces landscape permeability relative to lower traffic volume roads. I determined that wolves selected for characteristics of topographic variables and that selection varied across spatial and temporal scales. These results indicated that generalized models, build using landscape scale data, do not predict well at smaller scales. Annual variations in habitat selection suggest a need to integrate climatic variables such as snow depth and solar insolation.

Commercial hunt and predator control? The case of Rennie lake area wolf kill.

CLUFF, H. DEAN, Paul C. Paquet, and Marco Musiani

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2500 University Drive N.W., Calgary, AB, T2N 1N4, Canada (MM) John/Paul & Associates, Box 150, Meacham SK, S0K 2V0, Canada, and Conservation Biology Institute, Portland, Oregon, USA (PCP)

A controversial wolf hunt in 1998 killed 633 wolves in the 13,000 km2 Rennie Lake area of the Northwest Territories, a region straddling the tundra-boreal forest transition, and another 125 wolves from adjacent areas. Although wolves have been hunted there for decades, the controversy focused on the number of wolves killed and use of snowmobiles in the hunt. From available records, annual kill has averaged 258 wolves ± 59.7 (± 1 SE, n=10 years). The territorial government considered the 1998 hunt sustainable given the reproductive potential of wolves and also noted that a higher than average number of caribou brought a corresponding increase in wolves following

them. We re-examined the Rennie Lake area wolf hunt and evaluated radio-tracking and genetic data for wolves to determine the potential influence of the hunt on overall wolf survival and implications of reduced wolf predation on caribou. Our analysis suggests that the 1998 hunt targeted an estimated 2700 wolves from an area of at least 200,000 km2 in which an unusually high number of migratory caribou had congregated. Removal of about 750 wolves in 1998 could have released an estimated 15,000 caribou from predation that year, or 3% of the estimated half million caribou in the area then. If predation is additive mortality for caribou, then our data challenges the hypothesis that migratory caribou are lightly influenced by wolf predation. Accordingly, the commercial Rennie Lake wolf hunt may not only be a commercial hunt for fur, but also an indirect form of predator control.

Analysis of Wolf-Human Interactions in Denali National Park and Preserve, Alaska

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As wolves are reintroduced to suitable habitats and continue to expand their ranges, wildlife managers must be prepared to deal with increasing wolf-human interactions. Biologists in Denali National Park and Preserve recorded 127 interactions between wolves and humans: 20 in 2000, 59 in 2001, and 48 in 2002. Interactions included wolves approaching and following people, taking shoes and packs, and investigating tents and high human use areas. Given Denali's goals of ensuring human and wolf safety and minimizing human influences on wildlife, this trend is problematic. We categorized the total number of interactions by time of year (Apr - 1, May - 8, Jun - 44, Jul - 41, Aug - 26, Sep - 7); backcountry (n=72) and frontcountry locations (n=55); average approach distances (7.1m); and direct approaches by wolves (n=74). Although interactions declined from 2001 to 2002, and the percentage involving wolves approaching people decreased each year (2000 = 80%, 2001 = 58%, 2002 = 50%), interactions in which wolves approached humans in the frontcountry increased to 75% (18/24) in 2002, and over 75% of those approaches were to within 5 meters. We are investigating the reasons for these trends; if they continue in the future, they will require active management to minimize potential problems. Denali can improve management by 1) devising, implementing, and evaluating a management policy, and 2) establishing effective monitoring standards to better follow trends in wolf-human interactions. These recommendations will permit Denali to meet its goals and require few, if any, additional resources.

Daily movement patterns of gray wolves in the Bow Valley of Banff National Park, Alberta

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We studied the daily movement patterns of gray wolves (Canis lupus) in the Bow Valley of Banff National Park, Alberta, Canada between 1998 and 2001 using conventional radio-telemetry methods and GIS analysis. The objectives of the study were: (1) to determine how wolf daily movement patterns vary with season in a heavily fragmented, high human-use landscape; (2) to determine whether daily movement patterns during the denning/rendezvous season are influenced by pup presence; and (3) to determine when wolves use wildlife corridors and areas of high human-use relative to the surrounding landscape. Daily movements during the fall/winter season were primarily diurnal and crepuscular for wolves that used habitat further from the town of Banff, and primarily crepuscular and nocturnal for wolves that used habitat closer to the town of Banff. During the denning/rendezvous season, wolves moved primarily during night and crepuscular hours, in contrast to the diurnal pattern of human use. Pup production and rearing had no significant effect on the daily movement patterns of wolves during the denning/rendezvous season. Wolves used temporal resource partitioning to access habitat adjacent to areas heavily frequented by humans, with these areas being utilised almost exclusively at night. Wolf use of wildlife corridors occurred in all daylight periods. To increase habitat security for wolves in the Bow Valley, we recommend limiting human use of wildlife corridors, and restricting human use of the valley (outside town boundaries) to designated areas during daylight hours to increase the predictability of human activity for wolves through space and time.

Persistence and Social Organization of Wolf Family Lineages, Denali National Park, Alaska

HABER, GORDON

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Wolves were studied via year-round aerial radio tracking in 10 areas (15,000 km2) of Denali National Park and Preserve from 1995-2003. Two of the areas (4,000 km2) also included ground observation from 1966-2003 and, together with five others, non-telemetry aerial observation from 1966-1976 and 1993-1994. This and other research suggests there is much natural persistence among Denali wolf family lineages and that the effects of human-caused losses have been underrated in previous interpretations ("family lineage" is defined in terms of social as well as genetic continuity). Lineages survived at least 14-17 years in four of the 10 areas and 10-16 years in two others. One, "Toklat (East Fork)," is still present after at least 64 years. Toklat and neighbouring "Savage," which survived at least 17 years, illustrate key similarities and differences among persistent lineages. Both remained relatively stable in size despite major prey changes. Both featured durable social relationships, cooperative breeding (with close inbreeding at least in Savage), and sophisticated cooperative hunting involving learned traditions. Toklat produced simultaneous multiple litters more than four times as often as Savage and until annexing a major portion of Savage's territory in 1983-84 (following Savage's demise) had less distinct ranks and divisions of leadership and a more random form of temporary winter splitting. There is strong evidence that the kind of cooperation observed in both lineages develops largely through kin selection. A recent takeover of Toklat by two unrelated males indicates that reciprocity and other more direct forms of selection can also be important.

Plenary Sessions: Saturday, September 27, 13:35, Eric Harvie Theatre

World Wolf Congress 2003: Livestock Depredation Summit Summary Presentation

LIBERG, OLOF

Grimsö Wildlife Research Station, Swedish University of Agricultural Sciences

Dr. Olof Liberg will report on the Livestock Depredation Summit held on Thursday, September 25. Please refer to the description of the summit found on page 18.

Evolutionary and conservation genetics of the wolves

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Over the last few years, studies have been published that have dramatically altered our notions about the evolutionary history and conservation genetics of wolf-like canids. We will review the results of these recent studies and attempt a critical analysis of the findings and conclusions. We will identify problems that remain for understanding the recent history of wolf like canids and provide an additional perspective based on mitochondrial DNA analysis of ancient, historic and recent wolf-like canids. Our results suggest a complex Pleistocene history of population expansion, contraction and admixture underlies the puzzling genetic patterns found in extant gray wolves and related canids.

Sacred Connection

HOLT, LEVI

Native Ecosystems, 675 Granite Rd, Winchester, Id 83555, email nezperce@camasnet.com

The presentation is a reflection of the traditional Native American/First Nations perspective regarding Endangered and/or Threatened Species and the management of their respective habitats and ecosystems.

Saturday, September 27, 15:25, Max Bell Auditorium

Response of wolves to changing harvest levels on the Kenai NMW, Alaska

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We analyzed data on wolves on the Kenai National Wildlife Refuge from 1982-1993 to determine the effect of harvest on territory size, pack size, wolf density and dispersal rates. One hundred seven wolves were captured, radio-collared, and located 1,775 times from aircraft. Harvest (trapping/snaring and hunting) levels for wolves averaged 61% from 1982/83 through 1985/86, and declined to 14% from 1986/87 through 1992/93. Early winter wolf density averaged approximately 13 wolves/1,000 km2, and ranged from 17.0 wolves/1,000 km2 in 1983/84 to 9.4 wolves/1,000 km2 in 1985/86. Territory sizes were not correlated with pack sizes or annual harvest rates. Wolf dispersal from packs increased when harvest was low ($_2 = 11.73$, 1 df, P = 0.001), with a greater proportion per year of juveniles dispersing ($_2 = 8.07$, 2 df, P = 0.018) than adults or pups. Pack sizes and annual wolf densities were not correlated (r = 0.09, 50 df, P = 0.520; r = 0.06, 10 df, P = 0.864, respectively) with level of harvest, thus we hypothesize that other factors such as low pup recruitment and a declining moose population may have limited population growth during periods of reduced harvest.

Wolf population ecology in Finland

KOJOLA, ILPO

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I examined population trends, reproductive output, mortality and dispersal of wolves in Finland. Finland hosted 500-600 wolves before a major population decline that occurred in 1875-1895. Thereafter the presence of wolves was mostly dependent on dispersal from Russia. Reproductions were occasional owing to systematic extermination. Since mid-1995 wolves have again reproduced regularly, as an apparent result of more effective protection. Information about reproduction, mortality and dispersal is based on the use of radio and GPS transmitters. In total, 41 wolves from 10 packs or mated pairs were marked in 1998-2003. Population size increased in spite of relatively high mortality rate. The first reproductions since the late 1800s took place in central and western parts of the country. The number of litters born annually doubled from the late 1990s to present (approximately 10-11 including ca. 40 pups in early winter). Dispersal from natal territories usually occurred at the age of 11-16 months. Overall dispersal seemed directed quite evenly in all directions but direction appeared to be territory-specific to at least some extent. The new territories established by successful young wolves were located at a 30 to 250 km distance from their natal territory.

Structure and micro-scale differentiation in a wolf population of Italian Apennines

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In presence of stable and abundant preys, wolves may reach high local density, even in areas disturbed by humans. The effects of this concentration on the genetic population structure were evaluated in a region of Italian Apennines. From 1998 to 2003 a 3200 km2 wide provincial district, including a system of five natural preserves, was monitored for distribution, consistence and genetic structure of the local wolf population. A minimum of 10 wolf packs were detected yearly in the area, by wolf-howling in summer and snow-tracking in winter. Sixteen cases of mortality were recorded and samples collected from dead animals for genetic analysis. Moreover, individual genotyping relied on noninvasive sampling, based on collection of fresh scats, hairs and blood spots found on the snow. Microsatellite analysis was carried out on 10 highly polymorphic loci, giving negligible probabilities of identity (PIDsib in the order of 10-4). A high population density (3.4 wolves /100km2) was found with a considerable

closeness of packs (average distance between adjacent packs amounting to 13 km). Fifty multilocus genotypes were obtained, representing different geographic locations. The low resampling frequency of genotypes was attributable to a relevant pack turnover. Although the limited geographic scale, an appreciable genetic differentiation among areas was detected, suggesting the existence of local constraints to the gene flow within the population.

Two hundred years in the history of Scandinavian wolves: decline and recovery

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The Scandinavian wolf population suffered a dramatic decline during the XIXth century and was considered functionally extinct during the decade of 1960. However, a new breeding pack was established in 1983 in southern Sweden, more than 900 km away from the limit of the distribution of wolves in Finland and Russia. Since 1983 the wolf population has been increasing and now numbers more than 100 individuals. A harsh debate arose about the origin of the founders of this population. Using mitochondrial, autosomal and Y chromosome markers we have been able to reconstruct the history of the population and we concluded that it was founded by just two individuals immigrating from the neighbouring wolf population in Finland and Russia. The analyses also showed that one additional male arrived in the early 1990s and allowed a marked population growth, facilitating a demographic and genetic rescue. However, although these results imply some degree of communication between the different wolf populations, the study of museum specimens from the XIX and XXth century imply that Scandinavian wolves may have traditionally been isolated and that immigration has always been an exceptional event. The low genetic diversity in the extant Scandinavian wolf population and the elevated risk for inbreeding depression –as seen in captive Swedish wolves- implies that the maintenance of occasional gene flow may be important for the long-term survival of the population.

The population ecology of Isle Royale wolves

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Most basic theories of predation accommodate two fundamental aspects of predation, the per capita kill rate for predators and the effect of kill rate on predator population growth rate. These processes may be expressed as a pair of equations: $dN/dt = f(N) - Pg(\cdot)$ and $dP/dt = P(h(g(\cdot)))$, where *N* is the number of prey, *P* is the number of predators, f(N) is a function describing the influence of intraspecific competition on prey population growth, $g(\cdot)$ a function describing the per capita kill rate (also, functional response), and the function *h* describes how per capita kill rate influences predator population growth rate. Here we review empirical assessments of the functional and numerical response for the small, isolated population of wolves on Isle Royale National Park, Lake Superior, USA. From these assessments we conclude that kill rate depends not only on prey density, but also on predator density and winter climate. Our analyses also suggest that top-down and bottom-up processes are both important influencers of interannual variation and long-term equilibria for the wolf and moose populations of Isle Royale.

Wolf population recovery and pair formation patterns among successful breeders in Scandinavia

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During 1966-1977, the Scandinavian wolf population was regarded as functionally extinct. Since 1983, wolves have reproduced regularly in south-central parts of the Scandinavian Peninsula (Sweden and Norway). The founding wolves were Finnish-Russian immigrants. In this paper we focus on the recovery and pair formation patterns among

successful breeders during the years 1978-2002. The territory establishment and the increasing number of reproducing alpha pairs were studied by ground tracking on snow, by VHF- or GPS-telemetry, and by DNA-analysis. Although both sexes may disperse more than 800 km (males predominate), the distribution area of new pair formations and successful reproductions has been relatively stable. All reproductive territories have been established within a maximum distance of 250 km from the territory of first reproduction in 1983. Twenty years later, still this 1983-territory is very close to the population's distribution center. Most females and all dispersing males established new territories non-overlapping their natal territories. Among successful breeders where natal territories where known, preliminary analysis of dispersal distances showed no significant difference between females (131 ± 21 km, N=18) and males (149 ± 22 km, N=16; F1,32 = 0.36, p = 0.553). However, between wolf population density and sex an interaction was found (F1,30 = 14.82, p < 0.001), and female dispersal distances decreased when population density increased, while male dispersal distances remained unaffected. Behavioral and ecological explanations are discussed.

Saturday, September 27, 15:25, Max Bell Building, Room 252

Genetic Analysis of Manitoba and Saskatchewan wolf populations

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Interest in non-invasive technologies to assess wildlife populations has grown rapidly. This is largely due to the needs of scientists and managers for rapid, cost-effective methods to monitor how wildlife abundance, distribution, and genetic diversity, are all influenced by environmental/landscape disturbance. The analysis of mitochondrial DNA (mtDNA) and nuclear microsatellite markers derived from faecal material can be used to create genetic profiles of wolves, which can, in theory, be used to monitor population size, number of packs, home ranges, dispersal events, disease, and changes in genetic diversity over time. Accordingly, we isolated total DNA from scat collected in Prince Albert National Park, SK (PANP) and Riding Mountain National Park, MB (RMNP) and from wolf tissue samples collected from across Manitoba. We demonstrate the successful amplification of a portion of the control region of mtDNA and numerous microsatellite loci from tanned hide and scat samples. Little correlation appears between geographic location and genetic distance, suggesting a complex history of gene flow. Not surprisingly, RMNP exhibits a substantially reduced level of genetic diversity compared with the rest of the Province. Although similar haplotypes were detected in northern Manitoba and PANP, substantial differences among the haplotypes detected in the two National Parks indicate very limited levels of exchange at this scale. Finally, based on mtDNA, we confirm the presence of both grey and eastern wolf lineages just north of RMNP in Duck Mountain Provincial Park, MB.

Genetics of Arctic Island and Barren-Ground Wolves

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The grey wolf is the only terrestrial large carnivore found throughout the Canadian Arctic Archipelago. Currently considered a distinct subspecies on the basis of skull morphology, *Canis lupus arctos* has a total estimated population size of 800 individuals. In recent years, climate variability has decimated Peary caribou and muskoxen populations on many Arctic Islands; this declining prey base is the primary threat to wolf persistence.COSEWIC has deferred designation of the Arctic wolf as a Species of Special Concern pending further information regarding their numbers, status, and taxonomic validity. We present microsatellite evidence suggesting that wolves on the Arctic Islands (excluding Baffin), while genetically similar to each other, are distinct from barren ground wolves on the arctic mainland. Indeed, genetic distances between island and mainland wolves are comparable to distances calculated between wolves and coyotes. The waters of the Arctic Archipelago are frozen during much of the year. Therefore, isolation of island from mainland wolf populations most likely reflects prey specialization on specific

groups of caribou and muskoxen. Population subdivision of mainland wolves also corresponds to the distribution of associated barren ground caribou herds. Despite general isolation of Arctic Island wolves, we have identified four individuals, harvested on the mainland, with genotypes representative of island populations. It seems likely that this limited island-mainland wolf gene flow further reflects co-movement of wolves with their prey: in this case, the annual island-mainland migration of the Dolphin-Union caribou herd.

Extant ancient lineages of wolves in the Indian subcontinent

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We sampled 45 wolves from peninsular India considered to be the sub species *C. l. pallipes* and 23 wolves from the Himalayas and Tibetan Plateau considered as *C. l. chanco*. Feral dogs within wolf ranges and other indigenous dog breeds were also sampled. Sequences of mitochondrial control region and cytochrome b of these wolves and dogs were compared with Genebank sequences of 700 wolves and dogs from throughout the world. All peninsular Indian wolves have 1-4 closely related haplotypes for the CR and form a well supported, divergent sister lineage to the wolf-dog clade. This unique Indian lineage may have been independent for more that 400,000 years. Himalayan wolves west of central Kashmir formed a part of the widespread wolf-dog clade. While wolves from eastern Kashmir, Himachal Pradesh, and Nepal formed a very different basal clade. This unique lineage of five related haplotypes, likely diverged from other wolves 800,000 years ago. The Indian subcontinent thus has three divergent mtDNA lineages within the morphologically delineated wolf. No haplotypes of either of the novel lineage were found within the sampled Indian dogs and no dog haplotypes were found within wild wolves. This suggests that natural hybridization is rare between dogs and wolves in India. Peninsular Indian wolves number between 2000-3000, while the current status and ecology of the Himalayan wolves is unknown. Persecution of wolves is common in these parts of the Himalayas and they may well be one of the most endangered canids needing immediate attention for conservation and research.

Impact of management regime on genetic diversity

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Wildlife managers often focus on population size to guide hunting and trapping regulations. Existing management regimes in some areas of North America permit humans to kill 30% or more of wolf populations annually, for many consecutive years. Due to high reproductive potential, the number of individuals in a population can remain stable. Populations that face these sustained and high levels of mortality, however, may be influenced in less obvious but important ways. We compare genetic diversity in adjacent populations of wolves in coastal British Columbia and southeast Alaska. These populations share a single habitat and evolutionary history, but are subject to very different levels of hunting. We show that high levels of human caused mortality, although not necessarily reducing population size, are associated with a lowered level of genetic variability. Reduced genetic variability may lessen resiliency, making populations more susceptible to extinction due to disease, inbreeding depression, or other unforeseen environmental challenges.

A complete pedigree and loss of genetic variation in the Scandinavian wolf population

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The Scandinavian wolf population was reestablished in the beginning of the 1980's after natural immigration. In spring 2002 the population consisted of 91-107 animals, but the genetic basis is only three individuals. The population thus is vulnerable, and continuous genetic monitoring is important for its conservation. The Scandinavian Wolf Research Project SKANDULV has been studying this population since 1998. In this paper we report on genetic structure, behavioural inbreeding avoidance, and loss of genetic variation. DNA-samples were taken from blood during catching operations, from tissues of found dead animals, and from oestrus blood and faeces recovered during snow tracking. We now have DNA-profiles, based on microsatellite analysis, on 30 of the 32 different wolf pairs established since 1983, and have constructed an almost complete pedigree of the population. Sib matings occurred in the first pack, when no alternatives were available, but after a third individual joined the population in 1991, there has been no sib or half-sib matings, and a falling degree of social kinship between mates. Average heterozygosity in the different cohorts has fallen from 75 % in 1983 to 57 % in 2001, while average inbreeding coefficients has increased from 0 in the first litters in 1983-85, to 0,26 in 2001, a slightly higher coefficient than that obtained from full sib matings. Of 109 alleles monitored on 32 different loci, 5 have been lost from the population during the period 1983-2001. We also have started to analyze correlations between inbreeding coefficients and fitness characters to detect possible signs of inbreeding depression.

Mitochondrial DNA variability of grey wolves in Eastern Europe

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Previous genetic studies on Old World wolves showed little partitioning of mtDNA haplotypes on a regional scale, as most localities had a single unique genotype. However, genetic data available for European wolf populations, especially for Eastern Europe, were very limited. The aim of our research was to examine mtDNA variability of Eastern European wolves on the basis of more extensive data, and to analyse population genetic structure. We studied control region sequence data from a sample of 236 grey wolves from Poland, Latvia, Belarus, Ukraine, Western Russia, and Greece. We found 15 mtDNA haplotypes. Twelve of them had been previously reported from different areas in Eurasia. Among the three other haplotypes, two were found only in single individuals, whereas the third was common among wolves in the research area. A genetic diversity of the whole sampled population was 0.77, and decreased from East (0.81 in Russia) to West (0.47 in Poland). The phylogenetic relationships among haplotypes showed a divergence for two main clades; 95% of individuals had a haplotype from one clade, and only 5% from the second clade, but haplotype, and closely spaced localities frequently had the same haplotypes. An analysis of molecular variance (AMOVA) indicated local geographical structure with two main population genetic units. Our study provides evidence for high mtDNA variability of Eastern European wolves, and for genetic differentiation among neighbouring populations not separated by geographical barriers.

Saturday, September 27, 15:25, Donald Cameron Hall, Room 300

Summer predation patterns of Scandinavian wolves

SAND, HÅKAN1, Olof Liberg1, Örjan Johansson1, Petter Wabakken2, Barbara Zimmerman2, Per Ahlqvist1

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Summer predation patterns of Scandinavian wolves were investigated in five different wolf territories in central Sweden during 1999 - 2002. Wolf group size in summer ranged between one and six wolves among territories. Search for killed prey was carried out in three or four 10-day periods distributed throughout the summer. Methods to find wolf-killed prey included both traditional radio-tracking of VHF-collared wolves and data downloaded from GPS-based collars. For both methods we used a 30-minutes interval between consecutive positions and all locations where the wolves stayed 1 hour or more were searched for remains of killed prey. In total, we found 61 wolf kills during the study period (n=179 days) including 31 moose, 9 roe deer, 1 beaver, 6 badgers, 10 grouse, 2 hares, 1 duck and 1 vole. Thus, by number moose accounted for 49% and roe deer for 13% of the total number of prey found. In terms of biomass, moose accounted for 91%, roe deer for 6% and the remaining species for 3%. Summer kill rates on moose and ungulates (moose and roe deer) were equal, or higher compared to winter kill rates depending on the method of calculation. We conclude that Scandinavian wolves show a higher diversity of prey species utilization during summer than during winter, that moose is the main prey species in both seasons, and that summer predation patterns may be thoroughly investigated with the use of both VHF and GPS technology, preferably in combination with the aid of dogs for search of prey remains.

Diets of free-ranging Mexican gray wolves in Arizona and New Mexico

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No scientific studies were conducted on the Mexican gray wolf (Canis lupus baileyi) before it was extirpated from the wild, therefore little is known of the subspecies' natural history. The Mexican wolf is the smallest and most endangered gray wolf (Canis lupus) in North America. In 1998, the U. S. Fish and Wildlife Service began reestablishing a Mexican wolf population from captive stock into a portion of the subspecies' historic range. We collected carnivore scats (n = 1,682) from the Apache-Sitgreaves and Gila National Forests of Arizona and New Mexico from April 1998 through October 2001. We identified scats to carnivore species using DNA analysis (n = 47) and traditional field methods (i.e., diameter, location and sign; n = 417). Diet analyses of scats identified by DNA analysis as either Mexican wolf (n = 26) or coyote (Canis latrans; n = 21) revealed a significant difference between the 2 species' diets (P < 0.05). Mexican wolf diet consisted primarily of large ungulates (73% percent frequency of occurrence [PFO]), while coyote diet was more variable and composed of smaller prey items (65% PFO). Analysis of scats identified as Mexican wolf (n = 251) with traditional field methods revealed a diet consisting mainly of adult elk (Cervus elaphus canadensis (nelsoni); 37% PFO) and elk calf (36% PFO). Our results imply that the diets of reintroduced and wild-born Mexican wolves differ from coyote diets and do not differ from the diets reported for the larger, northern gray wolves found in North America.

Winter Diet Selection of Wolves in the Western Alps

MARUCCO, FRANCESCA, Luigi Boitani and Daniel Pletscher

Wildlife Biology Program, University of Montana (FM) Dipartimento di Biologia Animale e dell'Uomo, Universita' di Roma "La Sapienza"(LB) Wildlife Biology Program, University of Montana (DP)

I estimated the diet of the Valle Pesio wolf (*Canis lupus*) pack for 3-winter seasons (1999-2002) and evaluated winter wolf diet selection along wolf travel routes. Roe deer (*Capreolus capreolus*) was the main prey species for wolves in the area. Diet components differed between winters (P<0.001); relative use of red deer (*Cervus elaphus*) was greater in winter 2001, while use of wild boar (*Sus scrofa*) was greater in winter 2002 than during other winters. I evaluated possible biases in the scat collection method and determined an optimal sampling design using Monte Carlo simulations. Clusters of scat from the same kill site did not bias the total sample; however, scats that were not-independent could introduce errors in the diet estimation. Therefore, the best sampling design to reduce a possible bias was the "additive method," where a collection of scats along a wolf travel route was considered one sampling unit to avoid pseudo-replication. The final additive sample was more representative because it included kills and scat collection data. I examined changes in resolving power with respect to effort expended for a range of possible sample sizes. The standard error was used as a measure of resolving power. Within the range, trade-offs between resolving power and expended effort were used for making the final choice of sample size. The procedure provided a tool for optimizing sampling design of scat collection.

Evaluating interior Alaska wolf diets via stable isotope analyses

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Gray wolves *(Canis lupus)* are commonly viewed as obligate predators of ungulates with alternative prey providing little to their annual diets. However, salmon, primarily chum *(Oncorhyrnchus keta)* and chinook *(O. tshawytscha)*, are widely available from summer to early winter throughout much of interior Alaska. Although recent studies have shown that coastal wolf populations utilize salmon, there has been no assessment of use of salmon by non-coastal wolves. We hypothesize that this relatively abundant, and risk-free, food source should be an important component of interior wolf diets. As a part of wolf research conducted at Denali National Park and Preserve, we analyzed the isotopic signatures of carbon and nitrogen of bone collagen from radiocollared wolves that died during 1986-2002, and of tissues from their ungulate prey and locally-spawning chum salmon. Stable isotope analyses have been used in environmental studies to estimate the contributions from several sources (prey species) to a mixture (wolf tissue) when the isotopic composition of the sources are distinct. We provide an assessment of the utility of stable isotope analyses for differentiating wolf diets and investigate the availability and importance of salmon to Denali wolves.

Meals on wheels: wolf subsidies to scavengers in Yellowstone.

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Gray wolves often adopt a foraging strategy that results in partial consumption of their prey. We investigate the conditions under which partial consumption occurs and estimate flows of carrion biomass from wolf kills to the scavenger community. Wolves were tracked using radio telemetry until a kill was made. Once located, we sampled feeding activity until the carcass was fully consumed. Species-specific biomass removal was estimated weighting the number of minutes spent feeding by previously measured consumption rates. Factors affecting partial consumption by wolves were wolf pack size, prey size, snow depth and distance to road. Coyotes, grizzly bears, golden eagles, bald eagles, ravens and magpies were the principal beneficiaries of wolf-provided carrion. Our results demonstrate that wolves increase the time period over which carrion is available, and change the variability in scavenge from a late winter pulse dependent primarily on abiotic environmental conditions to one that is relatively constant across the winter and primarily dependent on wolf demographics. In addition, wolves decrease the year-to-year and month-to-month variation in carrion availability.

Saturday, September 27, 15:25, Donald Cameron Hall South Wing, Room 30

Maintaining viable wolf populations in protected and managed landscapes in the Central Rocky Mountains.

Session Chair: Cormack Gates, University of Calgary

Participants: Cliff White, Parks Canada, Glenn Brown, Alberta Guide Outfitter, Bob Jamieson, BC Rancher, ecologist and former hunting outfitter, Ken Schroderus, Alberta Trappers Association, Jim Pissot, Defenders of Wildlife Canada, Mark Hebblewhite, University of Alberta, Carolyn Callaghan, University of Calgary, Central Rockies Wolf Project

The Central Rocky Mountains is a rugged landscape comprised of protected and unprotected lands. The wolf population in the region was depleted prior to and during the 1950s but made a natural recovery during the 1970s – 1990s. Several challenges exist in managing wolves in this rugged landscape. The protected areas are the least productive landscapes in the region and contain few winter range areas for ungulates, thus supporting small densities of prey. Moreover, prey numbers have declined in the protected areas within the past two decades due to major habitat changes from fire management, human-caused mortalities, wolf predation, and management actions. Consequently, wolves range over broad areas and most of the packs occupying protected areas also range through unprotected areas, where they are exposed to mortality risk from hunters and trappers. In areas adjacent to the national parks (protected areas), elk numbers have declined during the past several years, and wolves are thought to be at least partly responsible for the decline.

Wildlife management issues are often complex, and the public is rarely aligned on either one side or the other on any particular wildlife issue - this one is no exception. Wildlife management strives to achieve objectives based on societal needs, which emerge from the values that various groups of people hold toward wildlife. Is it possible for us to find the common ground among people with disparate views of wolves and wolf management? This session presents a rare opportunity to observe and participate in a case study discussion on wolf management involving hunters, trappers, non-consumptive conservationists, wildlife managers, and scientists. Join us for a panel discussion that will also invite input from the audience in a respectful dialogue on managing a trans-boundary population of wolves that occupies national parks and surrounding lands in Alberta and British Columbia.

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Sunday, September 28, 08:30, Max Bell Auditorium

Wolves & Cougars: Large carnivore competition in Idaho following wolf reintroduction

AKENSON, HOLLY A., James J. Akenson

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In 1999 we initiated a 4-winter research project to evaluate the nature of the relationship between sympatric wolves and cougars in central Idaho. We examined the potential for competition between cougars and recently reintroduced wolves for food, space, and habitats through radio telemetry tracking and examination of 192 carcasses. We found that wolf and cougar diets were almost identical. Winter home ranges of wolves and cougars significantly overlapped, although the wolf pack home range size was more than 10 times the size of individual cougar home ranges. We observed interference competition at carcasses and evidence of wolf avoidance by cougars. Although no interspecific killing was documented between wolves and cougars, the effects of competition and a declining prey population were expressed in the cougar population dynamics: low recruitment and dispersal. A large-scale wildfire provided a unique opportunity to compare wolf and cougar responses to catastrophic environmental change. Wolves, with a large home range, were more adaptable than cougars. The combination of declining prey numbers, addition of wolf competitors, and large-scale habitat alteration amplified the competition between wolves and cougars. This high level of interspecific competition made it easier to recognize the initial mechanisms used by cougars to adjust to wolves joining the large mammal community. In future years predator:prey ratios will shift from the higher predator levels that occurred during this period of wolf establishment, toward a more "balanced" ratio of predators and prey. Cougar numbers and reproductive success will likely decline as a result of competition with wolves.

Wolf recolonization triggers trophic cascade in Banff National Park

HEBBLEWHITE, MARK, Cliff White, Tom Hurd, Cliff Nietvelt

Department of Biological Sciences, University of Alberta – MH, CN Banff Warden Service, Banff National Park Parks Canada – CW, TH

Wolves recolonized Banff National Park in 1986, and human activities lead to differential wolf densities across the Bow Valley. We used this serendipitous experiment to test the hypothesis that wolf recolonization initiated a trophic cascade in this Montane ecosystem. We investigated the effects of differential predation by wolves on 1) elk sub-population population growth rate, density, and survival; 2) willow regeneration, stem density, and height; 3) aspen regeneration, density and stand dynamics; 4) beaver density; and 5) songbird diversity and abundance during 1986 to 2000. We compared effects of recolonizing wolves across three spatial zones that differed in wolf use from low to high. Elk population growth rate was limited by predation by wolves and snow depth in areas with wolves, and was regulated by elk density in areas without wolves. In zones with and without wolf predation, annual survival was 0.68 and 0.86, respectively. Elk pellet group density was strongly negatively related to aspen regeneration, willow regeneration, willow stem density, and willow biomass. Threshold values for elk densities necessary to successfully regenerate aspen and willow were ~1 elk/km2 and ~5 elk/km2. Further, elk and active beaver lodge density were strongly negatively correlated. Finally, elk herbivory had a cascading negative effect on songbird diversity and abundance in areas without wolf predation. These alternating correlations between trophic levels support the trophic cascade hypothesis. Despite compelling evidence for a trophic cascade, management interpretation will differ across jurisdictions at the wolf population scale, and will require regional approaches to ecosystem management.

Elk habitat selection before and after wolf reintroduction in Yellowstone National Park

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For decades, elk *(Cervus elaphus)* have been the focus of debate in Yellowstone National Park over the issue of how a large ungulate population affects the quality of its habitat. Given the absence of wolves *(Canis lupus)* since the 1920's and termination of culling in 1968, elk population size and distribution were determined largely by climate and forage conditions. However, the reintroduction of gray wolves in 1995 has restored the major predator of elk to the Yellowstone ecosystem. In this study we tested for changes in elk habitat selection in response to heightened predation risk. Using locations of radiocollared cow elk from pre-wolf (1984-1990) and post-wolf reintroduction (2000-2002) periods, we generated Resource Selection Functions (RSF) to model elk habitat selection. These models characterize the relative probability of habitat use by elk based on site-specific habitat variables (e.g., wolf predation risk index, vegetation type, elevation, slope, snow water equivalent). Models were built for summer and winter seasons at the herd segment scale. Comparisons between pre-wolf and present-day (with wolves) models allow us to describe changes in elk habitat selection following wolf recovery. Also, by predicting areas of high probability of elk use, the models help to identify areas where elk are likely to influence vegetation, soils, and other components of their range.

Maintaining differentiation without geographic isolation in the North American gray wolf

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A common element of speciation models is geographic isolation. However, this requirement presents a problem for differentiation and related speciation of large carnivorous mammals that can disperse over long distances. The gray wolf is the most vagile terrestrial vertebrate species, and record dispersal events have been observed. Consequently, even widely separated populations are poorly differentiated. Wolves are generally described as territorial year-round. However, some populations of tundra and taiga-living wolves are reported to migrate over distances of hundreds of kilometres, and to be paler in coloration. Using satellite telemetry, we show that tundra wolves (n=19) follow barren ground caribou (n=19) on their 1500-kilometre annual migration. We also analysed genetics and coloration in tundra, taiga and boreal forest wolves (n=258, n=82 and n=64 respectively). Although tundra/taiga wolves overlap with forest conspecifics during the winter breeding season, they were differentiated from them and had Fst values of 0.30, 0.04, and 0.07 for mitochondrial, microsatellite and Y-chromosome markers (p<0.001 in all cases). Further, 93% of tundra/taiga wolves had a pale coloration whereas only 38% of forest wolves did (X2=85, p<0.0001). We suggest that specialization on migratory prey and selection for pale coloration in snowcovered habitats provide the basis for reproductive isolation. Tundra/taiga migratory and boreal forest territorial wolves are distinct but interconnected conservation entities. Hunting impacts on wolves may be substantial in areas where migratory and resident individuals congregate seasonally. Such impacts should be evaluated for the two ecotypes of wolves, and opportunities for migration should be maintained.

Wolf-prey interactions in Yellowstone National Park

SMITH, DOUGLAS, Tom Drummer, Kerry Murphy, Deb Guernsey Yellowstone National Park (DS, KM, DG), Michigan Tech Univ. (TD)

Wolf-prey interactions were studied in Yellowstone National Park from 1995-2000. We intensively tracked wolves for 30 days in early (Nov-Dec) and late (March) winter from the ground and fixed-wing aircraft. Our objectives were to determine wolf killing rate (kills/wolf/30 days) and prey selection. The primary prey of wolves was elk (91%) but bison (3%), moose (2%), and deer (2%) were also killed (2% unknown). The proportion of elk calves, cows, and bulls killed was 43%, 36%, and 21%, respectively. Wolves selected for calves, against cows, and proportional to availability for bulls. Average age of cow elk killed by wolves was 14 years old compared to 6 for hunter killed cows. Seasonally calves were selected in early winter and bulls in late. Two distinct wolf-prey systems exist in Yellowstone: 1) the northern area with a large elk population, and 2) interior park with low elk but more bison and moose. Wolves killed a greater variety of prey (elk, bison, moose) in the interior area compared to the northern area (elk). Wolf killing rate increased from early (1.6 elk/wolf/30days) to late (2.2 elk/wolf/30days) winter. Averaging early and late winter data and correcting for scavenger removal, consumable biomass was 3.3kg/wolf/day.

Sunday, September 28, 08:30, Donald Cameron Hall, Room 300

Habitat use by wolves in a humanized area of north-central Spain

CORTES, YOLANDA & Juan Carlos Blanco

WOLF PROJECT- CBC (ycortes@arrakis.es; YC); WOLF PROJECT- CBC (JCB)

We studied use of space by wolves with a carrion-based diet, living in a highly humanized agricultural area in north-central Spain. Our aim was to determine whether their habitat use patterns were similar to those of wolves living in wilder habitats. We monitored 11 radiocollared wolves for three years. Nine were collared in an apparently saturated population north of the River Duero and the other 2 in a recently recolonized area south of the river. Total home range (100% MPC) varied between 121-532 km2 for territorial wolves but were much larger for dispersers. Core areas (50% kernel) ranged between 0.8-22.2 km2 and were located in forested zones far from human settlements. Wolves selected diurnal resting sites with dense tree cover, moving at night through coverless inhabited areas. Territorial wolves selected areas with most tree cover, while dispersers used less forested and more humanized areas, suggesting severe intraspecific competition. The average distance between consecutive resting sites was 4.1 km (range 0-25 km) and minimum average distance covered at night was 19.5 km (range 1- 48.3 km). In 73% of overnight monitoring sessions (n= 44) wolves went to feed at livestock carrion dumps, and invested 21% of their total activity time there. We conclude that the patterns of space use of the wolves in our study were similar to those of wolves living in wilder areas of North America and Europe. However, the main limiting factor in our study area was the availability of safe refuge areas rather than food.

The effects of alpha wolf loss on reproductive success and pack dynamics

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We examine the effects of the loss of alpha (breeding) wolves (n = 134 cases) on pack structure, pup survival and future reproduction within territories. We analyzed data collected from both the literature and our own unpublished studies in the United States (Great Lakes, Northern Rockies, and Alaska) and Europe (Norway, Sweden and Greece). Loss through mortality, translocation, dispersal or disappearance was attributable to humans (n = 84), natural causes (n = 46) or unknown reasons (n = 4). When one alpha wolf was lost, > 1 pup survived to recruitment in 82% of cases; when both alphas were lost, > 1 pup survived in 70% of cases. Single pups traveling alone or with one other wolf survived in only half of the cases, whereas in larger groups of 3-5 and > 6 wolves, > 1 pup survived in 81% and 97% of cases, respectively. Whelping the following season occurred in about 50% of cases where one alpha wolf was lost and in only 15% of the cases where both breeders were lost. Nearly 2/3 of all wolf packs remained intact after a loss event, and of those that dissolved, about 3/4 of pack territories were later reoccupied by wolves. In some cases packs either split or budded, and in rare situations multiple litters resulted. Intervals to alpha replacement and next whelping were inversely correlated with populations size.

Wolf/elk Interactions on State Managed Feed Grounds in Wyoming

JIMENEZ, MIKE and John Stevenson

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We monitored wolves (*Canis lupus*) during winters 1999-2002 to determine the distribution of wolf packs, describe prey selection of wolves, and document the behavioural response of elk (*Cervus elaphus*) to the presence of wolves on 3 elk feed grounds in Wyoming. We used radio telemetry to locate wolves and estimate home ranges. We back-tracked wolves to locate carcass remains of elk killed or scavenged by wolves. Radio collared elk were followed to describe how elk responded to wolves hunting on the feed grounds. Two wolf packs recolonized the area and their home ranges overlapped in 2 feed grounds. We located 119 kills made by wolves on all 3 feed grounds and the adjacent national forest. The mean age of adult elk killed was 10 years and the oldest elk killed was 23 years old. Forty-three percent of the elk killed were cows, 4% bulls, and 53% were calves. Mean consumption of elk carcasses was 83% and surplus killing was documented on 6 occasions. Calf/cow ratios dropped in 2002 from a 5-year average of 24 calves/100 cows to 17 calves/100 cows. Approximately 2,400 elk were fed on the 3 feed grounds. Elk frequently left the northern and southern feed grounds but dispersed to the middle feed ground when wolves were present. We speculated that elk congregated in larger herds as a defence strategy and preferred the middle feed ground due to its relatively low snow cover and better visibility to see approaching predators. This unexpected crowding of elk on one feed ground became very controversial as state game managers were forced to adjust their winter feeding programs.

Group Hunting Behaviour in Wolves

MACNULTY, DANIEL R. and Douglas W. Smith

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The wolf *(Canis lupus)* is commonly thought to forage in highly cooperative groups, where each individual shares equally in the effort to capture prey. We examined this assumption by measuring the participation of individual wolves during communal hunts to quantify the extent to which wolves cooperate and to identify the

factors that affect the degree of cooperation. We directly observed the hunting behaviour of 53 individual wolves distributed in 3 packs in Yellowstone National Park from 1995 to 2000. Each individual was considered a sample unit and the binary outcome participate/do not participate was analyzed using a non-linear mixed effects procedure to account for within-wolf covariance due to repeated sampling. During attacks on elk *(Cervus elaphus),* individual wolves were less likely to participate as group size increased. Overall, individual participation increased until 2-3 years of age then declined as age increased. At all ages greater than 11 months, non-breeding wolves were more likely to participate than breeding wolves, and participation decreased for breeding wolves following their third year. Gender did not affect participation. These results suggest that (1) wolves are not obligate cooperative hunters, (2) an increase in pack size does not lead to an increase in cooperative hunting and (3) individual age and breeding status are important factors affecting cooperation in communal hunts.

Hunting behaviour of Scandinavian wolves on moose and roe deer

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Wolves (*Canis lupus*) kill rate, hunting success and chasing distances on moose (*Alces alces*) and roe deer (*Capreolus capreolus*) were studied in the small, but fast growing wolf population on the Scandinavian Peninsula. Wolves in one territory were radio- and snow-tracked during two successive winters (275 km and 493 km respectively). The territory included a newly formed pair during the first winter (1999–2000), and a pack including the adult male and three pups the following winter. Kill rate on moose was 7.4 days/kill for the adult pair and 4.0 days/kill for the pack of four wolves. The adult male participated in all known killings of ungulates until 25 March 2001 when the first ungulate, a roe deer, were killed by two pups. Chasing distances on moose and roe deer did not differ between failed and successful attacks or between the two winters. In contrast, hunting success of the adult male on both moose and roe deer during the second year of study was significantly higher as compared to the first year. We conclude that increased age and experience of the adult male contributed to the higher kill rate and higher hunting success during the second winter, as compared to the first winter when he was a yearling.

Sunday, September 28, 08:30, Donald Cameron Hall South Wing, Room 30

Non-lethal efforts to enhance wolf recovery and deter wolf/human/livestock conflicts in Montana.

Val J. Asher, FONTAINE, JOSEPH A., Susan Stone, Edward E. Bangs, Liz Bradley, and Larry Temple

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The level of human-wolf interaction and resultant wolf mortalities have increased proportionate to wolf population growth in the Northwestern United States (Smith et al. 2000). Wolf mortalities, legal and illegal, can significantly impact wolf recovery; therefore, developing effective techniques to limit mortalities is a common goal of many conservation and management agencies. In 2000, the U.S. Fish and Wildlife Service, the Turner Endangered Species Fund, and the Defenders of Wildlife initiated a joint project to investigate the use of non-lethal techniques to deter human-wolf interactions and ultimately wolf mortalities. Here we review the feasibility and efficacy of six popular techniques: flagging, radio activated guard stations, less-than-lethal munitions, predator proof fencing, den demolition, and receivers to landowners. We demonstrated that all techniques proved feasible and effective; however, differences in the duration of effectiveness and the overall costs may limit their respective application. Due to the necessity for close cooperation with landowners, we suggest the application of these techniques out of sheep pastures, our results suggest each has its limitations. When costs are limiting flagging may prove effective, but only if the deterrent is necessary for a short period. If the deterrent is required for a longer period, fencing may prove more effective, although the cost is considerably more. Further studies are necessary, but ultimately, the application of these techniques is highly dependent on the needs of the landowner and the availability of funding.

Incentive Strategies and Collaborative Conflict Management for Wolf Conservation

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In 1987, Defenders of Wildlife initiated the first livestock compensation program of its kind to reimburse livestock owners for wolf-caused losses. To date, the Bailey Wildlife Foundation Wolf Compensation Fund has reimbursed ranchers over \$200,000 in the Northern Rockies alone. Acknowledging that wolf survival is largely dependent on the tolerance of local residents, the compensation program has achieved great success. Ranchers, biologists, conservationists, local government leaders and others actively endorse the well-founded merits of the program. A natural outgrowth of the compensation program is The Bailey Wildlife Foundation Proactive Carnivore Conservation Fund which supports implementation of non-lethal preventative animal husbandry practices including guard dogs, electric night pens, fladry, task-specific range riders, a volunteer program called "Wolf Guardians," and other methods. This program assists ranchers in avoiding depredation losses and builds greater opportunities to manage conflicts often before they occur.

Wolf Diet and Activity Towards Livestock in Conditions of Decreased Natural Prey

TSINGARSKA – SEDEFCHEVA ELENA, Alexander Dutsov

BALKANI Wildlife Society, Dragan Tzankov Blvd. 8

The present study was made in the frames of the Wolf Study and Conservation Program (WSCP) in Bulgaria, started in 1997. The official wolf number in the country is overestimated and the official institutions policy towards the species is that it should be brought to a number of 150 individuals. Studies about wolf territory use, diet, activity to livestock, etc. are conducted under WSCP, with the purpose to have strong arguments against the official policy and to prepare wolf conservation strategy. The model area is in Middle-West Bulgaria. To define the wolf diet in this area wolf excrements have been collected and analyzed. Monitoring of wolf activity on livestock has been done since the beginning of the project, with the purpose to estimate the level of the wolf-human conflict. Through inquiry information is collected about frequency of wolf attacks, intensity in different seasons and time of the day, kind of livestock attacked, etc. The results from scat analysis show that wolf diet in the study area is diverse. Besides roe deer and wild boar, a large percent of remains from different domestic animals is found. Also hairs of representatives of fam. *Mustelidae* (Marten *Martes sp.)*, badger (*Meles meles*) and others are found. One of the main reasons for the diverse diet is probably the sharply decreased wild ungulate population number in the country during the last 12 years. The results from the wolf attacks is highest in late summer and fall and is lowest in December and January. Of domestic animals, goats and sheep are most often wolf victims.

Wolf depredation on livestock in the Swiss Alps, 1998-2002

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As a consequence of wolf *(Canis lupus)* recovery in the French and Italian Alps, wolf presence has been regularly recorded in Switzerland since the mid-1990s. In this small agriculture-dominated country several hundred thousand sheep graze, most of them unattended, and cattle breeding is an important economic activity. Like in other parts of the wolf range, depredation on livestock also occurs to a variable extent in Switzerland. We examined 384 wolf damage reports established – one per dead animal - by official game wardens between 1999 and 2002. During this period, wolves killed almost exclusively sheep. So far, no cattle was killed or injured. The number of attacks on livestock averaged annually $30.5 (\pm 16.1)$, and 3.12 domestic animals (± 2.76) were killed per attack. The mean number of days recorded between two attacks ranged from $2.9 (\pm 3.5)$ to $10.5 (\pm 14.7)$ depending on the area and the year. Most damages occurred in summer when sheep are found on the mountain pastures, above 2000 m. Compensation costs averaged 40,240 euros $(\pm 37,850)$ per year. In addition, according to the Swiss wolf management plan, damage prevention is financially supported by the federal government, and in case of recurrent depredation on livestock, wolves can be removed. So far, three wolves were shot by game wardens. Even a sporadic wolf presence generates conflicting situations that could potentially hamper wolf recovery in a whole country.

Nomads, sheep, and wolves: The conservation of cultural landscapes in eastern Mongolia

WILSON, WILLIAM

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One of the few areas that still supports a population of grassland wolves is Mongolia, where the sub-species is *(Canis lupus chanco).* Fragmentary historical knowledge of wolf behaviour on other temperate grasslands is available in the literature, but the wolves of Mongolia provide us with an opportunity to investigate fully how wolf behaviour has adapted to this different landscape, particularly with regard to hunting behaviour associated with gazelle *(Procapra guttorosa)* and other grassland species. The wolves described in this paper live in Ugtam Uul Nature Reserve on the eastern steppe of Mongolia. As this protected area is also inhabited by Buriat nomads and their domesticated animals - sheep, goats, horses, camels, and cattle - this paper also comments on the relationship between these nomads and the resident wolves, particularly with regard to conservation. While much of the literature relating to wolves resident on landscapes that also support domesticated animals stresses the conflicts that may occur between wolf and human interests, this type of conflict does not occur in Ugtam Uul Nature Reserve, at least not during the time of the study that is described in this paper. The importance of ethology to successful conservation is generally known. The data in this paper suggest how important a thorough empirical, as opposed to theoretical, understanding of grassland wolf ethology must be for the successful conservation of both wolves and pastoral cultures on temperate grassland landscapes. These data are also applicable for reintroduction programs for wolves on other grassland ecosystems around the world.

Sunday, September 28, 08:30, Max Bell Building, Room 252

Foraging ecology, economics, and conservation of Indian wolves

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We estimate the food habits of the endangered Indian wolves in the *Bhal* region of Gujarat, western India by analyzing 1246 wolf scats from 5 packs and by continuous monitoring of radio collared wolves from three packs for 1994 hrs. Analysis of scats suggested significant contribution by cattle (25.7%) to the diet of wolves. The frequency of occurrence of blackbuck *Antelope cervicapra* remains in scats was 55.5%, followed by nilgai *Boselaphus tragocamelus* (6.3%); whereas other species occurred in low proportion (<5%). Diet diversity was better depicted by scat data while the distinction between scavenging and predation was only possible through continuous monitoring of wolves. Average feeding interval obtained from continuous monitoring was 3.6 ± 0.7 (SE) days and average consumption/wolf/day of 1.8 ± 0.3 (SE). Adult male blackbuck contributed maximum (70%) to the biomass consumption by wolves whereas scavenging on cattle contributed 14 % and depredated cattle only 8%. Non productive cattle like male calves, sick and old cattle that were not brought back to the village at night since it was uneconomical to stall feed them, were depredated by wolves. Due to the presence of good wild prey populations, absence of small livestock like sheep and goats, and traditional livestock rearing practices, predation by wolves resulted in an estimated insignificant loss of Rs.820 (\$17) loss per village per annum. Persecution of wolves was minimal in this region compared to other areas in India. We propose that landscapes such as the *Bhal* with high wolf densities and low conflict levels be prioritized for targeting long-term wolf conservation efforts.

To prevent conflicts — a program of wolf conservation in the Western Carpathians (S Poland)

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The project, conducted since 1997, consists of : (1) Monitoring of number and distribution of local wolf population, impact of wolf predation on ungulates and livestock; (2) Co-operation with local forest services and wildlife agencies for proper management of wolf habitats; (3) Resolving of man/wolf conflicts through farmers

education, introduction of efficient methods of livestock protection; (4) Co-operation with media for education of local communities; (5) Lectures and seminars for groups involved in the wolf conservation and management on local level, in Poland and abroad; (6) Practice for students from Poland and abroad (7) Co-operation with Slovak landscape parks and hunters to estimate the impact of wolf shooting on trans-border wolf population. During this project the local wolf population slowly increased and reached 5 packs in 2002. Based on collected data and GIS analyzes the most important wolf areas, migration corridors and the main threats were defined. Recommendations for local and regional management plans were developed. In 1997-2001, every year 15-48 sheep were killed by wolves. Circumstances of all attacks were analyzed. In 2001-2002 guarding dogs and mobile fences "fladry" were introduced into 15 most suffered farms. As a result damages decreased more than 80% in 2002. Every year on average 5 wolf seminars were conducted and work experience for several interns were organized. Local agrotourist farms were involved in providing food and lodging for all participants. More than 1000 pupils from schools in wolf areas took part in lectures. Varied educational materials were produced and spread amongst local society.

Conservation problems and solutions for an isolated Iberian wolf population in Portugal

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In Portugal, the Iberian wolf is strictly protected under specific legislation since 1988. The Iberian wolf population in Portugal has approximately 300 individuals, divided in two subpopulations by a major geographical barrier, the Douro river, an extremely humanized valley. The Portuguese south Douro river wolf subpopulation is isolated, since no wolves are nowadays present in Spain. It is the most endangered part of the Iberian wolf population, with numbers and range suffering the major drastic regression in the last decades and facing the most serious conservation problems: habitat fragmentation (fires, increase of road network and human population density) and decrease or absence of wild prey (e.g. roe deer). Data presented are part of a research project conducted from 2001 to 2003. This subpopulation is composed by 25-30 individuals, organized in 8 packs. Each pack shows different peculiarities and different ecological characteristics, depending on prey and habitat availability, showing the generalist and adaptative character of the wolf towards the environmental conditions. For the definition of a conservation strategy for this subpopulation, management and conservation measures are proposed and discussed: measures to apply in areas identified as potential ecological corridors and in roads with the higher mortality rates, as well as proposals for roe deer reintroduction. The implementation of the Natura 2000 Network will be of a major importance once it will represent the only legal habitat protection in the region.

Linking Wolf Ecology, People, Place, and Planning: Moving from Restoration to Maintenance

SIME, CAROLYN A.

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Gray wolf conservation is challenged by the transition from population restoration to maintenance. Ultimately, both transition and maintenance require a climate in which people allow wolves to find their place among other native wildlife. By linking ecology, people, and place during its planning process, the State of Montana has made significant progress towards a successful transition. Montana Fish, Wildlife & Parks (FWP) emphasized a people-centered, rather than an agency-led or a political/legislative approach to create a conservation and management plan for a restored population. A diverse stakeholder group used an interest-based process to determine guiding principles and make recommendations to FWP. Next, FWP used participatory, consensus-building techniques in communities across the state so that all Montanans could become involved and help craft the program. An adaptive management framework emerged, so that the wolf population itself determines the management strategies. Liberal management tools are selected commensurate with population increases, while conservative tools are selected if the

population dips below a predetermined benchmark. Management tools are matched with prevailing land uses, landownership patterns, physiography, prey densities, and wolf ecology as they exist and interact with each other. An adaptive framework allows the program to resolve localized conflicts and permits wolves to re-occupy their niche without artificially restricting distribution through zoning or checking population growth through aggressive management across broad scales. Most importantly, a people-centered planning approach and the adaptive framework both recognize people's connection to place, so that the needs of people are met and wolves can be accommodated across the landscape.

Counting Wolves - Integrating Data from Volunteers

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Since 1979 Wisconsin Department of Natural Resources (WDNR) has used radiotelemetry, aerial surveys, and winter track surveys to obtain an annual overwinter count of the state's wolf population. As the wolf population began to increase and spread in the early 1990's, WDNR recognized a future need to supplement agency surveys. In 1995 we initiated a volunteer carnivore tracking program to recruit and train volunteers to conduct winter track surveys throughout wolf range. More than 300 individuals have participated in volunteer track surveys and submitted survey data. They have more than doubled the mileage surveyed in the state by agency trackers. An initial analysis in 2000 indicated that training increased volunteers' track detection rates, and volunteers with at least 40 hours tracking experience estimated the wolf population in their survey areas at an acceptable level (91% of the WDNR tracker's estimate for the same areas). Since 2000 we have instituted more stringent training requirements for volunteers and have begun integrating volunteer data, as well as public observations, into the dataset for determining the overwinter wolf count. By the end of the eighth year of the volunteer program in spring 2003, volunteers will have spent ~5,000 hours tracking at least 38,000 km in Wisconsin. We now conduct a more thorough comparative analysis of track encounter rates and wolf population estimates between volunteer and agency trackers. Volunteers provide useful data on the abundance of wolves and other carnivores, which improves WDNR's monitoring ability, while also encouraging public support for wolf management programs.

Plenary Session: Sunday, September 28, 10:50, Eric Harvie Theatre

Examining some common claims about wolf ecology and behavior

MECH, L. DAVID

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Because Wolves (Canis lupus) have garnered considerable attention by both the laypublic and by scientists, many claims have been made about wolf ecology and behavior that are in dispute. This presentation critically examines several of these subjects including the following: (1) wolf predation on inferior prey, (2) the danger of wolves to humans, (3) the alpha wolf concept, (4) the importance of inbreeding depression to wolf populations, (5) the importance of tradition in wolf populations, (6) the reasons wolves hunt in packs, (7) the wolf as a wilderness species , (8) wolves and the functional response, (9) wolves' effect on prey populations, (10) the need for intact wolf families.

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Poster Abstracts

(In alphabetical order of first author.)

Livestock depredation by a recovering wolf population: predicting future conflict areas

AHLQVIST, INGA

Grimsö Wildlife Research station, Swedish University of Agricultural Sciences

Following eradication campaigns against predators, wolf *(Canis lupus)* distribution and numbers became critically low in Scandinavia in the mid 20th century. The change in attitudes among the general public towards large carnivores during recent decades has allowed the wolf to rapidly recover in numbers and distribution. The recovery has led to conflicts with livestock, particularly reindeer *(Rangifer tarandus)* and domestic sheep *(Ovies aries)*. In Sweden, nearly all depredation events involving farm livestock are reported and verified in the field by trained experts. Extensive snow-tracking of wolves complemented with radio-telemetry has provided a detailed knowledge of the distribution and dynamics of wolf territories. Together, this information allows for examination of depredation patterns inside and outside established territories. We present data on wolf depredation on farm livestock in Sweden 1996 and 2002. In addition, based on the availability of domestic and wild prey and estimated future occurrence of wolves, we predict areas of potentially high level of wolf-livestock conflict in the future. The predictions will assist managers when designing management plans for the wolf in Sweden.

Breeding behaviour of Scandinavian wolf using GPS positioning

AHLQVIST PER, Håkan Sand, Olof Liberg

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A female wolf fitted with a GPS radio collar was monitored during the breeding season of 2002 in central Sweden. We studied the female's movement pattern in relation to the den and the time she spent in the den. The GPS transmitter was programmed for positioning every hour. Successful positioning dropped dramatically between the third and fourth of May indicating that the transmitter was under ground unable to contact the satellites. We consider this to be the time of birth. On the following five days the wolf stayed close to the den spending more than half of her time in the den. Thereafter she spent most of her time outside the den making longer and longer excursions. The GPS technology enables us to get much more detailed knowledge of wolves breeding behaviour than the traditional VHF technique.

Determination of potential sites for Mexican wolf reintroduction in Mexico

ARAIZA, MARCELA and Rurik List

Instituto de Ecología UNAM, 3er Circuito Exterior S/N Ciudad Universitaria, Coyoacán (MA & RL)

A landscape spatial analysis for the identification of potential sites for Mexican wolf reintroduction was made in Sonora, Chihuahua and Coahuila, Mexico by the use of a Geographic Information System, digital cartography and a set of criteria that can influence permanence and dispersal of wolves and can be applied on a regional scale. The spatial analysis showed that the sites with highest potential for reintroduction are the northern part of the Sierra Madre Occidental between Sonora and Chihuahua States, and Sierra del Tigre in Sonora. The following steps were the assessment in this area, of prey density and biomass (white tailed deer) and the determination of prevalence and distribution of Canine Parvovirus and Distemper in coyotes, foxes and domestic dogs. The prey biomass and density are in the inferior limit where a wolf population is reported to subsist. We do not consider the prevalence of these diseases an impediment for wolf reintroduction, but preventive and control measures are recommended. Neither the extension of this area nor the prey density is enough to maintain a viable population of wolves in the long-term, however, with an adequate reintroduction strategy to limit wolf poaching and raise local support for the reintroduction in adjacent areas, a larger area would be available. Furthermore, because of its natural connectivity, if wolves disperse or are reintroduced in E Arizona or W New Mexico a viable population of Mexican wolves could indeed exist in the region.

Steroidal Hormonal Profile of Mexican Grey Wolves from Mexican Zoos

Soto, Ma. Pia, Arturo Salame M., Juan A. Rivera, and ARMELLA, MIGUEL A.

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The Mexican Gray Wolf *(Canis lupus baileyi)* was eliminated from much of its original range (South US to Central Mexico). In Mexico there is no hard evidence of wild populations and all the known individuals of this species are in zoos or special enclosures. Reproductive programs in Mexico have had a moderate success, with strong differences among enclosures which limits a possible reintroduction program. Several studies about subspecies have focused on behavior and social structure, but only few on reproductive physiology. In this work we analyzed progesterone (P4), testosterone (T) and estradiol (E2) concentrations in feces of 12 individuals during the Winter and Spring reproductive seasons, using Electro Immune Assay (EIA) kits. Data were backed with behavioral observations to correlate with reproductive behavior. Samples of one pair of unknown sex were sexed by means of the concentration of T. In all males the P4 levels had a cycle pattern coincident with T levels, which also had a cycle variation. The E2 on the male is without significant changes. In the females, the P4 showed a cyclic pattern with many peaks during all the reproductive season. The T followed the same pattern described with P4 coinciding in several peaks, and E2 showed less concentration but with several peaks during the study. These are among the first records tending to evaluate Mexican gray wolf pairs in physiological ways as a means of selecting possible founder pairs for future reintroduction program.

A new drug combination for reversible immobilization of free-ranging gray wolves

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Twenty-seven free-ranging Scandinavian gray wolves (6 females < 1 yr, 7 females and 14 males > 1 yr) were immobilized from a helicopter with 5 mg medetomidine (M) + 250 mg ketamine (K) per animal during winter in 2002 and 2003. Mean (SD) doses were 0.162 (0.008) mg M/kg + 8.1 (0.4) mg K/kg in animals < 1 yr and 0.110 (0.014) mg M/kg and 5.7 (0.5) mg K/kg in animals > 1 yr. Mean induction times were 2.3 (0.8) min in animals < 1 yr and 4.1 (0.6) min in animals > 1 yr (p < 0.01). All but one animal were completely immobilized after one dart injection and remained immobilized for at least 45 min after darting. No major clinical side effects were detected during immobilization but transient hyperthermia were was seen initially in most wolves. Several wolves vomited during recovery. Atipamezole (A) at 5 mg per mg of medetomidine was injected i.m. for reversal 98 (28) and 93 (40) min after darting in animals < 1 yr and 41 (21) min in animals > 1 yr. Recovery was uneventful in 25 wolves. One adult male which did not respond to A was given intensive care and was fully recovered 8 hr after darting. Another adult male in poor body condition with a hemorrhagic enteritis never recovered and died 6 hr after darting.

Size and shape change in wolf skull in first year

Roberto J. Hermida & FELIPE BÁRCENA

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The compared analysis of postnatal cranial size and shape changes has been little studied in mammals. However, its study is of great interest because it allows understanding of the transformations that happen in the pup, which supposes in the wolf (*Canis lupus* L.) to pass from the unweaned state to that of hunter and meat consumer. This change in ecology implies deep transformations in cranial design that should qualify the individual for the new conditions, at the same time that it increases of size with the growth. We have studied these changes of the cranial size and shape in wolf along its first year of life, using technical of geometric morphometric. We have been able to observe that the stage of quicker growth takes place between the 3° and the 5° month of life, when the skull increases its size 25% in one month (4°). Nevertheless, shape change undergoes a maximum between the seventh and the ninth month. The quick increase of the cranial growth between the 3° and 5° month fits with the moment of maximum growth of the pup, and it facilitates the installation of the definitive teeth. The cranial shape changes that will facilitate the development and the insert of the necessary musculature for effective use of the new teeth don't take place until this is totally developed, after the sixth month.

Comparison of scat marking by wolves in different zones of their territory

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Recent studies on marking behavior by wolves (*Canis lupus* L.) have shown the important role of scats in visual and scent communication. The spatial distribution of wolf scats left during the reproductive period was analyzed. This study was carried out from spring to summer 1999 at Montes do Invernadeiro Natural Park (NW Spain). To analyze signaling differences in different parts of the territory, the area was divided into three zones by use: den area, access track to the den area, and the rest of the territory. In order to assess the possible function of scats as marks, the following variables were considered in relation to their location: height above ground level, type of substrate, and frequency of use of the different road sections. The results show significant differences in the distribution of scats left by wolves in the three zones of their territory. It was observed an important gradient in the use of scats as marks from the den area to peripheral zones of the territory. The large number of scats deposited in the den area was mainly at ground level and distributed randomly. This seems to respond rather to a physiologic necessity than to an activity of marking. However, in the periphery of the territory the scats were deposited preferably on conspicuous or high substrates and in crossroads, carrying out an important function as visual and scent marks.

Temporal changes in trophic behavior by wolf in NW Spain

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Wolf predation (*Canis lupus* L.) was studied for five years, from 1998 to 2002, in the central massif of Ourense (NW Spain). The study area comprises about 120 km2, with a high density of wild ungulates: roe deer (*Capreolus*), red deer (*Cervus elaphus*) and wild boar (*Sus scrofa*). Wild ungulate densities remained stable throughout the study period. Results show that wild ungulates were selected over other prey, supposing ? 79% of the consumed food, and roe deer was the main prey (54%). Domestic ungulates, mainly sheep and goat, were consumed as carrion and represented 9% of the diet. The depredation frequencies on the three species of wild ungulates varied throughout the study and these differences statistically significant. This fact can be explained because this area was occupied by different groups of wolves, showing different trophic specialization, maybe originated by a tradition based on the learning. During the study, the consumption of roe deer oscillated among 37-73%, red deer: 0-20%, wild boar: 3-25% and domestic ungulates: 1-21%. Nevertheless, the observed seasonal differences were statistically significant also. Wolves seem to respond to different levels of alimentary availability and to the reproductive behavior of the prey. By this way, the consumption of roe deer was stable in autumn and winter (38%). It increased in spring (44%), corresponding with the beginning of the sexual activity and of the first births, and it reached its maximum in summer (77%) when all the females had given birth.

Estimating the Population and Range of Minnesota's Wolves

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During winter 1997-98, the Minnesota Department of Natural Resources (MN DNR) completed its comprehensive gray wolf *(Canis lupus)* population and distribution survey, the third such survey in as many decades. The 1997-98 survey's objectives were to delineate changes in wolf range and population in preparation for delisting from the Federal Endangered Species Act and eventual management by MN DNR. The advances in GIS technology with each survey are striking. In 1978-79, there was no digital analysis, and all calculations were done by hand. In 1988-89, data entry was digital and some GIS analyses were done for road and human density, cover type, and ownership, but much of the analyses were still done manually. During the 1997-98 survey, data entry and analyses were facilitated by ArcView and ARC/INFO software. The data consisted of 3,451 wolf and wolf sign observations from 464 staff at 179 field stations. Investigation compared road and human density, land use, ownership, ecoregion, and wolf management zones. Analyses showed that the wolf population of 2,450, residing in an expanded wolf range of 88,325 sq. km., was the highest ever for Minnesota. Wolves that now reside in areas identified by GIS 10 years ago as having too many roads and humans to support wolves attest to the species' adaptability. GIS identified areas that may be colonized by wolf packs in the future; however, most are disjunct from the main range, scattered throughout southern and western parts of the state, and will likely add few wolves to the total population.

Impact of two kinds of barriers on wolves in Spain

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We studied the influence of two kinds of barriers on a wolf population living in agricultural areas in Spain: 1) one 4-lane, fenced highway without crossing facilities for wildlife or livestock in open, flat, agricultural land; 2) the corridor comprising the River Duero (100 m wide), one 2-lane, unfenced road, a railway line, two canals and two 500m-wide unforested strips with dispersed houses on each side of the river. From January 1998 to June 1999, the four radiocollared wolves that lived for over a month 15 km from the highway crossed it. The radiocollared territorial wolves crossed the highway between 4.4% and 8.7 % of the days they were located, while the figures for the two floaters were 22.2% and 23.6%. One young territorial female increased her crossing frequency five-fold in the dispersal period. We radiocollared 8 wolves less than 5 km from the River Duero. Between March 1997 and March 1999 (accounting for 184 monitoring days) we only detected one crossing. Between May and August 1999, three wolves are used to human activities, simple highways do not appear to fragment healthy wolf populations, an accumulation of obstacles may act synergistically, producing a barrier effect that is greater than that of the sum of each one. The River Duero and the infrastructures alongside it may have delayed the expansion of Spain's wolf population for almost two decades.

Can man-raised wolf pups survive in the wild?

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Adaptation of man-raised-wolves to the wild was studied on six wolf pups purchased from hunters. The first group was formed in May 2001 from 10-12 day old siblings (2 males and 2 females). These pups were in close contact with man-tutor (Vladimir Bologov) from the first day of the experiment and were completely socialized to him. The

second group was formed in June 2002 by introducing 2, 30 day old male siblings into the first group. New pups were socialized on yearlings from the first group and reacted on them as on parents, but did not have direct contact with the man-tutor. Most of the time pups were kept free living on a small island on lake, 300 m2 enclosure was used only for feeding wolves and temporary for handling. Wolves from the first group were regularly lead by the tutor into various areas in the wild forest outside of their main home site. Behavior was documented on video camera. Wolves from the first group were not afraid of humans until 1.5 years old, then they changed to active avoidance of humans, except the tutor. Both males from the second group avoided any contacts with humans from the very first days of the experiment and in all other aspects behaved as wild pups. Wolves from both groups showed normal for wild wolves reactions of orientation, avoidance of danger, and quickly learned to find and catch small prey. Reactions with ungulates were not studied at this stage of experiment

Impact of wolf predation and harvesting on roe deer in north-eastern Tuscany

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Wolf predation on roe deer was studied in north-eastern Tuscany, Italy. In one main study area (ISA), effects of predation and harvesting on roe deer population were compared. The use of roe deer by wolves was assessed by scat analysis. In ISA, roe deer represented 19.1% of mean percent volume (MPV) while in the other areas its use ranged between 10.9% and 53.4% of MPV. A low degree of variation was found in both annual and seasonal use of roe deer. Seasonal differences were more marked in those areas where roe deer use rate was lower. In ISA, roe deer was negatively selected among species: Ivlev index of selection ranged between -0.41 and -0.89. Moreover, the use of roe deer was not correlated with its density or with density of the main prey, wild boar. Analysing intra-specific selection, in ISA <1-year individuals were preferred by wolves, mainly during their first weeks of life. This trend was confirmed in the other areas, where fawns represented more than 50% of relative number of roe deer preys. In ISA, natural predation annually produced a mean decrease of about 3.7% of summer (after birth) consistence and 6.4% of yearly increase due to reproduction, while game management removed about 3.0% of spring (before birth) consistence. The overall impact of both predation and harvesting does not seem to affect growth rate of roe deer population.

Wolf predation on wild ungulates in southern Spain: a description of wolf attacks

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The study area is located in Sierra Morena, in Southern Spain, where the current population of wolf *(Canis lupus signatus)* is scarce. The wolf's distribution area (4308 km2) is characterized by a high density of wild ungulates such as the red stag *(Cervus elaphus)*, the fallow deer *(Dama dama)*, the wild boar *(Sus scrofa)*, the mouflon *(Ovis orientalis musimon)*, the roe deer *(Capreolus capreolus)*, and the Spanish wild goat *(Capra pyrenaica hispanica)*. Within the context of a project directed to set the basis for the wolf preservation plan in Andalusia (i. e., 'Bases para la elaboración del Plan de Conservación del lobo en Andalucía'), we undertook several field studies based on linear transects, consisting of a total distance of 3190 km. We found 62 ungulate corpses that had been predated by wolves. We have studied different variables in these attacks. Wolves usually rely on natural topographic discontinuities for their predatory strategies. This is true in the case of brooks and rivers (46,77 percent) and stony steeps (11,29 percent). We also found animal remains near human infrastructures such as fences used for the management of cervids (27,42 percent). The proportion of species found in each case is as follows: 79,03 percent of deer, 12,91 percent of fallow deer, 6,45 percent of wild boar and 1,61 percent of mouflon. A high proportion of captured deer (59,20%) were young (-2,5 years old). We also found a higher proportion of remains of female fallow deer as compared to male fallow deer.

Organochlorine pesticide, polychlorinated biphenyl and heavy-metal concentrations in wolves from North-West Russia

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The livers of 58 wolves from the Tver and Smoliensk regions of North-West Russia (54°N 31°E to 57°N 35°E) were analyzed for seven organochlorine pesticides, 24 PCB congeners, Aroclor 1254-matched summed PCBs (S PCBs), total mercury, cadmium and lead. Cadmium, most of the organochlorine pesticides and many PCB congeners were not detectable in any of the wolves. Hexachlorobenzene, alpha-HCH, pp' DDE, PCB congeners 118, 138, 149 and 156 and the heavy metal lead were detected in up to 6% of livers. Dieldrin (HEOD), PCB congeners 153, 170, and 180, S PCBs and mercury were detected more frequently. Contaminant levels were generally low; maximum wet weight (ww) concentrations of any of the organochlorine pesticides, S PCBs and mercury were less than 0.1 mg g-1, 1 mg g-1 and 0.25 mg g-1 respectively. PCB congeners 153, 170 and 180 were each positively correlated with the S PCBs and these three congeners accounted for 41% of the Aroclor 1254-matched PCB concentration. HEOD, S PCBs and mercury concentrations did not vary significantly between males and females nor between adult and young wolves apart from the S PCB concentration, which was, on average, five times higher in adults than juveniles. Liver residues were generally below the level normally associated with adverse effects except for lead levels which exceeded the critical 5 mg g-1 dry weight concentration in three of the 58 animals examined. This study represents the only detailed investigation of contaminants in wolves in Europe and the first in animals from Eastern Europe.

Hunting practices increase the prevalence of *Trichinella* in wolves from North-West Russia

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From 1998 to 2000, 184 animals (82 wolves, 29 red foxes, 55 mustelids, 5 raccoon dogs, and 13 domestic dogs), mainly shot by hunters in the Tvier and Smoliensk regions of North-West Russia, were tested for Trichinella larvae; 98 (53.3%) of them were found to be positive. The highest prevalence was detected among wolves (97.5%); this prevalence is the highest ever noted in a natural population of carnivores. Trichinella nativa was the most common species detected in the sample (98%). The prevalence of Trichinella infection could be explained by a carnivore-carnivore scavenging transmission. Moreover, the diet of wolves was investigated by a concomitant analysis performed on the same individuals used in our study, examining the stomach contents of 62 animals. The diet mainly consists of dogs and moose. Since no prey in the diet was strongly positive for Trichinella, we excluded these prey as indirect evidence of the predatory transmission of the parasite. However, during the hunting seasons of 1998-1999 and 1999-2000, skinned wolf carcasses were left in the forest as bait (approximately 567 carcasses). As reported previously, this epidemiological picture suggests that improper human behavior could be the main cause of the high prevalence of the infection in wolves within the study area.

Stable Isotope Analysis of Survivors and Non-Survivors under the Risk of Predation

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Predation affects ecosystem processes, structures communities, and influences life history strategies of prey. Predation is typically non-random and can influence the distribution of trait values in a population. Typically, investigations in this context have examined physical traits of prey. In contrast, isotopic signature "traits" integrate information primarily about how consumers interact with their environment (i.e. niche) and may provide insight into the trade-offs facing prey while foraging under the risk of predation. We examined stable isotope signatures (d15N and d13C) of surviving and non-surviving individuals within a single generation. In this preliminary study in a wolf-deer system of coastal British Columbia, adult deer that were predated (non-survivors) showed marginally different isotopic signatures than surviving adults. We used Akaike Information Criteria to guide model selection and inference. d15N signature was the most important parameter to predict mortality. Variability in d15N signatures of deer may relate to topographic and other habitat features that influence d15N values in forage in this heterogeneous landscape. Future studies will examine if physiological status, sex class and/or age class contribute to variability in isotopic signatures of coastal deer. If isotopic signatures are primarily related to niche, this approach may provide a novel tool to evaluate trade offs faced by prey. Understanding the ecological context of niche space is important; it allows insight into genetic, morphological, and behavioural variability within populations.

Differentiating Great Lakes Area Native Wild Wolves from Wolves and Wolf-Dog Hybrids

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The increase in wild wolf populations has been paralleled by an increase in captive animals that are wolf-dog mixes or are privately kept full wolves. Wildlife biologists are often consulted to identify these animals when the animals are collected after death or occasionally may be asked to verify whether a specific free-ranging animal may perhaps be a wolf or wolf mix. Unfortunately, at this time, there are few decisive DNA tests that are successful at verifying whether a specific animal is a full native wolf. Many clues can be used to discern whether an animal is a wolf or a wolf-dog mix, or if the animal appears to be a full wolf, whether the animal has been captive. This paper has been assembled to help conservation officers, field biologists, forensic staff, and others learn valuable clues in evaluating Canids.

U.S. Fish and Wildlife Service's Red Wolf Recovery Program

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The U.S. Fish and Wildlife Service's Red Wolf Recovery Program is an excellent example of integrated science, policy and resource management that successfully achieves red wolf conservation and recovery. The Program is coordinated and overseen by a supervisory Team Leader. The highly experienced Red Wolf Field Team implements an adaptive management plan designed to integrate scientific recommendations from a panel of scientists and managers known as the Red Wolf Recovery Implementation Team. The Red Wolf Captive Breeding Program implements the Red Wolf Species Survival Plan at almost 40 wolf breeding facilities operated by zoos and private partners across in the USA and Canada. The Red Wolf Island Propagation Program utilizes island locations to raise young wolves in a wild setting and learn survival skills as a pack member. Both the Ecological Services Division and the Refuges and Wildlife Division of the U.S. Fish and Wildlife Service provide integrated policy, funding and personnel support to help achieve red wolf recovery. The non-profit Red Wolf Coalition works with agency red wolf outreach staff to communicate regularly with people, media and organizations. The result achieved is continuing recovery of the world's only wild red wolf population currently in the form of 20 red wolf packs comprising approximately 100 wolves across 1.5 million acres in northeastern North Carolina in the USA.

Intraspecific Fostering in the Red Wolf (Canis rufus)

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The U.S. Fish and Wildlife Service's Red Wolf Recovery Program implements innovative fostering techniques to enhance the world's only wild population of red wolves *(Canis rufus)*. Fostering individual or multiple offspring from a source litter to a recipient litter was performed opportunistically. Fostering pups was initially conducted to determine effectiveness as a population management strategy. Subsequent attempts were conducted to allow a single pup to derive social benefits of growing up with siblings, to reduce numbers in a large litter or to supplement red wolf numbers and genetics in the wild. Eight separate fostering events involving captive-to-captive (n= 6) and

captive-to-wild (n=2) litters were attempted from 1987-2002. A total of 14 (range 1-3) pups were fostered during the reporting period. Fostered pup age for the source litter was 10.38 days (range 5-14). Fostered pup age in the recipient litter was 9.71 days (range 4-15). The time between removal from a source litter to placement with a recipient litter ranged from several minutes to about 6 hours. All pups involved in captive-to-captive fostering events survived to weaning. One of two pups involved in a 1998 captive-to-wild fostering event survived until weaning. Two pups involved in a 2002 captive-to-wild fostering event survived beyond weaning to 6 months. The utility of intra-specific fostering assists red wolf population management, and fostering could provide significant conservation application for recovery of other wolf species.

Foraging patterns of tundra wolves in the central Canadian Arctic

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Wolves living on the tundra of mainland Canada follow seasonal movements of migratory barren-ground caribou, which are their main prey. However, most wolves do not den near caribou calving grounds, but select sites closer to the treeline, which creates a period of low caribou density near dens. During this period of spatial separation from the main caribou herds, wolves must (1) search for scarce and/or alternate prey near the home-site, (2) travel to where prey are abundant, or (3) use some combination of (1) and (2). If strategy (1) is used, the duration of foraging bouts should increase over time because of progressive depletion of local resources. Furthermore, movement paths should be increasingly convoluted representing searching behaviour associated with scarce resources. The use of strategy (2) should be represented by long periods away from the den and relatively straight movement paths as the animal commutes to where prey are more abundant. We used Global Positioning System (GPS) radio-collars programmed to obtain locations at 30-minute intervals to test which strategy was used by wolves in the central Arctic. A total of 2,152 locations were collected for female wolf 388f from 22 June through 20 August, and 686 for male wolf 386m from 22 June through 8 July 2002. We report distance, frequency, and patterns of movement bouts, associated with foraging ecology of barren-ground wolves. We suggest there may be a relationship between depletion of local resources and energetic costs/benefits related to commuting distances that warrant strategy switching by tundra wolves.

Wolf predation and ungulate mortality in Italian Alps

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Wolf-ungulate interactions were studied in mountain region of western Alps (Italy) during three winters (Dec99-Apr00; Nov00-Apr01; Nov01-Apr02). This study was based on analyses of 581 wolf scats and 180 ungulate carcasses collected during the monitored period. Wolf diet showed that cervids were intensively used by wolves (84.2% occ). The proportion of red deer was 43.3%, while roe deer represented 39.9%. The 3rd most important food item was chamois (9.8% occ). Age classes of ungulates were determined from analyses of bones and hair remains founded in scats, showing that young ungulates were most largely used by the wolf. Species composition of wild ungulates dead for different causes was compared with their availability. Red deer was the main ungulates species killed by wolf (48.5%), followed by roe deer (42.4%) and chamois (9.1%). The red deer was preferred by wolves, while chamois was selected negatively and roe deer was used as available. Species composition of ungulates killed by wolves and recovered in wolf scats did not differ (_2=0.09; df=2; ns). Disease and starvation resulted important mortality factors of roe deer but not for the other species of ungulates. Roe deer was the main ungulate species dead by disease and/or starvation (54.8% %), followed by red deer (32.3%) and chamois (12.9%). Traffic accidents data showed similar results: the percentage of run down roe deer was 96.6% while red deer represented 3.4%. No carcasses of chamois were found.
Assessing Perceptions of Rural Stakeholders Toward Wolves in the Northern Great Lakes Region

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Inclusion of human dimensions into the development and modification of management plans for gray wolves *(Canis lupus)* in the Great Lakes Region is essential given the long and intimate relationship that humans have with wolves. Livestock producers are the sector of our society that will continue to interact directly (often as a conflict in the form of livestock depredation) with wolves as the wolf population in the Great Lakes Region continues to expand into more semi-agricultural lands. Conflicts that arise between livestock producers and wolves often are relayed into depredation control activities whereby government officials destroy wolves suspected of causing the conflict(s). Thus, the attitudes of livestock producers can be instrumental in shaping management plans and societal perceptions of wolves. Unfortunately, the attitudes and perceptions of the rural community toward wolves, livestock depredations, and management practices for preventing depredations have not been adequately assessed in North America. This study provides a comprehensive measure of attitudes of rural stakeholders in the Great Lakes Region and will lead to further studies that will extrapolate these findings to other regions.

Experimental Assessment of a Non-Lethal Control Method for Reducing Conflict

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Few studies have used a rigorous experimental approach in studying the depredation ecology of wolves in semiagricultural landscapes. The research we propose will test one specific method of non-lethal control, site-aversive conditioning, using an experimental design. We will test the effectiveness of aversive conditioning for altering wolf movements away from livestock areas, thereby preventing depredations on individual farms and chronic problem areas. Furthermore, this study will include farmers as an important stakeholder group in managing depredations. The success of this project will be assessed by the ability to exclude wolves from livestock areas and by the perceived effectiveness of non-lethal control as one management tool via a farmer-attitude survey before and after the study. Completion of this study will contribute valuable information to the ultimate goal of wolf conservation. If proven to be a viable management technique, site-aversive conditioning could be used to manage established (e.g. Minnesota), naturally recolonizing (e.g. Michigan and northern Maine), and reintroduced wolf populations (e.g. southwestern U.S.) that occur in semi-agricultural landscapes. We will provide state and federal wolf management officials with information to guide them in the use of non-lethal control as a management tool, as well as information on wolf depredation ecology and patterns within semi-agricultural landscapes.

Co-existence of Wolves and Arctic Foxes at a Den Site in Nunavut, Canada

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Wolves and arctic foxes are sympatric in the Canadian Arctic where both species may compete for food resources and denning sites. In 2000, in the Queen Maude Gulf Bird Sanctuary, Nunavut, we observed the simultaneous presence of adult and juvenile wolves and arctic foxes at one den over a two day period. Tolerant and aggressive interactions between adults of both species were observed. Pups from both species were observed at the den, however, were never seen simultaneously. Theory of interference interactions would predict that the dominant predator eliminate the sub-dominant predator from a given area by either predation resulting in the killing of the sub-dominant species or aggression resulting in avoidance behaviour and relocation of the sub-dominant species. Further, aggressive interactions would be even more severe at breeding sites where the survival of progeny could be

jeopardized. However, our observations suggest that aggressive interactions are not incessant, and illustrate that tolerant interactions occur between canid species. Our observations provide evidence for theory involving a continuum of possible interactions among canid species, and suggest that tolerance may facilitate co-existence.

Using logistic regression to model wolf habitat suitability

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The sixty six wolves that were reintroduced into Yellowstone National Park and Central Idaho in 1995 and 1996 have prospered to over 560 wolves in Wyoming, Idaho, and Montana. With the wolf population and occupied territory expanding, being able to predict where the wolves may disperse to next would help wildlife managers and policy makers with proactive planning. In 1999 a geographic information system (GIS) was developed to model wolf habitat suitability using road density and land cover data from a subset of Idaho, Montana, and Wyoming. Now, results from this model are re-assessed using current wolf pack locations, and the study area has been enlarged to include all of Idaho, Montana, and Wyoming, plus Washington and Oregon. The model was tested using data from the entire study area using wolf pack locations from 2001 for out-of-sample validation. Results indicated that the model created in 1999 was able to successfully predict suitable wolf habitat, and areas of future wolf occupation with a 91% overall accuracy. The resulting habitat suitability maps can assist management agencies in the identification of potential wolf habitat, areas where human/wolf conflicts are likely to occur, and areas that should be considered critical wolf habitat.

The transition from federal to state management: Consequences for U.S. wolf populations

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Is it a mistake to remove wolves from the protections provided under the federal Endangered Species Act, or is it the natural progression for a species saved from the brink of extinction? When is it time to end federal involvement with a recovering species? What happens if the state which will be given responsibility for an endangered species, does not want that species within its boundaries? Wolves have had protection over most of the U.S. for 30 years, thanks to the ESA. During that time their numbers have grown from fewer than 500 in one population in Minnesota, to in the neighborhood of 4,000 in two larger populations, in the Midwest and Northern Rockies. Wolves in most states across the U.S. will soon face the end of ESA protection. This will leave each portion of the wolf population, divided by political boundaries, to be managed by state laws. The ESA only requires that the species be managed in a way that will avoid extinction. Some powerful portions of the voting population do not support wolves.

This talk will look at the future of wolves under the proposed state management plans. Consulting with legislators, wildlife managers at the state and federal level, conservation biologists and leaders of NGOs involved in both wolf protection, and those working to eliminate wolves, this talk will attempt to synthesize this into a picture of what the future might hold, and how this could affect wolves in North America over the longer term.

Genetic diversity and relatedness within packs of an intensely hunted wolf population

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A population of wolves inhabiting Bialowieza Primeval Forest (BPF) on the Polish and Belarussian border has recovered after near extermination in the 1970s. Currently, it is intensively hunted in the Belarussian part of BPF and

protected in the Polish part. We used a combination of field observations, radiotracking and molecular analysis to study genetic diversity of the population after natural recolonisation. We also studied the effects of intensive hunting on the genetic composition and social structure of wolf packs. Both microsatellite and mtDNA analysis revealed high genetic diversity. For 29 individuals and 20 microsatellite loci, the mean heterozygosity was 0.737. Four mtDNA haplotypes were found. Three of them had previously been described from Europe. Their geographic distribution suggests that wolves recolonising BPF immigrated mainly from the north-east, and less effectively from the east and south-east. We traced the composition of 7 packs for 6 years. Packs were family units (a breeding pair with offspring) with occasional adoption of unrelated adult males, which happened more frequently in packs living in Belarussian part of the BPF, which was intensively hunted. Breeding pairs were either siblings or unrelated wolves. Pair bonds lasted from 1 to 4 years and usually ended with death of one or both mates. Successors of breeding females were their daughters, whereas a successor of a breeding male was either his son or an unrelated wolf. As exhibited by Bialowieza's wolves, high genetic diversity may result from immigration of outside individuals, which are easily recruited in a heavily exploited local population.

Wisconsin Wolf Damage Control Program

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The Wisconsin Department of Natural Resources (WDNR) is responsible for gray wolf *(Canis lupus)* management in the state of Wisconsin, USA. An important part of wolf management is dealing with human-wolf interactions; especially managing damage done to domestic animals. The WDNR Wolf Damage Control Program has two components: 1) reimbursing individuals for losses; 2) translocating wolves from chronic depredation sites. The WDNR wolf damage reimbursement program paid 119 claims, totaling \$ 285,729 from 1984 through 2002. Depredation by wolves on domestic animal has increased in recent years. Between 1976-1989 there were 5 cases of wolf depredation (average 0.4/year) as the wolf population varied from 15 to 31. From 1990-1997 there were 27 cases of wolf depredation (average 3.4/year) as the wolf population varied from 31 to 148. Between 1998-2002 there were 82 cases of wolf depredation (average 16.4/year) while the wolf population varied from 178 to 323 wolves. Overall, about half the depredations are on livestock and half on pets. The WDNR wolf damage reimbursement program is unique in that it pays for "missing" livestock under certain circumstances and that it pays for hunting hounds killed by wolves. In 2001, 11 of 17 cases of wolf depredation were on dogs. Wolf kill of 37 cattle in 2002 was the highest kill recorded. Depredation reimbursement payments have increased from \$ 200 in 1984 to \$ \$64,565 in 2002. Between 1991 and 2002, 36 wolves have been live captured and translocated; 16 are still alive; only 2 have successfully produced pups in new packs.

Wolves in Germany – returning slowly – but surely?

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About 100 years ago wolves were completely eradicated from Germany. Though strictly protected since 1990, some illegal killings took place. In 2000 the first reproduction of wild wolves was proven in the north of Saxony, close to the Polish border. Typical for the region are large forests, recultivated brown coal mining areas and some agricultural land. Five ungulate species are present in quite high densities. The wolf pack is centered on a military training area (145 km_). They live almost exclusively on wild ungulates as a first scat analysis showed. However, the offspring from this pack is emigrating into surrounding areas with agricultural use. The first proven sheep killing occurred in 2002. On behalf of the Saxony state environmental ministry we are working to monitor the pack's home range and the presence of newly forming pairs by searching for tracks, howling stimulation and conducting inquiries to hunters and foresters. We implement appropriate methods of livestock damage prevention in close cooperation with the shepherds, who have lost the tradition of protecting the sheep from large predators. To raise the acceptance for wolves among the affected interest groups as well as the local public in Saxony and adjacent states we put much effort into providing them with current, concrete and locally relevant information on wolves. However, the return of the wolf has created a diverse echo throughout German society. It is not yet clear how wolves and people get on in the country of Little Red Ridinghood in the long run.

Winter habitat use of wolves in managed landscapes in west-central Alberta

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Forested landscapes in west-central Alberta are facing increased pressures from forest harvesting and other land-use activities, which may alter the movements and distribution of wolves and ungulates. Information on habitat use by wolves in logged forests is scarce, potentially hampering long-term land-use planning. Nine wolves, from five wolf packs, were fitted with GPS radio-collars in the Rocky Mountain foothills, near Grande Cache, Alberta (2000-2001). We found wolves did not use the landscape randomly, but rather exhibited a significant preference for non-forested natural habitats (shrubs, water) over other habitats, in relation to their availability. Forest cutblocks were used proportionately more than both unharvested forest and non-forested anthropogenic habitats (pipelines, clearings), but selection of recently harvested areas was not significant. We found no evidence that wolves either preferred or avoided forest cutblock edges. While there was some variation with respect to the level of forest harvesting among the wolf pack territories, most areas are still in the early stages of exploitation. Nevertheless, these areas have been allocated for large-scale harvesting. Understanding the potential responses of wolves to rapidly changing landscape mosaics poses a significant challenge to researchers and managers; however, such information is critical to informing future land-management and conservation strategies. Wolves have been implicated in the decline of threatened caribou populations in our study region, and there is an urgent need to better address both proximate and ultimate factors underlying this interaction.

Wolf conservation and damage on livestock in the northwest of Spain

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Wolf (*Canis lupus* L.) population in Galicia (NW Spain) has remained stable during recent years. Currently wolf status in the region is estimated at about 700 individuals. Nevertheless, future wolf conservation is uncertain because of the increment of wolf damage on livestock. Cattle raising is an important economic activity in Galicia. A traditional livestock husbandry system is to rear cows and horses at large in some mountain areas. Wolves frequently attack this kind of livestock, but their scarce commercial value, their concrete space localization and the tradition of this wolf-prey relationship involve relatively problem acceptability. Currently intensive livestock raising methods are changing to increase profitability. Some of the livestock that was traditionally kept in stables at night now remains in the field. This high commercial value livestock (fattening up select calves, dairy cows and sheep) are permanently in the pasture lands. Births occur outdoors and newborns remain without any protection against the wolf. The higher vulnerability of the intensive livestock means an increment of wolf damage and its economic value. Cattle breeders associations requesting solution for this problem have increased the pressure on Public Administration. Resulting management decisions could jeopardize the future of the species. At the moment we are carrying out a study whose final objective is to minimize wolf impact on livestock in a specific area from Galicia.

A social approach to increase the success of livestock guarding dogs integration

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Since the first wolf reappeared in the Swiss Alps in 1994, 59 livestock guarding dogs (LGD) were proposed to sheep owners. We followed a methodology generally admitted in the literature. However, its application was problematic in our dense populated region (LGD disturbing the flock, roaming, frightening hikers). The aim of this study was to understand the origin of the troubles and to improve the methodology. The LGD were monitored from birth (when possible) to two years old in different contexts (barns, enclosures, alpine pastures). Data were recorded on video and analysed. Our findings show that 1) LGDs and sheep share analogous social behaviours (e.g. chin rest) in their respective behaviour repertoires 2) that we face two animal societies which interfere constantly. Problems occur when there are misunderstandings between the two species and often when the sheep owner (humans

represent a third society) interferes in appropriately. Hence, we should consider three social animals, which live together, but having their own rules and needs. Therefore, we are working at a society level. This is particularly important to obtain adequate reactions when LGDs encounter hikers on alpine pastures (e.g. pups are reared in the presence of people in the barns, but socials exchanges are avoided, except with the owner). This social approach gives better results and allowed me to easily explain the rules to the sheep owners. An adequate protection of our livestock is the key of the success for future wolf cohabitation.

The wolf return to the Swiss Alps: a difficult compromise

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The wolf arrives in Switzerland in the worst rural economic context. Since the Uruguay round agreements in 1988 and the emergence of the world trade organisation, the Swiss government had to adapt its agricultural policy. The consequences were the disappearance of farms in mountainous areas (of 9100 in ten years), decreases in product prices (e.g. minus 20% for the lamb and the wool is usually burned). The process is still going on. Besides the economical problems, the sheep industry is no longer adapted to predators. Only 8 % of the Alpine pastures gather enough sheep to pay a shepherd (e.g. the mean number of ewes and lambs on alpine pastures in the canton of Valais is 299). Additionally, losses of unguarded domestic animals are high (i.e. surplus killing and in mountainous regions, panicked sheep may fall, increasing the losses). Prevention measures are quite expensive and cannot be supported by the sheep farmers themselves. Consequently, there is a huge opposition towards the wolf and it became a political object. In the mean time, the Swiss government wants to make economies grow (US\$ 1.75 billion for 2002) and suggest protecting more flocks with less money. The future of the wolf in Switzerland is linked to local acceptation and financial supports, but in our economic situation, it is not a priority. Therefore, in the next coming years, a lot of recovery wolves will be legally (management plan) and illegally culled.

Attitudes toward wolf management in Croatia

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Attitudes of various interest groups (e.g., hunters (n=209), foresters (n=190), high school students (n=339)) and the public (n=1209) who reside in three zones within wolf range were documented using mainly personal interviews. The four categories were grouped by attitude toward management options score. Higher scores represented options that favoured wolves. Analysis focused on how these attitudes varied across space (zones 1, 2 and 3), amongst groups, and within groups across space. General public residents of zone 1, an area with the highest wolf densities, held the most positive attitudes (x = 2.70), followed by residents of zone 2 (x = 2.39) and zone 3 (x = 2.15); these differences were statistically significant. Hunters from zone 1 were the least supportive among hunters (x = 2.21) while hunters from zone 2 (x = 2.42) were the most supportive among hunters, followed by hunters from zone 3 (x = 2.40). There were no significant differences amongst the hunters. Foresters' scores were similar to those of hunters. Student scores were 3.37, 3.35 and 3.15 for zone 1, 2 and 3, respectively and were clearly the most positive of all groups. Such variability in public attitudes indicates the need for different communication efforts, and possibly different management practices across space. However, traditionally managers have managed wildlife for interest groups, as opposed to management for the entire resource constituency. If the goal is to represent the larger public, than wolf management in Croatia should consider these regional differences.

The relationships between seismic line density, wolf movement, and prey mortality

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Seismic lines are a common feature on Alberta's landscape. For some animals, lines are beneficial because they provide quick and easy travel routes through prey habitats. Wolves (*Canis lupus*), for example, travel three times faster on seismic than in the forest. What remains unclear is whether increases in travel distances result in more

encounters with prey and thus higher rates of prey mortality or how these relationships are affected by changes in line density (0 to 5km/km2) and prey behavior (e.g., woodland caribou, *Rangifer tarandus caribou*, avoid lines). A better understanding of the relationships between lines, wolf movement, prey encounters, and prey mortality is key to the proper management and conservation of Alberta's declining caribou herds. Using individual based movement models, we determined the relationships between line density and (1) travel distance, (2) the probability of encountering randomly distributed prey, and (3) the probability of encountering prey that avoid lines. Model results indicate that travel distance and the probability of encountering randomly distributed prey that avoid line density and the probability of encountering prey that avoid lines above which lines is better described by a sigmoid shaped curve. This suggests that there is a threshold of lines above which encounters with prey that avoid lines quickly increases. The validity of this latter model will be tested by comparing expected kill rates (based on encounter rates and expected rate of kill success, given an encounter) to actual caribou kill data obtained from the Boreal Caribou Committee.

Wolves in Russia - The Central Forest Nature Reserve (CFNR) Wolf Project

MILTNER, DANIELA

Central Forest National Reserve Wolf Project in Bubonitsy, Tver Region, Russia

The Central Forest Nature Reserve (CFNR) Wolf Project is based at the biological research station "Chisty Les" 450km northwest of Moscow. It was founded in 1973 by Victor Bologov. Research focuses on wolf ecology and wolfhuman interactions. Bologov has developed an easy, effective system to keep wolves away from livestock pens and pastures (objects attached to the fence and/or rope with strips of red cloth (fladry)). Since 1991 the project is run by his son, game biologist Vladimir Bologov. In Russia, wolves are not protected by any law, and can be hunted all year round, with all means. The use of poison is still allowed and government pays a bounty for every dead animal. It is the main goal of the project to achieve abolition of the bounty system and poison. The long-term aim is to stop wolf persecution and introduce a management plan instead. Across rural Russia wolves are often referred to as a "problem". People accuse them of inflicting damage on game populations, killing livestock and pets, attacking persons, and maintaining reservoirs of rabies. Bologov is working to improve the wolf's image. Many "wolf problems" are man made, and can be solved e.g. by appropriate game and livestock management. For this purpose, Bologov enters discussion with hunters, livestock owners and government officials, and offers them help to find a common solution. Furthermore, he holds lessons for schoolchildren about the ecological role of the wolf. Bologov cooperates with volunteers, students, and scientists from several European countries.

Can the situation of wolf population in southern Spain be considered critical?

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This paper offers an overview of the growth rate of a wolf population *(Canis lupus)* and its local distribution in Southern Spain from 1900 to 2002. We have used existing data in order to study the situation of wolf population growth in the past, whereas in the analysis of its current status we have undertaken several field studies, such as linear transects and simulated howling, as well as interviews. Wolf population in Southern Spain has constantly diminished in the last decades. In the nineteenth century the rate of population was higher and wolves were equally distributed in the whole area. This fact indicates that some particular populations were being progressively eliminated during the twentieth century. The first data available showing population rates was compiled during the 1960s, and it revealed a population rate ranging from 50 to 133 wolves. These data represent an underestimation, and this error was detected during the 1960s and in the 1970s. The first accurate estimation of the growth rate of the wolf population is based on field studies and was undertaken in the late 1980s. It detected a population rate ranging from 49 to 84 wolves. The current distribution is classified into two different groups, and our estimation has detected between 49 and 56 wolves. The main causes for this decrease are hunting and predatory control, but they also include other factors such as road building and human activities in general. In this paper we reflect on the future situation of the wolf in Southern Spain.

Human - Wolf Conflicts in Western North America: Can Fladry Protect Livestock?

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In Alberta (Canada, 1982 to 2001) and in Idaho, Montana and Wyoming (USA, 1987 to 2001) wolves killed various domestic animals among which sheep was the major prey in the USA (68%, n=494) and cattle in Canada (95%; n=1633). Contrary to Canada, under recovery programs wolves increased in the USA (R2=0.79, p<0.001) and depredation events increased proportionately (R2=0.79,p<0.001). In both countries, the number of domestic animals killed each year was correlated with wolves killed by authorities for depredation management (R2=0.61, p<0.001, and R2=0.92, p<0.001, for Canada and USA respectively). We tested anti-wolf barriers made of flags hanging from ropes (fladry) to impede access by wolves to food and livestock. During 18 experiments, fladry prevented captive wolves (n=9) from accessing food for up to 28 hr. Fladry prevented access by wild wolves to 100-m2 baited sites during two 60-day tests. In Alberta and Idaho, we also set fladry around three cattle pastures. Wolves approached on 23 occasions, but did not cross fladry for up to 61 days, nor were cattle killed. Wolves killed cattle on neighbouring ranches during the trials, and before and after the trials in the tested ranches. Our results suggest that fladry is effective on captive and wild wolves for >1 and ≥60 days respectively, and that wild wolves switch to alternative livestock. Our depredation data indicate that protecting livestock from wolves reduces the necessity for killing wolves. Fladry could offer a cost-effective mitigation tool for the problem of livestock depredation on a local scale.

Wolf predation on ungulates and livestock in the Western Carpathian Mountains (S Poland)

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Wolf predation was studied in 1997-2001 in managed forests (745 km2) composed mainly of coniferous monoculture, with an ungulate community dominated by roe deer *Capreolus capreolus*. The region (Western Carpathians, S Poland) is densely inhabited with well developed settlements and numerous herds of sheep on pastures adjacent to forests, and it is representative of current wolf habitats in Central Europe and areas which can be re-colonized in future. Analysis of 390 wolf scats showed that *Cervidae* made up 91% of biomass of consumed food. Even though red deer *Cervus elaphus* had a small share in the community (21%), it was a preferred prey of wolves (42% of biomass), followed by roe deer (33%). Wild boar *Sus scrofa* were taken proportionally to their abundance (4%). Similar preferences for prey were revealed by examination of 93 kills. Amongst red deer, wolves predominantly preyed on females (54% of killed deer) and juveniles (32%), and avoided adult males. Every year wolves killed on average 35 domestic animals, mainly sheep (on average, 5 individuals per attack). Depredation occurred from May to November, mostly in August (44%). Wolf annual predation on the local livestock was estimated at 7% of the total number of sheep. The contribution of livestock to wolf diet varied from 2 to 5% of food biomass.

Polar Wolf behavior in a mixed-species exhibit with Brown Bears

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Captive wolves tend to show a reduced ethogram or even stereotypes due to the limited activities they can perform in enclosures. Being carnivores, they are rarely chosen for mixed-species exhibits, which nowadays are frequently used to increase animal welfare. The aim of this study was to prepare a long-term ethogram of five Polar Wolves (3,2) and to assess what effect the presence of three bears (0,3) in the same enclosure (32000m_) might have, thus providing new data for further improvement of wolf welfare in captivity. Special focus lay on *inter*-species interactions and conflicts. Observations took place in four periods Oct.00-Feb.02, so seasonal differences could be taken into account. The animals were surveyed daily using continuous sampling technique. Generally, the wolves had a highly varied ethogram and showed *intra*-species activities during 73% (p<0,01) of the time. They initiated the

majority of *inter*-species interactions (93%, p<0,01) and "ignored" territorial claims of the bears. Most of these interactions had "play" character (82%, p<0,1) and usually ended in "hunting games". Conflicts over resources were rare and seldomly escalated (3%,p<0,1). Serious inter-species aggression never occurred during surveys. The results indicate that there is a major positive effect of the bears presence on the wolves, since additional behavior patterns (e.g. pack hunting, running games etc.) could regularly be observed. Thus, my study suggests that keeping these two carnivores together indeed is a very recommendable action and can be used in future zoo/wild animal park planning as an effective way to improve wolf welfare in captivity.

Causes of mortality of free-ranging Scandinavian gray wolves 1977-2003

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Historically, the gray wolf *(Canis lupus)* has been present in all parts of the Scandinavian Peninsula. However, in 1966 it was considered functionally extinct after extensive human persecution. No reproduction was recorded until 1978, when one litter of wolf pups was documented in northern Sweden. Scandinavian wolves experienced inbreeding until the arrival of a single immigrant in 1991 initiated increased heterozygosity and exponential population growth. At present the population comprises approximately 100 individuals distributed in the south central part of the peninsula. Since 1977, recordings have been made on dead wolves in Norway and Sweden. This study encompasses 82 dead wolves, of which 17 were radio collared. Overall, mortality of wolves >5-months-old was due to vehicular trauma in 22 (27%), legal kill in 19 (23%), illegal kill in 15 (18%), disease/anomalies in 9 (11%), farmers protecting livestock in 9 (11%), trauma in 3 (4%), unknown in 2 (2%), drowning in 1 (1%), suspected intraspecific fight in 1 (1%), and capture-related in 1 (1%). During the study period 23 wolf carcasses were submitted for post-mortem evaluation. Five wolves suffered from severe sarcoptic mange infection and cachexia, one animal died from hydrothorax due to subvalvular aortic stenosis and ventricular septal defect, one individual suffered from paraplegia due to scoliosis of the thoracic spine, one female died from old age, while two wolves probably died from injuries acquired in moose encounters. In addition, 12 radio collared wolves, including nine alpha animals, disappeared during the study period.

A quantitative description of the Iberian Wolf Howls

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The wolf population inhabiting the Iberian Peninsula has been isolated from other European wolf populations for almost a century. Several authors have proposed, based on morphological criteria, that Iberian wolves belong to a subspecies, *Canis lupus signatus*, different from other European wolves. As part of an ongoing study of vocal communication in Iberian wolves, we conducted a quantitative description of the characteristics of a sample of howls (n = 100) recorded from wild and captive populations in Spain and Portugal. The sample included howls of individual male and female wolves as well as group howls. Recordings, once digitized, were analyzed using commercially available software (Spectrogram 7.2). A total of 21 variables were measured for each spectrogram, including duration of the howl, mean fundamental frequency, coefficient of frequency variation of the mean frequency, and frequency of maximum amplitude of the fundamental. We present data on intra- and interindividual variability in the temporal and spectral structure of howls and compare our results with those obtained from other European and North American wolf populations.

Effects of a harvest ban on wolf population dynamics in Algonquin Park, Ontario

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Research conducted in Algonquin Park, Ontario during 1987-99 revealed that many Park wolves were dying at the hands of humans outside of the Park. This raised concerns about the long-term viability and integrity of wolves in the Park. In November 2001 an experimental 30-month moratorium on wolf hunting and trapping in the 39 townships surrounding Algonquin Park was enacted. We are comparing pack size and structure, and adult survival rates, measured during 2002-04 with similar data collected during 1987-97. Through March 2003 we radio-collared 46 non-pup wolves representing 18 packs and 8 solitary wolves. The only collared non-pup wolf dying during winter 2002-03 was killed illegally in a neck snare. Conversely, none of five collared wolves suffering from sarcoptic mange died during winter 2002-03 despite frequent temperatures below -30°C. Although adult survival rates during 2002-03 were considerably higher than observed prior to the harvest ban, it is too early to draw any conclusions regarding the long-term impacts of harvesting on this population. Power analyses suggest that we will be able to empirically assess the effects of the harvest ban on wolf population dynamics by June 2004. Beginning in June 2003 we will also radio-tag entire litters of pups and then follow the fate of these pups through the first year of their lives. By monitoring both pup and adult wolves we are examining the timing and relative importance of all major factors contributing to changes in pack size and population density, from birth of a new litter through to the following spring.

The Oldest Livestock Protection Method, Livestock Guarding Dogs – Wolf Partners in Survival

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Bulgarian Biodiversity Preservation Society - SEMPERVIVA, Kv. Tvurdi livadi 51/90

The most effective method for livestock protection is using specially selected dogs. Such dogs have been used and are still used in Middle Asia and in Europe. These dogs easily get socialized to livestock, mainly sheep. Different breeds of livestock guarding dogs exist. They are more or less similar to one another. Different breeds and types have differences in the character and the working abilities, formed by the conditions during their selection. Some breeds have significantly lost their working abilities, because of large carnivore extermination and because of selection in which working abilities are not valued as much. Bulgaria is one of the countries in which traditionally livestock guarding dogs are used since hoary antiquity. These are Karakachan dogs. This breed is the most primary type of livestock guarding dog on the Balkans. It had been formed by the Thracians and their descendants, the nomad Karakachan people. These dogs guard mostly sheep, but also goats and cattle. Bulgaria is a mountainous country, so these dogs usually work in a rough terrain and forested areas. The country has always been populated by wolves and bears. Nowadays their populations are still abundant. Wolf attacks are frequent and are daily round for many shepherds and livestock guarding dogs. Direct fights between dogs and predators are not rare. In Bulgaria the rule "wolf attacks - dog barks - wolf runs away" does not work. That's why shepherds value mostly the aggressiveness and initiative of these dogs, combined with a big mobility and working ability. These qualities are directly connected with dog physique. In 1997 a project, which aimed to decrease the human - wolf conflict in Bulgaria was started. Effective and nature friendly protection of grazing livestock is ensured. The project achieved very good results and proved the exceptional effectiveness of the method and these dogs.

Sources of non-invasive sampling: A comparison between oestrus blood and faeces

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In large ranging animals that are difficult to catch, like the elusive wolf, non-invasive sampling for DNA studies has a high potential, both for management and studies of population biology. We investigated the feasibility of two sources of non-invasive samples, faecal and oestrus blood, collected in the Scandinavian wolf population. Here we

evaluated different protocols for DNA extraction and marker techniques. Oestrus blood found in snow is expected to contain DNA of a higher quality than faecal samples. Oestrus blood is potentially very valuable since it should originate from the a -female (the only reproducing female). We typed both kinds of samples on 17 microsatellite loci and found that it was easier to obtain DNA from oestrus blood than from faecal samples (90% vs. 85% success). However, in samples from oestrus blood we often found apparent contamination of alleles from unspecified wolves whereas faecal samples did not seem to suffer from such problems. This implies that the contamination event occurred prior to sampling. The reasons for contamination are uncertain. Genotypes from both faecal and oestrus blood suffer from allelic drop-out and false alleles. In contrast to faecal samples, the amount of available DNA is small in oestrus blood, preventing a full use of a multitude approach. To conclude, we found oestrus blood to be more problematic than expected for nuclear DNA analysis whereas faecal samples resulted in reliable genotypes, if care is taken to avoid problems associated with allelic drop-out and false positives.

Where reintroduce Mexican wolves in Mexico?

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The Captive Breeding Program of the Mexican Wolf *(Canis lupus baileyi)* established by the USA and Mexico governments began in 1978. The purpose was to produce a captive breeding population, genetically healthy to choose individuals to be reintroduced on suitable areas of its original and historical range of distribution. Actually, the program has fulfilled this objective. On 1998 the second stage started the reintroduction of breeding groups to suitable areas. Mexican wolves have been introduced in federal areas of New Mexico, USA. Other areas in Mexican territory are being considered for the reintroduction of wolves, its original distribution was 80% in Mexican territory. Based on genetic algorithm to obtain the ecological species niche (GARP), and the geographical information system (GIS), the Historical Distribution Map for the Mexican Wolf has been generated with georeference data of wild wolves trapped in the states of Jalisco, Durango, Sonora and Chihuahua. Fundamental Niche model was obtained based on four dimensions for Mexico: temperature, pluvial precipitation, elevation and type of vegetation. This distribution map was overlapped on a current vegetation map. This map supports the decision from the Mexican government. The elected areas in Mexico must fulfill the following characteristics: extensive forest areas, no geographical barriers, fragments interconnected to set up a biological corridor with good prey availability, presence of water, low cattleman and forest activity, and reduced mining activity.

Sarcoptes mange (Sarcoptes scabiei) in a wolf of Satpuda forests of Betul, India

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A wolf that died from to a severe automobile accident was examined for skin complications existing prior to its death. Clinical examination revealed severe lesions in almost the entire abdomen, limbs, face & spinal areas. The lesions showed thickening, hyperkeratitis, folded appearance and wrinkling of the skin, along-with alopecia and bare patches on some skin areas. The wolf appeared emaciated and weak, along-with thinning and loss of hair, scab and crust formation, accumulations of foul smelling wet discharge suggesting Sarcoptes mange as the tentative diagnosis. On microscopic examining of skin scrapings mixed with 10% KOH solution, *Sarcoptes scabiei* were noticed. These mites were too small to be seen with the naked eye, but skin changes brought on by infestation can be dramatic. Sarcoptic mange spreads to new hosts through direct body contact or by transfer from common nests and burrows. Severely infested animals show distinct signs of poor health, and mange has proven fatal to wild animals, including wolves. *Sarcoptes scabiei* in wolves has been reported in several parts of the world and has been a serious cause of concern for many years. The availability of *Sarcoptes scabiei* infected prey such as deer, moose, etc. plays an important role in wolf infectivity and wolf survival. Treatment is not feasible for wild free-ranging animals unless a special opportunity is provided. Since wolf populations are currently declining it is prudent to help save every available wolf so as to restore this species for future generations.

Wolf trophic function loss in Sierra de la Culebra (NW Spain): relationships with livestock and human perception

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The Sierra de la Culebra is a hunting reserve of 67,340 ha located in NW Spain. This area is optimal for wolfhuman coexistence. Our study shows that 95.5% of the people surveyed accept wolves, and more than 80% of local shepherds have basic knowledge on wolf biology. Main land use are semiextensive sheep exploitations which use shepherd and guard dogs. Attacks to sheep flocks are frequent with an average of 80 cases/year in 19 villages. However, the mean number of sheep deaths per attack is small (1-2 sheep in 90% of the attacks). There are 5-6 wolf packs in the area. 45.6% of wolf diet is wild herbivore biomass *(Cervus elaphus, Capreolus capreolus, Sus scrofa)*, and domestic animals make up the rest, of which 27.11% is consumed as carrion. The total wild ungulate population of the area has been estimated as 1,000 red deer (2001), 673 roe deer (1997), and 1,000 wild boar (1994). In order to improve socioeconomic development and wolf acceptance, the following measures are proposed: Aid for the agrarian sector prioritizing quality over quantity; aids for the creation of agrarian societies; incentives for the reduction of flock sizes; use of one guard dog for every 200 sheep in large flocks, and one for every 100 in small ones; planting of native fruiting trees; fencing of dumps; control of dogs not assigned to the defense of flocks; measures to increase the populations of wild herbivores, 50% for red deer, 100% for roe deer, and 6% for wild boar.

Efforts to Restore the Gray Wolf to the Northeast United States

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Gray wolves are native to northern New England. Direct persecution and habitat alteration led to their demise. Extirpation of wolves in the Northeast took place by the late 1800's. The neighboring Canadian Province of Quebec has maintained viable wolf populations. It is from this source population that wolves potentially could recolonize suitable habitat in Maine and New Hampshire. Natural and human obstacles between the Quebec population and Maine are believed to be not conducive to wolf movement. The obstacles maybe significant enough barriers to prevent recolonizing from occurring. However, in recent years there have been numerous citizen sightings of large canids in Maine and northern New Hampshire. Furthermore, a wolf was shot in Maine in 1993. In the winter of 2001, a wolf was snared less then 40 kilometers from the Maine border. Similar conditions existed in both Wisconsin and Michigan prior to the passage of the Endangered Species Act of 1973.

The US Fish and Wildlife recognized that New York, Vermont, New Hampshire and Maine have potential wolf habitat and in the 1992 revised *Eastern Timber Wolf Recovery Plan* recommended this region as another recovery zone. The *July 2000 USFWS Proposal to Reclassify and Remove the Gray Wolf* listed the northeast as a separate distinct population ('DPS') segment for recovery. National Wildlife Federation ('NWF') supported the 2000 proposal even though the gray wolf protection would be reduced to threatened in the NE DPS. The continued delay of the national rule has prompted NWF to move forward with wolf recovery efforts in light of the inability of the federal government and the reluctance of the states.

A priority for National Wildlife Federation is the restoration of another gray wolf population in the Northeast. NWF's work follows the recommendations of Wydeven et al's paper in the 1998 Wildlife Society Bulletin.

NWF's work includes

- working with like minded organizations both Canadian and American to protect biotic corridors;
- fostering relationships with the Quebec government and citizens that encourages wolf sightings and offering support in monitoring dispersing wolves from Quebec;
- continued dialogue with stakeholders groups, year round tracking surveys in New Hampshire and Maine;
- and policy work with state governments on predator issues.

NWF's efforts will continue to ensure that the wolf becomes a reality in the Northeast.

Influence of Pseudo-Absence Points on Resource Selection Models for Wolves (*Canis lupus*)

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Predictive models that employ presence and absence data have been challenged on the grounds that actual absence is never known, and the use of pseudo-absence points may lead to spurious model results. We examined the effect of generating different candidate sets of pseudo-absence points on resource selection models for wolves. We used wolf *(Canis lupus)* track data collected on road-right-of ways and transects in Banff National Park and Kananaskis Country, Alberta, between November and March, 1997-2000. Habitat models were developed using logistic regression and Information Criteria. Pseudo-absence points were generated using standard random sample point generation algorithms, in an analytical frame of consistent spatial extent. The effect of these different pseudo-absence point surfaces on the final predictive model was examined by generating five random absence point surfaces, developing predictive spatial models, and comparing output probability models. Three sets of candidate pseudo-absence points (i.e. the latter approximating normal distribution). Dependent variables used in the model included slope, aspect (eastness and northness), elevation, greenness, distance to high greenness, terrain ruggedness, distance to high terrain ruggedness, stand-age, prey density, and distance to cover.

Implementing conservation education programs aimed at groups resistant to conservation goals

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Education is often cited as one of the key conservation strategies, yet there is a dearth of practical information available about setting up and running conservation education programmes. There is also a lack of cohesive information available about the efficacy of conservation education programmes that are taking place worldwide. Many lessons can be learned from both successful education initiatives and those that are not so successful.

Fostering co-existence and helping to mitigate carnivore/human conflict is a large part of any conservation strategy. However, the term 'conflict mitigation' implies that there are certain groups of people who are a threat or barrier to the conservation goals. In other words, they have a level of resistance (ranging from high to low) to the conservation goal, and also to any conservation strategies which are put in place. The more resistant the target group is to the primary conservation goal, the more difficult it will be to influence a change in behaviour that will help achieve the conservation goal.

Understanding the reasons behind the different 'levels of resistance' will help when formulating conservation education strategies. This means having a detailed understanding of the resistant groups. What motivates their actions and why.

The current research and work being undertaken is two-fold. To provide a central point of access through which information and resources will be made available to conservation educators (www.education4conservation.org), and to undertake ongoing research on those groups resistant to specific conservation goals.

Successes of a Largely Volunteer Wolf Education Program

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The Upper Midwest has experienced wolf recovery and management since the passing of the 1973 Endangered Species Act. Timber Wolf Alliance (TWA), a non-profit program of the Sigurd Olson Environmental Institute has been addressing the need for public education outlined in the state and federal wolf recovery and state management plans

of Wisconsin and Michigan since 1987. Started by a group of volunteers, TWA's programming promotes strategies, which enhance wolf populations and stable interrelationships. This programming continues to achieve its goals through the energies and commitment of a large group of citizen volunteers based primarily in Michigan, Wisconsin and, northern Illinois. Education is accomplished at a local scale through an active speakers bureau program. Volunteers give over a hundred wolf presentations to area schools, libraries, civic groups, rod and gun clubs and state and national park annually; in 2002, volunteers presented 128 programs to 7,443 people. Volunteers stay abreast of local attitudes, drafting educational editorials for local newspapers in response to public concern as well as informative articles for TWA's quarterly newsletter. College students facilitate the creation of a children's newsletter distributed widely to elementary schools. Volunteers staff booths and provide factual information to audiences at public events such as: deer hunting shows, trappers conventions, logging congresses, state fairs, and recreational events. Volunteers donate considerable time educating hunters about wolves prior to deer-gun seasons and assist state agencies with field data collection. The outcome has been an informed citizenry and, more importantly, an avenue for citizen involvement and action.

Wolf Awareness Week Poster: A History of Collaboration

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In 1990, the Timber Wolf Alliance, a nonprofit organization based in northern Wisconsin encouraged the Governor of Wisconsin to declare the third week of October as Wolf Awareness Week. Simultaneously, the Alliance worked with the Wisconsin Department of Natural Resources and the Chequamegon and Nicolet National Forests to produce the first annual Wolf Awareness Week poster: an awareness and educational tool for schools, libraries and nature centers. Roughly 5,000 were printed and distributed. By 1992, the governors of Michigan and Minnesota proclaimed the same recognition. In 1995, Timber Wolf Alliance expanded the awareness poster to an educational level with the inclusion of science-based information about wolves around the Upper Great Lakes region. Eleven state, federal and private agencies and organizations sponsored the piece and 30,000 were printed and distributed. In 1998 the Timber Wolf Alliance expanded the project by creating a similar poster on a national level highlighting wolves and wolf restoration around the United States. 25 organizations sponsored the poster and 50,000 posters were distributed across the country. In 2000, with support from four key national sponsors, Timber Wolf Alliance continued with the expansion and created and distributed 50,000 companion activity guides for kids. In 2002, 36 sponsors supported the national poster, 21 sponsors supported the kids' activity guide and 23 sponsors supported the Upper Great Lakes region poster for a total of almost 80,000 posters and 35,000 activity guides printed and distributed--all free to schools, education centers and general citizens.

School Education Program about Large Carnivores

TSINGARSKA – SEDEFCHEVA ELENA

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A School Education Program about large carnivores was prepared and implemented in the frame of the Wolf Study and Conservation Program. Photo exhibition, slide projection, study books for II, III, IV and V grade and other printed materials were prepared to support the education activities. In the school year 2000/2001, 60 schools were included in the program. 5000 pupils from IV and V grade worked with the study books. They participated in a competition for story, picture, etc. More than 1300 pupils' works were received. A poster and a calendar were made using pupils pictures, stories and poems. In the school year 2002/2003 50 schools were included. A competition was organized again. A questionnaire is spread among pupils before and after they work on the program. It is estimated that before the implementation of the education activities pupils have less knowledge about large carnivores. After working on the program their knowledge is better and their attitude is much more positive.

The U.S. Endangered Species Act: Origins, Evolution, and Future Challenges

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The U.S. Endangered Species Act of 1973 (ESA), considered by many to be the most far reaching law ever enacted by any nation for the preservation of endangered species, originated during a time period often known as the 'environmental decade'. More legislative laws and policies were created during this time frame than any other, before or since, pertaining to the environment and conservation. The ESA was a response to the growing environmental awareness of the time, and a need for the kind of management tools necessary to act early enough to save vanishing species. These tools were not in prior Acts, and the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), added momentum leading to the creation of the ESA to do so. Thirty years later there have been many changes that have evolved over time. Amendments to the ESA have occurred. Some of these amendments have led to stronger clarification of processes for the implementation of the ESA, such as management recovery plans. Incentives to private landowners were not included in the ESA of 1973. Critical habitat, cooperation among interested parties, private and public, and adaptive planning are key to survival of species. The outlook for many endangered species is not positive, although the reintroduction of wolves seems to be. Future challenges such as long term planning, citizen involvement, tribal and interagency cooperation will be discussed.

Gray wolf (*Canis lupus*) trophic relationships in the boreal forest: insights from stable isotopes

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Boreal forest ecosystems are composed of a diversity of fauna whose interactions are of particular interest to ecologists and managers. Stable-isotope analysis provides a means to investigate trophic relationships among boreal forest animals. We used this technique to investigate trophic dietary patterns in wolves occurring within and outside of a protected area (Prince Albert National Park) in the boreal forest eco-region of Saskatchewan, Canada. We measured stable carbon (d13C) and nitrogen (d15N) isotope values of hair from 16 mammalian species in order to evaluate potential isotopic inputs to wolf diets. We detected trophic separation and isotopic variation within and among species. Trophic segregation was detected among carnivores that included wolf, coyote, lynx, fisher, marten and wolverine. Wolves showed moderate variation in stable-isotope signature (mean \pm SD; 7.15‰ \pm 1.1), indicating dietary similarity among most individuals, however some individuals differed markedly. We also estimated the relative contribution of prey species into wolf diets (~33% ungulate, ~ 67% beaver). Our investigations will examine hair and other tissues to evaluate seasonal changes in wolf diet. We will discuss the trophic position of wolves in relation to the boreal forest food web and how stable-isotope techniques can be used to elucidate these and other investigations.

MEXICAN GRAY WOLVES: Status Report and Challenges Facing The Captive Breeding Program

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Formidable challenges facing the Mexican Wolf Recovery Program include the release of captive raised wolves. This presentation will outline the current status of the Mexican Gray Wolf in captivity and challenges facing captive managers in raising a "wild wolf." Listed in 1976 under the U. S. Endangered Species Act of 1973, the Mexican gray wolf is one of the rarest land mammals in the world. The ultimate goal of the Mexican Wolf Recovery Plan, signed in 1982, is the re-establishment of wild populations from captive-raised wolves. The captive population in the United States has been managed by the AZA Mexican Wolf Species Survival Plan. Today about 260 Mexican wolves survive,

and most are held at 43 captive facilities in the United States and Mexico. The others are free ranging in the Apache and Gila Forests of the Arizona - New Mexico border. Mexican wolves are held in a variety of facilities. The diversity of these facilities creates management challenges. Breeding pairs and release candidates are selected each year at the Mexican Wolf SSP Annual Meeting and approved by the USFWS Mexican Wolf Recovery Team leader. Critical issues facing captive managers focus on the development and improvement of husbandry practices that will increase chances of wild survival. Size of enclosures, feeding protocols, conditioning procedures and evaluation metrics all contribute to what character of wolf gets released in the wild. Captive managers need accurate and reliable information to develop effective husbandry practices that improve the chances captive raised wolves will survive in the wild.

Assessment of Dispersal in Wolves (Canis lupus) and Movement of Disease

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Connectivity is considered an important feature of maintaining large carnivores. However, we lack effective means of detecting dispersal and the value of connectivity. Riding Mountain National Park in south-western Manitoba, Canada, is considered an "island" reserve, and a combination of habitat fragmentation, human-caused mortality and disease may threaten long term survival of wolves (Canis lupus) in the park and surrounding areas. Fragmentation of habitat can increase risk to moving animals, and may intensify impacts of disease. Genetic research indicate that two separate species of wolf inhabit Manitoba, with gray wolves occupying Riding Mountain National Park (RMNP), and eastern wolves (Canis lyacon) inhabiting northern parts of the province. The extent to which these two types of wolves might interbreed is presently unclear, and this study may provide data to help assess this question. Standard tagging and telemetry methods tend to underestimate long-distance dispersal, and recent developments within non-invasive sampling techniques have allowed genetic studies of wild animals without catching, handling or observing individuals. We propose to assess wolf dispersal and disease movement over a four year period in the Riding Mountain ecosystem by 1) analysis of DNA obtained from wolf scats and 2) telemetry. In addition to complementing dispersal information available from scats, telemetry data provide an independent estimate of wolf dispersal to evaluate the non-invasive technique. This approach allows us to: A) determine wolf dispersal rates; B) detect movement of disease and other pathogens, and C) assess the performance of non-invasive genetic sampling to detect this information.

A methodology for monitoring wolf shyness

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Wolves may pose a threat to human safety if habituated to people. Habituation occurs when an animal is frequently exposed to humans without experiencing them as dangerous. A much-debated topic, which still holds no consensus, is to what extent we need to hunt or otherwise condition wolves to maintain their human fear. To evaluate the level of habituation we need a frame of reference, i.e. a standardized measure of wolf shyness. We report on a methodology applied to provoke and monitor encounters between wolf and man in Scandinavia. Season, age, wind, noise and topography significantly influenced the wolves' response to being approached, and these factors must be accounted for when conducting such studies. To make data comparable, we suggest provoked encounters to be carried out with only one person approaching, and when there is no wind. Preferentially, trials should be carried out in mid winter when snow tracking improves the accuracy of wolf positions. Also, mid winter is the season when alpha wolves are not influenced by site-dependant pups, which we found made them more on guard. We conclude that Scandinavian wolves are shy animals that seek to avoid a confrontation when approached by humans. However, their behaviour in such unpredictable encounters is in stark contrast to their behaviour in situations where the animal itself feels in control. Hence, wolves that enter close to buildings and farmyards have not necessarily lost their fear of humans *per se*.

A Look at the Feasibility of Wolf Recovery in Nova Scotia

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Insular environments pose challenges for wildlife populations. The wolf was extirpated in Nova Scotia in the late 1880s due to persecution and habitat modification undertaken by settlers after colonization. Free from persecution, wolves may be able to re-colonize Nova Scotia if wolf recovery is successful in the eastern United States. This study examines habitat characteristics and prey availability in Nova Scotia to determine if the Canadian province could support a population of wolves. I plan to use a Geographic Information System (GIS) to identify and estimate the extent of roadless areas, park or crown lands, areas differing in known prey densities, and connectivity to assess habitat suitability. To assist in analysis, data on radio-collared eastern coyotes from previous studies will be used to estimate likely wolf home range size requirements in Nova Scotia. Preliminary analysis suggests that portions of the province (Cape Breton and southern Nova Scotia) may be able to support a small population of wolves, though the viability of this population over the long term is of concern. It is suggested that connectivity to a recovered population of wolves in New Brunswick would be crucial to the long term survival of wolves in Nova Scotia.

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Jono Table See Test Laprementary Johnstein Johnst	Montana	105	Increase	Yes (Endangered)	NO
Watchington 17 In 7 set (1) 180 (1) open mark by the messan mail by the messan mail by the messan mark by the messan mail by the messan mail by the messan mail by the messan mark by the messan mark by the messan mail by the messan mark by themessan mark by theme	Wyoming	165	Increase	Yes (Experimental/nonessential)	No
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Yukon5000StableGame SpeciesNoAlberta4200IncreaseGame SpeciesNoAlberta4200IncreaseGame SpeciesNoSakuchevan4200IncreaseGame SpeciesNoMotion''4,000,000'StableGame SpeciesNoOutono2000IncreaseGame SpeciesNoCreenland (Denmark)50-100?Yes (in 95% of range)NoCreenland (Denmark)50-100?Yes (in 95% of range)NoPortugal200-300StableGame SpeciesNoSpain200-300StableYesYesYesSpain200-300IncreaseYesYesYesGermany50StableYesYesYesSwitzerland1-22YesYesYesSwitzerland1-23IncreaseYesYesYesSwitzerland1-21YesYesYesNorsxy10.15IncreaseYesYesYesYesPoland600Increase'Yes, Negations'NoYesYesPoland600IncreaseNo IncreaseNo'No. only if animals were insured'Ithuania-600IncreaseNo'No. only if animals were insured'Poland6001ncreaseNo'No. only if animals were insured'Ithuania-500Decrease/StableNoNoCostak2	Nunavut	5000	Stable	Game Species	No
British Columbia 9000 Increase Game Species No Alberta 4200 Increase Game Species No Saskatchewan 4300 Stable Game Species No Manitoba '9,000 Increase Game Species No Ontroito 9000 Increase Game Species No Outroito 2000 Stable Game Species No Creenland (Demark) 50:100 ? Yes No Portugal 20030 Stable Yes No Spain 2000 Increase Yes No Spain 2000 Increase Yes No Switzerland 1-27 Yes No No Switzerland 1-51 Increase Yes No No Switzerland 1-60 Increase Yes No No Switzerland 100 Increase/Stable No No No	Yukon	5000	Stable	Game Species	No
Alberta4.200InteresseCame SpeciesNoManitoba'4,000-6,000'StableGame SpeciesNoOntatio9000InteresseGame SpeciesNoQueber9000InteresseGame SpeciesNoQueber9000InteresseGame SpeciesNoCoreenland Dommab200-300StableGame SpeciesNoPortugal200-300StableGame SpeciesNoPortugal200-300StableGame SpeciesNoFrance40IncreaseYesYesFrance40IncreaseYesYesIaly400-560IncreaseYesYesSwitzerland1-27StableYesNoSwitzerland1-27StableYesNoSwitzerland1-28Increase/StableYesNoNorway10-15Increase/StableYesNoFinland100Increase/StableNoNoNoPoland600Increase/StableNoNoNoEstonia-500Decrease/StableNoNoNoEdatus'200-300StableNoNoNoUrbauria2000StableNoNoNoStowika200-300StableNoNoNoEdatus'200-200StableNoNoNoUrbauria2000StableNoNoNoUrbauria200	British Columbia	8000	Increase	Game Species	No
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Optimized Outbook Factors Status	Manitoba	4300	Stable	Game Species	No
Quebec5000IncreaseGame SpeciesNoIabrador2000StableGame SpeciesNoGreenland (Denmark)50-100?YesYesSpain2000StableYesYesSpain2000IncreaseGame Species (protected in the south)"Yes, but varies with regional laws"France40IncreaseYesYesIaly400-500IncreaseYesYesSwitzerland1-27YesYesGermany57StableYesYesNorway10-15Increase/StableYesYesNorway100Increase/StableYesYesSweden70-80Increase/StableYesYesPoland600-700Increase/StableNoNoStonia-500Decrease/StableNo (the only outlawed species)"No.insurance companies"Poland600IncreaseNoNoNoBelarus"2000StableNoNoNoRetarus"2000StableNoNoNoRetarus"2000StableNoNoNoSlowakia30-400StableYesNoNoSlowakia30-400StableYesNoNoSlowakia30-400StableYesNoNoSlowakia30-400StableYesNoNoSlowakia30-400StableYesN	Ontario	9000	Increase	Game Species	No
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Greenland (Denmark)50-100 $\widehat{\mathbf{r}}$ YesNoSpain2000StableYesYesYes, but varies with regional laws,"Spain2000IncreaseGame Species (protected in the south)"Yes, but varies with regional laws,"Irahy400-500IncreaseYesYesYesIrahy400-500IncreaseYes"Yes, but varies with regional governments,"Switzerland1-22Yes"Yes, but varies with regional governments,"Germany37StableYesNoNorway101-5IncreaseYesYesSwitzerland100IncreaseYesYesPland600-700Increase"Yes, except Bieszczady,"NoIstinata600100Increase"Yes, except Bieszczady,"No, Insurance too expensive,"Istinata2000StableNoNoNoIstaria2000StableNoNoNoIstaria2000StableNoNoNoIstaria2000StableYesNoNoStoraita2040IncreaseYesNoNoStoraita2040IncreaseYesNoNoStoraita2040IncreaseYesNoNoStoraita2040IncreaseYesNoNoStoraita2040IncreaseYesNoNoStoraita2040IncreaseNoNo	Labrador	2000	Stable	Game Species	No
Portugal200.StableYesYesSpain20000IncreaseGame Species (rotected in the south)"Yes, but varies with regional laws."France40IncreaseYes"Yes, but varies with regional laws."Switzerland1-22Yes"Yes, but varies with regional governments."Switzerland1-23Yes"Yes, but varies with regional governments."Switzerland1-24YesNoOrrway.10-15Increase/StableYesNoNorway.10-26Increase/StableYesNoFinland100Increase/StableYesNoFoland600-700Increase"yes, except liserzcady."NoFoland600Increase/StableNo"No. only if almals were insured."Itatvia900StableNoNoNoItatvia2000StableNoNoNoItatviane2000StableNoNoNoSlovakia350-400StableYesNoNoSlovakia350-400IncreaseYesNoNoSlovakia100-150IncreaseYesNoNoStorenia20-40IncreaseNoNoNoSlovakia350-400IncreaseNoNoNoSlovakia2500StableYesNoNoRelarus2000StableNoNoNoSurgala	Greenland (Denmark)	50-100	?	Yes (in 90% of range)	No
Spain2000IncreaseGame Species (protected in the south)"Yes, buy regional laws"Italy400-500IncreaseYesYesYesItaly400-500IncreaseYes"Yes, by regional governments"Switzerland1-22	Portugal	200-300	Stable	Yes	Yes
France40IncreaseYesYeslaby400-500IncreaseYes"Yes,by renonal governments"Switzerland1-27Yes"Yes,by renonal governments"Switzerland1-27Yes"Yes,by renonal governments"Switzerland10-15Increase/StableYesNoNorway10-15Increase/StableYesYesFinland100IncreaseYesYesPoland600-700Increase"yes, cercept Bieszcady"NoIstinia<500	Spain	2000	Increase	Game Species (protected in the south)	"Yes, but varies with regional laws"
Italy 400-500 Increase Yes "Yes, by regional governments" Switzerland 1-22 Yes "Yes, by cantons" Germany 57 Stable Yes No Norvay 10-15 Increase/Stable Yes No Sweden 70-80 Increase Yes Yes, by the state and insurance companies" Foland 600 Increase/Stable Mutet don't in reindeer areas "Yes, by the state and insurance companies" I thuania 600 Increase/Stable No "No.onit arance too expensive" I thuania 600 Increase/Stable No No No Relarus "20,00 Stable No No No Relarus 20,00 Stable Yes No No Slovenia 20-40 Increase Yes No No Slovenia 20-40 Increase Yes No No Slovenia 200-40 Increase Yes No No <td>France</td> <td>40</td> <td>Increase</td> <td>Yes</td> <td>Yes</td>	France	40	Increase	Yes	Yes
Switzerland1.27 StableYes"Yes, by cantons"Sorway10-15IncreaseYesNoNorway10-15IncreaseYesNesSweden70-80IncreaseYesYes, by the state and insurance companies"Poland600-700Increase"yes, except Bieszczady"NoPoland600Decrease/StableNo (the only outlawed species)"No, insurance too expensive".Lithuania600Increase/StableNoNoNoIabria900StableNoNoNoBelarus"2000StableNoNoNoUkraine2000StableYesNoNoCzech Republic-20StableYesNoNoSlovakia350-400StableYesNoNoSlovakia350-400StableYesNoNoSlovakia350-400StableYesNoNoSlovakia350-400StableYesNoNoSlovakia350-400StableYesNoNoSlovakia350-400StableYesNoNoSlovakia2000StableYesNoNoSlovakia2000StableYesNoNoSloveria400'DecreaseYesNoNoSloveria2000StableYesNoNoSloveria2000StableNoNo	Italy	400-500	Increase	Yes	"Yes, by regional governments"
Germany57StableYesNoNorway10-15Increase/StableYesYesYesSweden70-80Increase/StableHunted only in reindeer areas"Yes, by the state and insurance companies"Poland600-700Increase/StableNo (the only outlawed species)"No, insurance too expensive"Poland600Increase/StableNo (the only outlawed species)"No, insurance too expensive"Lithuania600Increase/StableNo"No, only if animals were insured"Latvia900StableNoNoNoBelarus"2,000-2,500"Increase/StableNoNo?Cech Republic-220StableNoNo?Cech Republic-220StableYesNoNoStovaria20-40IncreaseYes, since May 1995"NoStovaria20-40IncreaseYesNoNoStovaria20-40IncreaseNoNoNoStovaria20-40IncreaseNoNoNoStovaria20-40IncreaseYesNoNoStovaria20-40IncreaseNoNoNoStovaria20-40IncreaseNoNoNoLingaria7600Stable?NoNoMacedonia500StableYesNoNoRomania2500IncreaseNoNoNoStabla7NoNo<	Switzerland	1-2?		Yes	"Yes, by cantons"
Notway 10-15 Increase/stable Yes Yes Finland 100 Increase/stable Hunted only in reindeer areas "Yes, by the state and insurance companies" Poland 660-700 Increase/Stable No No Estonia <500	Germany	5?	Stable	Yes	No
SWE(BI) 10^{10-30} Increase105105Poland $600-700$ Increase"yes, except Bieszczady"NoPoland $600-700$ Increase"yes, except Bieszczady"NoEstonia <500 Decrease/StableNo (the only outlawed species)"No, insurance too expensive"Lithuania 600 IncreaseNo"No, only if animals were insured"Lithuania 600 Increase/StableNoNoBelarus"2,000-2,500"Increase/StableNoNoUkraine2000StableNo?Czech Republic-20StableYesNoSlovakia350-400StableYesNoSlovakia20-40IncreaseYesNoSlovakia20-40IncreaseYesNoSlovakia2000Stable?NoVugoslav Federation500Stable?NoYugoslav Federation500Stable?NoNugaria"800-1,000"StableYesNoRomania2500IncreaseNoNoRomania2500IncreaseNoNoRomania2500IncreaseNoNoRomania2500IncreaseNoNoRomania2500IncreaseNoNoRomania2500IncreaseNoNoStableYesNoNoNoIungaria"800-1,000"Stable	Norway	10-15	Increase/Stable	Yes	Yes
Intanto Total formation Theorem is a statute of the st	Finland	100	Increase Increase/stable	Hunted only in reindoor areas	"Ves by the state and insurance companies"
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Libuania 600 Increase No "No, only if animals were insured" Latvia 900 Stable No No No Latvia 900 Stable No No No Belarus "2,000-2,500" Increase/Stable No ? Czech Republic -20 Stable No ? Czech Republic -20 Stable No ? Slovakia 350-400 Stable Yes No Slovenia 100-150 Increase Yes No Croatia 100-150 Increase Yes No Mugoslav Federation 500 Stable ? No Hungary <50	Fstonia	<500	Decrease/Stable	No (the only outlawed species)	"No_insurance too expensive"
Iatvia 900 Stable No No Belarus "2,000-2,500" Increase/Stable No No Ukraine 2000 Stable No ? Czech Republic <20	Lithuania	600	Increase	No	"No, only if animals were insured"
Jelarus"2,000-2,500"Increase/StableNoNoUkraine2000StableNo?Czech Republic<20	Latvia	900	Stable	No	No
Ukraine2000StableNo?Czech Republic<20	Belarus	"2,000-2,500"	Increase/Stable	No	No
Czech Republic<20StableYesNoSlovakia350-400StableYes (exceptions)NoSlovenia20-40IncreaseYes, since May 1995"NoGroatia100-150Increase"Yes, since May 1995"YesBosnia-Herzegovina400?DecreaseNoNoYugoslav Federation500Stable?NoHungary<50	Ukraine	2000	Stable	No	?
Slovakia350-400StableYes (exceptions)NoSlovenia20-40IncreaseYesNoCroatia100-150Increase"Yes, since May 1995"YesBosnia-Herzegovina400?DecreaseNoNoYugoslav Federation500Stable?NoHungaryc50StableYes (exceptions)NoBosnia-Herzegovina2500IncreaseYesNoBulgaria2500IncreaseYesNoGreece200-300StableNoNoMacedonia">10,000"IncreaseNoNoMacedonia">10,000"IncreaseNoNoMacedonia250IncreaseYesNoMacedonia250IncreaseYesNoStria2007?NoNoStria2007?NoNoStria2007?NoNoStria2007?NoNoIcebanon<50	Czech Republic	<20	Stable	Yes	No
Slovenia20-40IncreaseYesNoCroatia100-150Increase"Yes, since May 1995"YesBosnia-Herzegovina400?DecreaseNoNoYugoslav Federation500Stable?NoHungary<50	Slovakia	350-400	Stable	Yes (exceptions)	No
Croatia100-150IncreaseYes.moc May 1995YesBosnia-Herzegovina400?DecreaseNoNoYugoslav Federation500Stable?NoHungary<50	Slovenia	20-40	Increase	Yes	No
Jobsina-rierzegovina 400! Decrease No No Jugoslav Federation 500 Stable ? No Hungary <50	Croatia Dogaća Hormogovina	100-150	Increase	Yes, since May 1995	Yes
Intgraw 300 3 and 1 100 Hungary <50	Vugoslav Federation	400§ 500	Stable	2	No
Initial 100 (Stable) 100 (Stable) 100 (Stable) Romania 2500 Increase Yes No Bulgaria "800-1,000" Stable No No Greece 200-300 Stable Yes No No Macedonia "51,000" Increase No No No Albania 250 Increase Yes No No Albania 250 Increase Yes No No Turkey "1,000?" ? No No No Syria 200? ? No No No Izebanon <50	Hungary	<u> </u>	Stable	Yes (excentions)	No
Bulgaria"800-1,000"StableNoNoGreece200-300StableYes"Yes, 80% paid by insurance"Macedonia">1,000"IncreaseNoNoAlbania250IncreaseYesNoTurkey"1,000?"?NoNoSyria200??NoNoLebanon<50	Romania	2500	Increase	Yes	No
Greece200-300StableYes"Yes, 80% paid by insurance"Macedonia" 1 , 1,000"IncreaseNoNoAlbania250IncreaseYesNoTurkey" 1 , 1000?"?NoNoSyria200??NoNoSyria200??NoNoIsrael150StableYesNoIordan200??NoNoJordan200??NoNoIordan200??NoNoIsrael150StableYesNoJordan200??NoNoSaudi Arabia300-600StableNoNoSaudi Arabia300-600StableNoNoCheiludjiang500?DecreaseYesNoCheiludjiang500?DecreaseNoNoXinjiang10000DecreaseNoNoMongolia"10,00-20,000"Stable?NoNoRussia"25,00-30,000"Increase/StableNoNoTurkmenistan1000StableNoNoUzbekistan3000StableNoNoVirgizstan4000StableNoNo	Bulgaria	"800-1,000"	Stable	No	No
Macedonia">1.000"IncreaseNoNoAlbania250IncreaseYesNoTurkey"1.000?"?NoNoSyria200??NoNoLebanon<50	Greece	200-300	Stable	Yes	"Yes, 80% paid by insurance"
Albania250IncreaseYesNoTurkey"1,000?"?NoNoSyria200??NoNoSyria200??NoNoLebanon<50	Macedonia	">1,000"	Increase	No	No
Turkey"1,000?"?NoNoSyria200??NoNoLebanon<50	Albania	250	Increase	Yes	No
Syria200??NoNoLebanon<50	Turkey	"1,000?"	?	No	No
Lebanon<50fNoNoIsrael150StableYesNolordan200??NoNoEgypt (Sinai)<50	Syria	200?	?	No	No
Istate150StableHesNoJordan200??NoNoEgypt (Sinai)<50	Lebanon	<50	: Ctabla	NO	NO
Jordan20011NONOEgypt (Sinai)<50	Israel	2002	2	No	No
Jack ProblemNoNoSaudi Arabia300-600StableNoNoIndia1000DecreaseYesNoCheiludjiang500?DecreaseNoNoXinjiang10000DecreaseNoNoXinjiang10000DecreaseNoNoTibet2000DecreaseNoNoMongolia"10,000-20,000"Stable?NoNoRussia"25,000-30,000"Increase/StableNoNoKazakhstan30000StableNoNoTurkmenistan1000StableNoNoUzbekistan2000StableNoNoTadjikistan3000StableNoNoTadjikistan3000StableNoNo	Fount (Sinai)	<u> 200:</u> <50	Stable	No	No
India1000DecreaseYesNoChina	Saudi Arabia	300-600	Stable	No	No
ChinaImage: ChinaImage: ChinaCheiludjiang500?DecreaseNoNoXinjiang10000DecreaseNoNoTibet2000DecreaseNoNoMongolia"10,000-20,000"Stable?NoNoRussia"25,000-30,000"Increase/StableNoNoKazakhstan30000Stable?NoNoTurkmenistan1000StableNoNoUzbekistan2000StableNoNoKirgizstan4000StableNoNoTadjikistan3000StableNoNo	India	1000	Decrease	Yes	No
Cheiludjiang500?DecreaseNoNoXinjiang10000DecreaseNoNoTibet2000DecreaseNoNoMongolia"10,000-20,000"Stable?NoNoRussia"25,000-30,000"Increase/StableNoNoKazakhstan30000StableNoNoTurkmenistan1000StableNoNoUzbekistan2000StableNoNoKirgizstan4000StableNoNoTadjikistan3000StableNoNo	China				
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Tibet2000DecreaseNoNoMongolia"10,000-20,000"Stable?NoNoRussia"25,000-30,000"Increase/StableNoNoKazakhstan3000StableNoNoTurkmenistan1000StableNoNoUzbekistan2000StableNoNoKirgizstan4000StableNoNoTadjikistan3000StableNoNo	Xinjiang	10000	Decrease	No	No
Mongolia"10,000-20,000"Stable?NoNoRussia"25,000-30,000"Increase/StableNoNoKazakhstan3000StableNoNoTurkmenistan1000StableNoNoUzbekistan2000StableNoNoKirgizstan4000StableNoNoTadjikistan3000StableNoNo	Tibet	2000	Decrease	No	No
Russia"25,000-30,000"Increase/StableNoNoKazakhstan3000StableNoNoTurkmenistan1000StableNoNoUzbekistan2000StableNoNoKirgizstan4000StableNoNoTadjikistan3000StableNoNo	Mongolia	"10,000-20,000"	Stable?	No	No
NZZKUISTAIN30000StableNoNoTurkmenistan1000StableNoNoUzbekistan2000StableNoNoKirgizstan4000StableNoNoTadjikistan3000StableNoNo	Kussia	<u>"25,000-30,000"</u>	Increase/Stable	NO No	No
Instant1000StableNONOUzbekistan2000StableNoNoKirgizstan4000StableNoNoTadjikistan3000StableNoNo	Turkmoniston	1000	Stable	INO No	NO No
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Tadjikistan 3000 Stable No No	Kirgizstan	4000	Stable	No	No
	Tadjikistan	3000	Stable	No	No

"Note: This information was obtained by assembling data from available bibliographic sources and the informed and subjective estimates provided by the experts of the IUCN/SSC Wolf Specialist Group and the Large Carnivore Initiative for Europe (Boitani 2000). Except for a few local situations that are well known, most of the numerical estimates should be considered no more than indicative of the general status of the populations. There are no recent reliable estimates for Iraq, Iran, Afghanistan, Nepal and Bhutan.

"From the book, Wolves, Behavior, Ecology, and Conservation. (In Press) Edited by L. David Mech and Luigi Boitani, University of Chicago Press.

"* Note: Arizona/New Mexico Data not included in original table, information provided by Mexican Wolf Recovery Program."



he Central Rockies Wolf Project is a non-profit charitable organization working toward long-term wolf conservation through scientific research and education.

Our scientific program focuses on two primary elements: protected area research and reducing conflicts between wolves and humans in areas surrounding protected areas.

We have conducted research in the protected areas of the region since 1988, and consequently have contributed significant knowledge to wolf ecology in mountainous habitat. Our protected area research program includes population ecology, habitat use, predator-prey ecology, and behavioural studies.

The Southern Alberta Conservation Cooperative is our practicebased program to reduce conflicts between wolves and humans in the foothills of the Central Rockies. We work very closely with the ranching community of southern Alberta to develop and test techniques to reduce losses of cattle to wolves.

Our education philosophy is rooted in the belief that people will be motivated to protect the environment when they truly value the environment. Valuing the environment happens when people understand and appreciate the environment. Wolves are a wonderful entry point to learning about the complexities of nature as they hold a high interest in the minds of people. This high interest in the wolf is the result of myths and legends, wilderness icon status, and its relationship to the domestic dog.

For more information on the Central Rockies Wolf Project, please visit

www.graywolf.ca or www.worldwolfcongress.ca email info@graywolf.ca