Programme and Abstracts

Felid Biology and Conservation

An International Conference

The Wildlife Conservation Research Unit, Oxford University
Panthera Foundation
IUCN/SSC Cat Specialist Group

17-20 September 2007

Oxford

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Cover Art: Priscilla Barlett

Cover Design:

Preface

This volume contains the programme and abstracts of the "Felid Biology and Conservation Conference" to be held in Oxford, 17-21 September 2007. The conference is organized by the Wildlife Conservation Research Unit (WildCRU) from the Zoology Department at University of Oxford, UK. The meeting has been made possible by the generous patronage of the Panthera Foundation and the collaboration of the IUCN/Cat Specialist Group.

This conference brings many international researchers, colleagues and friends to Oxford for what we hope will be a memorable occasion. As you will be aware, the meeting is concerned with all aspects of the study and conservation of all members of the Felidae. The event will start with a welcoming icebreaker in the stunning court of the Oxford University Museum of Natural History, where, following a welcome from David Macdonald, we are thrilled that Thomas Kaplan, chairman and founder of the Panthera Foundation, will present the Kaplan-Rabinowitz Prize to George Schaller (who will then address the assembly). The following three days of the conference will then go on to include an exemplary selection of papers and posters on the biology and conservation of the Felidae from a gathering of uniquely experienced and notable researchers. Finally there will be a gala dinner to round off the conference in the inspirational halls of Keble College.

Oxford provides an ideal venue for this international conference on the felids, large and small. The world renowned academic resources, exceptional architecture and fascinating history hopefully make this city an inspiration and pleasure for all to enjoy. For the WildCRU, this fascination with felids goes back a long way: David Macdonald began work on farm and feral cats in 1978, a project that led to a famous 50-minute BBC1 documentary, *The Curious Cat*, and he has maintained an unbroken lineage of felid projects ever since: currently the WildCRU has projects on species from lions in Zimbabwe to pumas in Chile, from tigers in Bhutan to clouded leopards in Borneo, and jaguars in Brazil to wildcats in Scotland – projects which involve morphology, genetics, behavioural ecology and, above all, attempts to solve the conflict all too often apparent between felids and folk.

We hope you have a wonderful stay in Oxford and find time to enjoy Oxford's beautiful colleges and serene parks. Above all, we hope this conference will help us all to understand better the biology of felids, and enable us better to advance the conservation of these beautiful creatures. We are grateful to the many delegates who have contributed their time and expertise to ensure the success of the conference.

David Macdonald

Andrew Loveridge

Conference Organisers

Scientific Committee

- **David Macdonald** (WildCRU, Oxford University, UK) (Chairman)
- **Andrew Loveridge** (WildCRU, Oxford University, UK)
- **Claudio Sillero** (WildCRU, Oxford University, UK)
- **Christine Breitenmoser** (IUCN/SSC Cat Specialist Group)
- **Urs Breitenmoser** (IUCN/SSC Cat Specialist Group)
- **Warren Johnson** (National Cancer Institute, USA)
- **Ullas Karanth** (WCS, India)
- **Mauro Lucherini** (Universidad Nacional del Sur, Argentina)
- **Gus Mills** (National Parks Board, South Africa)
- **Tadeu G. de Oliviera** (ProCarnivoros, Brazil)
- **Alan Rabinowitz** (WCS, USA)
- **John Seidensticker** (Smithsonian Institute, USA)

The Wildlife Conservation Research Unit (TheWildCRU)

The mission of the WildCRU is to achieve practical solutions to conservation problems. We do this through original scientific research of the highest calibre. All of our projects aspire to fulfil all four elements of what we have termed "The Conservation Quartet" – Research to understand the problem; Education to explain it; Community Involvement to ensure acceptance and participation, and Implementation of a solution. Crucially, at the WildCRU we train committed conservation scientists to conduct research, and to put scientific knowledge into practice.

From the moment of its foundation, in 1986, the WildCRU has grown to become renowned worldwide. The WildCRU has contributed exciting results to some of the most topical areas of research in modern animal biology. Today we are sited at Tubney House, outside the city centre, but remain part of the University of Oxford's Zoology Department, with close college links to Lady Margaret Hall and to the University's Field Centre at Wytham.

Our cross-cutting research encompasses the fields of animal behaviour, ecology, physiology, biochemistry, parasitology, epidemiology and genetics, coupled with a strong thrust in social sciences including public health, environmental economics and development. David Macdonald began work on felids in 1978, and they have remained a strong, and now substantial, strand of our work here at the WildCRU ever since. Now, with the support of the Panthera Foundation, we are initiating a new phase of training and research in felid conservation. Our success is reflected in a range of achievements but most importantly, our work has made a difference. It has helped, and we are dedicated to ensure that it continues help, solve problems for the benefit of wildlife, the environment and mankind.

Panthera Foundation

“Panthera's ambition is ultimately nothing less than to save all wild cat species across their ranges, and to do so in a scientifically rigorous and sustainable manner.”

Thomas S Kaplan, 2007.

Panthera is devoted to saving in situ populations of the world’s 36 species of wild cats and the landscapes they inhabit. We aim to achieve this goal by collaborating with, supporting and fostering the world’s leading wild felid conservationists in conducting rigorous scientific research, planning and implementing conservation actions, and working with local, national and international stakeholders to advance wild cat conservation. Panthera believes that large, contiguous populations of wild cats are important indicators of intact functioning ecosystems, and that the focused protection of wild cats furthers the conservation of a large number of other species present in those ecosystems.

Since its inception in 2006 Panthera has initiate programs across a broad arc, touching - even redefining - numerous aspects of wild cat conservation. Some of our initial collaborations include working with the American Museum of Natural History in New York on felid genetics; setting up and supporting some of the most ambitious range-wide conservation programs with the Wildlife Conservation Society on tigers, lions and jaguars; collaboration with WWF and the Snow Leopard Conservation Trust on snow leopards; and joint-ventures with Oxford University's WildCRU, Kenya’s Northern Rangelands Trust, and the Zoological Society of London. In addition, Panthera has independently initiated the first global scholarship program for post-graduate research in wild cat studies, established a young scientist and lifetime achievement award for work on wild cats, and put together a strategic lands initiative to assist in the purchase of vast tracts of land linking protected areas in critical habitats, such as the Brazilian Pantanal.

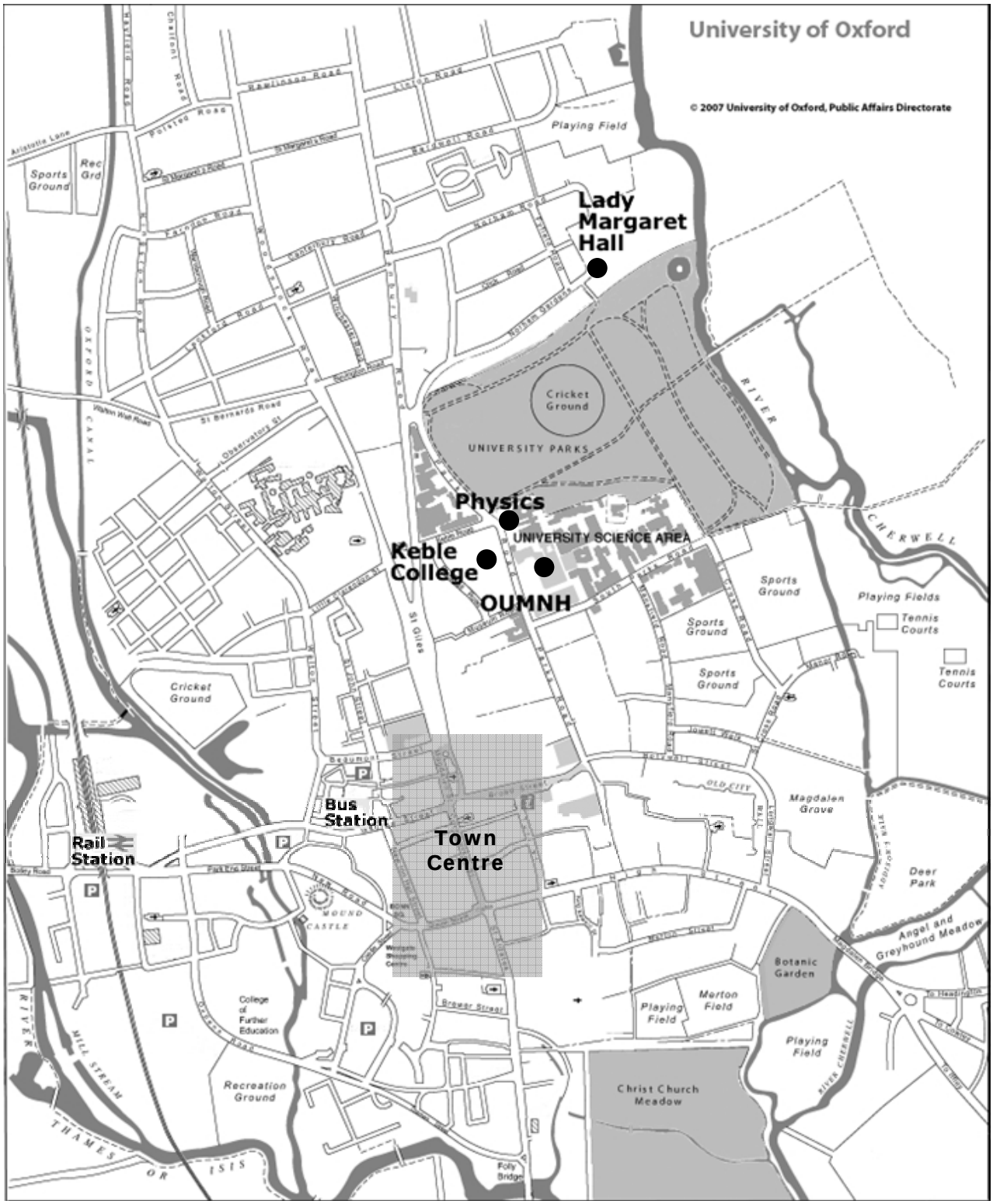
IUCN Cat Specialist Group

The IUCN/SSC Cat Specialist Group (Cat SG) brings together over 200 international leading cat experts from 50 countries, dedicated to advancing the understanding and conservation of the world's 36 wild living cat species. The Cat SG was founded in 1971 at a meeting of international cat specialists, with Professor Paul Leyhausen of the Max Planck Institute for Physiology of Behaviour elected Chairman. He was succeeded by the British conservation scientist Dr Norman Myers. In 1983, Peter Jackson, a British tiger specialist, was appointed, serving until his retirement in 2000. He was succeeded by Swiss carnivore specialists, Drs Urs and Christine Breitenmoser.

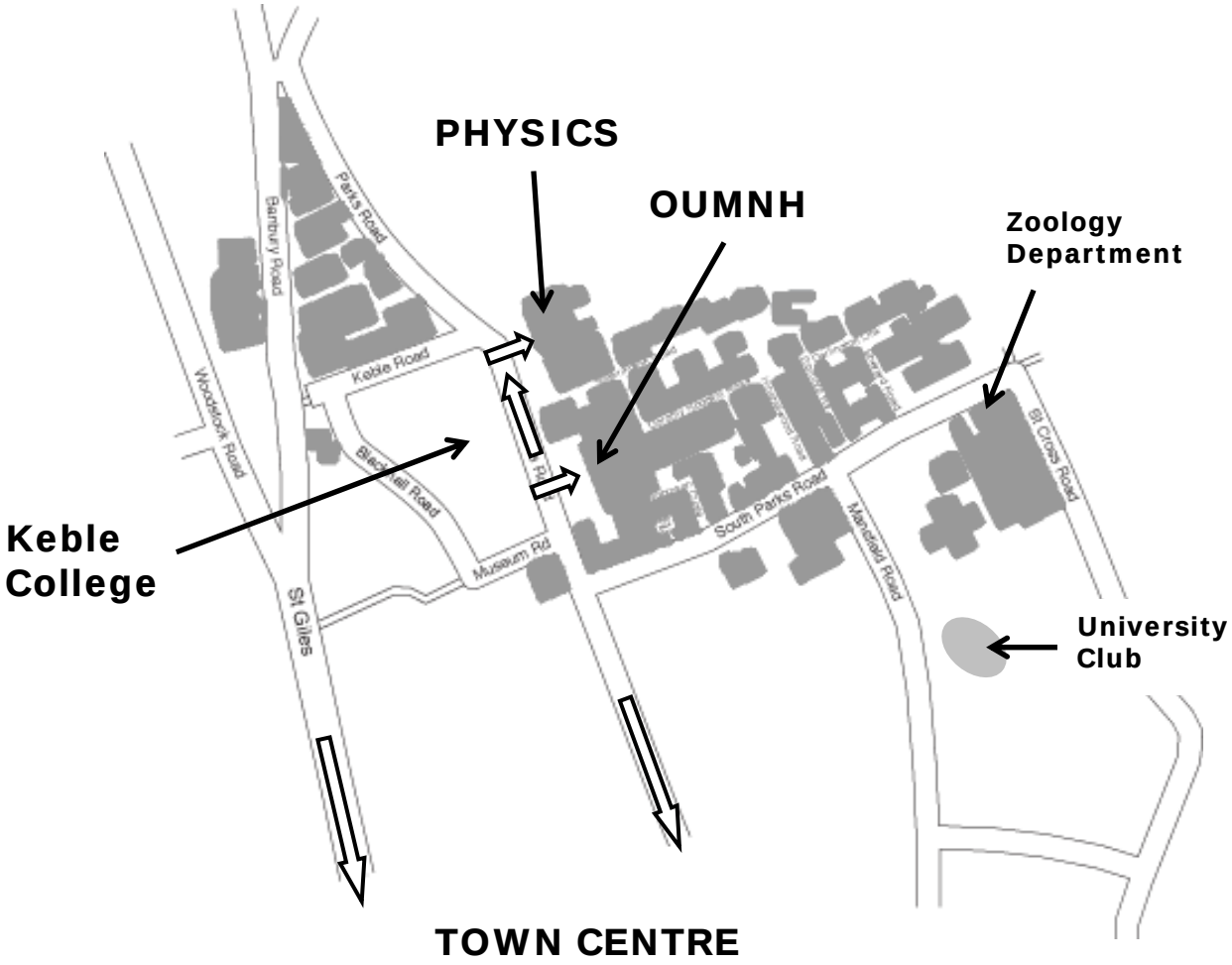
The group is one of over 120 similar specialist groups forming the Species Survival Commission (SSC) of the IUCN. The Specialist Groups perform species assessments for the IUCN Red List of Threatened Species ™, and produce species action plans and policy guidelines. These groups also provide information for the World Conservation Monitoring Centre, which is hosted by UNEP, and advise governments' party to CITES.

Additionally, the Cat SG focuses on its own initiatives such as: the development of tools for species status assessments; the compilation and distribution of intelligence and supporting the work of its members. In 1996, the Cat SG's major work, "Wild Cats: Status Survey and Conservation Action Plan" was published, becoming a standard reference on the natural history of the cats. A central concern of the group is to promote dialogue among scientists and practitioners throughout the world, believing that cooperation and knowledge sharing are critical for the conservation of the wild cats.

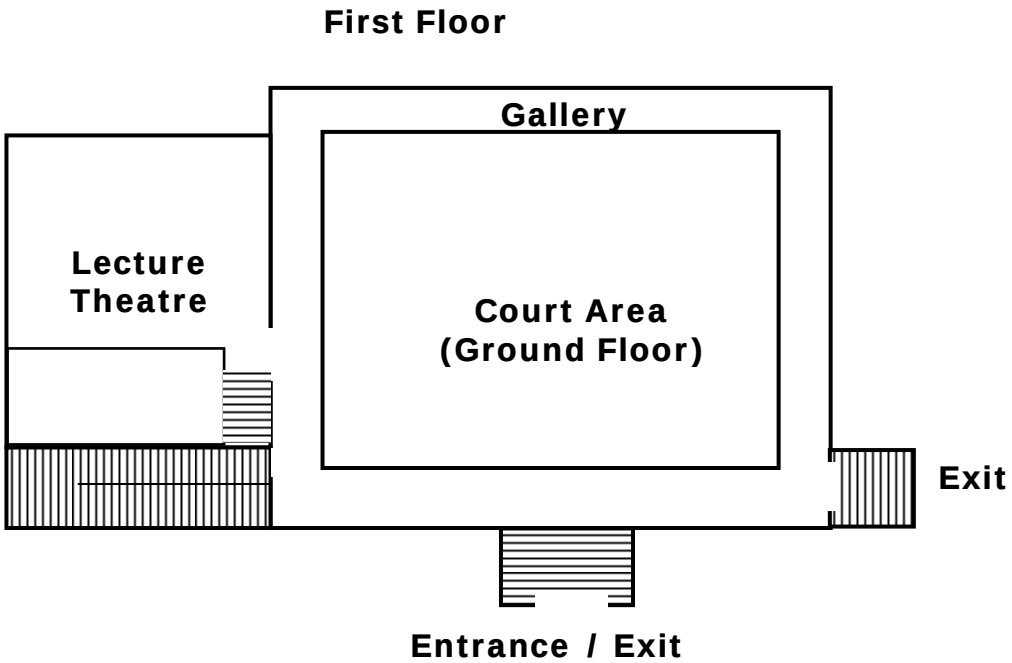
Map of Oxford



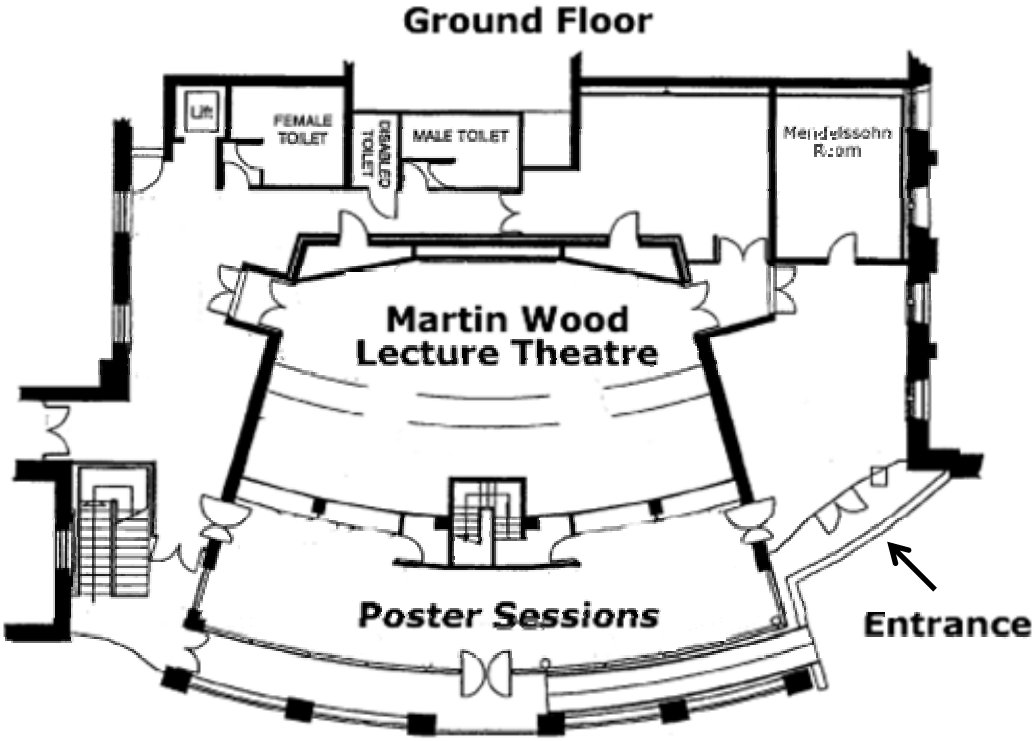
Map of Conference Venues

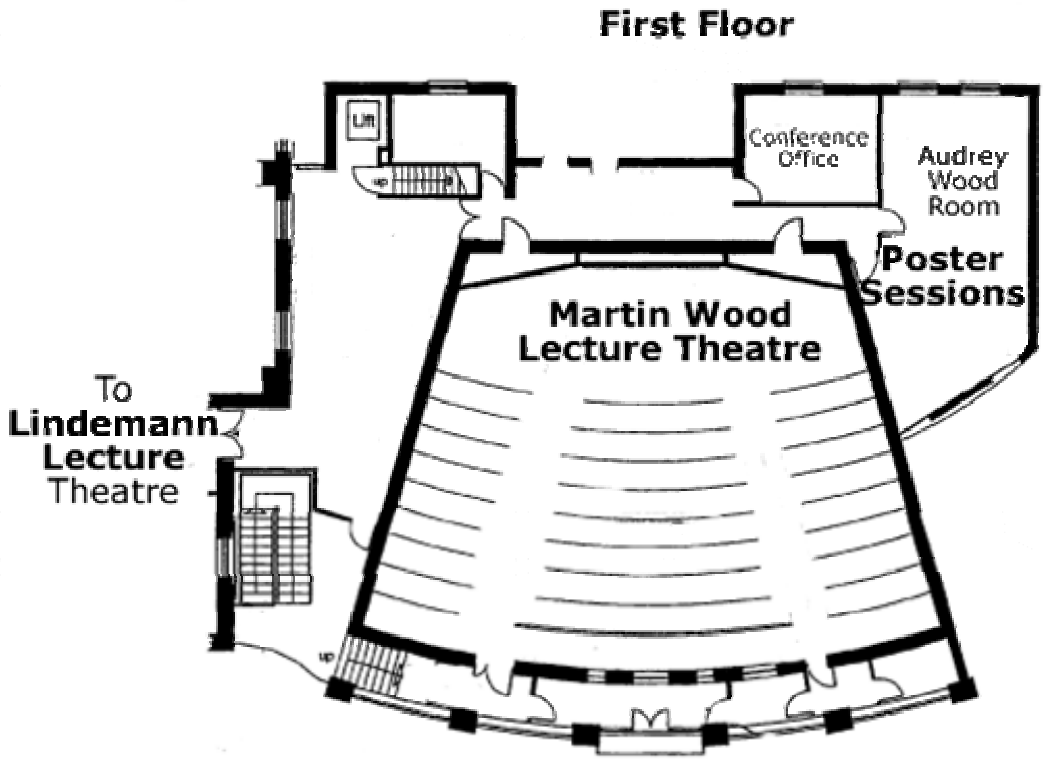


Oxford University Museum of Natural History (OUMNH)



Physics Department





Conference Events

Welcome Reception at Oxford University Museum of Natural History

Monday 17 September 18:00 to 20:00

Drinks and canapés will be provided. This is an opportunity for people to meet friends and colleagues attending the conference.

We are also delighted that Thomas Kaplan, founder and chairman of the Panthera Foundation, and George Schaller, will address this reception so please be there on time!

Closing Gala Dinner at Keble College

Thursday 20 September 19:15 to 23:00

To conclude the conference a drinks reception and five-course dinner will be served at the grand Dining Hall in the magnificent Keble College. The drinks reception will be outside in the college quadrangle, weather permitting. We suggest semi-formal dress (e.g. jacket and tie for gentlemen) for the evening.

The closing address for the conference will be made by Prof. David Macdonald. We hope all those wishing to attend to will have a very enjoyable, and relaxing, evening in the superb surroundings.

Keble College is one of the largest, and most striking, of the Oxford colleges. The college was founded in 1870 in memory of John Keble (1792-1866). Keble, along with other Oxfordians such as Edward Pusey and John Henry Newman, was one of the founder members of the 'Tractarian' movement. This movement named for their publications called the 'Tracts', attacking what they considered to be the weaknesses of the church and the disregard of the establishment for their religious responsibilities.

Tractarian sympathisers supplied the funding for Keble College, notably including the benefactor of the Chapel, William Gibbs, whose family's fortune was rooted in the valuable fertiliser Peruvian and Chilean bird droppings! The unusual brickwork of the college was the design of architect William Butterfield. The appearance was not always appreciated however, in fact there was a secret society established to which admittance was gained by stealing one of the college's bricks. It was hoped that this would eventually lead to the removal of Keble itself! In 1870 the college opened to 30 students, and the Chapel was opened on St Mark's Day 1876. However, if it was the intention of the College's founders to create a high church seminary, the first Warden, Edward Talbot, had other ideas, encouraging the teaching of science, and showing sympathy to the theory of evolution.

General Information

The Venues

The **Oxford University Museum of Natural History** houses the University's scientific collections of zoological, entomological and geological specimens. The Museum itself is a Grade 1 listed building, renowned for its spectacular neo-Gothic architecture. Among its most famous features are the Oxfordshire dinosaurs, the dodo, and the swifts in the tower.
The Museum's overall mission is to assemble, preserve, and exhibit the University's natural history collections and to promote research, teaching, and public education in the natural sciences based on the Museum's collections.
In 2005, together with neighbouring Pitt Rivers, the Museum was the winner of the Guardian Family Friendly Museum Award.

The **Physics Department** is one of the largest in the UK, achieving a 5* (top grade) award in the Research Assessment Exercise in 2001 and admitting about 200 new undergraduates annually. The Martin Wood Complex, in which the afternoon sessions of the conference will be held, is located within a 10 minute walk from the heart of historic Oxford. The location is convenient and very enjoyable as the department is situated right next to the University Parks, which consist of 70 acres of parkland on the West bank of the River Cherwell, together with a 4 acre spur of land running towards the south.

Lady Margaret Hall (LMH) is an Oxford college very closely associated with WildCRU, and where many of our graduates are members. It is only a 10-minute walk from the Physics Department across the University Parks.
Lady Margaret Hall admitted its first seven students in October 1879. They pioneered women's higher education in Oxford, entering a world of learning that had for centuries been a male monopoly. When the College celebrated its centenary, the foundation seven had increased to four hundred, including postgraduate as well as undergraduate students.
The first addition to the original north Oxford villa (Old Hall) was opened as early as 1881, and the site was progressively developed to accommodate the growing community of students. LMH now boasts a collection of fine buildings by major architects set in twelve acres of beautiful gardens extending to the banks of the river Cherwell.
Highly qualified LMH women continued the pioneering tradition of the first students, helping gradually to open education, medicine, the arts, science, law, commerce, and government service to women alongside men.
By 1979, when the College entered its second century, Oxford University had changed dramatically. Nearly all the former men's Colleges had begun admitting women. In these transformed circumstances the Fellows of LMH chose to give new form to the original idea of equal opportunity. Henceforth the College would select its students on academic merit alone, regardless of gender.
Since 1979, the College has provided a very special educational experience within a genuinely co-educational community, profoundly influenced by its own previous history of women's education.

Sightseeing in Oxford

Oxford is a treasure-trove for tourists and during the summer months becomes one of the most popular tourist attractions in the country. During the course of a week in Oxford, it is possible to see much of the city's attractions and highlights and to experience and savour some of its unique culture and history.
A guide to Oxford has been provided in the information pack but we would recommend anyone wishing to fit in some sightseeing pays a visit to Oxford Information Centre or Blackwell's Bookshop, both on Broad Street, to purchase one of the cheap city tourist guides available. These guides provide you with simple information on the history of the University and its colleges, and the most important tourist attractions, such as the Radcliffe Camera, The Ashmolean Museum, and the Botanical Gardens. We would especially recommend that whilst here at the Oxford University Natural History Museum you leave enough time to stroll through the eccentric Pitt Rivers' Museum at the rear of the OUNHM.

Conference Information

Registration
Registration will be available on Monday afternoon from 2 pm at LMH for delegates who have booked accommodation there, and also (from 6 pm) at OUMNH during the welcome Reception. We strongly advise that you arrive early to register, and get settled in well before the Reception and prize—giving ceremony. Registration will also be possible at OUMNH on the Tuesday morning (8.30 am) for the remaining delegates.

Payment
Please make any outstanding payments for registration, accommodation or the Gala Dinner to Richard Mercer. Payment in full should be made at registration or on arrival.

Presentations
All presentations should be submitted at registration. Posters will be put up by conference personnel during Tuesday morning (Session 1) or after lunch on Wednesday (Session 2). Posters from Session 1 will be available for collection from the Conference Office on Wednesday and Thursday. Posters from Session 2 can be removed after Thursday lunchtime or will be taken down by conference personnel after the tea break and be available for collection from the Conference Office in the Physics department on Thursday afternoon.

Conference personnel
Conference personnel will be immediately recognizable by their distinctive T-shirts, name-tags and general good looks. Please feel free to ask any of the personnel for help. Additionally a Conference Office will be open during the afternoons in the Physics Department on the second floor adjacent to the Audrey Wood room and any enquiries can be directed there. If you still are unable to identify us, look for anyone running around frantically .....

Special arrangements
If any delegate is in need of any special requirements please contact Richard Mercer or Joelene Hughes, who will both be at the registration desk and around the conference venues. Disabled access is available at both OUMNH and in the Physics department.

Computing, internet and email access
The Mendelssohn room in the Physics department has been allocated for people wishing to work on their laptops. There are socket points all around the walls so please feel free to set yourself up in there - please remember to bring adaptors to British 3-pin (square) plugs. Please note the electrical supply is 240V so please use transformers if necessary. We would request that, out of respect for speakers and other delegates, no laptops or mobile phones are used in the lecture theatres.

All delegates wishing to access the WiFi from within the Physics building were invited to register their details beforehand so we could set them up on the department network. Unfortunately system registration requirements mean we cannot offer to set people up during the conference. However many cafés, restaurants and other venues in town have WiFi access available either free or to customers. Please ask for information.

Security
Oxford is generally a safe city. Care should however be taken to avoid petty thieves and pickpockets who may target visitors. In the last few years Oxford has drawn a lot of attention from animal rights activists. Although we are not expecting any specific attention at this conference please do be aware of the potential risks that being involved in wildlife research may present. All delegates are required to wear their name tags throughout the conference, people without name tags may be asked for alternative ID or refused entry to the conference venues. Please also look out for anyone acting suspiciously and alert conference personnel.

General Information

Other useful information for your stay in Oxford and the UK

September is late-summer in the UK, you are likely to experience typical 'variable' British weather, too unpredictable to describe in advance! Have your summer clothes handy but also an umbrella.

Standard time in the UK is Greenwich Mean Time (GMT). Currently we are in the British Summer Time (BST) which is GMT + 1 hour.

Official currency in the UK is Sterling (British pounds; £). Most foreign currency can be exchanged at the high street banks, travel agents and other foreign currency exchange counters (there is one in Marks and Spencers and at some other high street retailers).

Shopping in Oxford can be an enjoyable, even if an expensive, experience! There are numerous stores and a variety of high street and boutique outlets. The Covered Market, open 9-5 Monday to Saturday, is always worth a visit for its variety of food stalls, clothing boutiques and shops. The other main shopping areas are found along the High Street, Cornmarket Street and Queen Street. Opening hours vary with most shops opening around 9.30 am and shutting around 5.30 pm.

Eating and drinking establishments are many and varied in Oxford. Places can be found that suit any budget and there is also a wide range of cuisine from all over the world. A list of some selected places recommended by the WildCRU has been included in your information pack. **Tipping** is acceptable but not compulsory. If you have enjoyed the service it is usual to leave an additional 10-15 % of the cost as a tip, however some places do include a 'service charge' on the bill (so check to ensure you are not tipping twice!). You can either ask for 'service charge' to be taken off or pay it at your own discretion.

Internet and email access outside of the conference can be found at a number of cafés and other venues around the city. A list of places has been supplied in your information pack. For places offering WiFi access please ask one of the organisers.

Public transport around Oxford is very easy and there is an extensive bus network. To get to specific locations there are numerous taxis to be found at taxi ranks (St Giles/railway station/Gloucester Green) or flagged down on roads. Tipping is not necessary, but is usual, especially on longer journeys. Again around 10% of the charge is recommended. To get **London, Heathrow or Gatwick** there is a regular 24 hour bus service from Gloucester Green with the Oxford Bus Company and Stagecoach both running excellent and cheap buses to Victoria Station in central London (approx. 100 mins) and the Oxford Bus Company running bus services to Gatwick (North Terminal – 120 mins; South Terminal 150 mins) and Heathrow (Terminals 1, 2 & 3 – 80 mins; Terminal 4 – 100 mins). Trains are more expensive however; fast trains take about 60 mins to get into London although you arrive at Paddington which is less convenient for connecting to the London airports. Be alert that slower trains stop at many stations en route, and take much longer, so you will probably want to take a fast train if you are going to London – these are clearly indicated on the display screen in Oxford Railway Station.

To telephone abroad simply dial the UK international dialling out code (00) then the international incoming code of the country you are calling (e.g. for Argentina the code is 54), followed by the number of the person you are calling. To get someone to call you they will have to dial their country code for dialling out, following the UK incoming code (44) and then the number they wish to call BUT missing off the first 0.

Exhibitors

Blackwells
Conference representative: TBA
Address: 8-51 Broad Street, Oxford, UK. OX1 3BQ
Contact: 01865 792792
E-mail: oxford@blackwell.co.uk
Website: bookshop.blackwell.co.uk

Oxford University Press
Conference representative: Ian Sherman
Address: Oxford University Press, Great Clarendon Street, Oxford, UK. OX2 6DP
E-mail: WebEnquiry.UK@oup.com
Website: www.oup.co.uk

Panthera Foundation
Conference representative: Jessica Craig
Address: Panthera Wildlife Trust Limited, 20 Berkeley Square, London, UK. W1J 6EQ
General contact: +44 (0)20 7318 0799
E-mail: jessica@panthera.org.uk
Website: www.panthera-foundation.org

People and Wildlife.
Conference representative: Jorgelina Marino
Address: Tubney House, Abingdon Road, Tubney, Oxfordshire, UK. OX13 5QL
General contact: +44 (0)1865 393100
E-mail: info@peopleandwildlife.org.uk
Website: www.peopleandwildlife.org.uk

Sirtrack Tracking Solutions
Conference representative: Rowan Calder
Address: Private Bag 1403, Goddard Lane, Havelock North, 4157, NEW ZEALAND
General contact: +64 6 872 8254
E-mail: calderr@sirtrack.com
Website: www.sirtrack.com

VECTRONIC Aerospace GmbH
Conference representative: Robert Schulte
Address: Carl-Scheele-Str. 12, D-12489 Berlin, Germany
General contact: +49 30 6789 4990
E-mail: mail@vectronic-aerospace.com
Website: www.vectronic-aerospace.com

Wildlife Conservation Research Unit
Conference representative: Prof. David Macdonald and Dr. Andrew Loveridge
Address: Tubney House, Abingdon Road, Tubney, Oxfordshire, UK. OX13 5QL
General contact: +44 (0)1865 393100
E-mail: wildsec@zoo.ox.ac.uk
Website: www.wildcru.org

Programme at-a-glance

Monday 17 September

12.00 – 18.00	Registration and collection of presentations for delegates staying at LMH: *Lady Margaret Hall*
18.00 – 20.00	Welcome Reception, Kaplan-Rabinowitz Prize-giving, registration, collection of presentations: *Oxford University Museum of Natural History*

Tuesday 18 September

8.30 – 8.45	Morning speakers to check presentations, final delegate registration & collection of presentations: *OUMNH*
9.00 – 12.30	Plenary Talks (tea break 10.55 for 20 mins) : *OUMNH*
13.30 – 13.45	Afternoon speakers to check presentations: *Martin Wood Lecture Theatre & Lindemann Lecture theatres, Physics Department*
14.00 – 15.40	Talks : *Martin Wood Lecture Theatre & Lindemann Lecture theatres, Physics Department.*
15.40 – 16.10	Tea break and Poster Session A: *Physics Department*
16.10 – 17.50	Talks : *Martin Wood Lecture Theatre & Lindemann Lecture theatres, Physics Department.*
17.50 – 18.30	Poster Session A

Wednesday 19 September

8.30 – 8.45	Morning speakers to check presentations : *OUMNH*
9.00 – 12.30	Talks (tea break, 10.55 for 20 mins) : *OUMNH*
13.30 – 14.00	Poster Session A with authors present : *Physics Department*
13.30 – 13.45	Afternoon speakers to check presentations: *Martin Wood Lecture Theatre & Lindemann Lecture theatres, Physics Department.*
14.00 – 15.40	Talks : *Martin Wood Lecture Theatre & Lindemann Lecture theatres, Physics Department.*
15.40 – 16.10	Tea break and Poster Session B: *Physics Department*
16.10 – 17.50	Talks : *Martin Wood Lecture Theatre & Lindemann Lecture theatres, Physics Department.*
17.50 – 18.30	Poster Session B

Thursday 20 September

8.30 – 8.45	Morning speakers to check presentations,: *OUMNH*
9.00 – 12.30	Talks (tea break, 10.55 for 20 mins) : *OUMNH*
13.30 – 14.00	Poster Session B with authors present : *Physics Department*
13.30 – 13.45	Afternoon speakers to provide presentations: *Martin Wood Lecture Theatre & Lindemann Lecture theatres, Physics Department.*
14.00 – 15.40	Talks : *Martin Wood Lecture Theatre & Lindemann Lecture theatres, Physics Department.*
15.40 – 16.10	Tea break and Poster Session B: *Physics Department*
16.10 – 17.50	Talks : *Martin Wood Lecture Theatre & Lindemann Lecture theatres, Physics Department.*
18.30	End of presentations.
19.15 – 23.00	Gala Dinner and closing address.

Oral Presentation Timetable

Tuesday 18th September

Morning - OUMNH

9:00	David W. Macdonald	Welcome
9:10	**Lars Werdelin**	**The Evolution and Interrelationships of Felids ["Evolution" Plenary]**
9:45	**Melanie Culver**	**Population and Conservation Genetics of Felids ["Genetics" Plenary]**
10:20	**Chris Carbone**	**Size Matters in Carnivore Ecology and Conservation ["Morphology" Plenary]**
10:55	*Tea & Coffee Break*	
11:20	**Craig Packer**	**Lion Conservation in Tanzania ["Ecology" Plenary]**
11:55	**Linda Munson**	**Wild Felid Diseases: Conservation Implications and Management Strategies ["Diseases" Plenary]**
12:30	*Lunch*	

Afternoon - Martin Wood Lecture Theatre, Physics

Session 1 – ECOLOGY

13:30	*Poster Viewing – Session A*	
14:00	Matthew Linkie	Managing Tigers and their Prey in a Human-Dominated Landscape in Sumatra
14:20	Sandra M.C. Cavalcanti	Spatial Ecology and Social Interactions of Jaguars (*Panthera onca*) in the Southern Pantanal, Brazil
14:40	Meggan Craft	Canine Distemper Virus Dynamics in Serengeti Lions: a Modeling Approach
15:00	V. Meena	Demography of the Asiatic Lions in the Gir Forest, India
15:20	Carlos A. Lopez Gonzalez	Comparative Ecology of Two Jaguar Populations under Different Land Tenure and Human Disturbance Regimes in Mexico
15:40	*Tea & Posters – Session A*	
16:10	Diana M. Ghikas	Variation in Cougar (*Puma concolor*) Survival by Individual Traits, Density, and Seasonal Weather
16:30	Michael E. Tewes	Effects of Drought on Wild Cats
16:50	John W. Laundré	The Landscape of Fear and the Conservation of Large Felids
17:10	Paul Funston	Variability in Lion Density and Survival in Kruger National Park
17:30	Hans H. de Iongh	Review of Research on Lion Ecology in West and Central Africa
17:50	*Poster Viewing – Session A*	
18:30	*Close of Day 1*	

Afternoon - Lindemann Lecture Theatre, Physics
Session 2 – GENETICS, SYSTEMATICS & MORPHOLOGY

13:30	*Poster Viewing – Session A*	
14:00	Gustav Peters	Acoustic communication in the Felidae – Beyond Purring and Roaring
14:20	Warren E. Johnson	Comparative Genomics and the Evolutionary History of the Felidae
14:40	Stephen J. O'Brien	Recognizing Felid Taxonomic Units: The Case of the Tiger and Clouded Leopard
15:00	Julie Meachen-Samuels	Jaws, Paws, and Claws: Predatory Adaptations of Felids
15:20	David W. Macdonald	On the Way to Cryptic Extinction through Hybridisation: Past History, Present Problem, and Future Conservation of the Scottish Wildcat
15:40	*Tea & Posters – Session A*	
16:10	Carlos A. Driscoll	Worldwide Phylogeography of the Wildcat, *Felis silvestris*, Suggests a Near Eastern Origin of Cat Domestication
16:30	Lorna Kennedy	Characterising the MHC in Domestic and Wild Felids
16:50	Eduardo Eizirik	Conservation Genetics and Molecular Ecology of Neotropical Felids
17:10	Christine Breitenmoser-Würsten	Reintroduction of Lynx in Switzerland – A Molecular Evaluation 30 Years after Translocation
17:30	Shomita Mukherjee	Geographic Variation in Jungle Cat (*Felis chaus*) Body Size: Is Competition Responsible?
17:50	*Poster Viewing – Session A*	
18:30	*Close of day one*	

Wednesday 19th September

Morning – OUMNH
Session 3 – FELIDS & PEOPLE

9:00	**Andrew J. Loveridge**	**Wild Felids and People ["Felids & People" Plenary]**
9:35	Silvio Marchini	Coexistence Project: Human Dimensions of the Conflicts between People and Jaguars (Panthera Onca) in Brazil
9:55	Nina Klar	How do Roads Affect European Wildcats and What Measures are Effective to Reduce Road Mortality?
10:15	Esteban Payan	Jaguar Depredation in the Llanos: an Ecological and Socio-Cultural Approach to Coexistence
10:35	Ashiq Ahmad Khan	Community Based Livestock Insurance Scheme; A Solution to Resolve Human-Leopard Conflict in Northern Pakistan
10:55	*Tea & Coffee*	
11:25	Guy Balme	A Model for Sustainable Trophy Hunting of Leopards in South Africa
11:45	**David W. Macdonald**	**Felid Societies ["Behaviour" Plenary]**
12:20	*Lunch*	

Afternoon - Martin Wood Lecture Theatre, Physics
Session 3 – FELIDS & PEOPLE (cont.)

13:30	*Poster Viewing – Session A (with authors)*	
14:00	Tej B. Thapa	Human-Felid Conflicts and Perspectives on Large Felid Management in Chitwan, Nepal
14:20	Alexandra Zimmermann	A Global Review of Human-Felid Conflict: Patterns and Priorities
14:40	Laurence Frank	Living with Lions on African Rangelands: One Successful Model, One Work in Progress
15:00	David C. Stoner	Demographic Effects of Hunting on Pumas: Source-Sink Dynamics and Implications for the Conservation of Exploited Felids
15:20	Laurie L. Marker	Cheetah and Ranchers in Namibia – Managing Conflict
15:40	*Tea & Posters – Session B*	
16:10	Monika Schiess-Meier	Human-Predator Conflict and Livestock Protection Methods in Botswana
16:20	John Goodrich	Social Structure, Human-Induced Mortality and Conservation of Amur Tigers
16:30	Amy Dickman	Investigating Key Determinants of Human-Large Cat Conflict around Ruaha National Park in Tanzania
16:40	Almira Hoogesteijn	How to Forward Jaguar Conservation in Flooded Savannahs of the Neotropics – the Ranchers Approach
16:50	Aaron Bueno-Cabrera	Cougar (*Puma concolor*) Impacts on Livestock Ranches in the Santa Elena Canyon, Chihuahua, Mexico
17:00	Hans Bauer	Human Lion Conflict in West and Central Africa
17:10	John D.C. Linnell	Is Hunting Large Felids Compatible with Their Conservation: Eurasian Lynx in Norway as a Case Study

17:20	Etotépé A. Sogbohossou	Tradition versus Conservation: Large Carnivores Socio-Cultural and Economic Importance in Benin, West Africa
17:30	Dennis K. Ikanda	Assessment of Man-Eating Outbreaks by African Lions *Panthera leo* in Southeastern Tanzania
17:40	*Poster Viewing – Session B*	
18:30	*Close of Day 2*	

Afternoon - Lindemann Lecture Theatre, Physics
Session 4 – BEHAVIOUR

13:30	*Poster Viewing – Session A (with authors)*	
14:00	Dale Miquelle	Living on the edge: Ecology and Conservation of Amur tigers in Northeast Asia
14:20	Ric Bernard	The Influence of Prey Size and Abundance, and Predator Size and Group Size on the Diet of Cheetahs (*Acinonyx jubatus*) and Lions (*Panthera leo*) in the Eastern Cape Province, South Africa
14:40	Mark O'Donoghue	Canada Lynx: Behaviour and Population Dynamics in Northern Canada
15:00	Sarah Durant	TBA
15:20	Tadeu Gomes de Oliveira	The "Ocelot Effect:" Small Felids Demography and Community Composition in Brazil
15:40	*Tea & Posters – Session B*	
16:10	Arturo Caso	Habitat Use, Spatial and Activity Patterns of the Jaguarundi in Northeast Mexico
16:20	Alexander Sliwa	Prey Consumption and Distances Covered by Black-Footed Cats (*Felis nigripes*) and African Wild Cats (*Felis silvestris*) - a Comparison of Two Small Felids from South African Arid Lands
16:30	Haemish Melville	Using Spoor Techniques to Examine the Hunting Behaviour of Caracals in the Kgalagadi Transfrontier Park
16:40	Advait Edgaonkar	Patterns of Spatial Co-Occurrence in Leopards (*Panthera pardus*) and Dholes (*Cuon alpinus*) in Satpura Tiger Reserve, India.
16:50	Urs Breitenmoser	Changing predation impact of reintroduced lynx (*Lynx lynx*) in Switzerland
17:00	Matt Hayward	Implications of the Prey Preferences of Large Felids for their Conservation
17:10	Steve Ross	The Spatial Ecology and Conservation of Pallas Cat (*Otocolobus manul*) in Central Mongolia
17:20	Paul Funston	Flexible Sociality Ensures the Persistence of Lion Populations When Persecuted by Humans
17:30	Anna Mosser	Group Territoriality of the African Lion
17:40	Jon R. Keehner	Hybridization Between White-tailed Deer and Mule Deer in Northeastern Washington: Are Mountain Lions Protecting the Genetic Integrity of Mule Deer?
17:50	*Poster Viewing – Session B*	
18:30	*Close of Day 2*	

Thursday 20th September

Morning – OUMNH
Session 5 – CONSERVATION & MANAGEMENT

9:00	**Alan Rabinowitz**	**Connecting the Dots: Saving a Species Throughout it's Range ["Conservation and Management" Plenary]**
9:35	Eric Dinerstein	Learning More about Fewer Tigers
9:55	Claudio Sillero-Zubiri	Highland Cats: Conservation of the Rare and Elusive Andean Cat
10:15	Rodney Jackson	Snow Leopards: Conservation Challenges for the 21st Century
10:35	Eric W. Sanderson	A Comparison of Range-Wide Priorities for Large Cat Conservation
10:55	*Tea & Coffee*	
11:25	Gerardo Acosta-Jamett	Conservation of *Oncifelis guigna* in Fragmented Forests of Central Chile
11:45	**K. Ullas Karanth**	**Many Ways of Skinning a Cat: Methods and Tools for Studying Wild Felids ["Tools & Methods" Plenary]**
12:20	*Lunch*	

Afternoon - Martin Wood Lecture Theatre, Physics
Session 5 – CONSERVATION & MANAGEMENT (cont.)

13:30	*Poster Viewing – Session B (with authors)*	
14:00	Astrid Vargas	The Design of Ex-situ Programs for Endangered Species Conservation: The Iberian Lynx as a Recent Example
14:20	JoGayle Howard	Physiological Reproduction in Felids and Contributions to Conservation
14:40	Christiaan W. Winterbach	Sero-Prevalence of Feline Immunodeficiency Virus in African Lions – is it Host Density Dependent?
15:00	Carly Vynne	Landscape Matrix Composition Affects Distribution of Puma and Jaguar in a Cerrado Ecosystem
15:20	Igor Khorozyan	Following the Ghost of the Mountains, the Leopard *Panthera pardus* in Armenia
15:40	*Tea & Posters – Session B*	
16:10	Paule M. Gros	Effect of Land Protection, Savanna Type, and Competitor Occurrence on the Status of Cheetahs
16:20	Andrew Loveridge	Modelling the Distribution of African Lion Populations Using a GIS Meta-Analysis
16:30	Krzysztof Schmidt	Conservation of the Eurasian Lynx in Fragmented Habitat of Eastern Europe
16:40	Philip J. Nyhus	Beyond Conservation: The Tiger as Driver to Restore Biodiversity in China
16:50	Luciano M. Verdade	The "Lion" versus the Puma…
17:00	Bart Harmsen	The Biology of the Jaguar in the Cockscomb Basin, Belize
17:10	Quinton Martins	Leopards of the Cape Mountains: Small Cats with Big Problems
17:20	R.S. Chundawat	Resource Selection Function Model to Identify Habitat Suitability of Tigers in a Dry Tropical Forests of India
17:30	Gianetta Purchase	Review of the Status of Carnivores in Protected Areas of the Zambezi Basin, Including an Assessment of Human-Carnivore Conflict

17:40	Thomas McCarthy	A Study of Snow Leopard in Chitral Gol National Pak, Pakistan using GPS-satellite Collars and Camera Traps
17:50	*Close of Day 3*	

Afternoon - Lindemann Lecture Theatre, Physics

Session 6 – TOOLS & METHODS

13:30	*Poster Viewing – Session B (with authors)*	
14:00	Kyle P. McCarthy	Assessing Sign Surveys for Estimating or Predicting Snow Leopard Population Size
14:10	James L. David Smith	Female Tiger Home Range Size: a Critical Measure of Tiger Habitat Quality
14:20	Craig Tambling	Is it Possible to Use GPS Data Clusters to Predict Lion Kill Sites?
14:30	Pradeep Malik	Field Immobilization of Tigers (*Panthera tigris tigris*) Using a Combination of Medetomidine and Ketamine and Reversal with Atipamezole in Panna National Park, India
14:40	Osvaldo Eric Ramírez Bravo	Predictive Habitat and Population Viability Models for Jaguars (*Panthera onca*) in the Sierra Madre Oriental, Mexico
14:50	Jan Schipper	Understanding the Effect of Study Design on Estimates of Species Density: Camera-Trapping Jaguar *Panthera onca* and their Prey
15:00	Andrew C. Kitchener	Using GIS as a Tool for Understanding the Biogeography of Cats – the Roles of Volcanoes, Medicines and Ice Ages
15:10	Alain Fontbonne	Development of a Non-Invasive Intra-Uterine Artificial Insemination Technique for Large Felids
15:20	Adam Dillon	Estimating Ocelot Densities in Belize Using Camera Trapping and Radio Telemetry Techinques
15:30	Diana Castro	Does Scat Morphological Misidentification Influence Ecological Studies? A Case Study with the European Wildcat (*Felis silvestris*) in Portugal
15:40	*Tea & Posters – Session B*	

Session 7 – UPDATES FROM THE FIELD

16:10	Fridolin Zimmermann	Estimation of Lynx (*Lynx lynx*) Densities in the Swiss Alps Using Photographic Capture-Recapture Sampling
16:20	Sandeep Sharma	Noninvasive Genotyping for Identifying Individual Tigers (*Panthera tigris*) and its Potential for Their Population Estimation
16:30	E. Daniel Cossíos	Phylogeography and Conservation of Small Cats from the High Andes
16:40	Lon Grassman	Ecology and Conservation of Five Felid Species in Thailand (1996-2003): Future Conservation Challenges for the Kingdom
16:50	Bilal Habib	Status of Snow Leopard in Wakhan Corridor of Afghanistan – an Assessment after 30 Years.
17:00	Jamal A. Khan	Ecology and Conservation of Leopard (*Panthera pardus fuska*) in Gir National Park and Sanctuary
17:10	Leonardo Rodrigo Viana	Estimating Jaguar (*Panthera onca*) Density Using Camera-Trapping and Capture-Recapture Methods in the Parque Estadual do Rio Doce (PERD), the Largest Atlantic Forest Fragment in Minas Gerais, Southeastern Brazil
17:20	Claudia Manfredi	Habitat Use and Selection of Geoffroy`s Cats (*Oncifelis geoffroyi*) in Three Areas of Central Argentina
17:30	Linda Kerley	Using Dogs to Monitor Amur Tigers in Russia
17:40	Philipp Henschel	The Status of the Leopard (*Panthera pardus*) in the Congo Basin
17:50	*Close of Day 3*	

Poster Presentations

Poster Session A

Ecology

Analysis of Factors that Affect Jaguar (Panthera onca) Abundance Along its Distribution
Osvaldo Eric Ramírez Bravo & Carlos Alberto Lopez Gonzalez

Energy Needs of Bobcats (Lynx rufus) in an Arid Environment in México
Cynthia Elizalde-Arellano, Juan Carlos López-Vidal, Lucina Hernández García, John W. Laundré

Using the Landscape of Fear to Analyze Habitat Use of Bobcats in the Chihuahuan Desert of México
Juan Carlos Lopez-Vidal, Cynthia Elizalde-Arellano, John W. Laundré & Lucina Hernandez

The Distribution, Ecology and Behaviour of Leopards in Sri Lanka: Does the Absence of Intra-Guild Competition Matter?
Andrew Kittle & Anjali Watson

Diet and Prey Profiles of Three Sympatric Large Carnivores in Bandipur Tiger Reserve, India
Anish P Andheria, K. Ullas Karanth & Sama Kumar

Spacing Pattern and its Dynamics of the Iriomote Cat
Nozomi Nakanishi, Masako Izawa, Maki Okamura, Noriaki Sakaguchi & Teruo Doi

Snow leopard in Himalaya: Resource Partitioning and Coexistence with Tibetan Wolf
Sandeep Sharma, Trishna Dutta & Yash Veer Bhatnagar

Assessing Habitat Suitability for Tiger (Panthera tigris) and its Prey Species in the Indian Part of Terai Arc Landscape
Rajapandian Kanagaraj, Thorsten Wiegand, S.P. Goyal, Stephanie Kramer-Schadt, A.J.T. Johnsingh, K. Ramesh, Qamar Qureshi, Meraj Anwar & Ashish David

Feeding Ecology of European Wildcat in a Mediterranean Area with a Low Mammalian Prey Abundance
Àngel Such-Sanz, Josep María López-Martín & Joaquim Gosàlbez

Philopatry, Dispersal and Static Interaction in Serengeti Cheetah
Pete Laver & Marcella J. Kelly

Small Felid Community Study in a Dry Forest
Leonardo Maffei, Erika Cuéllar & Andrew Noss

The Ecology of Eurasian Lynx Depredation on Domestic Sheep in Norway: Are Sheep Prey, or Just Something That Gets in the Way?
John Odden, John D.C. Linnell, Ivar Herfindal & Reidar Andersen

Ecological Correlates of Lion Home Range Size in a Dystrophic Savanna Ecosystem
Andrew J. Loveridge, Marion Valeix, Zeke Davidson, Hervé Fritz & David W. Macdonald

Habitat Suitability for Jaguar and Puma in Southern Atlantic Forest of Brazil Inferred from Proportion of Area Occupied and Prey Richness.
Marcelo Mazzolli & Matthias Hammer

Felids & People

Spatial-Temporal Range-Use Pattern, Livestock Predation and Conservation Needs for the Tarangire Lions in Northern Tanzania
Bernard Kissui & Craig Packer

Incorporating Caracal Feeding and Ranging Behaviour in the Management of this Damage-Causing Carnivore
N.L. Avenant & H.O. de Waal

Promoting Local Conservationist Networks to Deliver Action across Tiger Landscapes: an Example from Central India
Claudio Sillero-Zubiri

Modelling Hotspots of Human-Jaguar Conflicts in Latin America
Alexandra Zimmermann & Scott Wilson

The Value of Lion as a Component of the Photographic/Non-Consumptive Tourism Market
Zeke Davidson, Andrew Loveridge, Kate Smith & David Macdonald

Linking Human Activities and Unprovoked Lion Attacks in Southeastern Tanzania
Hadas Kushnir

The Role of Human Attitudes to Big Cat Conservation: Colombia as a Tropical Example
Esteban Payan, Katherine Homewood, Sarah Durant & Chris Carbone

Human–Wildlife Conflict, Unequal Knowledge, and the Failure to Conserve the Zanzibar Leopard (Panthera pardus adersi)
Helle V. Goldman & Martin T. Walsh

Leopard Population Dynamics, Sport Hunting and Conservation in the Soutpansberg Mountains
Julia Chase-Grey, Sandra Bell & Russell Hill

Determination of the Diet in a Free-Ranging Cheetah Population Living on Farmland in Namibia
Bettina Wachter, Anne-Sophie Blanc, Jörg Melzheimer, Urs Breitenmoser, Susanne Thalwitzer, Mark Jago & Johann Lonzer

The Impact of Local Attitudes, Ecotourism and the Media on Big Cat Conservation
Tessa McGregor

A Study of Livestock Depredation by Tigers in and Around Buffer Zone of Corbett Tiger Reserve
Jamal A. Khan, Sharad Kumar, Afifullah Khan, Azra Musavi, P.K. Malik, Digvijay S. Khati & G.D. Sarin

Puma and Farmer Interactions: a Multi-Scale Approach in Three Eco-Regions of the Chilean Andes
C. Bonacic, N. Galvez, F. Amar, J. Laker, T. Murphy & D.W. Macdonald

Highway and Diseases Threatening the Conservation of Felids in the Pristine Forests of the Anden-Amazon Region of Southeastern Peru.
Renata Leite Pitman, Robert Williams & Sarah Cleaveland

Genetics, Sytematics & Morphology

Non-Invasive Monitoring of Steroids in Hair: the Domestic Cat as a Model
Elena Carloni, Pier Attilio Accorsi & Roberta Viggiani

Genetics as a Conservation Tool for the African Lion, Panthera leo, in Zambia
Paula A. White

Assessment of Semen Quality and Sperm Cryopreservation in the Iberian Lynx (Lynx pardinus)
N. Gañan, R. Gonzalez, J. Garde, A. Vargas, F. Martinez, M. Gomendio & E.R.S. Roldan

The Wildcat (Felis silvestris, Carnivora, Felidae) in Thuringia - a Combined Morphological and Genetic Study
Stefan T. Hertwig, Stefanie Stepanow, Anne Jungnickel, Matthias Krüger, Gottfried Jetschke, Thomas Möhlich, Burkhard Vogel & Martin S. Fischer

The Reliability of Pelage Characters for the Diagnosis of the European Wildcat (Felis silvestris silvestris)
Beatrice Nussberger & Darius Weber

Establishment of Genetic Profiles in Cheetahs Using Microstatellites Developed in the Domestic Cat
Guillaume Queney, Delphine Delattre, Alain Fontbonne, Jean-Yves Routier & Bertrand Lafrance

Molecular Evidence for Species-Level Distinction in Modern Clouded Leopards (Neofelis nebulosa)
Valerie A. Buckley-Beason, Warren E. Johnson, Willliam G. Nash, Roscoe Stanyon, Joan C. Menninger, Carlos A. Driscoll, JoGayle Howard, Mitch Bush, John E. Page, Melody E. Roelke, Gary Stone, Paolo P. Martelli, Ci Wen, Lin Ling, Ratna K. Duraisingam, Phan V. Lam & Stephen J. O'Brien

The Elusive Sundaland Clouded Leopard: Reclassified and What Now? Common or Threatened in Sabah, Malaysia?
Andreas Wilting, Heike Feldhaar & Frauke Fischer

The Promise of SNPs (Single Nucleotide Polymorphisms) for Wildcat Conservation: Detecting Hybridisation with Domestic Cats
Rita Oliveira, Raquel Godinho, Ettore Randi & Paulo Célio Alves

Female Promiscuity and Sexual Conflict among Serengeti Cheetahs
Dada Gottelli, Jinliang Wang, Sultana Bashir & Sarah M. Durant

Conservation Genetics of Jaguars (Panthera onca) and Other Endangered Felids Using a Noninvasive Approach
Cristina Pomilla, Alan Rabinowitz, Luke Hunter, Salisa Rabinowitz & George Amato

Poster Session B

Conservation & Management

Evaluation of the Success of a Wild to Wild Cheetah Translocation in Matusadona National Park, Zimbabwe
Gianetta Purchase & Colleen Begg

Lynx Programme: an Integrated Approach to Iberian Lynx Conservation in Southern Portugal
Eduardo Santos, Miguel Lecoq, Richard Allcorn, Ana Emauz & Filipa Loureiro

Distribution and Conservation Status of Small Felids on the Uruguayan Savanna Ecoregion, Southern Brazil and Uruguay
Graziela Dotta, Diego Queirolo & Alberto Senra

Serval Monitoring Project - Zambia
Christine Thiel*

Avian Influenza H5N1 in Clouded Leopards (Neofelis nebulosa)
Khongsak Thiangtum, Wanchai Tonwattana, Daraka Tongthainun, Yong Poonvorawan & Thaweesak Songserm

Jaguar Epidemiology Program in Brazil
Mariana Malzoni Furtado, Cyntia Kayo Kashivakura, José Soares Ferreira Neto, Anah Tereza de Almeida Jácomo & Leandro Silveira

Demography of Cheetahs in South Africa and the Role of Small Reserves in their Conservation
Charlene Bissett, Ric Bernard & Dan Parker

Metapopulation Dynamics and the Management of Puma Populations in North America
John W. Laundré & Lucina Hernández

Relationship between Tigers, Leopards Their Prey and Farmers in Bhutan
Sonam Wang

Factors Affecting Guild Composition of Wild Felids in Pristine and Logged Tropical Forest in Sabah, Malaysia: a Camera-Trapping Study
Andrew J. Hearn, Joanna Ross, Daniel Pamin & David W. Macdonald

Jaguar Distribution and Conservation Status in Brazil
Natália Mundim Tôrres, José Alexandre Felizola Diniz Filho, Paulo De Marco Junior, Anah Tereza de Almeida Jácomo & Leandro Silveira

The Kaplan Awards Program: a Grants Program for Students Working on Wild Cat Conservation
Nicole Williams & Luke Hunter

Population and Habitat Viability Analysis of the Jaguar in Mexico
Rurik List, Cuauhtémoc Chávez, Juan Cornejo, Luis Carrillo, Heliot Zarza & Gerardo Ceballos

Conservation Status of Felids in Mole National Park, Ghana
Cole Burton, Cletus Balangtaa, Moses Sam & Justin Brashares

Sumatran Tiger Conservation in Human-Dominated Landscapes
Joseph Smith & Thomas Maddox

Small Neotropical Felids Ecology in Fragmented Agricultural Landscapes of Southern Brazil
Tadeu Gomes de Oliveira, Carlos Benhur Kasper, José Bonifácio Garcia Soares, Fábio Dias Mazim & Adilson Schneider

Leopard (Panthera pardus) Conservation on Namibian Farmlands
Andrew Stein, Todd Fuller & Laurie Marker

Tools & Methods

Modelling Spatial Interference between Wildcats (Felis s. silvestris) and Domestic Cats (Felis s. catus) in Slovenia
Hubert Potočnik, Tomaž Skrbinšek, Franc Kljun & Ivan Kos

Presence-Absence and Occupancy Study of the Bengal Tiger (Panthera tigris tigris) and the Indian Leopard (Panthera pardus fusca) using Faecal DNA Analysis
Ashwin Naidu, Jyotsna Bhagavatula & Imran Siddiqui

Measuring Progresses of an Education Programme for the Conservation of the Andean Cat
Mauro Lucherini, Maria Jose Merino & Emma Casanave

Death on the Road and Rescue in the Lab: Female Gamete Recovery and Conservation in the Iberian Lynx (Lynx pardinus)
R. Gonzalez, M. Gomendio, A. Vargas & E.R.S. Roldan

Cryobanking of Iberian Lynx (Lynx pardinus) Somatic Cells: Optimization of Isolation, Culture and Cryopreservation for a Genetic Resource Bank
C. Crespo, M. Gomendio & E.R.S. Roldan

How to Count Lions: Census Techniques for Estimating Densities of Large Felids
Meggan Craft, Karyl Whitman, Craig Packer, Sarah Durant, Paul Funston & Tom Maddox

Seasonal Profiles of Ovarian Activity in Eurasian (Lynx lynx) and Iberian Lynx (Lynx pardinus) Based on Fecal and Urinary Hormone Metabolite Analyses
Martin Dehnhard, Frank Goeritz, Sergey V Naidenko, Astrid Vargas, Christian Voigt, Antje Frank & Katarina Jewgenow

Updates from the Field

Using New Lightweight GPS/GSM Transmitters to Monitor Movement and Predation of Eurasian Lynx (Lynx lynx)
Ivan Kos, Miha Krofel, Hubert Potočnik, Tomaž Skrbinšek & Franc Kljun

A Fine-Scale GPS Study of the Movements of African Lions (Panthera leo) on Ongava Game Reserve, Namibia
Ken Stratford & Sabina Stratford

FFI's Sumatran Tiger Protection and Conservation Program
Stephen Browne & Debbie Martyr

Home Range and Activity Patterns of the Margay (Leopardus wiedii) at "El Cielo" Biosphere Reserve, Tamaulipas Mexico
Sasha Carvajal, Arturo Caso, Patricia Downey, Arnulfo Moreno & Michael Tewes

The Wild Cat of Crete
Alessandra Belardinelli, Petros Lymberakis & Beranardino Ragni

Spatial Ecology and Abundance of Mexican Bobcats in Northwestern Mexico to Assess its Conservation Status
Claudia N. Moreno Arzate, Adriana Rodriguez Martinez, Ruby Gonzalez Sierra & Carlos A. Lopez Gonzalez

Effectiveness of Three Types of Collars Used to Monitor Free Ranging Lions (Panthera leo) in the Okavango Delta, Botswana
Hanlie Winterbach, Edwin Young, Paul J. Funston & Christiaan Winterbach

Sumatran Tigers in Riau: Estimating the Abundance in Three Major Habitat Types
Sunarto Sunarto, Sybille Klenzendorf, Maju Bintang Hutajulu, Marcella Kelly, Mike Vaughan & Jim Nichols

Toward the Survival of Two Endangered Felid Species of Japan
Masako Izawa, Teruo Doi, Maki Okamura, Nozomi Nakanishi, Akira Murayama, Tomotsugu Hiyama, Daehun Oh, Ayumi Teranishi & Ai Suzuki

Small Sample Size and Wild Extrapolation; Preliminary Results from a Telemetry Study of Tigers in the Sundarbans of Bangladesh
Adam C. D. Barlow, Ishtiaq Uddin Ahmed, James L. D. Smith, Abu N. M. Hossain

Study on the Ecological Characteristics of Clouded Leopard in Riau, Sumatra.
Bintang Hutajulu, Sunarto, Sybille Klenzendorf, Jatna Supriatna, Arif Budiman & Ahmad Yahya

Jaguar Persistence in Fragments of the Atlantic Coastal Forest, Southeastern Brazil
Renata Leite Pitman & Marcelo Mazzolli

Assessing the Power of a Monitoring Method for European Wildcats (Felis silvestris silvestris) Which Combines Lure Sticks and mtDNA Haplotyping
Darius Weber

Do Nature Reserves Adequately Protect Pallas' Cats in Central Mongolia?
James D. Murdoch, Tserendorj Munkhzul & Claudio Sillero-Zubiri

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Felid Biology and Conservation Conference

An international conference

ORAL PRESENTATION ABSTRACTS

Listed in order of presentation

Tuesday 18th - Morning

The Evolution and Interrelationships of Felids

Lars Werdelin*

Swedish Museum of Natural History, Stockholm, Sweden

Felids originated in the Oligocene or late Eocene and have an extensive if patchy fossil record. Their nearest living relative is thought to be the Asiatic linsang, with an estimated divergence time of ca. 33 Ma. This predates the earliest known felids in the fossil record. The major radiation of felids begins in the early Miocene with the genus *Pseudaelurus*. Unfortunately, the interrelationships between different species of *Pseudaelurus* and between it and later, more derived felids are very poorly known. By the late Middle Miocene two major clades of felids had evolved: the Felinae or conical-toothed cats and the Machairodontinae or saber-tooth cats. These two clades are often portrayed as highly divergent in morphology and killing behavior. Machairodont cats span a wide range of morphologies, with some convergent on Felinae. In the Pliocene, Machairodonts split into two clades, the Smilodontini and the Homotheriini. Both clades became globally extinct near the end of the Pleistocene. The fossil record of conical-toothed cats is poor and difficult to relate definitively to living genera and species. The interrelationships of living cats have also proven to be a formidable problem due to the very rapid bursts of speciation characterizing the subclades. However, recent analyses indicate the presence of eight subclades, of which the pantherine lineage (genera *Panthera* and *Neofelis*) was the first to branch off and the domestic cat lineage (genus *Felis*) the last. There remain large discrepancies between this phylogeny, based on molecular data, and the fossil record. My lecture will end by suggesting some possible means of addressing this issue, which is the current major obstacle to a fuller understanding of the evolution of felids.

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Population and Conservation Genetics of Felids

Melanie Culver[1*], Carlos Driscoll[2], Eduardo Eizirik[3] & Goran Spong[4]

[1] *Arizona Cooperative Fish and Wildlife Research Unit, USGS, & School of Natural Resources, University of Arizona, Tucson, USA*
[2] *Wildlife Conservation Research Unit, Oxford University, Oxford, UK*
[3] *Centro de Biologia Genomica e Molecular, Faculdade de Biociencias, PUCRS, & Instituto Pro-Carnivoros, Porto Alegre, Brazil*
[4] *Department of Wildlife, Fish and Environmental Studies, Swedish Agricultural University, Sweden*

Conservation genetics plays an important role in the conservation and management of felid species throughout the world. A wide variety of topics can be addressed through genetic research, from relatedness among known individuals to species-wide or genera-wide assessments. Genetics allows us to gather information on evolution, taxonomy, population characteristics, mutation rates, migration rates, and population size. Genetic monitoring programs offer a way to track a multitude of population metrics across time. Yet the full potential of genetic methods to elucidate felid biology is largely untapped. This talk will provide an overview of felid genetic studies that have relevance to the conservation and management of felids worldwide. Specific areas of felid genetic research to be covered include species and subspecies-level taxonomy, hybridization, phylogeography, inbreeding, bottlenecks, gene flow, effective population size, kinship, paternity, genetic mutation, and adaptation. Also discussed will be the potential advances in our understanding of felid genetics, resulting from the ongoing era of genomics and bioinformatics.

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Size Matters in Carnivore Ecology and Conservation

Chris Carbone[*]

Institute of Zoology, Zoological Society of London, Regent's Park, London, UK

Body size is a fundamental biological trait that influences many aspects of carnivore ecology and conservation. Size affects carnivore diet, which in turn influences behaviour, energetics and area requirements (day range, home range and population density). All of these factors in turn influence how species respond to increasing environmental change due to human expansion and to other human threats. Size therefore has important implications for conservation management not only affecting species responses to threats, but also our ability to monitor populations and make informed conservation decisions. In this paper I will present the results of recent macroecological work on carnivore ecology and discuss how this approach can be used to help us understand patterns observed in specific field settings.

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Lion Conservation in Tanzania

Craig Packer[1,2*]

[1] *University of Minnesota, St. Paul, USA*
[2] *Tanzanian Wildlife Research Institute, Arusha, Tanzania*

According to recent guesstimates of lion numbers across Africa, Tanzania contains 25-50% of the lions left on the continent. Our current work primarily focuses on the urgent anthropogenic factors that must be addressed to conserve lions into the next century: the rising levels of human-lion conflict over livestock depredation in pastoralist areas and man-eating in agricultural areas, large-scale habitat destruction by Tanzania's largest tribe, the Wasukuma, the interactions between inbreeding and infectious diseases in small, isolated populations, the impact of unregulated trophy hunting of lions, and the impacts of greater variability in annual rainfall in the face of global climate change. I have also established Savannas Forever, an NGO which systematically identifies areas with high levels of human-lion conflict and collects baseline data in 240 rural villages to evaluate effectiveness of conflict-mitigation strategies. SF explicitly links conservation with poverty reduction and increases communication between local communities, conservationists, and rural development agencies. By embarking on a coherent large-scale lion conservation program in Tanzania, we hope to provide a model framework for similar efforts to sustain viable lion populations in Botswana and Namibia and restore at-risk populations in Kenya, Zambia, Zimbabwe and Mozambique.

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Wild Felid Diseases: Conservation Implications and Management Strategies

L. Munson[1*], K. Terio[2], E. Lane[3], N. Robert[4] & F. Courchamp[5]

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[2] *Zoological Pathology Program, University of Illinois, Maywood, IL, USA*
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Disease threats to wild felids may be increasing due to habitat restriction, encroachment from domestic animals, and biomagnification of environmental pollutants or infectious agents. Whereas infectious diseases have likely always circulated through wild felid populations, emergence of more pathogenic strains, co-infections with other pathogens, or loss of resistance through genetic impoverishment may explain higher mortality rates in some populations. Recent epidemics of canine distemper and tuberculosis in African lions, and feline leukemia virus in Florida panthers illustrate the conservation impact of these diseases. Intervention should be justified by modeling that is based on data acquired through long-term monitoring of wild populations. Captive animals usually serve as poor surrogates, because the spectrum of diseases that affect their health often differ from their wild counterparts. Serosurveys provide valuable information on infectious agents that wild felids encounter, but not on associated morbidity or mortality. The widespread occurrence of feline immunodeficiency virus antibodies in healthy African lion populations exemplifies the difficulty in interpreting results. Monitoring should be founded on health exams during any handling of wild felids and thorough necropsies of all available carcasses. Accrual of long-term data will determine if recently recorded epidemics are unusual or part of normal felid population cycles.

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Tuesday 18th – Afternoon, Session 1 "Ecology"

Managing Tigers and their Prey in a Human-Dominated Landscape in Sumatra

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A fundamental requirement for managing large carnivores is understanding their responses to living in human-dominated landscapes. This study focussed on a tiger subpopulation living in a 963 km^2 forest block inside Kerinci Seblat National Park (KSNP), Sumatra, surrounded by farmland and a logging concession. We aimed to assess tiger habitat selection across this forest landscape that had varying levels of anthropogenic threats and prey abundance. Tiger and prey distributions were recorded across 80 2 km^2 grid cells using four repeat detection/non-detection surveys, which enabled the use of logistic regression models to estimate both detection probability and occupancy parameters of tiger prey. The most parsimonious individual prey occupancy models were then used in conjunction with the different threat types to investigate the covariates that influenced tiger habitat use. No difference was found between survey team detections, but rainfall was found to effect detection probabilities and was subsequently controlled for. Proximity to logging roads or public roads, slope and prey snare trap locations were important covariates for tiger prey species in different combinations. Tiger habitat selection was positively and significantly related to the presence of tapir, and then sambar and negatively related to deforestation and proximity to illegal logging camps.

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Spatial Ecology and Social Interactions of Jaguars (*Panthera onca*) in the Southern Pantanal, Brazil

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Understanding the social dynamics and space use of jaguars is essential for management strategies that would ensure their long-term conservation. We initiated an intensive study of jaguar ecology in the Pantanal, with GPS-based radio collars that allowed the intensive monitoring of 10 jaguars and the examination of their space use, movement rates, and social interactions. Estimates of home ranges varied among individuals and seasons. Home ranges sizes in the dry seasons were generally larger than in the wet seasons. Core areas sizes did not differ between the seasons but stability and site fidelity within individual ranges varied considerably among individuals and seasons. We found a pattern of spatial avoidance among females during the wet season. Among males, home range overlap was extensive, both in the wet and in the dry seasons. Jaguars did not move independent of each other. Cats were located <200 m apart more often than expected. Our data suggest either a low survival rate of young or that jaguar may in fact be a more social species than previously thought. The understanding of how different ecological variables influence the land tenure system of jaguars will be of key importance for the conservation of this secretive carnivore.

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Canine Distemper Virus Dynamics in Serengeti Lions: a Modeling Approach

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Because felids are generally found at low densities, they are unlikely to be threatened by specialist pathogens; however, they are almost always members of large carnivore communities, and are susceptible to generalist pathogens. Generalist pathogens, such as canine distemper virus (CDV), can have devastating effects on wild felid populations; in 1994 over 1000 Serengeti lions died from CDV. In order to understand the CDV transmission dynamics among lions in the Serengeti ecosystem, we built a spatially-explicit mathematical model of CDV transmission based on pride location, demographic, and contact data from the Serengeti Lion Project. We use this model to (1) analyze the impact of nomads and residential male lions in epidemiological dynamics, and (2) ask whether lion populations can sustain CDV epidemics without repeated introduction from other sympatric carnivore species, such as hyenas and jackals. Even when we used extreme parameters for lion contact patterns, we could not produce the number of infected prides and duration of the epidemic as observed in 1994; we conclude that other carnivore species were likely involved in repeated spillover events to lions during 1994 epidemic. These findings have management implications in reducing the threat of infectious diseases to lions and endangered carnivore populations.

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Demography of the Asiatic Lions in the Gir Forest, India

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Based on four year monitoring of individually identified lions we present data on survival, births and recruitment. Demographic profile was obtained by categorizing each lion sighting into six age-criteria. Prime adult females (Mean ± SE), (31.6 ± 1.6) and prime male (24.6 ± 4.4) consisted majority of the population. The adult sex ratio was 76.4 males to 100 adult females. The ratio of cubs to adult female ratio was 50:100. Males did not associate with females and tended to move and feed independently. 12% of total sightings (n=487) were male-female associations of these 70% were mating pairs. Group size (Mean ± SD) of males was 1.4 ± 0.50 (1-3, n=283) while adult female group size was 1.3 ± 0.53 (1-4, n=291). Mating occurred throughout the year with a peak during winter. Birth occurred throughout year with peaks during late winter and monsoon. Average litter-size was 2.3 ± 0.21. Survival of cubs to recruitment age was 44% (N = 33). Cub mortality in intensive study area (n = 15) were due to infanticide (60%), abandonment (13%) and other natural causes (26%). Adult mortality was due to natural causes 66%, accidents 21% and un-identified 13%. Lion densities varied (8 - 16 lions/ 100 km^2) in different park areas.

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Comparative Ecology of Two Jaguar Populations under Different Land Tenure and Human Disturbance Regimes in Mexico

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Jaguars (*Panthera onca*) remain one of the least known felid species of the world with a trend to persist in remote pristine places, and increasingly becoming in contact with humans. The objective of this study was to compare the basic ecology of two jaguar populations under contrasting management systems to understand their conservation needs while coexisting with humans. The study sites are located in Sonora and Queretaro, Mexico. On these study areas we utilized a suite of methods (spoor, camera-traps, and prey surveys) to determine distribution, habitat association and abundance. We found significantly different habitat use between populations, where both species are mainly associated to tropical forests; also jaguars in Sonora are using oak-woodlands, and pine-oak in Queretaro, avoiding human created habitats. We found jaguar abundance in Sonora as 1.4 individuals per 100 sq. km in Sonora, and 0.5 individuals per 100 sq. km in Queretaro. Ungulate prey abundance is significantly higher in Sonora than Queretaro. Another difference between areas is the lack of human presence in Sonora. Although both populations are vulnerable to extirpation, the causes are different; Sonora is more exposed to poaching, while Queretaro is affected by human encroachment and habitat fragmentation.

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Variation in Cougar (*Puma concolor*) Survival by Individual Traits, Density, and Seasonal Weather

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Vital rates (survivorship, fecundity) and migration rates of an animal population determine its size and composition, and represent the aggregate life-history performances of its constituents. Understanding how individual traits, population characteristics, and extrinsic factors influence survivorship and fecundity is essential for predicting population dynamics and effective conservation. It can also reveal valuable insights about life-history strategies. To examine how survival varied with a cougar's identity (e.g., age, sex) and behaviour (e.g., habitat use), density, and seasonal weather, I analysed long-term data from a hunted population of cougars in SW Alberta studied by Jalkotzy and Ross during 1981-1994. Habitat use was measured in a novel way which accounted for extreme behaviour. I developed generalized-linear models to identify different influences on cougar survival. Cougars died mostly during winter. Recently-independent offspring, older individuals (>8 yrs), and males, experienced greater mortality. During winter, survival increased significantly if cougars frequented habitats >1.4 km (♀) or >2.2 km (♂) from a highway, between 1445-1678 m (♀) or 1513-1646 m (♂) elevation, and with <33% (♀) or <41% (♂) closed-canopy cover (>50% and >45% open-canopy cover) within 1 km^2 of a cougar's location. Winter survival was higher during dry winters and following wet springs. Density-dependent effects on winter survival were not evident.

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Effects of Drought on Wild Cats

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Drought can have significant impacts on the population ecology of wild cats in arid and semi-arid environments. We used long-term studies of ocelot (*Leopardus pardalis*; 25 years) and bobcat (*Lynx rufus*; 8 years) to illustrate a precipitation-prey-cat model and the biological consequences of moderate to severe drought on wild cats. Drought can reduce prey abundance, which can yield insufficient energy, protein, and possibly vitamin A for wild cats. These reduced nutritional levels can be manifested in changes of optimal foraging patterns (e.g., prey switching, functional and numerical responses) of wild cats and changes in spatial patterns, habitat use, health, reproduction, and survival. The potential mechanistic trigger of insufficient vitamin A also will be identified. Conservation strategies derived from application of this drought-prey-cat model will be examined, including management of prey habitat and possible prey supplementation in selective situations. Finally, the potential application of this model to other felids in arid and semi-arid environments will be described, including tiger (*Panthera tigris*) in southwest Asia, serval (*Leptailurus serval*) in Africa, cougar (*Puma concolor*) in North America, and pampas cat (*Oncifelis colocolo*) in South America, with suggestions for future research.

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The Landscape of Fear and the Conservation of Large Felids

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Wild felids survive by catching and killing prey. Traditionally, it is assumed that the key to conserving large felids is to insure there is sufficient prey to support viable predator populations. However, sufficient numbers of prey is not the only factor; the prey need to be available or vulnerable to predation. The new concept of the landscape of fear predicts that prey species will try to reduce predation risk by being more vigilant in or avoiding risky areas. The level of predation risk of an area is determined by the lethality of the predator or its ability to catch prey. High risk areas are where the predator has the best chance to catch its prey. Thus, for the predator, the landscape of fear becomes the landscape of opportunity and the amount and configuration of risky habitat becomes important in the predator's survival. Here we explore this flipside of the landscape of fear and discuss ways this model can be used in the conservation efforts of large felids. We suggest that an analysis of the landscape of fear for the prey of large felid predators will help identify those landscape elements important for the survival of these felids.

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Variability in Lion Density and Survival in Kruger National Park

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Few lion populations have reliable estimates of population size, trends in these, or demography. We developed a statistically robust approach for estimating selected population variables. We then chose the Kruger National Park to evaluate the threat of the disease bovine tuberculosis (BTb) in various prey biomass zones. We calibrated call-up surveys, defined the sampling intensity for a desired precision, and estimated lion densities in six prey biomass/BTb zones. Assigning sex and age to responding lions allowed the extraction of age distributions, from which we estimated survival rate. We collated previous estimates to define the likely lion trend that did not change for 30 years. Density and survival rates were both strongly associated with prey biomass. However, some of the variation in survival was associated with the prevalence of BTb in lion prey – against expectation rates were higher in areas that had high prevalence of BTb. The effect of BTb on the lions may be negligible at present, but droughts could disrupt the hierarchical influences of prey biomass and BTb prevalence on lion densities and survival. To evaluate any accentuated effect of BTb on lion demography population surveys should include structure assessments and be complimented by focal assessments of fecundity.

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Review of Research on Lion Ecology in West and Central Africa

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The number of free ranging lions in West and Central Africa is now estimated at 1700 individuals according to the African lion database. Lion populations have declined during the past decades and populations are scattered and isolated. This review covers the results of ecological research in selected national parks in West and Central Africa. Lion density (max 3 lions per 100 km2) and average group size of lions (1.7) in the study area is much lower compared with East and South Africa. Wild prey biomass per kg of predator is similarly low, when compared with national parks in East and South Africa. Finally limited morphometric data on West African lions indicates differences in body length, body weight and nose pigmentation, compared with their South and East African counterparts. The review of current research shows small dry season and large wet season home ranges of pride members and seasonal movements of individual lions outside national parks during the wet season. Main threats to the lion populations in the selected case studies from West and Central Africa are (a) habitat fragmentation and isolation (b) lion livestock conflicts and retaliatory killing and (c) poaching of prey.

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Tuesday 18th – Afternoon, Session 2
"Genetics, Sytematics and Morphology"

Acoustic communication in the Felidae – Beyond Purring and Roaring

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Particular felid vocalizations like purring and roaring have continued to intrigue scientists and laypersons for a long time. Already during the first half of the 19th century the presence resp. absence of these two vocalization types in species of the Felidae were hypothesized to be correlated with differences in their hyoid anatomy and were regarded as the decisive characters to separate the subfamilies Felinae and Pantherinae. Detailed vocalization data of varied scope are currently available in more than 30 of the 39 extant felid species. All felid species share a 'basic' acoustic signal repertoire, comparable both in respect of repertoire composition and size; several vocalization types are restricted to a few species each only. Both graded and discrete sound types occur. Felid vocalization data are used to test general concepts in vertebrate acoustic communication like the frequency scaling rule and the acoustic adaptation hypothesis. The recently published complete molecular phylogenetic tree of the Felidae represents a rigorous framework within which vocalization character distribution and evolution can be studied and hypotheses as to ultimate causes of vocalization character stasis or change in this carnivore family can be put forward.

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Comparative Genomics and the Evolutionary History of the Felidae

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Genomics, the study of the relationships between genetic features and biological function, integrates traditional disciplines like molecular, population, and quantitative genetics with new technologies in molecular biology, bioinformatics and automated robotic systems. Two major accomplishments have recently vaulted the Felid family into the genomics era. First, annotation of the 2-fold coverage domestic cat genome sequence was completed. Second, a robust model of the molecular genetic phylogeny of the Felid family was established, which enables us to interpret geographic, temporal, and evolutionary patterns with increased confidence. Our new molecular phylogeny, based upon analyses of 22,789 bp (19 autosomal, 5 X-linked, 6 Y-linked and 9 mitochondrial genes) is the most comprehensive resolution of the Felidae achieved to date. Combined with 14 fossil calibration dates, an accurate estimate of divergence dates among lineages was established, showing that modern felids arose in the late Miocene (around 10.8 MYA) and subsequently evolved into 8 major lineages through a series of intercontinental movements. Advances in comparative genomics will continue to assist felid research by allowing more-efficient identification of genes and mutations of functional importance and facilitating application of discoveries and molecular tools across species.

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Recognizing Felid Taxonomic Units: The Case of the Tiger and Clouded Leopard

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Molecular genetic techniques are providing the means to clarify felid evolutionary history and taxonomic nomenclature reflecting this history. Recent graduate research by Shujin Luo on tigers (*Panthera tigris*) and Valerie Beason on clouded leopards (*Neofelis nebulosa*) exemplify the process and the associated scientific and political issues. Strong phylogeographic monophyly and large genetic distances were found between *N.n. nebulosa* (mainland) and *N.n. diardi* (Borneo) with mtDNA, nuclear DNA, and 51 microsatellite loci, which along with fixed subspecies-specific chromosomal differences, is equivalent to comparable measures among the other Panthera species and supports reclassification as a new species (*Neofelis diardi*). By contrast genetic assessment of 134 tigers revealed relatively low genetic variation, but significant population subdivision. A distinct partition of the Indochinese subspecies *P.t.corbetti* into northern Indochinese and peninsular Malayan populations suggest recognition of six taxonomic units or subspecies: Amur tiger *P.t. altaica*, northern Indochinese tiger *P.t. corbetti*, South China tiger *P.t. amoyensis*, Peninsular Malayan tiger *P.t. jacksoni*, named for the tiger conservationist Peter Jackson, Sumatran tiger *P.t. sumatrae* and Bengal tiger *P.t. tigris*. These results provide an explicit basis for clouded leopard and tiger species and subspecies recognition, and will lead to the improved management and conservation of these distinct geographic populations.

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Jaws, Paws, and Claws: Predatory Adaptations of Felids

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Unlike canids and canid-like predators, cats display a relatively weak relationship between body size of predator and body size of prey. This might reflect the fact that canid and canid-like predators such as hyenas kill with jaws alone, whereas felids kill with a combination of jaws, claws, and paws. Large felids rely on muscular forelimbs to grasp and immobilize large prey, and often kill with a forceful bite that suffocates the prey. By contrast, smaller felids use lighter, rapid, and more precise limb movements to capture small prey that are killed by bites to the skull or cervical vertebrae. Consequently, cats that kill large prey should have adaptations for increased bite force and relatively more robust forelimbs than those that take small prey, where adaptations for speed might be favored. Here we explore the relationships among forelimb and paw strength, skull strength, and prey size in living felids using morphometrics on bones and radiographs to reveal internal structure. Results suggest that felids that kill large prey have relatively robust canines and incisors, more robust metacarpals and relatively wider paws. There are also morphological distinctions between cats that kill predominantly large prey and those that kill both large and small prey.

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On the Way to Cryptic Extinction through Hybridisation: Past History, Present Problem, and Future Conservation of the Scottish Wildcat

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The Scottish wildcat is the only remaining indigenous felid in Britain. Sadly, the Scottish wildcat has been, and still is, in danger of cryptic extinction through introgression with domestic cats. Conservation scientists striving to protect wildcats have been facing two crucial questions. One is whether "wildcats" still exist, and the other is, if so, whether it is possible to distinguish wildcats from hybrids within an introgressed population of "wild-living" cats. For the past 15 years, we have studied ecology, morphology and genetics of the Scottish wildcat, as well as wildcats all over the world, to answer those simple (and yet scientifically unanswered) questions. The results have suggested (1) there are still "wildcats" in Scotland that are worth conserving by all means, and (2) those "wildcats" can be distinguished on the bases of both morphological characteristics and genetic markers. At the same time, we also (and sadly) have found (1) there are not many "wildcats" left – as few as only *c.* 10% of the "wild-living" cats, and (2) introgression may have progressed further than conservationists had appreciates. The picture does not look optimistic for the future of the Scottish wildcat, but at least we know the direction in which to proceed.

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Worldwide Phylogeography of the Wildcat, *Felis silvestris*, Suggests a Near Eastern Origin of Cat Domestication

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The domestic cat is the world's most popular pet numbering more than 600 million and is also an important medical model for genetic diseases, yet little is know with certainty of the cat's origin, early natural history or genetic background. To investigate the relationships between domestic cats and their indigenous wild congeners we typed 36 short tandem repeat loci and sequenced 2.6 kb of the mitochondrial genes ND5 and ND6 in ~1000 cats from wild and domestic settings, including representatives of registered-breed and random-bred pet cats from both feral and household environments. Additionally, six *Felis bieti* and twelve *F. margarita*, the closest relatives of *F. silvestris*, were included as comparative outgroups. Phylogenetic and clustering analyses identified five genetically distinctive wildcat populations, present in Europe (*F.s. silvestris*) , Southern Africa (*F.s. caffra*), Central Asia (*F.s. ornata*), the Near East (*F.s. lybica*) and China (*F.s. bieti*), here subsumed under *F. silvestris*. Domestic cats carried genetic signatures that differentiated them

from all wildcats, including the critically endangered Scottish wildcat, except those from the Near East. Multiple genetic analyses produced concordant results tracing the origins of cat domestication to at least five maternal wildcat lines originating in the Near East.

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Characterising the MHC in Domestic and Wild Felids

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The Major Histocompatibility Complex (MHC) in the cat (FLA) contains highly polymorphic genes, many of which are critical in regulating the immune response. The cat MHC contains up to three DRA and DRB genes, but lacks DQ and DP genes. We have investigated FLA-DRB alleles in a variety of domestic and wild felids. DNA samples from 109 domestic cats and 67 wild cats (from 16 different species) were characterised using DNA sequencing and cloning, and Reference Strand-mediated conformation analysis (RSCA). Results indicate that individual cats can have one to six alleles present, suggesting that different haplotypes may carry one, two or three DRB genes. To date, we have been unable to assign alleles to specific loci. Fifty of our samples are from family members, but it has not proved easy to assign haplotypes. This may be complicated by the possibility that available primers do not amplify all alleles. Interestingly there was some sharing of alleles between different species. One allele was found in lions and jaguars, and another in amur and persian leopards. The Indian desert cat shared an allele with the domestic cat. Further work is needed to dissect the complexity of the FLA-DRB genes.

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Conservation Genetics and Molecular Ecology of Neotropical Felids

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The Neotropical region harbors 10 species of wild felids, all of which are currently threatened by a variety of human activities. Conservation efforts on behalf of these species are hampered by the scarcity of information on basic aspects of their biology, including geographic range, ecology, population structure and evolutionary history. In this paper we describe and discuss recent results addressing two specific issues: (i) population genetics of remnant jaguar populations in Southwestern Brazil; (ii) genetic and ecological analyses of a hybrid zone between two wild felids (*Leopardus tigrinus* and *L. geoffroyi*). In the first topic, we will discuss the conservation implications of our genetic analyses of 35 wild-caught jaguar individuals originating in several

fragments of Inland Atlantic Forest, now isolated by human-dominated landscapes. Multi-locus microsatellite analyses indicate detectable genetic differentiation among fragments, suggesting a strong effect of recent genetic drift as a likely explanation. In the second topic, we will describe a hybridization process identified between two wild felids where their geographic ranges meet, which we have characterized from genetic (multiple markers), ecological (diet, habitat association) and morphological standpoints. We address the history of this phenomenon, and relate it to another hybrid zone involving *L. tigrinus* and *L. colocolo.*

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Reintroduction of Lynx in Switzerland – A Molecular Evaluation 30 Years after Translocation

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Lynx went extinct in most of Central and Western Europe at the end of the 19th century. In the 1970s, re-introduction programs started in the Alps and in adjacent mountain ranges of Switzerland, Slovenia, Italy, Austria and France. For all projects, the founder individuals came from the same source population, the Carpathian Mountains of Slovakia. Some of the animals released were closely related (siblings, parent-offspring). Because of the clandestine manner of some of the releases in Switzerland, the whole re-introduction remained obscure, but all together, there were not more than 14-16 animals released in the Swiss Alps and 8-10 in the Jura Mts, respectively. The two populations in Switzerland are still relatively small and isolated. They consist today of not more than 40 - 60 reproducing individuals. From this situation, the following questions arise: Do the re-introduced populations have nowadays a reduced genetic variability compared to the Slovakian source population and other autochthonous populations in Europe due to the bottleneck created by the reintroduction? Do the two geographically separated populations of Switzerland differ genetically today? To address these questions, genetic analyses were performed using microsatellites, Currently, preliminary results based on 22 microsatellites and 530 samples from 13 populations are available.

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Geographic Variation in Jungle Cat (*Felis chaus*) Body Size: Is Competition Responsible?

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There is a striking difference in body size of jungle cats (*Felis chaus*) in the west and the east of their distribution with Israeli cats being 43% heavier than Indian cats. We tested the hypothesis that increasing competition from other small felids towards the east is responsible for the difference in body size. We measured jungle cat skulls for eight cranial and dental variables and related these to independent variables such as species richness (local and regional), latitude, longitude, temperature and precipitation. Data from a narrow band between latitudes 24.0° N and 33.9° N where Bergmann's rule was largely not observed showed that the western population ($\leq$ 50.0° E longitude) of jungle cats is larger than the eastern (> 60.0° E longitude) population with

the size difference being most evident in the upper carnassials (P^4L). Species richness at the regional level showed a significant negative relation to P^4L. An even spacing in CBL for a small-cat guild from India through null model analysis indicated the occurrence of character displacement/release. The results support the hypothesis that competition is responsible for geographic variation in jungle cat body size in the region where Bergmann's rule does not apply.

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Wednesday 19th – Morning, Session 3 "Felids & People"

Wild Felids and People

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Wild felids have always been a source of fascination for people and our relationships with them vary from awe and inspiration to fear and loathing. This presentation seeks to explore a few of the issues surrounding our seemingly ambiguous relationship with the wild Felidae. Images of felids are used to symbolise the strengths of governments and chiefdoms, adorn our currencies, coats of arms and emblems of national sports teams and guard our sacred and ceremonial places. Their skins are sought-after fashion items, their body parts are used in traditional medicines and felid hunting trophies (particularly the large felids) command high prices. Felids are a significant attraction for tourists visiting wild places and are often iconic flagship species for conserving wild habitats. Yet at the same time, felids impact the lives and livelihoods of people who must live alongside them and wild felids have been extirpated in many places as a result. Livestock killing and man-eating by large felids are non-trivial costs borne by local communities, particularly in areas where big cats roam freely. In terms of conservation there is much advantage in the fact that felids are charismatic enough to capture our imagination and earn our admiration. However there are also many challenges to conserving creatures with sharp claws and teeth and carnivorous appetites. If felid species and the environments in which wild populations thrive are to be conserved for the future we must address conflicts with local people. We must find novel ways to incentivise conservation of felids and their habitats and find ways to educate people about their value to ensure communities and cats are able to co-exist.

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Coexistence Project: Human Dimensions of the Conflicts between People and Jaguars (*Panthera onca*) in Brazil

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Jaguar conservation has relied upon ecological aspects of the species, those relative to its feeding ecology - predation on livestock - in particular. This strictly ecological-economic approach does little to protect jaguars where hostility toward the species is socially and culturally ingrained. Vitally, the goal of my research was to identify the factors – besides ecological and economic ones – that explain variation in jaguar persecution and assess their relative importance. Questionnaires and interviews were used to assess knowledge, values, beliefs, attitudes and norms toward jaguars, plus socioeconomic and demographic variables. Approximately 600 students (ages 6-18) on the Amazon's agricultural frontier and 400 landowners in Amazonia, Pantanal and Atlantic Forest were assessed. I found that livestock depredation is often the proximate cause of persecution. However, the rather great variation in tolerance to depredation is explained mainly by education and cultural background. These findings suggest that effective strategies to resolve human-jaguar conflicts should combine measures to decrease depredation and education/communication interventions to increase tolerance to jaguars. Based on the findings, education and communication interventions – e.g. lectures, posters and stickers, radio advertisements, cartoon

magazines for children and practical guides for landowners - have been conducted in rural communities around Cristalino State Park, in Amazonia.

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How do Roads Affect European Wildcats and What Measures are Effective to Reduce Road Mortality?

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The wildcat (*Felis s. silvestris*) is a species of conservation concern throughout Europe. After some centuries of massive hunting and deforestation only small isolated populations were left. Despite strict protection still only 10-15% of the suitable habitat in Germany is populated. What are the reasons? Today road mortality and habitat fragmentation are major threats. We radio-tracked 12 wildcats in three years along a new motorway to document its effects. Moreover 2738 wildcat sightings and 402 causalities from Southwest-Germany were analysed and constructive details of roads as well as landscape features were reported. Most wildcat casualties occurred near forests larger than 1000 ha and nearly no kills were found near buildings. Guard railings and the lack of road verges pose a high risk to the wildcat. On one motorway 35% of the estimated population was killed every year. A wildcat proof fence with a metal sheet at the top was effective in keeping animals from the road. Because of the high risk of population fragmentation this measure will only be recommended when crossing possibilities are present. Our results can be used to define conflict areas and target roads where wildcat-proof fences and other measures should be established.

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Jaguar Depredation in the Llanos: an Ecological and Socio-Cultural Approach to Coexistence

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Jaguar distribution in the Colombian Llanos is largely unknown and uncertain with constant persecution by cattle ranchers. We evaluated presence, studied the spatial, ecological and socio-cultural aspects of jaguar-livestock conflict in this Neotropical savannah habitat (100,242 km^2). Some 1,800 jaguars are estimated present; all associated to major rivers and riparian forests, but never far from cattle pastures. Free roaming pigs were most predated by jaguars (91%), followed by cattle (21%), goats, horses and dogs. For cattle, jaguar depredation never exceeded 5% of the standing stock. Small and poor cattle ranches are more vulnerable to jaguar depredation and than larger ones, since they suffer higher depredation impact and are less tolerant. They run an unprofitable production system mainly due to poor acidic soils, lack of technology, extreme drought and flood dynamics and lack of connectivity to markets; resulting in extensive area grazing and to rear stock in a semi-wild manner – which in turn increases depredation risk and decreases the viability of implementing anti-predatory management strategies. Approximately, 0.4

jaguars are hunted annually per 100 km^2. Linear trends show that attack numbers decrease as distance of attack site to water, forest edge and homestead increases. Cheap and easy anti-predator management techniques are suggested.

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Community Based Livestock Insurance Scheme; A Solution to Resolve Human-Leopard Conflict in Northern Pakistan

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Part of the moist temperate forest in the NWFP province of Pakistan that hosts a total of 55 common leopards (*Panthera purdus*), has seen an escalation in human-leopard conflict. The available data (since June, 2005) on livestock predation reveals that a total of 413 goats, 10 cows, seven oxen, two buffalos and one horse have been killed in 115 km^2 of study area. In spite of damages to livestock, and retaliatory killings the overall situation of leopard conservation stayed reasonably good till a leopard turned man-eater (June, 2005). Since June, 2005 a total of nine leopards have been killed in retaliation from the area. Keeping in view the gravity of the situation, and magnitude of problem, WWF-Pakistan launched a "Community Based Livestock Insurance Scheme" to overcome the economic losses of farmers. In this regard communities were mobilized to generate a fund, managed and administered by community. Considering the success of the scheme, its membership is increasing steadily and the government and other organizations have shown their interest to support the initiative and replicate in other places. This innovative scheme launched for the first time in Pakistan and provides a tangible incentive to local communities to support conservation and find ways to live in harmony with leopards.

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A Model for Sustainable Trophy Hunting of Leopards in South Africa

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Leopards are highly sought-after as a trophy hunting species in Africa yet there is still remarkably little scientific input on the allocation of harvest quotas and the implementation of hunting practices. In KwaZulu-Natal, South Africa, we show that an uneven distribution of hunting effort contributed towards high mortality rates and low recruitment in a nominally protected leopard population. Against this backdrop, we developed a revised protocol for the trophy hunting of leopards in the province, which has since been adopted by the local statutory authority. The revised protocol is based on five key recommendations: (1) limiting the number of CITES tags allocated in the province to five each year, (2) evenly distributing the allocation of permits across the province, (3) allocating applications for leopard hunts to individual properties rather than hunting outfitters, (4) linking the likelihood of obtaining a tag to the size of the property, and (5) restricting the trophy hunting of leopards to adult males. This protocol represents the first scientifically rigorous effort to ensure the sustainable trophy hunting of leopards and, as such, has

potential to act as a model for the hunting of the species where currently permitted or proposed across its range.

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Felid Societies

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Felids differ hugely in body size and, not surprisingly, their prey, habitats and home ranges also differ greatly between species. But how do these differences in their behavioural ecology shape their societies and, indeed, is there a typical felid social system? This paper will review felid societies, exploring the known variation both between and within species, and tackling the questions of which sociological and ecological selective pressures affect these societies. Indeed, how does the spectrum of felid societies differ from that of other Carnivores, and especially canids (which span a broadly similar range of sizes and environments)? The review will also explore evidence for cooperation within felid societies. It emerges that intra-specific variation of facets of social life yield clues to the selective pressures shaping felid societies. Surprisingly few species have been studied in sufficient detail to offer comprehensive generalizations, but a case study of lions reveals generalizations about inter-population differences across this species' range. A further analysis of how one population of lions reacts to seasonal migrations of its prey, and another reacts to inter-annual variation, suggests how patterns in resource availability and dispersion may affect lion society. Further comparisons lead to wider generalizations about felid society and identify questions for the future.

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Wednesday 19th – Afternoon, Session 3 "Felids & People" (cont.)

Human-Felid Conflicts and Perspectives on Large Felid Management in Chitwan, Nepal

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The increasing encounter between felid, livestock, and humans raises concerns about the large felid management. I assessed causes of livestock depredation by large felids (tiger and leopard); spatial and temporal distribution of depredation; and effectiveness of the conflict mitigation programs in the Chitwan National Park (CNP) through literature review, field study and participatory appraisals. Over 800 cases of depredation by large cats occurred between 2000 and 2003 showed depredation patterns are varied geographically, seasonally, and in relation to type/size of livestock and proximity to forests. Habitat encroachment, proximity to livestock, behavior of particular predator and intra specific competition are factors forcing felids to kill livestock. In spite of damage, the local people still had a positive attitude towards the felid, because of tangible benefits derived from the park management. Economic compensation, capacity building and local development through the strategy of participatory conservation are considered to be successful to some extent in reducing conflicts and developing local guardianship in conservation. This study clearly indicated that a shift in attitude of people towards wider recognition of felid for ecosystem function and adaptive management.

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A Global Review of Human-Felid Conflict: Patterns and Priorities

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Conflicts between people and felids pose a significant threat to the survival of many cat species. In order for management strategies to be effective, a thorough understanding of the dynamics of human-felid conflicts is necessary. This paper presents the results of a cross-species, systematic review of human-felid conflicts world-wide. Using a combination of literature review, surveys and GIS meta-analysis, we provide a quantitative assessment of patterns and determinants that are known to influence the severity of human-felid conflicts. First, we examine which of the felid species are affected by conflict, to what extent, and what major ecological and biological factors determine this. Second, we provide a geographic overview of both the occurrence and response to felid conflicts world-wide. Third, we review conflict response efforts, examining the variability and similarities of mitigation strategies in order to illustrate gaps as well as overlap across the species. The results of this cross-taxonomic study reveal hotspots of conflict occurrence and the global coverage of research and applied work; thereby highlighting gaps and needs within this aspect of felid conservation. This provides a helpful platform both for further predictive and analytical work, as well as for the coordination of management of human-field conflicts.

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Living with Lions on African Rangelands: One Successful Model, One Work in Progress

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The African lion is in steep decline, due primarily to direct killing by humans in response to depredation on livestock. Outside of well-protected areas, ever expanding populations of people and domestic animals reduce wild prey, inevitably leading predators to take livestock. Although ancient traditional husbandry methods effectively protect livestock, in the absence of strong economic motivation to preserve predators, it is to rural Africans' financial advantage to eliminate them. We here describe one commercial rangeland of Kenya where ranchers using traditional practices are able to minimize losses and tolerate predators, supporting a stable population of lions at a density of 0.6-0.7/km^2. Tolerance is the product of both lucrative ecotourism and a strong conservation ethic, and shows that Living With Lions is not difficult if livestock producers are motivated to take the necessary measures. We describe a second Kenyan rangeland where traditional pastoralists gain neither financial nor psychological benefits from predators, and have driven lions to very low numbers, approximately 0.01/km^2, in spite of a rich wild prey base. However, recent economics-based conservation initiatives show significant promise; the trend in lions numbers is strongly positive, as are expressed attitudes of the people, who are now beginning to realize financial benefits from lions.

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Demographic Effects of Hunting on Pumas: Source-Sink Dynamics and Implications for the Conservation of Exploited Felids

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The puma (*Puma concolor*) is a large New World felid that has demonstrated remarkable resilience to anthropogenic impacts, remaining one of the most prevalent large carnivores in North American ecosystems. Presently, pumas are subjected to annual harvests over much of their North American range, yet the impacts of sustained hunting on demographic structure and population persistence are not well understood. We have been monitoring two puma populations in Utah, USA since 1997. We compared demographic characteristics between an exploited and a protected population to examine the behavioral mechanisms of population recovery and stability. The treatment population had a younger age distribution, low survival, declining density, and variable fecundity, whereas the control population exhibited the opposite trends in nearly every parameter. Under these conditions, hunting created an ecological trap on the treatment site, resulting in a source-sink dynamic. Post-treatment data suggest that following the reduction in hunting pressure the sink population not only recovered, but began functioning as a source. We offer empirical evidence for the occurrence of source-sink dynamics in an exploited puma population, and argue that because of common life-history characteristics, this species may serve as a model for the conservation of other exploited felids.

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Cheetah and Ranchers in Namibia – Managing Conflict

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Over the past century, the world's cheetah population has undergone severe reduction in both numbers and range due to habitat loss and fragmentation, depletion of natural prey, conflict with humans for livestock and ranched game, and indiscriminate removals of cheetah exacerbating population decline. The largest remaining population of free-ranging cheetah is found in Namibia where 90% are found on livestock and game ranches. The management of predators on private land is complex, as non-lethal predator control is not the norm. This paper uses examples from a long-term study of cheetah on Namibian ranchland to explore these issues and to share information regarding effective conflict mitigation that encourages sustainable coexistence between ranchers and wild predators. Strategies include using livestock guarding dogs and encouraging conservancy land management that can sustain predators as an integral and valuable component of the ecosystem. In addition, economic incentives through a "cheetah friendly" eco-label can encourage ranchers to manage their land in a way that is both ecologically sound and profitable. Depending on individual circumstances, modified techniques used in Namibia are likely to have widespread applications in other places where conservation on private land is critical to the maintenance of viable populations of cheetah and other large carnivores.

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Human-Predator Conflict and Livestock Protection Methods in Botswana

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Large carnivores come into frequent conflict with farmers when caught raiding livestock. This study sought to understand and reduce the predator-livestock conflict in Khutse Game Reserve and the surrounding farmland of Kweneng District, Botswana. From 2000 to 2006, we computerized reports of livestock killed by predators, which are kept by the Botswana Department of Wildlife and National Parks, conducted interviews with local farmers and started to survey locations of kills. Preliminary results indicate that leopards and lions were the primary source of the predator-livestock conflict. Between 2000 and 2004, the number of annual losses attributed to leopards almost doubled, increasing from 276 to 450, and annual losses attributed to lions increased by a factor of almost 5, from 119 to 561. Local farmers reacted to this situation by killing 18 lions near the reserve in 2005 and 2006. Predator attacks occur manly at night and outside of kraals, suggesting that improvements in kraaling and herding techniques will effectively reduce losses. These results, along with our ongoing research, will be used to develop effective livestock protection methods to contribute to the long-term viability of carnivore populations in Africa.

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Social Structure, Human-Induced Mortality and Conservation of Amur Tigers

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We used radiotelemetry and snow-tracking to examine home range size, overlap, and changes in land tenure of Amur tigers in relationship to human-induced mortality and population density in Russia, 1992-2004. Home ranges of 19 resident females (mean = 402 ± 128 km^2) were smaller than those of six males (mean = 1379 ± 531 km^2; $P<0.001$). Overlap between three pairs of males (mean = 0.14 ± 0.12%) and between six pairs of females was low (mean = 0.07 ± 0.09%), so we concluded that both sexes were territorial. Adult females that survived long enough (i.e., were not poached) often divided their territories with their daughters when the offspring reached adulthood (two known cases and three suspected cases), resulting in a 42% ± 14% reduction in territory size. Both mothers and daughters reproduced in their smaller territories, so divisions resulted in nearly a 2x increase in density of breeding females. This suggests that tigresses maintain large territories so that they can divide them with their daughters. This apparently limited population growth rates when poaching was heavy because tigresses did not survive long enough to divide territories with their daughters. Thus, poaching has consequences far beyond the loss of individuals.

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Investigating Key Determinants of Human-Large Cat Conflict around Ruaha National Park in Tanzania

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Human-wildlife conflict is an issue of pressing conservation concern, particularly when it involves threatened species, and accurately identifying the causes of conflict is fundamental to developing effective resolution strategies. This study investigated pastoralists' attitudes towards wildlife, particularly large felids, in the area around Ruaha National Park in Tanzania, which is a globally important area for biodiversity. Pastoralists reported intense conflict with wildlife, especially big cats, and were largely hostile towards the nearby Park, as wild animals cross the boundary and cause problems on village land. Although the level of retaliatory wildlife killing was low, this was mainly due to circumstantial constraints rather than innate tolerance, highlighting a likely conservation concern for the future. A range of factors affected the severity of respondents' conflict with large cats, including ethnic group, wealth, income sources, social status and levels of livestock loss experienced. Successful conflict mitigation will depend upon reducing depredation through better husbandry, and upon improving the cost-benefit ratio of wildlife presence to ensure that local people receive direct, relevant benefits from conservation. Identifying the main factors influencing conflict, and therefore developing the most appropriate mitigation schemes, should have significant benefits both for human and wild cat populations in this important area.

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How to Forward Jaguar Conservation in Flooded Savannahs of the Neotropics – the Ranchers Approach

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Cattle ranching are not at odds with jaguar conservation, on the contrary it is probably one of the few land uses in which we can forward the survival of this species. The approximately 950 000 km^2 of Bolivian, Brazilian, Colombian and Venezuelan savannahs dedicated to meat production, provide a model for successful conservation programs. More than 20 years of accumulated experiences working together with ranchers is comprised in two main areas: a) those directly related to jaguar management, briefly addressed, and b) those related to ranching that affect wildlife populations, cattle productivity and therefore jaguars. We expand on our experiences and results obtained working together with ranchers on a set of six jaguar conservation oriented goals: a) cattle management to decrease predation, b) extension programs for ranchers to improve cattle productivity (husbandry and pasture management) c) promotion of "green" meat economy, d) successful harvest of wildlife to create revenues to finance wildlife protection, e) use of water buffaloes to control chronic predation areas and f) tourism.

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Cougar (*Puma concolor*) Impacts on Livestock Ranches in the Santa Elena Canyon, Chihuahua, Mexico

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Few studies try to clarify the different sources of livestock loses to large felids. This is critical information needed to evaluate the effect of a predator. We investigated livestock losses by cougars in the Santa Elena Canyon, a northern Mexican protected area were ranchers reported cougar predation claims. Our objectives were to determine the impact of cougars on the livestock industry and to identify the factors associated with livestock kills. We used interviews with rancher owners to document the number of livestock lost/yr for 2001-2003. We identified three groups of livestock loses: by cougars, 8% of total economic loss, by other animals (25%) and by others factors (67%). We found a positive relationship between cougar predation on livestock and the amount of mountain terrain, forest vegetation and relative abundance of cougar in each ranch. Apparently, there is no relationship between livestock husbandry and predation rate, although we discuss the role of other variables. We concluded that current cougar impact on livestock ranches in the Santa Elena Canyon is very low. However, we recognize the need to improve livestock husbandry in the area in order to avoid livestock mortality and further reduce the impact of cougars on this human activity.

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Human Lion Conflict in West and Central Africa

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The lion is threatened in West and Central Africa; livestock encroachment and indiscriminate killing of lions are main threats. Human lion conflict mitigation is therefore key to persistence; several experiments were carried out within the region. In Pendjari NP (Benin), enclosures of clay instead of traditional thorny shrub cut depredation figures by more than half. Around the Niger side of 'W' NP, depredation was estimated at US$ 138 per household per year, more than half caused while grazing; people identified improved herding as the most appropriate measure here (effectiveness not yet measured). A livestock corridor through a chain of protected areas has helped reduce conflict in Benoue NP, while close monitoring reduced depredation from 9 to 0 attacks in enclosures and from 60 to 18 on the pastures of 6 pilot villages around Waza NP (both in Cameroon). Cases in Tchad and Guinea identified yet other mitigation measures, including the use of dogs, sensitisation over rural radio and using relevant Sourats from the Koran; data on effectiveness are lacking, however. These projects demonstrate that mitigation can be effective provided judicious choice from a varied suite of mitigation options is made, adapted to local circumstances.

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Is Hunting Large Felids Compatible with Their Conservation: Eurasian Lynx in Norway as a Case Study

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The lethal control and hunting of large carnivores is highly controversial. On one hand it is advocated as a way of reducing conflicts and empowering local people, as well as being regarded as a source of income due to the sale of trophies and the continuation of a long time tradition. Opponents on the other hand claim that it is not sustainable or compatible with their conservation. We examine a case study from Europe – the case of lynx hunting in Norway. Our data consist of 160 years of harvest data that trace the decline and partial recovery of the population in a period with little regulation. In addition we have data from the last 13 years during which data on hunting quotas, harvest bags and population monitoring are available as the management system has become increasingly organised. Radio-telemetry studies of lynx ecology have also been conducted during this period. The results trace the fate of a lynx population through many changes in policy and management and illustrate how improved scientific knowledge can be fed into a management system to improve its sustainability. Our results indicate that lynx hunting can be compatible with maintaining or increasing population density, and that it can probably reduce, or at least limit, some depredation conflicts. However, it is also clear that unregulated or poorly regulated hunting can rapidly reduce population size.

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Tradition versus Conservation: Large Carnivores Socio-Cultural and Economic Importance in Benin, West Africa

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While traditional medicine and its impact on wildlife conservation are well documented in Asia, few researches tackle the problem in Benin and West Africa in general. This study addresses the trade of lions and other large carnivores for traditional uses and its possible implication for conservation in Benin. Objectives were to inventory large carnivores and their products on markets, study the marketing network of these products, inventory local knowledge related to carnivores' conservation and make suggestions for a better integration of populations traditions in protected areas wildlife management. Data were collected by market surveys and interviews. Results showed the importance of large carnivore (especially lion) trade for different classes of the population, from rural areas around protected areas to biggest cities. Magic uses are more important than medicinal uses. The analysis of the marketing network showed that products come mainly from different neighboring countries. The relative importance of this trade confirms the threat that represents tradition for lion and other large carnivores' conservation in Benin. Nevertheless, the place of large carnivores in Benin' Culture can also be positive for conservation.

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Assessment of Man-Eating Outbreaks by African Lions *Panthera leo* in Southeastern Tanzania

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Sporadic and prolonged attacks on humans characterize human-lion interactions in southeastern Tanzania. Approximately 1800 lions survive in this vast unprotected region and up to 400 human lion-related fatalities have been recorded in the past 10 years (1997-2007). We used a statistical approach to distinguish between sporadic attacks and prolonged outbreaks in three affected districts, verifying each incident in the field through trace-backs of 340-recorded attacks. Three key sporadic attack locations and five prolonged outbreaks sites have been identified and mapped. Initial results suggest that human attacks are endemic and systematic with annual tolls of 0-5 fatalities in sporadic attacks and up to 10-40 fatalities in occasional prolonged (>18 mos) outbreaks. Sporadic attacks are less lethal, and offending lions less dedicated to human predation whereas prolonged outbreaks are characterized by bold acts of determined man-eaters. These findings will enable Tanzanian wildlife authorities to scale appropriate intervention efforts in the future.

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Wednesday 19th – Afternoon, Session 4 "Behaviour"

Living on the edge: Ecology and Conservation of Amur tigers in Northeast Asia

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Living at the northern edge of tiger distribution, Amur, or Siberian tigers (*Panthera tigris altaica*) are subject to constraints unlike those of other tiger populations. The single most important feature driving features such as distribution, home range size, daily movements, and to some extent population dynamics are prey density and distribution. Prey densities in northern temperate forests of the Russian Far East appear to represent the lower limits at which tigers can survive: low prey densities appear to be the primary factor preventing recolonization of suitable habitat in Northeast China. Amur tigers must maintain huge home ranges, and require greater energetic demands in terms of daily travel distances than their southern counterparts. The ecological constraints imposed on tigers in this northernmost landscape have important consequences in terms of conservation strategies: landscape planning requires conservation efforts focus not only on "core" protected areas, which represent a small percentage of the available tiger habitat. Unprotected, multiple-use lands represent the majority of tiger habitat, and management of such lands must provide for the economic well-being of local people as well as provide minimum requirements for tigers.

The Influence of Prey Size and Abundance, and Predator Size and Group Size on the Diet of Cheetahs (*Acinonyx jubatus*) and Lions (*Panthera leo*) in the Eastern Cape Province, South Africa

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We have studied the feeding biology and diet of lions and cheetahs re-introduced to three reserves (20000 – 30000 ha each), with different herbivore stocking rates and different relative abundances of prey. Data (species, age and sex of kills) were collected using opportunistic sightings and 14-day long continuous observations over four years. We have used descriptive statistics and correlation analyses to explore the relationships between predator body size and group size, prey size and abundance, and diet. Prey selection by lions is a balance between prey abundance and body size, and on all reserves abundant large prey are killed while similarly abundant but smaller (<50 kg) prey are killed less often. For cheetahs, abundance may be more important than prey species size, and there is a strong correlation between species abundance and number of kills. Where the most abundant species is large (i.e. kudu; adult body mass ~ 200 kg), the corrected mass, which accounts for age and sex of kills, is kept low (60 – 130 kg) through selection of young animals ~ 90% of kudu kills by female cheetah) and adult females (~35% of kills by male cheetahs). While lions kill more adult prey than juveniles (<10% juveniles), cheetahs kill more juveniles (>40%).

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Canada Lynx: Behaviour and Population Dynamics in Northern Canada

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Canada lynx, *Lynx canadensis*, have been relatively well-studied, largely because of their well-known regular "10-year" population cycles, and their economical importance to fur trappers. Most research, however, has been conducted in the southern part of their contiguous geographical range, where their boreal forest habitat is more fragmented and human influences on their dynamics greater. From the mid-1980s through the mid-1990s, three intensive studies of lynx were conducted in the Yukon and Northwest Territories of northern Canada. This presentation summarises and synthesises the main results of these studies. Lynx reached peak densities of between 17 and 45 animals per 100 km^2 in 1990-91, a year after the cyclical peaks in abundance of snowshoe hares, their main prey, and then their populations crashed over the next two to three years to densities of about 2 per 100 km^2. Cyclical changes in the abundance of lynx were associated with major changes in their demography, movements, patterns of habitat use, social organisation, and foraging behaviour. We present the major results of these studies and discuss outstanding research questions and implications for lynx conservation.

The "Ocelot Effect:" Small Felids Demography and Community Composition in Brazil

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Neotropical felids are among the least known of all Felidae. This applies to their demographic parameters, which, in turn, are very important for management. The use of camera-trapping associated with mark-recapture statistics made possible the assessment of demographic parameters of species of solitary habits/cryptic behaviour. Here we present the results on density, abundance ranking, and the community composition of small felids in Brazil. Camera-trapping and the use of the software CAPTURE provided density estimates for ocelot, margay, little spotted cat, Geoffroy's cat, pampas cat, and jaguarundi, as well as abundance ranking and species community composition in several areas of Brazil. Densities varied between 0.04 and 0.38 animals/km^2. The ocelot was the most abundant felid, and there was a strong negative correlation between its abundance and that of the little spotted cat. Evidences were strongly suggestive to consolidate the hypotheses that, in fact, the ocelot affects several aspects of the demography of the smaller sympatric species. Where the ocelot is the most abundant felid, the smaller species tend to be rare, thus causing "the ocelot effect," a.k.a. "the pardalis effect." This presents a series of implications for the smaller species' management and conservation.

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Habitat Use, Spatial and Activity Patterns of the Jaguarundi in Northeast Mexico

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The jaguarundi (*Herpailurus yaguarondi*) is considered an endangered species by international treaties and various laws. Habitat use, spatial and activity patterns of jaguarundi have been minimally studied with the only previous telemetry research examining three individuals in Belize. We began this study in coastal Tamaulipas, Mexico, in 1991. Twenty jaguarundis (12 male, 8 female) were captured at a rate of one jaguarundi per 1,320 trap nights. Jaguarundi habitat use was distributed 53% in mature forest and 47% in pasture-grassland. Mean home range size of 9.6 km^2 was found for adult males and 8.9 km^2 for adult females. Extensive overlapping of home ranges occurred between jaguarundis of the same gender and different genders. Mean hourly movement was 223 m with a mean area covered in a 24 h period of 0.68 km^2 and a mean total distance of 652 m. Jaguarundi activity was diurnal with two activity peaks; one peak between 0900-1000 h and the other between 1600-1700 h. These ecological patterns will be compared with other sympatric similar-sized felids.

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Prey Consumption and Distances Covered by Black-Footed Cats (*Felis nigripes*) and African Wild Cats (*Felis silvestris*) - a Comparison of Two Small Felids from South African Arid Lands

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Two field studies into feeding ecology and behaviour of two small felids of South Africa yielded information on prey captured and distances covered, by observing individuals directly. Both species include a large diversity of prey items in their diet (invertebrates, reptiles, birds and small mammals). Black-footed cats (BFC) average smaller (♂♂=1.9 / ♀♀=1.3 kg) than African wild cats (AWC) with weight (♂♂=5.1 / ♀♀=3.9 kg).
Average distances travelled per night by 10 BFCs (5♂♂ / 5♀♀) during 85 nights, where they were continuously observed, was 8.42 ± 2.09 km (4.42-14.61 km), for 8 AWCs (5♂♂ / 3♀♀) on 94 nights were 5.1 ± 3.35 km (1.07 - 17.37 km). Average prey mass consumed was 237 ± 105 g (67 - 611g) for BFC and 401 ± 358 g/night (2 - 2250g) for AWC. BFCs consumed 30.3 ± 17.1 g / km (6.5 – 110.2g) while AWCs 107.9 + 133.8 g/km travelled (0.94 - 979.9g). Respectively BFCs captured 12.4 ± 5.3 prey items/ night (2 – 26) and AWCs 13.7 + 17.2 prey items/night (1 - 113). Further comparisons between the two species are drawn, to elucidate their respective predatory role in the felid guild.

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Using Spoor Techniques to Examine the Hunting Behaviour of Caracals in the Kgalagadi Transfrontier Park

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San trackers were employed to assist with the interpretation of caracal spoor while conducting research in the Kgalagadi Transfrontier Park. Caracals were spoor-tracked for 535 km, and all identifiable behaviour patterns were noted. Specific sequences of behaviour that related to hunting were identified from the spoor. These sequences were extracted from the data set and were used to analyse the methods used by caracals for hunting. Six component behaviours (crouch, stalk, take-off, chase, pounce and a kill) of hunting were identified. Based on these behaviours and the sequences in which they occurred it was possible to identify the process by which caracals hunt. Caracals use a flexible hunting technique that is adapted to a specific set of circumstances. Correspondence analysis was used to model the sequence in which the components of hunting should occur to have the greatest chance of a hunt resulting in a kill. The prey selection, killing technique and the hunting success of caracals, with reference to larger prey, was investigated using these methods. A hunting success of 10 % was recorded. Caracals prey upon a variety of prey including many small carnivores. Caracals killed prey using a combination of a throat bite and a nape bite.

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Patterns of Spatial Co-Occurrence in Leopards (*Panthera pardus*) and Dholes (*Cuon alpinus*) in Satpura Tiger Reserve, India.

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There have been numerous anecdotes and some recorded instances of agonistic interactions between leopards and dholes. We used the co-occurrence of tracks to assess whether the two species tended to use the same spatial area at different times. A system of trails was divided into 500 m contiguous sections and monitored for the presence of tracks of leopards, dholes and other carnivores over three years in summer and winter. Two hundred and twelve sections were repeatedly scanned by two observers for the presence of tracks a total of 5294 times. There was some evidence for structuring in the use of sections by the carnivore community as described by the C-score index, generated against a null model. Dholes were more widespread in their use of the trails than leopards. Both leopards and dholes consistently used more sections in winter than in summer. There was a weak negative relationship between use of sections by leopards and by dholes for sections intensively used by leopards. The proportion of times tracks of the two species co-occurred was compared to the expectation in all sections, in sections with a high encounter rate of prey species, and seasonally. The evidence for avoidance is discussed.

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Changing predation impact of reintroduced lynx (*Lynx lynx*) in Switzerland

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Case studies in predator-prey relationship do often not fit theoretical considerations. Testing hypotheses derived from theoretical models in field studies on large mammals is hampered by the difficulty to control side effects and to assess short-term findings in the light of unknown long-term dynamics. Reintroductions of carnivores offer chances for experimental approaches, but even such studies – typically designed to evaluate the founding of the population – seldom allow assessing long-term predator-prey relationship. We have studied feeding behaviour of Eurasian lynx in three reintroduced populations in Switzerland. Lynx were observed by means of radio-telemetry in five distinct studies starting 0-30 years after the release of the animals and lasting for 3-10 years. Although the predator-prey system is rather simple, with roe deer as the main prey and chamois as the only significant alternative prey, we found that the predation impact changes considerably over time: Lynx were responsible for 9-63 percent of known roe deer mortality. Lynx showed a considerable numerical and functional response to changing roe deer abundance. Winter mortality and hunting regime shaped the ungulate populations in the Swiss mountains for a long time. Lynx predation now adds a complex and dynamic element hard to cope with for wildlife managers.

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Implications of the Prey Preferences of Large Felids for their Conservation

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A new line of research has recently evolved that describes the prey preferences of individual predators and investigates why those specific preferences have evolved. This paper reviews the published data on the prey preferences of large felids and makes recommendations for their conservation based on these preferences. Amongst the African guild of felids, lions prefer prey the largest prey outside the megaherbivores, leopards prefer medium-sized prey from denser habitats which assist its solitary hunting strategy, and the morphological limitations of the cheetah restrict it to medium-sized prey from open habitats. The main conservation implication of this research is the fundamental importance of an adequate prey base of each predators' preferred prey in order to conserve them. Thus, studies looking solely at habitat requirements based on vegetation communities may fail without cognizance of the habitat requirements of the prey of large felids. This research has also led to the ability to predict the diet and carrying capacity of large felids. Finally, African predators with the smallest preferred dietary niche breadth were more highly threatened with extinction (e.g., cheetah, lion) than those with a broader preferred dietary niche breadth (leopard).

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The Spatial Ecology and Conservation of Pallas Cat (*Otocolobus manul*) in Central Mongolia

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The spatial ecology and resource utilisation behaviour of Pallas cat (*Otocolobus manul*) was studied in Central Mongolia from August 2005 to August 2007. The study's objectives were to relate spatial patterns and behaviour to current and potential threats to the species' conservation in the wild. A total of 27 Pallas cats were radio-collared (15 females, 12 males) and their positions tracked using radio-telemetry every 3-4 days. In order to understand the spatial utilisation patterns being recorded, factors potentially influencing the behaviour of Pallas cats were also surveyed. Prey resources were surveyed using box trapping line transects and spotlight surveys using distance methods; the density and habitat associations of key resources, such as refugia and potential dens, and other terrestrial predators were also surveyed using distance methodology. The interactions between Pallas cats and their environment were studied on a seasonal basis in order to understand how Pallas cats may be affected by current and future human induced changes to Mongolian steppe ecosystems. Recommendations are made to promote the species conservation in the wild.

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Flexible Sociality Ensures the Persistence of Lion Populations When Persecuted by Humans

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Lions are unique amongst felids in that they live in complex and large social groups known as prides, which are defended by coalitions of males. Cooperative defence of cubs and territory by adult lionesses are thought to be the key drivers of this behaviour. This social pattern is thought to typify lions generally, and is observed at both extremes of low and high lion density. We, however, present data on circumstances where this social pattern is abandoned in favour of living in much smaller groups, or as solitary individuals, irrespective of density. This is predominantly observed in populations that are heavily impacted by human persecution as preventative or retaliatory responses to livestock depredation. We investigate what thresholds are necessary to modify lion social organisation to such an extent, and then show that lion populations can persist quite well with such a pattern once these thresholds have been surpassed. Other factors that might influence group and pride size, such as available prey size and biomass, are also investigated as possible drivers of this behaviour. The findings presented offer new and important insights into the conservation and management of lion populations that are nowadays being most widely affected by human persecution.

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Group Territoriality of the African Lion

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Lions, unlike other feline species, depend upon mutual social relationships for their survival. Applying a three-part approach, we tested the hypothesis that group territoriality is the basis of lion social behavior: 1) creation of reproductive 'real-estate maps', forming a lion's-eye view of fine-scale landscape value, 2) empirical analysis of group-territorial competition, and 3) simulation modeling of an evolutionary switch from solitary to group territoriality. Analysis was based upon a 38-year individual-based dataset of lions in the Serengeti National Park, Tanzania. River confluences were the most valuable landscape feature (significantly associated with higher reproductive success), and larger prides (measured as the number of adult females and/or males) gained and maintained access to these areas. Reproductive success was negatively impacted by neighbor density and females adjusted their within-pride grouping patterns in response to the potential threat of neighboring prides. The simulation model explores whether group-territorial behavior is more likely to evolve in a heterogeneous landscape that supports a high density of conspecifics. This research provides the first solid example of group territoriality in a mammalian species and provides a better understanding of how the evolution of a complex behavioral trait is ultimately linked to the landscape.

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Hybridization Between White-tailed Deer and Mule Deer in Northeastern Washington: Are Mountain Lions Protecting the Genetic Integrity of Mule Deer?

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Throughout western North America, mule deer (*Odocoileus hemionus*) herds are steadily declining in numbers. Many studies investigating the decline of the species have focused on loss of habitat, over-harvest or predation. Concurrent to the decline in mule deer, white-tailed deer (*Odocoileus virginianus*) are increasing in abundance and distribution in many areas where they are sympatric with mule deer. Hybridization amongst overlapping populations of mule deer and white-tailed deer has been confirmed in many locations. Levels of backcross and overall genetic introgression are unknown. F1 hybrids are known to lack an effective “anti-predation strategy” and we speculate Mountain lion (*Puma concolor*) predation may be the last line of defence of the genetic integrity of Mule deer by selecting for F1 hybrids and preventing genetic introgression of whitetail genes into mule deer herds. Testable hypotheses determining current levels of hybridization, hybrid fawn survival and predator selection ratios are the first steps in our investigation into the role of hybridization in mule deer declines.

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Thursday 20th – Morning, Session 5 "Conservation & Management"

Connecting the Dots: Saving a Species Throughout it's Range

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With a loss of perhaps 30,000 species a year from the earth, we face an ongoing biodiversity crisis that is not being adequately addressed. Despite innumerable workshops and increasing numbers of scientific and technical publications, most scientists and conservationists give no thought to long term strategies that provide practical guidelines for saving individual species from extinction. With millions of dollars being put towards the study and conservation of some of the most charismatic megafauna, such as the great cats, even these species continue to experience range collapse, fragmentation, and genetic deterioration. We now recognize three critical areas for in-situ conservation: the delineation, mitigation, and measurement of critical threats; an understanding of landscape genetics and how landscape characteristics structure populations; and the involvement of people and governments at the national, regional, and local levels. However, while many initiatives incorporate these factors in efforts to conserve large cats, many remain restricted to a scale that fails to consider the needs of the species across its entire distribution. Here we demonstrate an approach that incorporates these initiatives and puts into motion a conservation plan for the jaguar that identifies and protects a genetic and biological corridor across the species existing range.

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Learning More about Fewer Tigers

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The accumulation of knowledge about the ecology, behavior, and distribution of wild tigers during the last three decades has been rapid and a welcome contribution to the scientific literature. If only this increased knowledge base, applied properly, could arrest and reverse the accelerating decline of tigers across their range. We track important discoveries and events in two related timelines covering the past 30 years: first, in regards to new discoveries about wild tigers and second, to conservation events that directly impinge upon the survival of increasingly fragmented populations. We conclude that tiger populations, like those of many other top predators, have reached a "tipping point," where they are now experiencing a range collapse, and population extinctions will accelerate. In response, we outline a set of research questions that could directly improve tiger population and habitat management and a set of conservation initiatives that could set the stage for a range-wide recovery.

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Highland Cats: Conservation of the Rare and Elusive Andean Cat

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Rarity may imply small numbers or simply a lack of knowledge due to a species being elusive or difficult to detect. As field studies on the Andean cat (*Oreailurus jacobita*) progress, a suit of reasons underpinning its rarity are beginning to unveil. The species is restricted to the High Andes of Chile, Bolivia, Argentina and Peru. While occurring at low density, it seems to be widely distributed within its range. Habitat specificity, a narrow dietary niche and apparent competition with other high-altitude carnivores (notably the sympatric Pampas cat and culpeo fox) all appear to impose some limit to the species distribution or abundance. Additionally, intensive hunting of prey populations in the past and human persecution in some localities are having a detrimental effect. The High Andes are vast and sparsely populated, providing good scope for the species' protection. Unfortunately ecological surveys in these conditions also require complex logistics. A multi-national alliance of field researchers has combined their experience to develop and apply suitable methods in a study around the tri-national frontier between Chile, Argentina and Bolivia. Habitat assessment, sign transects, camera trapping, skin records and interviews indicate that Andean cats have a preference for rocky outcrops that provide suitable shelter, and the proximity to '*vegas*', small marshes with concentrated productivity in an otherwise barren landscape. A mapping exercise to depict habitat quality type indicates core areas and potential corridors with possible consequences for population structure and genetics. Our study provides a good example of how trans-frontier collaboration can promote good conservation practices and help determine which actions are required to protect rare carnivore populations in mountainous areas.

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Snow Leopards: Conservation Challenges for the 21st Century

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Rare, sparsely distributed and notoriously elusive, snow leopards roam over a vast patch-work of high, fragmented mountain ranges embracing twelve Central Asian countries. The population continues to decline from widespread poaching for their prized fur and medicinally valued bones, killing in retaliation for livestock depredation, and widespread depletion of its natural prey base. Current conservation efforts emphasize anti-poaching, the betterment of traditional livestock guarding practices, predator-proofing of night-time corrals to remove the primary root cause for retaliatory killing, the creation of livestock-free areas, and concomitant provision of economic incentives designed to encourage local people to perceive snow leopards as being "worth more alive than dead." For example, these include handicraft sales in Mongolia, community-based tourism enterprises such as traditional homestays, trekking and nature guiding in India, and

livestock insurance and free veterinary care programs in Pakistan. Although implemented under broad community agreements with mutually-agreeable incentives intended to foster balanced co-existence between human and predator, programs are often too narrowly applied, top-down in design and implementation, unduly dependent upon external expertise, heavily subsidized, and difficult to monitor. We examine key elements for enhancing conservation success which may also be applicable to other solitary species occupying remote, fragile alpine rangelands.

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A Comparison of Range-Wide Priorities for Large Cat Conservation

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Range-wide priority-setting is one mechanism for assessing the range-wide condition of felid species and working toward consensus on their conservation. The Wildlife Conservation Society, in collaboration with a wide variety of partners and cooperating specialists, has conducted range-wide priority-setting exercises recently for three of the world's large cats: jaguars (1999), lions (2005-2006), and tigers (2005-2006). These exercises document range-wide collapses in all three species over the last 100+ years, with range declines from 50% (jaguars), 80% (lions) to more than 90% (tigers), but also show that there are still robust populations, representative of diverse ecological settings, where conservation efforts can assure long-term survival. The status of these species and the variety of approaches which can be brought to their conservation highlights general trends in tropical conservation in Latin America, Africa and Asia; however, where for all these species, their existence depends on conservation efforts that reduce human-caused mortality and protect the prey base. This approach is applicable to many wide-ranging felid species including cheetahs (currently) and snow leopards (near future).

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Conservation of *Oncifelis guigna* in Fragmented Forests of Central Chile

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In central Chile, most of native forest has been replaced by plantations. This transformation may affect the habitat availability and conservation of specialist wild carnivores as *Oncifelis guigna*, the smallest wild cat in America. For assessing the impact of forest fragmentation on this species its habitat use and selection was studied. The study was undertaken in two coastal areas in central Chile from 1999-2004. Habitat use and selection were determined by scent-stations (SS). In each station the structure and composition of the vegetation was characterized, and distance to native forest, creeks and closer road, measured. *O. guigna* preferred dense scrub habitats, far of roads and near to big forest patches as protected areas. When their presence was detected in pine plantations, its abundance was lesser than in forest and dependent of the closeness to native forest and to the age of the plantation, preferring older plantations with native forest regeneration in the understory (<1.5 m). Because of the high importance of fragments of native forest immersed in pine

plantations, it is proposed their maintenance for the conservation of *O. guigna* and a rational harvesting of pine plantation in *O. guigna* corridors.

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Many Ways of Skinning a Cat: Methods and Tools for Studying Wild Felids

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Wild cats seriously challenge curious researchers: their secretiveness, nocturnal habits, scarcity and solitary nature are like the proverbial skin that can be peeled off in several different ways. Cats can be studied as individuals to understand their diets, habitat choice, space use and social systems. Their populations can be examined to estimate parameters like densities, vital rates and other facets of dynamics. At a landscape level, changes in geographical range, occupancy, extinctions and other meta-population phenomena become study objectives. Here we review an array of field natural-history methods, survey techniques and equipment that scientists have developed to address these challenges. They cover tools that range from observation of cats or their spoor, collecting scats or kills, to more invasive techniques like capture, immobilization and radio-tagging. At the level populations, additional techniques ranging camera-trap and faecal DNA sampling are employed. At the spatial scale of landscapes, cat studies can involve simple questionnaires or any of the other advanced invasive and non-invasive tools. Finally, a powerful array of intellectual tools that synthesize ideas from various allied sciences such as biostatistics, information theory, modeling and geography can now be innovatively combined with field techniques, to unveil the hitherto secret lives of wild cats.

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Thursday 20th – Afternoon, Session 5
"Conservation & Management" (cont.)

The Design of Ex-situ Programs for Endangered Species Conservation: The Iberian Lynx as a Recent Example

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Endangered species ex-situ breeding programs are complex, expensive conservation tools that require extensive planning, organization, and integration into a broad recovery strategy. Such programs should not threaten on-going in-situ activities by competing for funding or taking away social relevance from in-situ conservation efforts. Although ex-situ programs often emerge as a response to a crisis situation, they should only be initiated based on feasibility, including the availability of adequate infrastructures, trained staff, and long-term administrative and financial support. In this presentation we will discuss general planning and implementation principles, using the recently established Iberian Lynx (*Lynx pardinus*) Conservation Breeding Program as an example. In general, planning must include establishing realistic and measurable goals, determining the number, origin, and placement of founders, identifying those responsible for program management and implementation, and addressing funding requirements. Other important aspects include genetic management, husbandry (nutrition, enrichment), reproduction, veterinary and health issues, potential reintroduction, and training/education/outreach strategies. Ex-situ breeding programs should incorporate adaptive management schemes and use science to help understand the bases of success or failure and adapt accordingly. Although general planning principles might apply across taxa, each species should be carefully examined and adapted to in-country realities.

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Physiological Reproduction in Felids and Contributions to Conservation

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Biomedical advances have allowed 'hands-on' studies of reproductive anatomy, gametes, fertilization, developmental biology and sperm cryosensitivity in felids. The advent of noninvasive fecal hormone monitoring has permitted characterizing gonadal cyclicity, pregnancy and seasonality with emerging insights into adrenal function (stress). Twenty-eight of 36 extant wild felid species have benefited from these approaches. Basic studies continue to identify fascinating phenomena ranging from teratospermia (extraordinary numbers of malformed sperm) to exquisite light sensitivity in regulating seasonality (Pallas' cat) to influence of management/social systems on eliciting stress (clouded leopard) or reproductive suppression (cheetah). Applied research has focused mostly on assessing reproductive status in captivity or nature. For example, finding that

Florida panthers ejaculated >90% pleiomorphic sperm helped justify subsequent *in situ* genetic restoration. Certain 'assisted breeding' techniques, especially artificial insemination, also are being applied to manage felids *ex situ*. In summary, modern tools in reproductive sciences have been used to significantly increase scholarly knowledge about felids. Particularly revealing is that the mechanisms regulating reproduction are not always conserved across the Felidae family. Certain approaches also have application for assessing fertility potential of wild felids in captivity or nature, with a subset being tested to maximize retention of genetic diversity within *ex situ* populations.

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Sero-Prevalence of Feline Immunodeficiency Virus in African Lions – is it Host Density Dependent?

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The Feline Immunodeficiency Virus (FIV) is confirmed to be endemic in free-ranging populations of nine Felidae and one Hyaenidae species. FIV is widely distributed in multiple populations of the lion (*Panthera leo*) in Africa at diverse FIV-prevalence levels. We found a correlation ($R^2 = 0.732$, n=9) between sero-prevalence of FIV and lion population density, indicating that the prevalence of FIV in lion populations may be density dependant. We investigated indirect measures of potential contact between individuals in prides and between prides to determine if these indices support the FIV density dependence hypothesis. High density lion populations from the Okavango Delta (Botswana) and the Kruger National Park in South Africa are compared with low density populations from the Makgadikgadi Pans National Park and the Kgalagadi Transfrontier Park in Botswana. Average group size and pride size were used as indicators of contact between individuals within the pride. The potential contact between prides was assessed from home range size, the home range overlap between neighbouring prides and the average and maximum distances lions moved. These indices indicate a higher rate of contact between individuals in high density populations than low density populations.

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Landscape Matrix Composition Affects Distribution of Puma and Jaguar in a Cerrado Ecosystem

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Species with large habitat requirements can rarely be supported in protected areas alone and the majority of mortality for large carnivores occurs outside of the reserves designed to provide them safe haven. We are examining how changes in the landscape matrix affect the viability of wide-ranging carnivores in and around Emas National Park, Brazil. Specially-trained scat detection dogs

were used to locate faeces of puma, *Puma concolor*, and jaguar, *Panthera onca*. Three dog-handler teams sampled a 4000 km^2 area, consisting of natural habitat, pasture, and croplands, between April and September of 2004, 2006, and 2007. We collected more than 100 scat samples, plotted their locations on land use maps, and analyzed the samples for diet contents and parasite load. Samples are being used to confirm species, identify individuals, their sex, reproductive status, and stress hormone levels. Puma were found inside and outside the national park, and appear to make extensive use of forest fragments on private lands surrounded by croplands and pasture. Crop harvest cycle and amount of edge habitat predict occurrence of puma. By contrast, jaguars were found primarily within the national park in close proximity to closed canopy forest.

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Following the Ghost of the Mountains, the Leopard *Panthera pardus* in Armenia

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We present three issues of spatial ecology of the endangered leopard in Armenia: (1) taxonomy in the Caucasus in relation to other parts of the Middle East; (2) identification of leopard scats in the wild visually and by fecal bile acid thin-layer chromatography as a part of scat counts; (3) research of range structure, habitat use and detection probability in space and time by scat counts all over the country. The camera photo-trapping efforts are underway. Craniologically, the leopard from the Caucasus, Turkmenistan and northern Iran belongs to the Caucasian leopard *P. p. ciscaucasica* (Satunin, 1914) which is a priority over the commonly used name Persian leopard *P. p. saxicolor* Pocock, 1927. Visual identification of leopard scats is scientifically robust and appropriate for further use in practice. Detection probability of leopard scats is low. The two areas where it was the highest ($p = 0.45$) are designated as the Priority Leopard Conservation Areas (Nuvadi and Khosrov Reserve). Three other areas appear to be the true linkages ($p = 0.24$) and the remaining 11 areas are the would-be linkages (lowest $p = 0.03$). The critical habitats are xerophilous sparse forest and arid grassland. The survey design and conservation issues are discussed.

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Effect of Land Protection, Savanna Type, and Competitor Occurrence on the Status of Cheetahs

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Conservation planning for large carnivores requires information on species status at national or regional scales, but detailed field studies are of limited geographic extent. Can semi-quantitative assessments of status derived from field interviews provide information about the factors affecting carnivore populations over large areas? This paper presents two analyses of the status of the cheetah, *Acinonyx jubatus*, at a country-wide level in Tanzania. The first analysis uses two-way ANOVA to explore the effect of land protected status and savanna type on population status, a synthetic variable derived from parameters measured in interviews. Overall cheetah status was

better outside than inside of national parks and game reserves, and in acacia savanna than in miombo savanna. However, the proportion of cubs in populations seemed higher in miombo savannas. The second analysis addresses the relationship between a series of parameters describing conservation status in the cheetah and in co-occurring larger carnivores using canonical correlations. Perceived trends for populations of cheetahs and lions, *Panthera leo*, were positively correlated, though the prevalence of cheetah cubs in a population was negatively correlated with the number of female lions per pride. Positive correlations were found between group sizes and perceived abundance of cheetahs and jackals.

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Modelling the Distribution of African Lion Populations Using a GIS Meta-Analysis

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Populations of African lions are thought to have declined substantially over the last few decades. We used a GIS based analysis to predict the distribution of current lion populations and the threats they face across Africa. We extracted data on lion numbers and ranging behaviour, prey availability, rainfall, human density and livestock density from the literature and from existing GIS data layers. The positive relationship between herbivore density and rainfall has already been established. We show that lion density in protected areas is closely related to prey biomass and that lion home range size is negatively correlated with prey biomass. With a GIS, we used this relationship to identify sites where lion density was lower than predicted by rainfall and prey density. We correlate this deviation with factors that impact the survival of lions such as human populations and livestock density. Expanding human and livestock populations, prey depletion and habitat conversion may be the key factors responsible for declining lion numbers. Lion populations are most vulnerable in low rainfall areas where home ranges are large due to low prey density. To safeguard viable populations of lions, Protected Areas in arid regions need to be comparatively larger than those in more mesic parts of the continent.

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Conservation of the Eurasian Lynx in Fragmented Habitat of Eastern Europe

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The Eurasian lynx living in NE Poland are on the westernmost limit of the natural range of the species and they occupy highly fragmented habitat. Research conducted in Białowieża Primeval Forest (BPF) showed that the lynx population is highly vulnerable to exploitation by humans. Their current range in Poland also contracted during recent 20 years. Data on lynx ecology in BPF show that these felids rely specifically on roe deer – its staple prey, utilize large (up to 300 km^2) home ranges, are dependent on forest habitat and its population maintenance is supported via dispersal among neighboring forest patches. We hypothesized that the ecological circumstances

for lynx in NE Poland may create obstacles for their population genetic diversity. We performed genetic analyses of microsatellite DNA of lynx samples from BPF and compared with those from Latvia and Estonia, where lynx occur in a nearly continuous habitat. Lynx from BPF had significantly lower genetic variation than those from continuous range. There was also significant genetic structuring among the populations (F_{ST}: 0.11 – 0.15). The results suggest that the peripheral populations of Eurasian lynx may be genetically isolated from the core of the species range, thus being exposed to the increased risk of extinction.

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Beyond Conservation: The Tiger as Driver to Restore Biodiversity in China

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China remains an enigma in the world of tiger and felid conservation. The South China tiger (*Panthera tigris amoyensis*) is extinct in the wild and the captive population is genetically impoverished. For decades China has been perceived as a symbol of environmental degradation, driven by its expanding human population, blistering economic growth, and unprincipled conservation ethic. China today is criticized as the consumer of illegal trade in wildlife, tiger farming, and ineffective wildlife management. But missing from this uncomplimentary characterization is the beginning of a transformation that may parallel the rapid and unexpected shift in its economic and population policies. We argue China is at a tipping point in its conservation history. Just as forest cover in parts of Europe and North America declined then increased and large carnivores like wolves morphed from symbols of repugnance to symbols of wilderness, the tiger has potential to catalyze China's biodiversity revitalization. We review the status of tigers and tiger conservation, the results of recent field surveys, evaluate the latest initiatives to develop capacity to restore wild tiger populations in China, and discuss the significant ramifications for tiger and felid conservation throughout Asia.

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The "Lion" versus the Puma...

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Cattle ranches spread over vast areas of Brazil. Beef production represents a considerable part of the total export of Brazilian agribusiness. Brazil is the second most taxed country in the world (approximately 34% of its Internal Gross Product), only behind Sweden (approximately 38%). Both state and federal taxes apply to beef production in Brazil, varying 12 to 14% of the gross production of each ranch paid on a year basis. As voracious as it is, IRS in Brazil is popularly called "The Lion". Cattle depredation by jaguars and pumas occurs throughout most of the country, especially in Brazilian Pantanal and Amazon basin. Economic loss in big ranches is seldom higher than 2% of total yearly production. However, it generally results in cat culling by local people. Improvements in cattle management can dramatically decrease cattle depredation by

big felids. In addition, a tax-waver policy could be cost-effective on a case-by-case basis. Official statements of predation – required to avoid fraud – should be locally made by the Federal Agricultural Agency (CATI), already established in Brazil, upon previous training of its agents. This strategy could be more effective on felids conservation in agricultural landscapes.

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The Biology of the Jaguar in the Cockscomb Basin, Belize

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Beginning with Alan Rabinowitz' seminal study of jaguar in the Cockscomb Basin, Belize, this part of Central America has been a focus of jaguar research and conservation. Progressively expanded protected areas created the first reserve specifically to protect jaguar, and has been the site of ongoing research on jaguar biology since 2002. Initially focused on jaguar abundance surveys within the protected area, additional research objectives in the Cockscomb include jaguar and puma niche partitioning, jaguar territorial behavior, and jaguar/cattle interactions in areas adjacent to the reserve. Five consecutive years of abundance studies have indicated a range of between approximately 8-12 jaguar per 100 sq. kilometers, a high density of jaguars relative to other abundance studies using the same methodology. Minimum sampling area for estimating the effective sample areas was suggested to be approximately 150-200 sq. kilometers. Jaguar densities within the park have been found to be significantly higher than in adjacent, human-dominated areas. Jaguar prey selection follows similar diet studies in other jaguar sites, with some increased emphasis on medium and smaller prey species. Changes in prey selection from 1982 (previous to hunting ban in the Cockscomb) to 2004 were also documented, with the list of prey species remaining similar, but diet composition found to have changed.

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Leopards of the Cape Mountains: Small Cats with Big Problems

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The leopard (*Panthera pardus*) is the apex predator in the Western Cape, South Africa. It has until recently been regarded as vermin by farmers and conservation officials and been highly persecuted for over 350 years. It is now restricted to the more inaccessible mountains, such as the Cederberg. We have initiated several projects to highlight conservation concerns and needs of this elusive felid. One of these, a conservation genetics study, examines the extent of the genetic isolation of this population from leopards elsewhere in Southern Africa, as Western Cape leopards appear to be significantly smaller than their northern counterparts. Apart from being almost half the mass, they also utilize far greater home ranges than previously recorded. Furthermore, a leopard density study, as determined by camera trap mark-recapture techniques, indicates that these elusive felids occur in low numbers in this region. We recommend further research on leopard ecology, farmer education in animal husbandry techniques as well as a revision of present "problem animal" legislation is order to assist in the future conservation of this threatened large predator.

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Resource Selection Function Model to Identify Habitat Suitability of Tigers in a Dry Tropical Forests of India

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Dry Tropical Forests, the largest tiger habitat, comprise of nearly 47% of the total habitat available to the tigers in India. Despite this, there have been few studies addressing their resource selection in this habitat. To understand their ecological requirements, tigers were radio tagged and monitored over a period of seven years (1997-2004) in Panna Tiger Reserve in central India. Locations of six radio collared tigers (two males and four females) were obtained three to four times a week. Habitat type (land use), distance from water, isotherm and grazing pressure were chosen to evaluate the resource selection function of the tigers. With help of GIS, these resource categories were mapped and overlaid on the location map of individual tigers. A uniform grid was generated to evaluate availability of these resources. Resource Selection Function was modelled using multivariate logistic regression using only presence data of individual tigers. The Resource Selection Function model predicted habitat suitability of tigers for Panna Tiger Reserve and its adjoining forest habitats. This model highlights the importance of water availability, presence of inviolate areas and distribution of dense forest in determining the habitat suitability for tiger. As determined by the RSF model, a large proportion of unsuitable habitat indicates that a larger landscape will be required to maintain a viable tiger population in Dry Tropical Forest. This model provides useful guidelines for the management of tiger habitat in Dry Tropical Forests.

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Review of the Status of Carnivores in Protected Areas of the Zambezi Basin, Including an Assessment of Human-Carnivore Conflict

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The Zambezi Basin is a large ecological area where little is known about the status and distribution of carnivores, and the degree of conflict with humans This paper presents the results of a review of available literature, and information from people working in protected areas, regarding the status, distribution and levels of conflict with humans of all carnivore species in protected areas that fall within the Basin The results of the survey provide a spatial link between the documented Southern African and East African regions of the African continent assisting with identifying areas of priority for conservation. In many protected areas of the Basin, the large carnivore species occur in low densities and are under threat from human activities. Some species no longer occur in protected areas where they were reported previously. Conflict with the large carnivore species is common. The distribution and status of the smaller species corresponds to historical data to a much larger degree, although the review recorded a few new locations for some species. It is clear that in some protected areas of the Basin there is a need for transboundary management of carnivores.

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A Study of Snow Leopard in Chitral Gol National Pak, Pakistan using GPS-satellite Collars and Camera Traps

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Snow leopards (*Uncia uncia*) are one of the least understood and most difficult of the large cats to study. Only two long-term ecological studies of the species have been undertaken and those used ground-based telemetry of VHF radio-collared cats in Nepal (1980s) and Mongolia (1990s). In both studies serious logistical challenges contributed to small data sets and equivocal findings. In 2006 we began collaring snow leopards in Chitral Gol National Park, Pakistan, using GPS-Argos collars. Simultaneously we initiated camera-trapping within the park to monitor all large carnivores. Initial data indicate snow leopards captured within the park frequently travel far outside the protected area (>12 km) to low elevation sites of high human density to hunt and even rear cubs. Home-ranges exceed 50 km^2. Camera capture rates (0.0035/trap-day) indicate low leopard density amid a mix of carnivores (wolves, jackal, leopard cat and fox). Video footage of collared and un-collared leopard behaviour suggests no impact on markhor hunting success (video to be shown). Background radio "noise" across central Asia has seriously impacted this and other researcher's use of Argos collars and we discuss the ramifications on this study and steps taken to ameliorate the problem.

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Thursday 20th – Afternoon, Session 6 "Tools & Methods"

Assessing Sign Surveys for Estimating or Predicting Snow Leopard Population Size

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The legendary camouflage and secretive nature of snow leopards (*Uncia uncia*) has made them difficult to monitor; however, conservation requires dependable methods to estimate abundance. We assessed the accuracy of universally used sign surveys recorded in three areas of the Tien Shan Mountains of Kyrgyzstan and China, and in the Altai Mountains of Mongolia, by comparing them with four independent methods for predicting and estimating snow leopard population size. Correlation analyses suggested that sign surveys were affected by observer bias and environmental variance. However, when such bias and variation were accounted for, sign surveys (36-151 sign occurrences/ridgeline km) were significantly correlated with photo rates (0.09-2.37 photos/100 trap-nights) and genetic individual identification results (minimum population = 3-9). Capture/recapture density estimates were highly variable (0.09-0.87 individuals/100 km^2) and were not correlated with other measures. Potential snow leopard densities based on ungulate biomass (0.9-8.7 individuals/100 km^2) were uncorrelated with other indices, perhaps due to poor ungulate density estimates and effects of snow leopard poaching. Clearly, having confidence in estimated densities, or even the detection of significant changes in the abundance, of a low-density species such as the snow leopard will require more effort and better documentation, whatever method is used.

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Female Tiger Home Range Size: a Critical Measure of Tiger Habitat Quality

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International concern for tigers reached a crisis level with reports in 2006 that tigers were extirpated from two reserves in India. Conservation funding organizations and government agencies are demanding more rigorous assessment tools to monitor tiger conservation efforts. Since 1995 tiger assessment has relied on mark recapture techniques using camera traps and presence/absence surveys based on sightings, photographs or visual observations of tiger sign. However, there are serious limitations to these techniques because of lack of independent validation of results by other field methods. We use data obtained from GPS collars placed on five resident female tigers and one resident male tiger at sites in Thailand, Bangladesh and Nepal to provide an independent estimate of tiger density based on female home range size. Home range size varied from 12 to 75 km^2 for females and was correlated to estimates of prey abundance in our study and also in the literature. Efforts to restore tiger habitat and reduce poaching are dependent on ability to monitor positive response to management intervention and negative response to continued poaching and habitat degradation. Female home range data provide a highly sensitive way to measure changes in tiger habitat quality.

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Is it Possible to Use GPS Data Clusters to Predict Lion Kill Sites?

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The use of GPS collars in radio telemetry and its potential use are on the increase, advancing from pure location data in time and space to other aspects of animal ecology. GPS clusters have been used on carnivores to determine the occurrence of kills for both puma and wolves. Here we attempt to use GPS clusters to determine the location of lion kills in the Kruger National Park. GPS collars were set to a one hour schedule during the night and a three hour schedule during the day. A GPS cluster was assumed if consecutive points were within 100m of the previous point. Approximately 50% of all GPS clusters were investigated on foot from a total of over 3300 clusters. More than 300 kills were successfully located from the clusters. Logistic Regression Models were created based on factors that effect lion hunting success and characteristics of the GPS data that suggested kill sites. Best models were derived to predict the presence or absence of kills for the lion GPS data. The results suggest that a combination of a 24 hour movement ratio, time of day and length spent in one spot can predict clusters that are confirmed kills.

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Field Immobilization of Tigers (*Panthera tigris tigris*) Using a Combination of Medetomidine and Ketamine and Reversal with Atipamezole in Panna National Park, India

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Safe immobilization of free ranging tigers is of special concern and a challenging task. Many factors such as terrain, forest cover, time of the day, season, location of the animal and most importantly psychological state of the animal influence success in tele-injection and response to anesthetic drug. Careful selection of most appropriate drug and projectile equipment is important. Five females and two males were effectively immobilized on 11 occasions using 50-60 µg/kg medetomidine and 1-2 mg/kg ketamine by i.m. injection via projectile dart. All the animals were located on kills and darted from elephant back from a distance of 15-35 meters. Duration of sedation was satisfactory for all field procedures and radio collaring. Recumbency occurred in 8-11 minutes after darting and all field procedures were completed in 30-45 minutes. Reversal of the sedation was done using 25-35 mg of atipamezole intramuscularly. Recovery was smooth usually within 10-14 minutes of i.m. injection of atipamezole. Advantage of medetomidine and ketamine combination for sedation of tigers included small drug volume for darting, rapid and smooth induction, predictable duration of sedation and ability to reverse anesthesia. It is concluded that a total dose of 10-12 mg of medetomidine and 150 mg – 200 mg of ketamine provides practical and safe immobilization of tigers in free ranging conditions.

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Predictive Habitat and Population Viability Models for Jaguars (*Panthera onca*) in the Sierra Madre Oriental, Mexico

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Due to habitat loss, it is necessary to identify areas with potential viability for endangered species. In the case of jaguar (*Panthera onca*) little is known for extreme distributional areas, making it necessary to create conservation strategies to assure long term survival. For this purpose, a spatial dynamic model (PATCH) was used to determine priority areas in the Sierra Madre Oriental, México. It was developed, with a static model created estimating mortality (human population density and paved road density) and survival (vegetation index and physiographic aspects) probability. Demographic information used, was previously published. Three scenarios were considered: actual conditions, human population growth in 15 years, and paved road density increase in 15 years. Results show that actual conditions provide sufficient habitat for jaguar survival in a 200 year span. However, increase in human population and road density will result in species extinction in a 50 year span with an increase in possible conflicts. The results of this model will help to concentrate resources into certain areas to assure long term survival for jaguar populations.

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Understanding the Effect of Study Design on Estimates of Species Density: Camera-Trapping Jaguar *Panthera onca* and their Prey

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The use of camera-trap surveys to study rare and elusive species is rapidly becoming the standard for gaining knowledge about absolute density and other population parameters. The lack of a standard approach makes comparisons between sites very difficult and results in poor assessments of conservation status at the species level. A diversity of density estimates exist for jaguar *Panthera onca*, yet patterns in the data likely reflect data collection methods and not regional variations. One reason for the variation in density estimates is the lack of standards for parameterization of variables used in a study designs, including distance between cameras, buffer zone distance, number of traps, and area sampled. In this study we examine the effect which study design can have on estimates of density for jaguar using two methods. First we conduct a literature review to understand the historical context and to explore the diversity of study design, density estimates and protocols used to date. Secondly we design an experiment by adjusting the standard parameters within a camera-trapping survey of a known population on jaguar in Costa Rica. Our findings demonstrate the need to both standardize methods in study design and develop new tools for the analysis of camera-trap data.

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Using GIS as a Tool for Understanding the Biogeography of Cats – the Roles of Volcanoes, Medicines and Ice Ages

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Many felid species have very wide geographical distributions and their external appearance and size may vary considerably as a consequence. In this paper we review the geographical variation in several felid species, ranging in size from the wildcat, *Felis silvestris*, to the biggest cats, the tiger, *Panthera tigris*, and lion, *P. leo*, using both morphological and genetic data. We also show how glacial cycles have influenced the geographical distributions of felids today, using models developed from GIS datasets of temperature, precipitation, topography and habitat. Finally we discuss the influence of geographical barriers, stochastic events such as volcanic eruptions, and ancient human impacts on the geographical distributions of some big cats, including the tiger, and how these may influence our current understanding of geographical variation, taxonomy and future conservation action.

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Development of a Non-Invasive Intra-Uterine Artificial Insemination Technique for Large Felids

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Artificial insemination (AI) is expected to become a promising tool in wild felid conservation programs. In felids, partly due to teratospermia, much better results are obtained after AI when the semen is deposited directly inside the uterus. So far, AI in wild felids has mainly been tried in captive animals, using surgery - laparotomy or laparoscopy. Such a surgical technique is too invasive to be used without any risk of post-surgical complications in wild animals living in the field. In order to develop a non-invasive AI technique, we adapted a trans-cervical intra-uterine inseminating technique. A human ureteral catheter (4 or 5 Fr) is optically guided through the cervix ostium up to the uterine horns inside a very thin human ureteroscope (Karl Störz Inc., Germany) inserted inside the proximal vagina. The duration of the entire procedure often takes less than 10 minutes. Successful trials have been made in hormonally induced oestrous large felids females: one tiger, one lioness, one leopard, one jaguar and four cheetahs. Because habitat fragmentation is an important threat to the long term survival of large cat populations, this technique would be a very useful tool for virtually restoring connectivity among isolated and distant populations, hence reducing the risk of inbreeding depression.

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Estimating Ocelot Densities in Belize Using Camera Trapping and Radio Telemetry Techinques

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We estimated ocelot density in the broadleaf rainforest of western Belize by conducting 5 camera trapping surveys from Jan 2002 – Jun 2004. To collect data on home range size, we radio collared six ocelots (three male, three female) from Sep 2003 – Aug 2004. Density estimates ranged from 10.79 to 53.68 ocelots per 100 km^2 when using traditional ½ mean maximum distance moved (MMDM) camera trapping methods to estimate the radius of an ocelot's home range. However, density estimates were negatively related to camera spacing and a final ocelot density estimate of 25.82–25.88 per 100 km^2 was determined. 100% MCP and 95% fixed kernel home ranges were determined for individual ocelots during each wet and dry season, resulting in average radii of 2.16 to 3.54 km. Male and female ocelots showed extensive home range overlap both among and between sexes. Density estimates determined using actual seasonal home range radii were lower than estimates determined from traditional ½ MMDM camera trapping methodology, suggesting that traditional methodology may underestimate density. This study provides the first density estimate for ocelots in Central America, gives new information on ocelot home range size and overlap, and highlights the differences in methodologies used to determine density.

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Does Scat Morphological Misidentification Influence Ecological Studies? A Case Study with the European Wildcat (*Felis silvestris*) in Portugal

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The European wildcat elusive behaviour and low densities make it difficult to study, thus indirect methods based on scat identification are generally applied. In these studies, species identification is based on morphological characteristics. Nevertheless, the potential identification error rates are not quantified, nor the resulting implications in subsequent studies. The recent development of DNA based techniques provide more accurate species identification, avoiding the inherent subjectivity of traditional ones. In this study, we determined error rates on morphological identification of wildcat scats to evaluate the consequent bias in habitat selection. Scats were collected in three geographically distinct areas in Portugal and were identified based on morphological characteristics by three trained researchers. Habitat composition was analysed in a 4km2 area surrounding the scats' locations. A total of 75 potential cat excrements were collected and a subset of 58 was genetically identified using a SSCP technique. Results revealed that 37% of the scats were correctly identified and misidentified scats belonged to red foxes (52%) and dogs (11%). Despite the high error rates, first results did not show significant differences between habitat selection analysis based on genetic and morphologic identifications. However, the high detected bias suggests that other biological aspects may be misinterpreted.

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Thursday 20th – Afternoon, Session 7 "Updates from the Field"

Estimation of Lynx (*Lynx lynx*) Densities in the Swiss Alps Using Photographic Capture-Recapture Sampling

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Large carnivores are conflict species and their conservation in human dominated landscapes is generally management dependent. Taking sensible management decisions requires efficient monitoring providing reliable estimates of the population size within a short time. Automatic camera trapping using capture-recapture statistics have been used successfully to estimate densities of carnivores with individually distinctive markings. We applied this methodology for Eurasian lynx during winter in three areas in the Swiss Alps: a long-term reference area of 550 km^2, a 760 km^2 area of intermediate size, and in a large area of 965 km^2. Thirty seven, 54 and 62 trap sites with two opposing cameras at each site were sampled in these areas, respectively. The model M_h fitted the capture history data well and resulted in an estimated density $(\hat{D}(S\hat{E}\hat{D}))$ of 1.53 (0.22), 1.26 (0.20) and 1.44 (0.18) independent lynx/100 km^2, respectively. Our results show that camera trapping can be applied even at low densities if the study design is carefully adapted to the habitat and the species' land tenure system. However, caution is required when extrapolating densities across areas of similar habitat as abundance can vary across ranges and scales.

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Noninvasive Genotyping for Identifying Individual Tigers (*Panthera tigris*) and its Potential for Their Population Estimation

Sandeep Sharma*, Trishna Dutta, John Seidensticker & Jesus E. Maldonado

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Tigers (*Panthera tigris*) are an endangered cat species of Asia. Their effective conservation and management requires reliable and precise population estimates, which are often difficult to obtain by conventional population monitoring methods owing to their solitary nocturnal nature and large home-ranges. Direct methods of population estimation of tigers require accurate identification of individuals that is often difficult in the wild. Here we present a noninvasive method developed to identify individual tigers by genotyping their hair and fecal samples. We screened nine microsatellite loci in 33 captive tigers. Seven of these loci were found to have high amplification rates and adequate levels of heterozygosity (Mean observed het = 0.53) and polymorphism for genotyping individual tigers with numbers of alleles per locus ranging from six to 23. We found a low probability of identifying matching genotypes for unrelated individuals (3.04 x 10-12) demonstrating the potential use of this method for population estimation and identification of individual tigers in the wild. We also present our results of experimentation involving weathering of scats and the use of various preservative media to test the reliability of genotyping old and degraded scat samples.

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Phylogeography and Conservation of Small Cats from the High Andes

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The Andean cat is one of the rarest felids of the planet, living only at high elevations within the Andes. Another species, the pampas cat, is largely distributed throughout South America and has been subdivided into numerous subspecies. However, the validity of these divisions is uncertain, as well as the conservation status of each of them. The limited information about these species severely constrained management programs. A first step toward the conservation of species integrity is to determine the population's structure. The analysis of a portion of the mtDNA control region was performed on populations from the high Andes of Peru, Bolivia and Argentina. Genetic diversity of the pampas cat revealed 44 haplotypes that clustered in six highly divergent clades. The strong geographic structure of these clades and the signal of demographic reduction detected in some of them suggest they may require a special protection status. In contrast, only three haplotypes were detected in the Andean cat. A strong geographic structure but an extremely low genetic diversity was observed. This makes the Andean cat one of the less genetically diverse cat species of the world.

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Ecology and Conservation of Five Felid Species in Thailand (1996-2003): Future Conservation Challenges for the Kingdom

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The ecology of five felid species was examined in 3 study sites in Thailand between 1996 and 2003. Leopard cats (*Prionailurus bengalensis*; N = 34), a marbled cat (*Pardofelis marmorata*; N = 1), Asiatic golden cats (*Catopuma temminckii*; N = 2), clouded leopards (*Neofelis nebulosa*; N = 6), and leopards (*Panthera pardus* N = 3) were captured and radio collared in Kaeng Krachan National Park, Khao Yai National Park, and Phu Khieo Wildlife Sanctuary. Cats were radio-tracked to determine spatial and temporal patterns, and insights into diet were gleaned through the examination of scat contents. Summary ecological patterns are presented for each species, and the threats to felids in the study areas are discussed. Although most of the wild lands in Thailand are protected, threats to wild cat populations remain, including: poaching of cats and their prey, harvesting of aloewood (*Aquilaria crassna*), and increased fragmentation and anthropogenic use of felid habitat. The long term persistence of wild cats in Thailand and subsequent conservation strategies are discussed.

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Status of Snow Leopard in Wakhan Corridor of Afghanistan – an Assessment after 30 Years.

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The endangered snow leopard (*Panthera uncia)* is known to occur in areas of Hindu Kush range in Northeast Afghanistan including Afghan Pamir ranges in Wakhan Corridor. Information pertaining to the current status of snow leopard has been lacking due to three decades of civil conflict in Afghanistan. We conducted baseline surveys in 11 valleys of the proposed Big Pamir Wildlife Reserve (PBPWR) using standard SLIM formats from 10th August to 22nd September 2006 as part of Afghanistan Biodiversity Project. Presence of snow leopard was confirmed in almost all surveyed valleys during the study. The density of snow leopard signs was estimated to be 3.69 signs/km for the proposed wildlife reserve. Based on the estimates the snow leopard density could be 1-2 animals/100 km^2. Interviews conducted with the Wakhis, local pastoral community, has indicated depredation of livestock (goats, sheep and yak etc.) during the winter season and also reported events of surplus killing by snow leopard. Mitigation of conflict is one of the most important aspects to be dealt with for the conservation of the snow leopard in the Wakhan Corridor, as loss of live stock has serious implications for local communities having very low income sources.

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Ecology and Conservation of Leopard (*Panthera pardus fuska*) in Gir National Park and Sanctuary

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We studied leopards (*Panthera pardus fuska*) in Gir Protected Area in Gujarat from 2002 to 2005 to investigate ecology and leopard-human conflict outside southern boundary of Gir. Six baited cage traps, set up randomly for 30 days, in western Gir, allowed capture of five males of which four were radio-collared. One female, rescued from outside southern boundary of Gir, was also collared and released in Gir Protected Area. Capture and monitoring data indicated male biased adult sex ratio and a high turn over in adult male population. The overall prey density, estimated by distance sampling, was 72.1±3.45 individuals/km^2 with chital being the most abundant prey species (47.8±3.2 individuals/km^2). Chital (28.8%) and sambar (26.3%) dominated leopard diet (n = 693 scats). Chital accounted for 61% of kills located during the study (n = 318). 38.2% of chital killed by leopards (n=114) were snatched by lions. Niche overlap between leopard and lion was 67%. Average male home range was 12.4±2.4 km^2 (n = 4). Male leopards showed extreme territoriality and death of one male led to range extension of another collared male. The collared female moved out and survived in agro ecosystem-human habitation complex occupying 76 km^2 area. *Canis familiaris* contributed 48% to its diet (n=45).

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Estimating Jaguar (*Panthera onca*) Density Using Camera-Trapping and Capture-Recapture Methods in the Parque Estadual do Rio Doce (PERD), the Largest Atlantic Forest Fragment in Minas Gerais, Southeastern Brazil

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Severe reduction in habitat and widespread hunting have been claimed to have decimated the populations of the jaguar (*Panthera onca*) from the Rio Doce valley of the Brazilian Atlantic Forest. To investigate this claim, camera trapping was used to verify whether jaguars were still present in the Parque Estadual do Rio Doce, the largest Atlantic Forest fragment in the state of Minas Gerais, Brazil. Between June 2004 and October 2005 a sampling effort of 2,825 trap-nights resulted in 17 photos attributed to four *P. onca* individuals. Using the M (h) model in the program CAPTURE, an abundance of 12 ± 5.86 (SE) individuals was obtained. The density estimate was calculated based on the "Full MMDM" (Full Mean Maximum Distance Moved) for estimating effectively sampled areas. This method resulted in an estimate of 4.8 individuals per 100km^2. Complementary data regarding jaguar dietary preferences and hunting pressure from humans in the park were also collected. Results identified three prey species. Hunting pressure was obtained by analyzing police records (n=133) spanning 12 years (1992-2004). Overall, 190 individuals, 107 guns and 113 hunted animals were apprehended. A majority of those arrested (68%) originated from six out of the nine municipalities that surround the park.

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Habitat Use and Selection of Geoffroy`s Cats (*Oncifelis geoffroyi*) in Three Areas of Central Argentina

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To understand habitat use and selection by wildcats is important for conservation strategies, especially where human impact is high as in most central Argentina. We aimed to study the use and selection of the habitat by radiotagged Geoffroy's cats in three areas with a variable degree of human alteration in Pampas grassland/scrubland: Campos del Tuyú Wildlife Reserve (CdT), Tornquist Provincial Park (TPP) and Los Álamos farm (LA). The average home range sizes were 3.43 ± 1.83 km^2 at CdT (n = 303 locations, four individuals), 7.67 ± 2.27 km^2 at TPP (n = 254, three individuals) and 2.08 ± 2.21 km^2 at LA (n = 371, four individuals). Habitats with the most dense vegetation coverage were the most frequently used: dense grassland at CdT (78,2% of locations, no selection), dense wood patches of exotic trees at TPP (47,4%, positive selection) and dense natural scrubland at LA (25,3%, positive selection), where also natural grassland and open scrubland were often used (21.6% and 21.3%). On average, habitat selection tended to increase with the level of human alteration of the area. Although *O. geoffroyi* shows a certain degree of flexibility in its use of habitat, patches with dense vegetation coverage, which could offer both shelter and availability of prey, appear to be important.

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Using Dogs to Monitor Amur Tigers in Russia

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We used scent-matching dogs to identify individual Amur tigers by scats to monitor tigers on Lazovsky State Nature Zapovednik (LZ). LZ is a key habitat for tigers in the Russian Far East. We located scats by snow-tracking tigers and by using scat-detection dogs during snow free periods, and we estimated tiger abundance using mark-recapture methods. Used correctly, we found that scent-matching dogs can accurately identify individual tigers an average of 98% of the time. In 2005, we collected 137 scats during mark-recapture surveys and identified 10 adult tigers 40 times over eight capture occasions. The best fit model (M <th>) using the program CAPTURE resulted in an estimate of 10 tigers (SE = 0.82) with a 95% confidence interval of 10 to 14 individuals. Our results illustrate how using scent-matching dogs to identify individuals in conjunction with mark-recapture sampling methods can be a useful technique for population monitoring of Amur tigers, as well as other cat species. This method may represent an alternative to genetic analysis or remote cameras when those techniques are impractical or ineffective.

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The Status of the Leopard (*Panthera pardus*) in the Congo Basin

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The status of the leopard in the rain forests of the Congo Basin remains a matter of controversy. While authors of earlier status surveys described this region as a stronghold for the species, and estimated that above 40% of Africa's leopards occurred in these forests, recent evidence suggests that leopards are indeed one of the main casualties of Central Africa's bushmeat crisis, and have consequently become locally extinct in numerous forest sites on the fringes of the Congo Basin. Here we present field data collected on leopards in four rainforest sites in Gabon, which differed in the amount of human disturbance they received. Leopard population density and mean leopard prey weight was highest in a remote national park, and leopards were absent from a site frequented by commercial bushmeat hunters. We identified a linear relationship between leopard population density and the distance from permanent settlements, and incorporated this relationship into a leopard population model which we designed for Gabon and the remaining Congo Basin countries. While the status of the leopard seems satisfactory in most of Gabon and the Republic of Congo, our model suggests that the species is almost extinct in southern Nigeria, south-western Cameroon, and Equatorial Guinea.

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Felid Biology and Conservation Conference

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POSTER PRESENTATION ABSTRACTS

Listed in order of presentation

Poster Session A

ECOLOGY

Analysis of Factors that Affect Jaguar (*Panthera onca*) Abundance Along its Distribution

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A few studies have determined jaguar density, where available data shows a great variation between study areas, where authors consider a similar density along the entire jaguar range. The present study reviews 23 studies using the number of sightings, as they relate to density, and to avoid any methodology biases and increase samples size. In the case of track collection, only hunted animals were used to avoid overestimation. Factors such as temperature, precipitation, study area size, and length of study were analyzed. The number of sightings was plotted against latitude, to determine patterns throughout jaguar distribution. We show that temperature and precipitation had no effect on jaguar distribution, which can be explained through similar environmental characteristics in all studies. In the other hand study area size and study length have a strong relationship with number of sightings. This indicates that differences between studies could be related to site pre-selection with high densities. Similarly, we observe a trend to have a concentration of sightings in certain areas, which can be translated as a metapopulation distribution. Further research is needed to comprehend jaguar concentrations and their temporal dynamics. With this information, a series of reserves could be proposed along the continent.

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Energy Needs of Bobcats (*Lynx rufus*) in an Arid Environment in México

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Most felids, as is the case for bobcats (*Lynx rufus*), meet their daily energy demands through a strict meat diet. Thus the energetic demand for bobcats dictates the number and types of prey an individual needs to capture and consequently the survival of individuals in an area. In extreme desert environments little is known about the energetic demand of this species. We estimated energy demand of bobcats in the Chihuahuan Desert of Mexico by first estimating their daily activity levels with GPS collars. We then estimated the energy demand with the model: E_a = 5.8(kcal/kg*h)*$W^{0.75}$(kg)*t(h) + 2.6(kcal/kg*km) *$W^{0.60}$(kg)*d(km); where *W* is the weight of the individuals, *t* is travel time and *d* is distance travelled. Preliminary estimates of mean daily energy budgets are 483.8 and 458.2 kcal/day for female and male bobcats respectively. To sustain this demand, a female bobcat needs to annually consume 327.8 hares or 2971.3 mice and a male cat will need 346.1 hares and 3137.3 mice. This information is important in understanding how bobcats can survive in desert environments and coexist with similar carnivores as coyotes. These data on the minimal energy requirements are also important in the conservation of this species in desert environments.

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Using the Landscape of Fear to Analyze Habitat Use of Bobcats in the Chihuahuan Desert of México

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Bobcats are one of the wider ranging felids in North America, living in diverse ecosystems from temperate and tropical forests to deserts. They are a stalking predator often associated with rocky habitat and dense vegetation. Although those habitat characteristics are uncommon in deserts, in the Mapimí Biosphere reserve, Chihuahuan desert, bobcats are common predators. The question is how they survive in this environment. Based on the theory of optimal foraging, we predicted that bobcats are seeking out the limited rocky and densely vegetated "islands" that occur in the desert. Based on the theory of the landscape of fear, we further predicted that their prey (lagomorphs and rodents) will use these islands less than surrounding areas. We tested the first prediction by fitting bobcats with GPS collars to track their half-hourly movements over 24 hours. We are testing the second prediction by estimating the abundance of prey inside and out of areas of high use of bobcats. Preliminary data support the first prediction in that bobcats are using areas of dense vegetation. If the prey abundance data support the second prediction, then the landscape of fear model can help explain how bobcats are surviving in the desert environment.

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The Distribution, Ecology and Behaviour of Leopards in Sri Lanka: Does the Absence of Intra-Guild Competition Matter?

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Intra-guild competition is a wide-ranging phenomenon that can strongly impact the ecology and evolution of carnivores, particularly the subordinate species in an interaction. Understanding how this competition affects the distribution, population structure, space use and behaviour of top predators is vital for effective species and landscape level management. In Sri Lanka, the endangered leopard (*Panthera pardus kotiya*) has been the top predator for at least 5 000 – 10 000 years, providing a rare opportunity to investigate the ecological ramifications of the long-term absence of intra-guild competition. We used individual observations, camera traps and spoor analysis to investigate island-wide distribution, and study the ecology and behaviour of leopards in the arid-zone Ruhuna National Park (RNP). Leopards are widely distributed in Sri Lanka, including protected and unprotected areas. The RNP density (17.9/100 km^2) and male home range size (22.5 km^2; n=3) are consistent with those of populations where intra-guild competition is present, and together with small female core areas (1.58 km^2; n=4), appear primarily influenced by prey density. Leopards here are predominantly solitary and nocturnal, like most populations undergoing intra-guild competition. Kills were irregularly cached in trees, consistent with areas with few or absent larger competitors, or where the dominant competitor is a competent climber.

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Diet and Prey Profiles of Three Sympatric Large Carnivores in Bandipur Tiger Reserve, India

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Biodiversity conservation entails that the tiger, one of the key umbrella species, is protected. Scientific studies on food consumed by the tiger and other carnivores will lead to better understanding and will also help design efficient conservation strategies. To this end, a field study of diets of three sympatric large carnivores, the tiger *Panthera tigris*, the leopard *Panthera pardus* and the dhole *Cuon alpinus* was conducted by us in Bandipur Tiger Reserve, India. We collected and analysed 381 tiger, 111 leopard and 181 dhole scats. Using regression equations, frequency of occurrence of prey items in these scats was converted to relative biomass and number of prey consumed. Our results showed that almost 88-97% of biomass consumed by these three predators is provided by ungulate species. We observed some specialized predation and also an overlap of the dietary niche among them. Importantly, 73% of biomass consumed by tigers, was provided by large ungulates, gaur and sambar, whereas medium sized chital and wild pig formed 65% and 83% of the biomass intake of leopards and dholes respectively. Our study supports the prediction that the abundance of ungulate species in different size classes is responsible for facilitating sympatry amongst the three predators.

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Spacing Pattern and its Dynamics of the Iriomote Cat

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The Iriomote cat, *Prionailurus bengalensis iriomotensis*, is a small felid endemic to Iriomote-jima Island (284 km^2) in the Ryukyu Archipelago, Japan. The home range and spacing pattern of the population in this cat have been investigated by radio-tracking and photo-trap since 1983. We summarized all data on home ranges obtained from 1983 to 2006 and estimated the spacing pattern and its dynamics. Iriomote cats were basically intrasexually territorial. Home range size varied among areas and among seasons, being affected by habitat conditions and reproductive behaviour. Females had small fixed home ranges and normally stayed in the same area for several years. Although home ranges of males were usually larger than those of females and sometimes they expanded during mating season, they were affected by the distribution of females. Furthermore, two types of males were observed: residents and transients. Transient males moved long distances and some of them were able to establish home ranges in vacant areas. Despite of home range shifts between individuals, the spacing pattern in the Iriomote cat was generally stable little even when the individual cats alternated as long as the habitat conditions remained unchanged.

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Snow leopard in Himalaya: Resource Partitioning and Coexistence with Tibetan Wolf

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Niche partitioning facilitates coexistence of sympatric large carnivores in any ecological community. Snow leopard (*Uncia uncia*) and Tibetan wolf (*Canis lupus chanco*) are highly endangered sympatric carnivore species of Himalaya, Tibetan plateau and other parts of central Asia. In an attempt to understand more about coexistence of these two top predators of Himalaya, we studied their food and habitat niche partitioning and resource sharing, by examining distribution pattern and microscopic analysis of their scats. We used multivariate statistical models developed in conjunction with habitat information in GIS domain. It was found that both species have a high degree of dietary overlap, but the two species tend to coexist by segregating their habitat. Snow leopard were mainly concentrated in closed, broken terrain with minimal amount of human disturbance; however wolves mostly use open, rolling terrain and does show some tolerance to human disturbance relative to that of snow leopard in our study area. Habitat openness and land form ruggedness were two main predictor variables responsible for differential habitat use and habitat separation of both species. Our study results provide important ecological info

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Assessing Habitat Suitability for Tiger (*Panthera tigris*) and its Prey Species in the Indian Part of Terai Arc Landscape

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The tiger (*Panthera tigris*), large carnivore of the cat family, with its special habitat needs such as abundant large wild ungulate prey and undisturbed habitats, cannot be saved in small forest fragments. We developed Habitat Suitability (HS) models using logistic regression for tiger and its four major prey species, sambar (*Cervus unicolor*), chital (*Axis axis*), nilgai (*Boselaphus tragocamelus*) and wild pig (*Sus scrofa*), in the Indian part of Terai Arc Landscape. This Landscape was surveyed for tiger and its prey species and sampling of foot transects (1001.2km), 887 and 1530 circular plots for pellet groups and vegetation, respectively, were carried out. Prey models were included in developing tiger model. Models were evaluated with separate data sets. This study revealed that this biologically rich habitat, which was contiguous in the past, is fragmented and tiger habitats are in nine blocks connected by 12 potential corridors but it makes only five units when connectivity with Nepal considered. HS model for tiger showed prey species and habitat features were effective predictors. HS models for prey species showed habitat features (e.g., dense forest, tall grass, open forest, river and elevation) and disturbance factors (e.g., village and road) were effective predictors.

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Feeding Ecology of European Wildcat in a Mediterranean Area with a Low Mammalian Prey Abundance

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We studied the diet of European wildcat (*Felis silvestris silvestris*) in the Mediterranean mountain of *Port de Tortosa i Beseit* Natural Park, Catalonia (Spain). The analysis of the faeces (n = 99, 452 prey items) shows that in this environment, where rabbit is absent and small mammals diversity and abundance are very low, the wildcat prey mostly on small mammals, mainly on rodents (81% of prey), specially on wood mouse, *Apodemus sylvaticus*, and birds (7,5% of prey). The wood mouse represents 74,8% of the prey, being the 4 and 3 (59,9% and 20,4%) the most consumed age classes. It is the primary prey (66,7%; 75,0%; 80,7% and 75,9% of preys consumed in spring; summer; winter and fall respectively) and the most abundant species in the area in every seasons. Our work reveals an extremely high consumption on wood mouse, compared with other Mediterranean areas where the rabbit is scarce or absent and it feeds on rodents. In conclusion, this work shows the wildcat as an opportunistic mammal predator, preying mainly on the most available small mammal prey, although the low diversity and abundance of mammals.

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Philopatry, Dispersal and Static Interaction in Serengeti Cheetah

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Social interaction within populations can affect resource dispersion, home range placement and inter-specific agonistic behavior. Within protected areas it is important to understand dispersal behavior where it may expose individuals to external risks. Little is known about cheetah (*Acinonyx jubatus*) dispersal behavior on the Serengeti Plains. We used data for 240 female and 315 male cheetah between 1969 and 1994. We tested for dispersal using MRPP, and examined static interaction using MRPP, simple overlap metrics, and Spearman's Rank Order Correlation Coefficient (rs). 17% of females and all males shifted between juvenile and adult ranges, with most males present as only juveniles or adults. Using Kernel Density Estimation, fewer unrelated than related pairs overlapped in lifetime and core ranges. Degree of overlap differed significantly between unrelated and closely related pairs. Overlap in unrelated pairs decreased during the wet season and increased during the dry season. 70% closely related and only 27% unrelated pairs showed attraction, while no related pairs and 16% unrelated pairs showed avoidance. We conclude: degree of relatedness and seasonal resource distribution influence area requirements, health and hunting success of females in this population. Future research could focus on the movement of dispersing males and potential for metapopulation dynamics.

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Small Felid Community Study in a Dry Forest

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Camera traps have become an important source of information for cryptic/nocturnal species. From January 2002 to January 2005 we set 24-32 pairs of camera traps in two-month systematic sampling efforts, two or three samples per site, at four dry forest study sites in order to study carnivore/felid abundance. The sites ranged across a precipitation gradient from 400 to 800 mm/year. Individual ocelots (*Leopardus pardalis*) and Geoffroy's cats (*Leopardus geoffroyi*) could be identified from pelage patterns, allowing density estimates applying capture-recapture methodologies, but this was not the case for jaguarundi (*Puma yagouaroundi*). We found that density of ocelots is greater in wetter habitats and declines in drier habitats, whereas Geoffroy's cats are scarce in wetter habitats and become more abundant as precipitation declines. We found no relation between ocelot and jaguarundi abundance, and only a very weak negative correlation between abundance of Geoffroy's cats and jaguarundis respectively. Body size, activity, and abundance (photos/1000 night traps) versus density comparisons are discussed.

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The Ecology of Eurasian Lynx Depredation on Domestic Sheep in Norway: Are Sheep Prey, or Just Something That Gets in the Way?

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Livestock depredation is a major source of conflict with large carnivores. In Norway, compensation is paid for between 5000 and 10000 sheep each year following lynx depredation. In this study we aimed to understand the ecology of lynx depredation on sheep in a boreal forest habitat where sheep were grazed in the forest without any form of protection. The study involved the radio-collaring and intensive tracking of 42 Eurasian lynx in Hedmark county, SE Norway from 1995-2000. Our results included the following (1) Despite a very low density of alternative prey sheep did not constitute a major source of food, (2) Most sheep were killed as a form of surplus killing, and were not consumed to the same extent as wild prey, (3) Male lynx killed more sheep than any other age class of lynx, (4) Lynx did not select sheep grazing areas - their movements selected for areas of high wild prey density, (5) Shooting lynx only a minimal losses on subsequent depredation except in cases where the population was reduced. All in all the results allowed us to reject the claims that sheep were regarded as a normal prey. It appears that sheep are simply killed when they are encountered by lynx when they are searching for wild prey. However, the results are likely to be highly context dependent.

Ecological Correlates of Lion Home Range Size in a Dystrophic Savanna Ecosystem

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Understanding variation in animals' home range size is of importance to management and conservation. In lions, one comparison of different populations suggested that home range size is negatively correlated to prey availability, however little is known about such variation within populations. Most behavioural studies on lions have been undertaken in eutrophic savannas. Here, we describe the ranging behaviour of lions from one population in a dystrophic savanna, Hwange National Park, Zimbabwe. We show that home ranges are larger than in eutrophic ecosystems. We also document that pride home range size increases as pride biomass increases. Once controlled for pride biomass, pride home range size decreases as prey availability increases, confirming that this relationship is consistent across spatial scales. Male home range size was less influenced by prey availability but was influenced by the number of females within a male home range. No seasonal difference in home range size was apparent, but lionesses tended to have smaller home ranges when annual rainfall was lower and hence prey abundance was higher. This suggests that pride ranges probably respond to changes in food availability at the annual level. Finally we show that the abundance of buffaloes, and to a lesser extent kudus, has a greater influence on the size of lion ranges than other herbivores species.

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Habitat Suitability for Jaguar and Puma in Southern Atlantic Forest of Brazil Inferred from Proportion of Area Occupied and Prey Richness.

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Two month-long expeditions to the southern Atlantic forest of Brazil were conducted in 2006. Parameters collected from vestiges and camera-trap sampling were mammalian prey richness and proportion of area occupied (PAO) by jaguar and pumas. Eight quadrats 4 x 4 km were sampled, over an area of 130 square kilometers, where fourteen species of mammals were recorded (CI ($\hat{N}$)=14 to 14, CAPTURE). Capture probabilities from PRESENCE were high for puma (p=1), but low for ocelot (p=0.15, SE=0.08) and for jaguar (p=0.1, SE=0.07), resulting in estimated PAOs of 25% for puma, and 100% for both jaguar and ocelot. It is argued that jaguar were expected to have capture probabilities similar to puma, as they both leave signs on open trails when present. The resulting PAO for jaguar PAO is thus likely to be an artifact derived from low area fidelity and/or low density, rather than a product of its low detection probability. This conjecture is substantiated by the low frequency and non-detection of important prey species in many of the sampling quadrats. Results do not diminish the importance of the study site, instead, these observations objectively identify the need to restore prey populations in the area.

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FELIDS & PEOPLE

Spatial-Temporal Range-Use Pattern, Livestock Predation and Conservation Needs for the Tarangire Lions in Northern Tanzania

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The long-term conservation prospects for lion populations in many migratory ecosystems will depend on resolving conflicts with humans. We analyze the seasonal movement patterns of lions in the greater Tarangire ecosystem and assess how such patterns influence livestock predation. While the Tarangire lions remain safely within the confines of the National Park in the dry season, they spend considerable time outside the park in the wet season. The neighboring Maasai suffer extensive livestock depredation during the wet season, and they retaliate by killing lions in proportion to the number of livestock killed. Between January 2004 and July 2005, 76 lions were killed by pastoralists in retaliation against livestock predation, while 215 livestock including cattle, shoats, and donkeys and dogs were attacked by lions. We are testing several intervention strategies that directly reduce livestock predation rates, as well as education programs to pastoralist communities, incentive and outreach programs that increase pastoralists' tolerance to carnivores, and governmental policies that expressly address human-carnivore conflicts.

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Incorporating Caracal Feeding and Ranging Behaviour in the Management of this Damage-Causing Carnivore

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Despite its wide distribution, importance as a medium-sized predator and notoriety as a stock raider, little is known on the use of prey and space of caracal *Caracal caracal*. This applies not only to pristine or conserved areas, but also to farming areas where caracal can be the major predator on small stock, and can cause substantial losses. We have studied the prey use, density, territorial behaviour and short term use of space of caracal in a conservation and a small stock farming area in relation to prey available. The results obtained can be used as a baseline against which to gauge the effect of caracal depredation on small stock in farming areas where its natural prey base is depauperate. Our contribution furthermore gives a summary of studies conducted by the authors relevant to the control of this damage-causing predator. The abovementioned studies have contributed to a holistic research programme that aims to improve methods and procedures to manage caracal, reduce the financial impact on the livestock industry, and address the issue of biodiversity/ecosystem conservation in livestock areas. Subsections of the programme are further explored, highlighting opportunities for collaboration within and between a number of research fields.

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Promoting Local Conservationist Networks to Deliver Action across Tiger Landscapes: an Example from Central India

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The Satpuda forests of central India harbour seven Tiger Reserves connected by forest corridors, the largest block of tiger habitat in India. With the realization that the region offers one of the best prospects for tiger conservation, a handful of local organisations and conservationists have teamed up to establish the Satpuda Landscape Tiger Programme (SLTP). The network of partners helps to coordinate and optimise activities to deliver long-term solutions for the protection of Satpuda tigers. SLTP works by directly protecting wildlife while addressing some of the most urgent needs of the people living close to tigers. This innovative approach operates by restructuring existing projects into a network working across a landscape, funding specific needs and developing better communication between them, government agencies and local communities. While partners retain their identity, good ideas are shared and their implementation expanded accordingly. Dedicated conservationists are rewarded through Conservation Empowerment Bursaries, enabling them to focus all their energy on their conservation work. Some of SLTP early successes include improved gathering of intelligence and conflict data, tiger surveys outside reserves, enforcement and health workshops, as well as a mobile Health Unit and an Education Unit that service local communities across the Satpuda landscape.

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Modelling Hotspots of Human-Jaguar Conflicts in Latin America

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The jaguar (*Panthera onca*) occurs in a variety of habitats throughout Central and South America, including forests, swamps, grasslands and areas adapted for cattle ranching. Predation on livestock occurs frequently and conflicts with farmers are widespread. With a shortage of undisturbed habitat for jaguars, reliance on range outside protected areas is inevitable. Jaguar-human conflicts occur in all 18 range states, but their characteristics vary greatly and are determined by ecological, economic and sociological settings. This paper presents the results of a large-scale survey of jaguar-human conflicts across the range. A meta-analysis using GIS datasets of variables that influence the frequency of conflict, such as habitat type, land-use, human geography, protected area coverage and jaguar distribution is combined with results from a quantitative survey of jaguar conflicts across the range. Spatial analysis of these conflict hotspot maps allows us to present a predictive model, providing an understanding the spatial dynamics influencing the emergence of conflicts, as well as to simulate the probability of an area becoming a conflict hotspot in the future. Such a model is a useful tool for land-use and strategic planning in the conservation of large cats, especially for populations outside protected areas.

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The Value of Lion as a Component of the Photographic/Non-Consumptive Tourism Market

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The value of lion to photographic tourism was investigated using a survey of questionnaires put to tourists visiting lodges within and surrounding Hwange National Park, Zimbabwe. Responses elicited from subjective preference and contingent valuation indexes revealed that lions were indeed the most sought after animal in Hwange. Furthermore, tourism related revenue would suffer a 22.4% loss if there were no lions in the park. The value of lions (species at the population level) as a component of the photographic safari product offering was estimated at US$80,000.00 per lodge, per annum at the reduced volume of tourism prevalent in Zimbabwe today (occupancy average of 36%). Some tourists were prepared to pay an average of US$21.00 for a guaranteed lion sighting, although the method of providing a guarantee was not elucidated.

Linking Human Activities and Unprovoked Lion Attacks in Southeastern Tanzania

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Human-wildlife conflict is one of the greatest threats to wildlife conservation worldwide. With the human population expanding, an increase in conflict with wildlife has led to an increase in retaliation against offending species. This is particularly true for African lions (*Panthera leo*), which not only threaten peoples' livelihoods through livestock depredation but also peoples' lives. In Tanzania, almost 600 people have been killed and over 300 injured in unprovoked lion attacks since 1990. Half the attacks occurred in the southeastern portion of the country, and within this region, particular areas experienced intense conflict while others were conflict free. Previous studies found that people were at highest risk while sleeping in makeshift huts in agricultural fields, walking at dawn and dusk, and using outdoor toilets at night. Results from a study in 12 villages across three districts indicate that people perform these activities in different ways across districts and even between villages in the same district. Thus, people in different areas may be at risk for different reasons, and local variations in human behavior may explain why some villages experience attacks while others do not. Such information may provide new approaches for preventing lion attacks in the future.

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The Role of Human Attitudes to Big Cat Conservation: Colombia as a Tropical Example

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Jaguars, pumas and ocelots are threatened by processes resulting from human activities, mainly habitat loss, retaliatory hunting and prey competition. Evaluating and acknowledging human attitudes, which drive these processes, will contribute to cat coexistence and conservation. We

present data on questions about attitudes towards big cats, ranging from rural school children to Andean pumas (n=50), Llanos cattle ranchers to jaguars and pumas (n=37), and indigenous Amazon communities to jaguars, pumas and ocelots (n=70). Questions deal with coexistence of cats and people, conservation, depredation, hunting and management, abundance, and admiration. Most respondents (70%) would like to see a large cat, although less than 55% like sharing their land with felids and there is a general opinion (83%) that cats should survive but "not in my backyard". Ranchers think it is important to conserve jaguars (64%) and prefer to share their lands with them than with pumas. Although, 37% consider jaguars a problem animal. Amazonian Indians prefer sharing their land with ocelots (89%) than with jaguars (40%). Half of all interviewees think jaguars attack unprovoked, 77% have heard of attacks and 75% fear it. Llanos and Amazon cat abundance is perceived as decreasing but Andean puma as increasing. Admiration prevails among respondents.

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Human–Wildlife Conflict, Unequal Knowledge, and the Failure to Conserve the Zanzibar Leopard (*Panthera pardus adersi*)

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Panthera pardus adersi is (or was) a little-known subspecies endemic to the main island of the Zanzibar archipelago, Tanzania. Rapid population growth and the expansion of farming in the 20th century destroyed leopard habitat and decimated their natural prey, bringing them into increasing conflict with people. Villagers responded by initiating campaigns designed to exterminate leopards and punish the witches believed to be using them to attack people and their livestock. Officially sanctioned leopard killing continued into the 1990s, by which time some international authorities had declared the Zanzibar leopard extirpated. When an integrated conservation and development project in Zanzibar began to take an interest in leopard conservation, they were advised by external consultants that it was too late to save this beleaguered felid. But Zanzibaris continue to allege the presence of leopards, and some government officials express the hope that leopard-keeping witches can be persuaded to display their charges to fee-paying tourists. Conservationists have failed to reconcile these conflicting ideas, and have failed to conserve the leopard itself. We argue that this case raises uncomfortable questions about the effectiveness of orthodox conservation initiatives when human–wildlife conflict is compounded by conflicting scientific and indigenous knowledge about endangered species.

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Leopard Population Dynamics, Sport Hunting and Conservation in the Soutpansberg Mountains

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The leopard (*Panthera pardus*) is heavily hunted across South Africa, both legally and illegally. Few data exist, however, on population numbers and thus current hunting pressure may be unsustainable. Wildlife management authorities wish to increase legal hunting of leopards but have

no information on leopard population density to support this decision. Most leopards are killed as livestock predators and are viewed by landowners as a drain on economic resources. However, sport hunting can be used as a tool to conserve leopards if local communities profit from it and off take numbers are sustainable and based on empirical data from population studies. Money gained by landowners or local communities from selling hunting permits can be used to offset stock losses, be channelled back into the community, encourage the toleration of leopards on private land and prevent illegal poaching. Our current study is utilising extensive camera trapping to obtain information on leopard population dynamics and inform sustainable management decisions. These data will be integrated with a detailed study of local attitudes to leopards to investigate the effectiveness and potential of sport hunting as a conservation tool.

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Determination of the Diet in a Free-Ranging Cheetah Population Living on Farmland in Namibia

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Cheetahs on Namibian farmland are considered a threat by farmers to their economic revenues from livestock and wildlife, leading to the indiscriminate elimination of cheetahs. To help assess the economic cost of cheetahs on farmland, we determined their diet composition on the basis of faecal samples. Prey identity was determined by creating imprints of hair in faeces and comparing these with reference specimens of hairs from known prey species. Imprints were created using celluloid plates; a quick and simple method. To obtain quantitative information on diet composition the proportion of hair from different species in faeces was corrected for prey size. This calibration was determined by offering 13 captive cheetahs individuals of different prey species of known weight and collecting all faeces produced. We found a logarithmic relationship between the mass of the prey animal offered and the mass that was consumed of it to produce one faeces. Application of this calibration to faeces from free-ranging cheetahs revealed that livestock comprised only a small proportion of the cheetahs' diet. However, the diet composition strongly depended on whether cheetahs were assumed to have fed on juvenile or adult prey animals and whether prey was completely or partially consumed.

The Impact of Local Attitudes, Ecotourism and the Media on Big Cat Conservation

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Big cat populations are declining around the world. They need space and a sustainable prey base; both increasingly threatened by human development and population growth, but their eco-pulling power and high media profile can significantly enhance their conservation prospects. The iconic status of big cats makes them attractive to the media and tourists alike. They are charismatic species representative of particular habitats; consequently people can relate to them and are

interested in preserving them. The study involved three species in three different geographical locations: Royal Bengal Tiger *Panthera tigris tigris* in Sundarban, Bangladesh (1985 – 2005), Snow Leopard *Uncia uncia* in the Altai Republic, Russian Federation (2003 – 2006) and Arabian Leopard *Panthera pardus nimr* in Musandam, Oman (2005 – 2006). All cases involved surveying and monitoring remote study sites, subject to high levels of poaching and human disturbance. Local people were involved from the outset. Their livelihoods and Religious/Cultural traditions were documented with particular emphasis on the role played by the study species in the Muslim, Hindu, Christian and Animist cultures. The ways in which tourism influenced local people, livelihoods and wildlife was assessed, together with the efficacy of media exposure in raising awareness and influencing conservation of the study animals.

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A Study of Livestock Depredation by Tigers in and Around Buffer Zone of Corbett Tiger Reserve

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We studied livestock depredation by large carnivores in and around buffer zone of the Corbett Tiger Reserve, India in 2002 and 2003. Blocks in south and south east of buffer zone had highest abundance of tigers accounting for 36.5%, 43.5% and 44.7% of tiger population in 1999, 2001 and 2003 censuses. A total of 311 livestock kills and injuries were recorded out of which 61% livestock kills and 18.6% injuries were by tigers. A total of 30.5% and 69.5% of livestock kills were recorded inside and out side of buffer zone respectively. Majority of the livestock kills were recorded on south and southeast portion of buffers zone also having highest tiger abundances in three censuses. Livestock depredation increased significantly in rainy season. Tigers killed significantly higher number of cows than buffalo in buffer zone. The distribution of livestock kills showed significant differences in terms of sex of prey species, weight categories, vegetation types, topography, tree and shrub cover, distance to water and human settlements. Analysis of 38 tiger scats collected from buffer zone showed chital (47.9%) and sambar (14.6%) as dominant prey species with very low contribution of livestock to tiger diet which is in contrast to the observed pattern of livestock depredation.

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Puma and Farmer Interactions: a Multi-Scale Approach in Three Eco-Regions of the Chilean Andes

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Pumas (*Puma concolor*) prey on livestock along the west side of the Andes of Chile. The resulting conflict between pumas and livestock owners, promotes the hunting of this protected species. We report ongoing research using camera traps, scat analyses and interviews of farmers in three different eco-regions, the Altiplano (18 SL), Mediterranean (36 LS) and Temperate Rainforest (38 LS). Stakeholders and livestock owners in each of these different study areas belong to three distinct ethnic groups (i.e. respectively, the Aymara, Mapuches and descendents of European colonists). In the temperate rainforest, camera sites were located in a large fragment >5 km from each other and at different altitudes (i.e. 400, 800 and 1000 masl). Camera trapping days ranged from 48 ± 2.1 to 75 ± 32 at each camera site with an average interval between photos of 31.3 ± 14.6 days. A total of 147 photographic captures were registered. Pumas (7% of total pictures) were detected mainly in large fragments between 4:00 and 7:00 am during winter of 2006. In addition to pumas, the cameras captured photographs of five native mammal species distributed in two orders, four Carnivora and one Artiodactyla. Also, feral dogs (18.4% all pictures) and three exotic species were detected, including wild boar (*Sus scrofa*), brown hare (*Lepus capensis*) and European rabbit (*Oryctolagus cuniculus*). In the Mediterranean ecosystem, puma diet mainly consists of hares (96% of faces content) followed by small percentages of sheep (5.3%) and foals (3.5%) (n=120 scats). Current pilot work in the altiplano region includes workshops with school children about puma conservation and other species. Interviews of farmers are ongoing in all three regions and will allow comparisons between the different ethnic groups. *Project funded by The Darwin initiative, CONAMA & The Wildlife Trust Alliance.*

Highway and Diseases Threatening the Conservation of Felids in the Pristine Forests of the Anden-Amazon Region of Southeastern Peru.

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The Interoceanic Highway, connecting Brazil to the Pacific, is under construction. Catastrophic impacts have been predicted for the high biodiversity forests of the western Amazon and eastern Andes. In Peru, the highway will bisect a globally important complex of protected areas where at least seven species of cats occur. Surveys of domestic dogs and their diseases inside and around two of the largest and pristine national parks in the region (Manu and Alto Purus National Park, with ~4.5 million ha) show that there is no control of domestic animals inside these protected areas and that canine parvovirus and distemper (which has been demonstrated as a potential threat to large felids) occur widely in the domestic dog population, even in the most remote parts of these parks. Contact between domestic dogs and wild felids are often reported by local people. Rabies poses an additional threat, with transmission from vampire bats a potential threat, as demonstrated by camera trap evidence of a vampire bat attacking a puma, and high levels of infection in vampire bats resulting in ~20 recent human deaths recorded in the region. In this study, we propose a series of management measurements to minimize adverse impacts on wild felid populations, addressing issues associated with control of domestic animals and their diseases, maintenance of habitat next to the highway, underground passages for wildlife and economic alternatives for the local people based on ecotourism opportunities.

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GENETICS, SYSTEMATICS & MORPHOLOGY

Non-Invasive Monitoring of Steroids in Hair: the Domestic Cat as a Model

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The long term monitoring of steroids' production may provide crucial information on the reproductive biology, the social status and the welfare of wild animals. However, researchers have only limited opportunities to collect biological samples in the field, and currently sampled tissues, secretions or excreta (faeces, serum, saliva, urine) can at best deliver information on the endocrine profile of the previous 24-48 hours. The determination of steroids in hair presents several advantages: hair is easily and non-invasively sampled, does not entail health concerns, is conveniently preserved, and supplies a measure of the hormonal activity averaged over a chosen period, insensitive to the impact of acute stress, included that caused by handling and restraint during sampling procedures. A two-point sampling (shave and re-shave), that can be profitably applied during capture and recapture, provides accurate timing of data, but even shed hair or hair caught in hair traps may still grant precious indication of the individual's hormonal profile. Here we relate on our attempt to validate this method by comparing cortisol', testosterone' and progesterone's levels determined in the hair and in faeces of the domestic cat (*Felis silvestris catus*) considered as a model species.

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Genetics as a Conservation Tool for the African Lion, *Panthera leo*, in Zambia

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The African lion, *Panthera leo*, is a key feature in Zambia's tourism industry, with both non-consumptive (photo-tourism) and consumptive (trophy hunting) tourism vital to the national economy. Zambia's Luangwa Valley is a prime area supporting both of these activities. However, the dense vegetation and sparse road network in much of the region make it difficult to accurately assess the lion population. As a result, the long-term sustainability of current levels of trophy hunting is unknown. Working in partnership with the Zambia Wildlife Authority (ZAWA), I utilized genetic data in conjunction with field surveys and operator interviews to estimate population size and determine movements of lions between fully protected areas (National Parks) and adjacent non-protected areas (hunting blocks). Mitochondrial DNA was used in assigning trophy male lions taken in hunting blocks to their natal prides. Microsatellite data were used to identify individual lions and estimate population size. The goal of this study was to provide empirical data on lion populations in Zambia from which sound lion management policies, including sustainable hunting quotas, can be developed. Future research, including additional sampling of resident prides within the hunting blocks and radio-tracking of adolescent and adult males, will further refine these results.

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Assessment of Semen Quality and Sperm Cryopreservation in the Iberian Lynx (*Lynx pardinus*)

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Iberian lynx is critically endangered and the remaining two populations are threatened by inbreeding depression. A captive breeding programme has been initiated along with a genetic resource bank and the development of assisted reproductive techniques. Semen evaluation provides information about male reproductive potential. Sperm cryopreservation allows the exchange of genetic material within and between natural and captive populations through artificial insemination and *in vitro* fertilisation (IVF). Samples from dead animals create new reproductive opportunities. Since 2004 we have performed 17 electroejaculations under anaesthesia on seven different captive males. Mean total ejaculate volume was 390 µl with a mean concentration of $6.5x10^6$ sperm/ml, a sperm motility index of 67, 15% morphologically normal sperm and 34% sperm with intact normal acrosomes. Considerable variation existed between males. Spermatozoa were cryopreserved successfully in straws using Tes-Tris, Triladyl and PDV-62 diluents with 20% egg yolk and 4% glycerol, one-step glycerol addition and 0.125 ºC/min cooling rate. Fertilising ability of cryopreserved spermatozoa is tested by means of heterologous IVF of *in vitro* matured domestic cat oocytes. These results are important for conservation of genetic resources and management of *ex situ* and *in situ* programmes. *Funded by Ministry of the Environment and CSIC.*

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The Wildcat (*Felis silvestris*, Carnivora, Felidae) in Thuringia - a Combined Morphological and Genetic Study

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To investigate the population structure of and variability within the fragmented Thuringian wildcat population as well as its degree of hybridisation with domestic cats, we analysed morphological and molecular characters in a complementary approach. We first examined 49 morphological characters in 69 specimens from the collection of the Phyletisches Museum, Jena. Statistical analysis of the data yielded few characters unambiguously separating the two taxa (e.g., intestine length). A complementary analysis based on two independent molecular marker systems (an established set of 11 microsatellites and a stretch of the mitochondrial D-Loop) in 33 wildcats and 19 domestic cats supported the diagnostic value of these morphological characters. Our results from both morphological and molecular data indicate the separation of domestic and wildcats in Thuringia today, in contrast to the results of previous studies of the wildcat in Scotland, Bulgaria and Hungary. Despite the fragmented distribution of small populations in isolated habitats, we found no signs of inbreeding effects or a serious loss of genetic variability. The findings of our study indicate that only a few diagnostic morphometric traits are needed for the successful identification of pure wildcats. Moreover, our conclusions provide a basis for conservation management strategies.

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The Reliability of Pelage Characters for the Diagnosis of the European Wildcat (*Felis silvestris silvestris*)

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The reliability of the classification of wildcats according to phenotypic characteristics has been questioned. In order to clarify this question, we submitted pictures of 50 cats to five experts and asked them to classify the cats according to three categories: wildcats, domestic cats or undistinguishable. Biological specimens of all cats were also classified by means of mtDNA sequencing and for some of them a craniological diagnosis was available. Preliminary results indicate non negligible error rate by phenotypic classification.

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Establishment of Genetic Profiles in Cheetahs Using Microstatellites Developed in the Domestic Cat

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Non-invasive techniques of assisted reproduction may be useful in order to provide complementary tools that may help, in specific cases, to restore connectivity among isolated and distant populations, hence reducing the risk of inbreeding depression.
For this purpose, genetic profiles have been established in cheetahs in order to optimise natural matings or artificial inseminations with the highest genetic heterogeneity as possible. The genetic prints have been obtained from an 8 microsatellites panel already developed and commonly used in the domestic cat. Genetic profiles have been obtained from 17 cheetahs of different origin: 9 in South Africa (6) and French zoos (3) and 8 in Djibouti. The results show a mean polymorphism of 5.5 allels per marker (2 to 8) and a strong genetic structuration among sub-species. 12 specific allels were identified in the South-African sub-population (out of a total of 30 allels) and 11 specific allels were identified in the Djibouti sub-population (out of a total of 29 allels).
The allelic diversity and the heterozygosity calculated from these microsatellites markers are comparable with what is seen among different breeds in the domestic cat.

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Molecular Evidence for Species-Level Distinction in Modern Clouded Leopards (*Neofelis nebulosa*)

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Among the 37 living species of Felidae, the clouded leopard (*Neofelis nebulosa*) is generally classified as a monotypic genus basal to the Panthera lineage of great cats. This secretive, mid-sized (16–23 kg) carnivore, now severely endangered, is traditionally subdivided into four southeast Asian subspecies. We used molecular genetic methods to re-evaluate subspecies partitions and to quantify patterns of population genetic variation among 109 clouded leopards of known geographic origin. We found strong phylogeographic monophyly and large genetic distances between *N. n. nebulosa* (mainland) and *N. n. diardi* (Borneo; n=3) with mtDNA, nuclear DNA, and 51 microsatellite loci. Thirty-six fixed mitochondrial and nuclear nucleotide differences and 20 microsatellite loci with nonoverlapping allele-size ranges distinguished *N. n. nebulosa* from *N. n. diardi*. Along with fixed subspecies-specific chromosomal differences, this degree of differentiation is equivalent to, or greater than, comparable measures among five recognized Panthera species (lion, tiger, leopard, jaguar, and snow leopard). These distinctions increase the urgency of clouded leopard conservation efforts, and if affirmed by morphological analysis and wider sampling of *N. n. diardi* in Borneo and Sumatra, would support reclassification of *N. n. diardi* as a new species (*Neofelis diardi*).

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The Elusive Sundaland Clouded Leopard: Reclassified and What Now? Common or Threatened in Sabah, Malaysia?

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Recently the reclassification of Bornean clouded leopards (*Neofelis nebulosa diardi*) to species level (*N. diardi*) was suggested. Our molecular data support this reclassification by wider sampling. Furthermore we show that Sumatran animals cluster with specimens from Borneo in comparison to mainland individuals, providing evidence that Sumatran individuals belong also to *N. diardi*. A significant population subdivision was apparent among *N. diardi* between Sumatran and Bornean individuals and we suggest the recognition of two subspecies. For conservation

purposes this subdivision necessitates separate conservation strategies. During field work conducted in Tabin Wildlife Reserve (Sabah, Malaysia) we aimed to fill up the tremendous knowledge gap concerning distribution, status and ecology of Sundaland clouded leopards. We applied a track classification method to obtain a rough population estimate of 9 individuals/100 km² in the study area. Our landscape analysis in Sabah confirmed the presence of clouded leopards in 25% of Sabah's surface. However, only four isolated areas covering 5% of Sabah are classified as totally protected reserves and in the remaining areas selective logging and licensed hunting are permitted. Our preliminary assessment in Sabah shows that *N. diardi* might be under heavy pressure of extinction and a higher priority should be placed to protect this species.

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The Promise of SNPs (Single Nucleotide Polymorphisms) for Wildcat Conservation: Detecting Hybridisation with Domestic Cats

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Crossbreeding with widespread domestic cats is one of the main threats for wildcat (*Felis silvestris*) survival. Former genetic studies using microsatellites have described different scenarios across Europe, such as extensive hybridisation in Hungary and Scotland, and rare introgression of domestic alleles in Italy, Germany or Portugal. However, the use of microsatellites fails to detect early events of hybridisation and hybrids beyond first generation might remain unidentified. To improve the power of differentiation between wild and domestic cat, we are searching new potential markers for the unequivocal distinction between them. In this work, we present data on single nucleotide polymorphisms (SNPs) at candidate genes controlling phenotypic traits which underwent selective pressures during domestication, such as those related to coat colour, reproduction or behaviour. First results revealed the existence of very informative SNPs in exonic portions of the genome, with high genetic differentiation between European wild and domestic cats. In addition, SNPs are extremely important for non-invasive genetic studies, providing a useful tool for the conservation of this threatened feline.

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Female Promiscuity and Sexual Conflict among Serengeti Cheetahs

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Cheetahs live at low density and need large home ranges, which makes them vulnerable to population declines. Understanding the parameters that affect their reproductive success is crucial for cheetah conservation. In this study we made use of a long term behavioural and genetic dataset comprising cheetah mothers, their cubs and putative fathers to infer the mating system of the Serengeti cheetah population. A statistical analysis programme was adapted to infer paternity from the analysis of thirteen microsatellite loci. Our data showed a high rate of multiple paternities in

the population; 43% of litters were fathered by more than one male. The results also demonstrated that female fidelity was low, and provided some evidence that females chose to mate with unrelated males. This pattern indicates that pre-copulatory male manipulation of females was counterbalanced by polyandry. Although almost 60% of resident adult males were sampled, paternity assignment was low, indicating that males living outside the park boundaries may contribute substantially to cheetah reproduction. This finding reinforces the role that cheetah's high mobility plays in their ecology, and should be taken into consideration in any management programmes aimed at the conservation of this species.

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Conservation Genetics of Jaguars (*Panthera onca*) and Other Endangered Felids Using a Noninvasive Approach

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The Global Felid Genetic Program, in collaboration with WCS and Panthera Foundation, focuses on the molecular ecology of endangered felid populations, promoting, when preferable, the use of noninvasive sampling. The program attempts to identify genetic threats and to provide needed technical assistance and information for applied conservation management decisions. Our pilot project on the jaguars of Central and South America aims to assess how genetic diversity and structure of jaguar populations have been affected by habitat loss. Following deforestation, jaguar range has halved since the beginning of the 1900. Habitat fragmentation is expected to reduce genetic diversity and increase genetic structure due to isolation and drift. However, loss of genetic diversity may be slowed by fine-scale spatial structure such as isolation-by-distance, which characterize many continuous populations, masking a population size reduction. Analyses of population genetic structure of jaguars at different scales, from site to regional and across the range, will help us detect fine-scale natural structure and will allow for comparisons between areas which have been human-impacted at a different degree. As part of a collaborative effort, scat samples are being collected throughout the jaguar range, 98 samples have been obtained from Gran Chaco National Park, Bolivia, and 269 samples from Cockscomb Basin, Belize. Preliminary analyses of 50 Bolivian samples resulted in a 98% species identification success rate, and in the identification of 23 jaguars. Mitochondrial DNA diversity (590bp of the control region, h=0.2667, π=0.00118) was low when compared to previously published data for comparisons across the range. Optimization for a molecular sexing essay and 17 microsatellite markers selected from literature is underway.

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Poster Session B

CONSERVATION & MANAGEMENT

Evaluation of the Success of a Wild to Wild Cheetah Translocation in Matusadona National Park, Zimbabwe

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Between 1993 and 1994, 21 cheetahs were captured on private land in the southern lowveld and translocated to Matusadona National Park (MNP), Zimbabwe as part of a national strategy to mitigate conflict between farmers and cheetahs. 14 cheetahs (eight males, six females) were successfully released. At the time of release, MNP had no resident cheetah population, but high densities of lions (0.2 lions/km^2) and a resident population of spotted hyaenas. Impala provided the predominant prey base. Home range sizes soon after release were large and the cheetah utilised areas outside of MNP (Male average: 136 km^2; Female average: 267 km^2). Five years post release home ranges had significantly reduced (Male average: 32 km^2; Female: 23 km^2). Over a 10-year period, the prey base for cheetah remained stable, however lion density declined to 0.07/km^2 in 2005 in response to decreasing buffalo density. The population has persisted but has not increased substantially: 17 cheetahs estimated in 1998, and 20 adult cheetahs in 2005. The small increase in the cheetah population post 1999 appears to coincide with the decline in the lion density. The translocation is considered a success as a viable cheetah population has been established, however given the continued small population size and possible sensitivity to lion density, further monitoring is advised.

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Lynx Programme: an Integrated Approach to Iberian Lynx Conservation in Southern Portugal

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The Iberian Lynx is the most threatened cat of the world. Its population and range has been declining steeply in the last decades and currently faces a critical situation across the entire range. The Spanish population has started showing some signs of recovery through intensive habitat management of the two major sites for the species and an ex-situ conservation programme has also been established. In Portugal the conservation efforts that have been carried out in the last two decades were not able to revert the species critical trend. In 2004, Liga para a Protecção da Natureza – a national NGO – through a partnership with Fauna & Flora International, created the Lynx Programme. This Programme (that includes a LIFE funded project) aims to restore a corridor of quality habitat for the species under long-term protection and management that connects the Monchique/Caldeirão mountain range to the border with the Spanish community of Andalucia (Sierra Morena). The strategy will link core areas of habitat to allow the species to expand its habitat range, together with the creation of good shelter and feeding conditions. We believe that these efforts can play a crucial role for the Iberian Lynx conservation in Portugal.

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Distribution and Conservation Status of Small Felids on the Uruguayan Savanna Ecoregion, Southern Brazil and Uruguay

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Information about distribution patterns and conservation status of small felids at the northern Pampas (Uruguay and southern Brazil), are scarce and present several geographical gaps of knowledge. In southern Brazil, recent studies have focused mainly on genetic, molecular analysis and food habits. Otherwise, in Uruguay, none has been done recently except by two new reports of *L. wiedii*. We present distribution maps of small felid species that occur in all Rio Grande do Sul and Uruguay, obtained through data collected from museums, bibliography and fieldworks. We added layers of regional ecoregions, to evaluate the influence of contiguous habitats in the composition of felid species; and layers of protected areas to check their conservation efficiency toward the species. Six species are present, four come from the north, *L. pardalis* and *L. tigrinus* occurred until the end of forested habitats whereas *L. wiedii* and *P. yagouaroundi* extend along gallery forests inside Uruguayan Savanna; otherwise, *L. geoffroyi* and *L. braccatus* come from the south until the end of open habitats. However, little information is available for some of these species and efforts must be done to supply this lack, principally when less than 0.7% of the ecoregion is inside protected areas.

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Serval Monitoring Project - Zambia

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The serval monitoring project is newly established to study the ecology and status of the *Leptailurus serval* population of Luambe National Park (LNP), Zambia. Presently, it is the only existing in situ serval project. Little is known about these wild cats besides the early 1980s study in the Ngorogoro Crater, Tansania. Servals are common wild cats of the savannah, but as they are common, there has been little care directed at their needs, dangers to their living conditions and their habitat. LNP consists of typical savannah biotopes but also includes gallery forests and humid savannah. Humid savannah is one of the most endangered habitats. Studies on servals as an umbrella species could also help to preserve this type of biotope. This study will depend mostly on telemetry data, as well as genetic data (e.g. hair from hair snares), digital photo library to calculate the actual population size and on faeces analysis. Besides ecological studies on the *Leptailurus serval*, the interspecific interaction with other predators (especially lion, leopard and African wildcat) is also of importance. Just as is the determination of potential conflicts and interactions with humans and/or livestock.

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Avian Influenza H5N1 in Clouded Leopards (*Neofelis nebulosa*)

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Felid species are known as susceptible mammals for avian influenza A (H5N1) infection. In 2004, two clouded leopards (*Neofelis nebulosa*) in the Thai zoo died after showing clinical signs of fever and respiratory distress. At necropsy, severe pulmonary consolidation and multifocal haemorrhaging were found in several organs. Histopathology and immunohistochemistry showed the evidence of avian influenza A (H5N1) virus in the lungs. In addition, influenza A virus was isolated from lung samples. Sequencing and phylogenetic analysis of HA and NA genes of virus isolates showed that the virus was virtually identical to the H5N1 virus circulating in poultry. These two clouded leopards were most probably directly infected with avian influenza A (H5N1) virus by feeding on infected poultry carcasses. This finding extends the host range of this virus among felid species and has important implications for wild felid conservation.

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Jaguar Epidemiology Program in Brazil

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The jaguar is Brazil's largest terrestrial predator and one of the least known large mammals. The potential role of diseases in wild carnivore populations is still poorly understood. This is especially true for the jaguar where the potential impact of diseases in free ranging animals remains unknown. Considering that in a developing country such as Brazil the interaction between jaguars and domestic livestock tends to increase, it is possible that there is sharing of diseases among them. This ongoing study aims to assess the statement of health of free-ranging jaguar populations at four different biomes in Brazil. So far, 34 biological samples (serums and ectoparasites) of captured jaguar at scientific research are being tested for *Toxoplasma gondii, Leptospira* spp, *Brucela abortus*, Canine distemper, FIV, FeLV and rabies. Preliminary analyzes presented positive results for *T. gondii* and *Leptospira* spp. Samples from the livestock herds (cattle and sheep) from each locality will be collected to contrast the results from jaguar samples. We expect that this study will contribute for a better knowledge of potential disease outbreak in free ranging jaguars.

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Demography of Cheetahs in South Africa and the Role of Small Reserves in their Conservation

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The cheetah (*Acinonyx jubatus*) is listed on CITES appendix 1 as vulnerable in sub-Saharan Africa. The conservation of cheetahs in Africa is problematic, especially for free-roaming animals where conflict with humans and livestock is inevitable. However, the creation of enclosed (usually small, < 60 000 ha) reserves in South Africa may provide a conservation alternative. We conducted a questionnaire based survey to quantify key demographic parameters and to assess the role of small reserves in cheetah conservation. All re-introduced cheetahs reproduced, with females having more than one litter after re-introduction (range: 2-11 litters). Average litter size varied between 3.1 and 4.4 cubs prior to the cubs reaching independence. Mortality rates were significantly different amongst the respondents. Most reserves that had other large predators present, or coalitions of male cheetahs, had significantly higher mortality rates (~30%) than those without (~3%). Reserve size did not affect cheetah survival, except when other large predators and cheetah coalitions were present. Based on these results, we conclude that small reserves can provide an important conservation alternative for cheetahs in South Africa. However, the problems associated with the confinement of large predators and the management of the reserves as a metapopulation must be considered.

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Metapopulation Dynamics and the Management of Puma Populations in North America

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Pumas in the United States are listed as a game species. Thus, long term conservation of this felid species has to be done within the framework of an annual harvest. To achieve long-term viability of hunted puma (*Puma concolor* Pocock) populations (even at historically low densities), we propose a management plan based on the metapopulation concept that designate *source areas* (closed to hunting) and *sink areas* (open to hunting). We use data from Idaho and Utah to demonstrate how the management plan might be implemented. We use minimum and maximum densities of resident animals to calculate minimum and maximum effective population sizes, neighborhood areas (regional management units), and usable habitat within the units. We designate sink and source areas based on their size, accessibility to hunters, and juxtaposition. We show that closing 63% of puma habitat to hunting would ensure long-term puma population viability while permitting traditional hunting levels in other areas. This system could be adapted to existing state hunting management units, and we outline several steps by which wildlife agencies might set up a process to manage puma hunting. We suggest this approach could be useful for other felid species that are managed as game species.

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Relationship between Tigers, Leopards Their Prey and Farmers in Bhutan

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Tigers and leopards are listed as 'endangered' in the 2000 IUCN Red List of Threatened Species. They are also the most elusive and charismatic species in Bhutan. This is understood and accepted by the authorities in Bhutan and protective support is written into the law. However, these big cats are causing significant economic and social loss to farmers through predation and perceived, probably correctly, as the most serious threat to domestic livestock, particularly cattle. Due to this economic blight and despite the law, species are killed, their habitat degraded and their future threatened. Real conflict exists, which, if it is to be resolved, requires research to underpin long-term and practical solutions acceptable to the people of Bhutan. A project jointly funded by the Save the Tiger Fund, World Disney, The Whitley Fund and Government of Bhutan was developed in collaboration with experts from Oxford and Cornell University to assess the ecological relations between these two felid, their prey and humans living in Bhutan's National Park, and will ultimately lead to a programme that aims to ensure the long-term survival of these felids, their habitats, and prey, by reducing the conflict with local farmers.

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Factors Affecting Guild Composition of Wild Felids in Pristine and Logged Tropical Forest in Sabah, Malaysia: a Camera-Trapping Study

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Bornean tropical forest contains a guild of five species, clouded leopard *Neofelis nebulosa*, marbled cat *Pardofelis marmorata*, bay cat *Catopuma badia*, flat-headed cat *Prionailurus planiceps*, and leopard cat *Prionailurus bengalensis*. The behavioural ecology of none is well-known, and the dynamics of their interactions obscure. One is endangered, three threatened, and their presumed primary habitat, is rapidly being lost and/or altered in the region. The niche characteristics of, and the impact of forest destruction and management on, each of these species is under investigation through the use of a large scale camera-trapping study based at Danum Valley and Tabin Wildlife Reserve in Sabah, Malaysian Borneo. A systematic deployment of replicated camera trap-lines in each of several habitat types offers preliminary insight into relative densities of each species, and the impacts of various forest management practices. These results are presented, as are related project activities associated with environmental education, training and awareness-raising in the region, supported by the UK's Darwin Initiative. Project findings will be used to provide recommendations for a Bornean wild cat conservation action plan, and presented at a GCP/ITBC-hosted Bornean wild cat conservation workshop, during September 2009.

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Jaguar Distribution and Conservation Status in Brazil

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Jaguar (*Panthera onca*) historical distribution ranging from northern Argentina to southern United States, but with human population increase and natural habitat conversion jaguars have been reducing their distribution to 54% of its historical range. Conservation plans should rely on basic scientific information, specially the knowledge of past and present geographic distribution to evaluate a species conservation status, estimate population size, connectivity and habitat preference. This study proposed to estimate jaguar potential distribution using ecological niche modelling approaches extrapolating present data to unknown areas. We accumulated a total of 1049 jaguar's occurrence points (795 spatially unique in 4 km side grid-cell size), and used climate, topographic and vegetation data as predictive variables. We use GARP and Maxent modeling techniques and compared model's performance through ROC and AUC statistics. Maxent resulted in more restrictive predicted distribution and presented a higher value of AUC (0.93) than GARP (0.89). The models suggest highly suitable areas in Pantanal, Paraguayan Chaco, and Caatinga, and low suitability in most areas of the Amazon. These models appear to do not estimate efficiently the range distribution of this species, but provide an objective ranking of site suitability useful for conservation planning and effort prioritization under financial constrains.

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The Kaplan Awards Program: a Grants Program for Students Working on Wild Cat Conservation

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The Kaplan Awards Program (KAP), created by the Panthera Foundation and WCS, supports graduate students working on conservation of wild felids. The KAP makes grants up to $25,000 per project per year, and encourages multi-year funding for outstanding projects, contingent upon performance. Since the inception of the KAP in early 2005, a total of USD $356,378 has been awarded to 22 students including three projects funded for a second year. The mean grant award is USD $16,199, ranging from $6,367 to $21,300. A total of 14 felid species are studied by KAP grant recipients in Africa (nine projects), Latin America (six projects), Asia (six projects) and North America (one project). Of students funded, 64% are nationals studying in their own country and 36% are foreign nationals. The key foci of funded projects are human-cat conflict mitigation (14), population estimates and surveys (14 projects), ecological research (8), genetics (4), and methods testing (3); many projects cover multiple topics. With an average yearly contribution of USD $178,000 per year and a commitment to support students through the duration of their degree, the Kaplan Awards Program is dedicated to promoting up and coming felid biologists as well as international felid conservation.

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Population and Habitat Viability Analysis of the Jaguar in Mexico

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Mexico is an important stronghold for the jaguar, but with ongoing habitat loss and jaguar poaching throughout the country, it became necessary to assess the viability of the species to determine the strategies for their conservation. We used program VORTEX to identify the factors that have a greater effect on the probability of extinction. These are; number of cubs per litter, increase of reproductive females and reduction of female's maximum reproductive age, female and cub mortality. Poaching mortality significantly reduces population growth and increases the risk of extinction of the small populations. This effect is stronger in females, as when take is over 3% of the female population, extinction makes populations non-viable over 100 years. Population sizes < 100 individuals are not viable. The populations of the five different jaguar regions were assessed, taking into account habitat loss, carrying capacity and poaching, with the Sonora and Tamaulipas populations, in the temperate north, being at greater risk, and the Selva Maya in the tropical south being viable in the long-term. Information gaps were identified, as well as key players and actions which can reduce the risk factors and increase long-term viability of the jaguar in Mexico.

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Conservation Status of Felids in Mole National Park, Ghana

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The conservation of wild felids in West Africa represents a critical challenge, as populations are poorly known but suspected to have severely declined. Mole National Park (MNP) in northern Ghana is considered important to the long-term survival of felids such as lion, leopard and serval in West Africa. Nevertheless, no previous assessment has been undertaken in the park. We used camera traps, spoor surveys and local knowledge to assess the status of felids and other mammals in and around MNP. Fifty camera traps were deployed over 1283 camera-trap nights and >60 km of transects and 36 village questionnaires have been completed. Results confirm the presence of two felids, leopard (6.1 photos/100 trap nights) and caracal (1.4), along with 29 other mammal species. Lion and serval have not been detected, but patrol records and questionnaires suggest they are present. Other carnivores detected include spotted hyena, African civet, and side-striped jackal. Among prey species, bushbuck, warthog and waterbuck are relatively abundant, while larger ungulates (e.g. buffalo, hartebeest) appear to be rare. Results indicate that hunting pressure is high in MNP, and that felids are killed for skins and as threats to livestock. More effort is needed to protect these regionally significant populations.

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Sumatran Tiger Conservation in Human-Dominated Landscapes

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Habitat loss and an increasingly pervasive human population continue to drive the decline of remaining Sumatran tiger (*Panthera tigris sumatrae*) populations. Much of Sumatra's landscape is now dominated by a matrix of oil palm, degraded forest and rural settlement. Our objective was to identify the anthropogenic and environmental factors associated with species persistence in this environment. Repeated detection/non-detection surveys of 100 survey cells across two study sites, totaling 1200km^2, recorded 25 medium/large mammal species from 2400 hours of search effort and 2000 camera trap-nights. We present field methods and a statistical framework able to identify key landscape factors associated with the probability of species occurrence in this context. Preliminary results from the principle study site indicate that mammalian diversity differed between major habitat classes with highest overall species richness recorded in areas dominated by degraded forest, rather than oil palm or rural settlements. In the principal study site tigers used more remote forest habitats characterized by low levels of human activity. Our results provide a basis for collaborative Sumatran-wide surveys of tiger and prey species distributions and associated threats, which will underpin future landscape conservation measures.

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Small Neotropical Felids Ecology in Fragmented Agricultural Landscapes of Southern Brazil

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Studies of Neotropical felids are still incipient, especially those on radio-telemetry and density for the smaller species. Since July 2005 we've been monitoring specimens of little spotted cat, margay, jaguarundi, and Geoffroy's cat through radio-telemetry and camera-trapping in two areas of strong agricultural activities in southern Brazil. The 11 animals captured were fitted with radio-collars and tracked by conventional telemetry. Camera trapping efforts used 3 – 5 cameras simultaneously. Analyses were made using the software LOAS and Animal Movement (telemetry), and CAPTURE (camera-trapping). Here we present a preliminary assessment on home range, activity patterns, habitat use, and density estimates for these species. Home range estimates varied from 2 to 35 km^2, were smaller for the female little spotted cat and larger for the male jaguarundis. Data were indicative of a strong association of small felids to fragments of native forest cover, especially for margay and little spotted cat, as >90% of their locations were in such habitats. Geoffroy's cat, on the other hand made extensive use of open areas, including crop fields. Density estimates in disturbed but ocelot free environments varied between 0.12 and 0.35 animals/km^2.

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Leopard (*Panthera pardus*) Conservation on Namibian Farmlands

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Large carnivore conservation depends on educated management. On farmlands of northcentral Namibia, the largest carnivores (lions and spotted hyenas) have been extirpated, while leopards, brown hyenas, and cheetahs remain. These farms comprise a mosaic of management strategies that reflect mixed income sources, ethnic groups, and attitudes towards predators. Currently, many livestock farmers feel that predators are the biggest threat to their livelihoods, and often blame the 470 km^2 Waterberg Plateau Park (WPP) as a source of their perceived depredation problems. Although conflicts between farmers and predators, in general, are well-documented in this area, few studies have explored the interplay of ecology and economics with an eye toward sustainable carnivore management. In this study we investigated the population ecology and prey selection of leopards, and conducted interviews of farmers, tourists and trophy hunters to assess the perceptions and tolerance of the farming community, as well as the potential costs and benefits that farmers could receive from maintaining leopards on their farms. More generally, we assessed the management strategies of the local stakeholders, including the farming community and WPP, to provide management recommendations for the regional leopard population. While incorporating occasional removals, farmlands provide more productive leopard habitat and benefits to farmers.

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TOOLS & METHODS

Modelling Spatial Interference between Wildcats (*Felis s. silvestris*) and Domestic Cats (*Felis s. catus*) in Slovenia

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Extensive fragmentation, alteration and loss of habitat since the 18th century resulted in extinction processes in wildcat populations throughout Europe. The habitat has improved to some extent, which can be seen from some recolonizations that happened in the 1920s. However the negative effects of fragmentation are amplified by intensive urbanization, natural resource use and development of traffic infrastructure. Experiences from Scotland, Hungary and Portugal indicate that habitat loss and fragmentation are probably the most important direct and indirect threats to the wildcats in Europe that also increase penetration of domestic cats into wildcats' habitats. We used data from radiotelemetry study of both wildcats and domestic cats as well as presence data from nation-wide monitoring for analyses. Using different methodological approaches we constructed and validated predictive habitat model for Slovenian part of Dinaric region and fragmentation and connectivity models for the entire area of Slovenia. We used ecological Niche Factor Analyses (ENFA) to build a habitat model for the Wildcat. Domestic cat–wildcat presence data were used to build potential distribution model between domestic cats and wildcats using GLM. We evaluated potential threat of penetration of domestic cat into wildcats' habitats in Slovenia by overlapping wildcat's habitat and distribution models.

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Presence-Absence and Occupancy Study of the Bengal Tiger (*Panthera tigris tigris*) and the Indian Leopard (*Panthera pardus fusca*) using Faecal DNA Analysis

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The tiger (*Panthera tigris tigris*) is a flagship species for conservation in India. In habitats outside well protected tiger reserves, tigers are found in low densities and such areas cover up to nearly 90% of the tiger habitat in India (Karanth and Nichols, 2002). It is important to assess whether tigers are present in such areas rather than estimate their absolute abundance. The objective of our study is, therefore, to ascertain the presence of tigers and leopards (*Panthera pardus fusca*), by non-invasive faecal DNA analysis, pug-marks and scrapes. The Kawal Wildlife Sanctuary is a dry deciduous forest with a low density of tigers and is subject to heavy human interference. An un-encroached forest area of around 220 km^2 of this sanctuary has been selected for our study. GPS locations of faeces collected, pug-marks, scrapes and other signs of tiger and leopard activity were taken while traversing on animal trails. DNA was isolated from the faecal samples and screened using species-specific polymerase chain reaction (PCR) primers developed for the reliable identification of leopard and tiger faeces. This can confirm the presence of tigers and leopards as well as map their distribution for use in geo-referencing while implementing conservation plans.

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Measuring Progresses of an Education Programme for the Conservation of the Andean Cat

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EduGat Program is an education and community participation initiative aiming to support the conservation of the endangered Andean cat *Oreailurus jacobita*. The program has already completed 10 campaigns in the communities within the potential distribution range of this cat in Argentina. We visited 39 localities, carried out formal education in 19 schools (reaching 504 students), no-formal activities, eight participative community workshops, festivals and informal interviews. Each target public was reached by a different set of activities. Programme evaluation, through both quantitative and qualitative tools, suggested that our activities for school children were particular successful. Most of them enjoyed and learnt a lot (85% and 90%, respectively, of the auto-evaluations), and their attitude towards the Andean cat improved (85.1% of favorable responses after our activities vs. 58.4% before).We also observed the need to increase efforts to guarantee teacher and adult participation in conservation plans. To improve the effectiveness of the Program, we are implementing new initiatives: create a network of local educators to raise awareness; produce new educational materials to increase the comprehension of ecological concepts; facilitate capacity building for the development of community-leaded ecotourism. We used these feedbacks to develop a more complete assessment of programme success.

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Death on the Road and Rescue in the Lab: Female Gamete Recovery and Conservation in the Iberian Lynx (*Lynx pardinus)*

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Iberian lynx (*Lynx pardinus*) is regarded as the most endangered felid in the world. A genetic resource bank was established to preserve current genetic variability. At present, dead animals are the only source of female gametes and a strategy for conserving ovarian tissue and oocytes was implemented. One ovary from each of five Iberian lynx females, two of them killed in road accidents in the Doñana area, was obtained outside the breeding season, taken to the laboratory within 12h to 48h and ovarian tissue was sliced and cryopreserved for future use in xenotransplantation. Whenever possible, oocytes were collected and matured *in vitro*. Only oocytes recovered from one female within 12h after death matured *in vitro*: 6/16 oocytes (37%) reached metaphase-II after culture in TCM199 with additives for 24h at 38.5ºC in 5%CO_2/air. This is the first report of *in vitro* oocyte maturation for this critically endangered species. Scarcity of material and time elapsed between death and recovery of ovaries are the main limiting factors for success, but every effort should be made to secure conservation of this valuable resource. This will allow *in vitro* production and cryopreservation of embryos, thus complementing cryobanking of male germplasm. *Funded by Ministry of the Environment and CSIC.*

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Cryobanking of Iberian Lynx (*Lynx pardinus*) Somatic Cells: Optimization of Isolation, Culture and Cryopreservation for a Genetic Resource Bank

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Iberian lynx is critically endangered. Despite considerable efforts for conservation in its natural habitat, population size is decreasing. When an animal dies, its genotype is lost. This is particularly critical for immature individuals that never reproduce. To preserve a maximum of genetic diversity we set up schemes to routinely bank somatic tissues and cells that could be used in future research and in the development of nuclear transfer techniques that can benefit *in situ* and *ex situ* conservation programmes. Since 2004, tissue samples from 16 necropsied and from 55 biopsied individuals from Doñana and Sierra Morena were collected. Tissues were routinely cryopreserved in liquid nitrogen and cultured for fibroblast isolation and growth. Cells were successfully isolated, cultured and cryopreserved from 93% of necropsies and from 84% of biopsies (some cultures are ongoing). Cryopreserved tissues were found to grow in culture after months of storage. Factors affecting cell viability (e.g. time of recovery), isolation (explant or collagenase treatment), culture, and cryopreservation under various conditions were examined in detail in biomaterials obtained from necropsies. These studies reveal the feasibility of rescuing and banking biomaterials from dead and live animals from wild and captive populations. *Funded by Ministry of the Environment and CSIC*.

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How to Count Lions: Census Techniques for Estimating Densities of Large Felids

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Accurately estimating densities of wildlife species is critical to effective management and conservation. Species that live at low densities, such as carnivores, are notoriously difficult to census, as are gregarious species whose clumped distributions produce extremely high variances in population estimates. We estimated the density of Serengeti lions using both indirect and direct survey techniques: spoor counts, playbacks using hyena vocalizations, day and night fixed-route transects, and nonrandom line transect surveys. We compared these estimates (mean and confidence intervals) to the known number of lions (as determined through individual recognition and frequent radio telemetry by the Serengeti Lion Project) during the same time frame. All of the estimates derived from the direct/indirect survey techniques required correction factors, and repeated re-estimates would be required to reduce their associated variances. We summarize the benefits and drawbacks of each technique in terms of accuracy, precision, expense, effort, practicality, suitable habitat type and behavioral bias.

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Seasonal Profiles of Ovarian Activity in Eurasian (*Lynx lynx*) and Iberian Lynx (*Lynx pardinus*) Based on Fecal and Urinary Hormone Metabolite Analyses

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The Iberian lynx is the most endangered felid species. An important tool for the ex-situ conservation program for Iberian lynx is the development of non-invasive methods to monitor reproduction. Our objective was to analyze seasonality of reproductive parameters in Eurasian lynx and to compare them with Iberian lynx. Fecal hormone analyses and transrectal ultrasound examination of the ovaries was performed in ten Eurasian female lynx over three years. The same approach was used in Iberian lynx females. In both species, seasonal fecal hormone profiles showed two peculiarities: a significant positive correlation between gestagen and estradiol metabolites and elevated concentrations of fecal gestagen metabolites post-partum. This ovarian activity was confirmed by ultrasonography and elevated serum progesterone levels. Fecal and urinary gestagen metabolites were identified by a radiometabolism study in Eurasian lynx. It revealed that the majority of radiolabelled metabolites were substances with higher polarity than progesterone, only a minor peak was identical with progesterone. The HPLC profile of Iberian lynx feces showed the same elution pattern suggesting similar gestagen metabolism. To conclude, the seasonal ovarian activity in lynx is characterized by a non-pregnancy related luteal activity. The post-partum gestagen activity is unique for felid species, and its biological role is presently unknown.

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UPDATES FROM THE FIELD

Using New Lightweight GPS/GSM Transmitters to Monitor Movement and Predation of Eurasian Lynx (*Lynx lynx*)

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Classic VHF radiotelemetry of animals with large home ranges is time consuming and there are often cases when the animals "disappear" due to unknown causes, one of which might be dispersion. Research is often hindered or even limited by national borders and/or inaccessible terrain. Use of GPS technology provides better efficiency in monitoring of movement of animals with higher precision even in remote areas and across national borders. Recent decreases of transmitters' weight made this technology feasible for telemetry of mid-sized animals. We will present preliminary results from a study of Eurasian lynx (*Lynx lynx*) using the new lightweight (285 g) Televilt Tellus GPS collar with remote GSM download technology. We captured a young female lynx on Snežnik plateau in Southern Slovenia and fitted her with the GPS/GSM collar. We tracked her movement in the northern Dinaric mountain range of Slovenia and Croatia and estimated success rate of GPS positioning in this very rugged karstic terrain. In addition, we will present methodology we used for locating prey remains and success rate of finding them, as well as preliminary data on prey preferences and predation rate of Eurasian lynx in Dinaric landscapes.

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A Fine-Scale GPS Study of the Movements of African Lions (*Panthera leo*) on Ongava Game Reserve, Namibia

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Ongava Game Reserve (OGR) is a private reserve (270km^2) located adjacent to the southern boundary of Etosha National Park (ENP) in Northern Namibia. OGR's habitat is predominantly mopane scrub, and it is home to a fluctuating population of African lions (*Panthera leo*). There are at least three resident groups (ngroup = 4-9) and a varying number of transient specimens (from ENP), often adult males and coalitions of young adult animals, giving a total number of individuals in the range 24-33 (density about 9-12 animals / 100km^2). In order to better understand the movements of the individuals, we fitted GPS collars (Blue Sky Telemetry, Scotland) to adult female resident lions and recorded their location every 15 minutes. After several months of recording, we were able to construct a comprehensive picture of the fine-scale movements of these animals, including idle / active times, movement velocities, visits to water holes and putative kill sites. We also found that the individuals made transient movements into areas significantly outside their home ranges as calculated by conventional observation methods. We suggest that under conditions where both group size and density are highly variable, home ranges are dynamic rather than static.

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FFI's Sumatran Tiger Protection and Conservation Program

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Kerinci Seblat National Park in Sumatra, was established in 1981 and is recognized as the single most important area for tigers in Sumatra, where like tigers the world over, they face a number of threats, primarily from illegal poaching and land clearance. To facilitate tiger conservation in the park, FFI established in 1994 an effective species protection program, based on strengthening law enforcement and raising the presence and effectiveness of the National Park Authority. This is achieved through regular patrolling in key areas to reduce direct threats to tigers and their habitat, strengthening the capacity of investigative and enforcement agencies, raising awareness, supporting collaborative community forest protection patrols, strengthening local NGOs, training government staff, dealing with serious wildlife crime, responding to human-tiger conflict issues and assisting with research and monitoring. With limited resources the project has achieved a lot, for example, removing over 3,500 tiger snares, resolving 110 human-wildlife conflict incidents, issuing 250 formal warning letters, 40 convictions, 15 Tiger skins seized, 25 animals (mostly cats) confiscated, and 30 National Park rangers trained in tiger protection and conservation field techniques. This talk will elaborate on these successes, outline the approach taken by FFI and our plans for the future.

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Home Range and Activity Patterns of the Margay (*Leopardus wiedii*) at "El Cielo" Biosphere Reserve, Tamaulipas Mexico

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The margay (*Leopardus wiedii*) is listed as endangered in Mexico, and is an Appendix I species under CITES. The only previous study on this felid was in 1989 in Belize where a single individual was radio-tracked. The northernmost distribution of the margay is found at "El Cielo" Biosphere Reserve (REBC) in Tamaulipas, Mexico. In 2002, we started an in situ project to evaluate the status of the margay population at the RBEC. The goal of this project was to determine home range size and activity patterns of margays using radio telemetry. We used 20 tomahawk traps baited with live chickens for 420 nights. We captured 15 margay with a total of eight different individuals (five males and three females). Margays were sedated with tiletamine-zolazepam (Telazol) at a mean dosage of 4 mg/kg, and fitted with VHF radio-collars. Mean home range value for four males was 4.03 km^2 and 0.96 km^2 for a female. Activity patterns indicated highest activity between 1800 h and 0400 h, confirming that margays were primarily nocturnal. Even though that this is the newest information available for the species, we are continuing this study to better assess the population of the margay at the REBC.

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The Wild Cat of Crete

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The presence of *Felis silvestris cretensis* (Haltenorth 1953) on the Mediterranean island of Crete, Greece, was uncertain until a live specimen was trapped for the first time in 1996. The cat was captured in the Psiloritis Mountains, following a collaboration between the Dipartimento di Biologia Animale ed Ecologia (University of Perugia, Italy) and the Natural History Museum of Crete (University of Crete, Greece). Since then, four dead specimens, identified as *Felis silvestris cretensis* have been found in the three main mountain ranges of the island. Data collected from the coat-colour patterns and body/skull parameters of the specimens are reported, as well as some of the results of a radiotelemetry study carried on the live specimen captured. More recently photo trapping has been used as a survey method, during which two pictures of the same specimen and five pictures probably corresponding to another three specimens (two males and one female) were obtained. All the data collected during this research are discussed and reviewed.

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Spatial Ecology and Abundance of Mexican Bobcats in Northwestern Mexico to Assess its Conservation Status

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A lack of ecological studies on bobcats (*Lynx rufus*) in Mexico has precluded wildlife managers and decision makers to successfully determine its conservation status; the objective of the study was to gather baseline ecological data to help assess its conservation status in the sky islands of the Sierra Madre Occidental. Utilizing a suite of methods (spoor, camera-traps and observations) we determined habitat seasonal use for 2002, 2003, and 2005. Bobcats used nine habitat types, most importantly juniper-oak woodland (34.8% records), pine forest (18%) and pine-oak (15.5%) significantly differing from availability; we also recorded significant differences between years and seasons. Habitat use was similar between 2003 and 2005, differing from 2002. We estimated a density of one individual per 20 sq. km., which is low compared to other bobcat studies. Low abundance and spatial habitat use patterns appear to be related to precipitation variation and consequently on prey distribution. Alternative restrictions on harvest and modification of conservation status should be applied to this population classifying it to vulnerable to extinction.

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Effectiveness of Three Types of Collars Used to Monitor Free Ranging Lions (*Panthera leo*) in the Okavango Delta, Botswana

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We evaluate the effectiveness to collect range use and movement data using normal VHF radio collars, GPS collars and GPS collars with satellite link. The cost per plot depends on the actual lifespan of the collars, cost of the collars, veterinary costs, staff and transport costs. Local topography and conditions and study objectives will determine the most economic collar to use for a project.

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Sumatran Tigers in Riau: Estimating the Abundance in Three Major Habitat Types

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Despite its critical status, the distribution and population status of the Sumatran tiger (*Panthera tigris sumatrae*) remains unknown in Riau Province. To estimate the abundance of tigers we used camera trapping data with standardized capture-mark-recapture (CMR) protocols. We systematically sampled 86 sites located in four blocks that represent three major habitat types in the landscape. We accumulated 13,406 camera trap nights, covered 2,123 km^2 of effective sampling area, and obtained 58 independent tiger pictures. We photographed nine individual tigers under CMR protocols, plus four individuals during ad hoc samplings. We pooled tiger data across sampling blocks to run in Program CAPTURE. We estimated adult tiger density in forest habitat to be 0.94 individual/100km^2 (95% CI: 0.35 to 1.53). Relative density estimates for each block were derived based on the proportion of tigers captured, taking into account the effective sampling area of each block. Highest density of adult tigers (individuals/100km^2) was documented from Kerumutan (wet flat forests, 1.27 to 5.5), followed by Rimbang-Baling (hilly forests, 0.92 to 4.03), and Tesso-Nilo (dry flat forests, 0.64 to 1.4). The influence of factors - such as level of disturbance from human activities, and index of prey abundance - on tiger density are discussed.

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Toward the Survival of Two Endangered Felid Species of Japan

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There are two small-sized wild felids in Japan: the Iriomote cat, *Prionailurus bengalensis iriomotensis* endemic to Iriomote island (284 km^2), and the Tsushima leopard cat, *P. b. euptilura* occurring on Tsushima islands (710 km^2). Population size was estimated as ca. 100 individuals for both felids now, and the Iriomote cat is categorized as "Endangered" on the Red List by IUCN (2000) and both as "Endangered" on RL by the Ministry of Environment of Japan (2002). Urgent implementation of the conservation programs and the collection of basic biological data for each species are indispensable to the future survival of Japanese wild cats. Ecological characteristics of two felids were partly different because of different climates, habitats, and fauna on respective islands. Population trend is also different in the two felids. Population size of the Iriomote cat is almost stable and that of the Tsushima leopard cat has decreased during these three or four decades. Although some conservational issues are common, clear difference in human activity between two islands caused different categories and seriousness of conservational issues related to the two species. We compared the situation of two felids and suggest necessary conservation program based on basic biological data.

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Small Sample Size and Wild Extrapolation; Preliminary Results from a Telemetry Study of Tigers in the Sundarbans of Bangladesh

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The Sundarbans of Bangladesh and India represent one of the largest remaining wild tiger habitats. Effective management of this area will require information on tiger resource needs and population status. A study using Geographical Positioning System collars has been initiated to help fulfil this need. Live and dead cow baits were used to entice tigers into areas with leg-hold snares. Two adult female tigers were captured from 506 "cow nights". The tigers were monitored for 6 and 2.5 months respectively. The collars recorded 648 and 1,528 locations. Estimated 95% Minimum Convex Polygon home ranges were 13.9 and 11.5 km^2. Each tiger used 64% (CV 0.21) and 83% (CV 0.33) of its home range every month. Estimated age at capture and subsequent movement patterns suggest that both tigers were resident territory holders. Incorporating these preliminary results into "optimistic" and "pessimistic" scenarios implies a carrying capacity of resident female tigers in the Bangladesh Sundarbans of between 95-286 individuals. Further collaring of tigers living in different parts of the Sundarbans is required, however, to make stronger inference on resource selection and variation in home range size under the different ecological variable represented by this unique habitat.

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Study on the Ecological Characteristics of Clouded Leopard in Riau, Sumatra.

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Recent studies have diagnosed the distinction of Clouded Leopards in Indonesia (*Neofelis diardi*) from those in the mainland Asia (*N. nebulosa*). Due to the elusive, nocturnal and arboreal habits, studies are considered very difficult which imply on the lack of information needed to suggest specific conservation measures for this endangered species. The availability of camera traps allows us to investigate basic ecological aspects of the Indonesian Clouded Leopard. We estimated the density and occupancy of Clouded Leopards with standard Capture-Mark-Recapture and detection-nondetection analyses using camera trapping data set up in Tesso Nilo – Bukit Tigapuluh Conservation Landscape, May 2005 – December 2006. We accumulated 13,406 effective camera trap nights, covered 1,240 km^2 effective sampling area, and photographed 12 individuals. We estimated the density of Clouded Leopards of 1.29 ± 0.54 (± SE) individuals per 100 km^2, occupancy (ψ ± SE) of 0.40 ± 0.04; and detection probability (P ± SE) of 0.38 ± 0.07. We also investigated other ecological characteristics of the cats such as the habitat use, time of active and other aspects that can be derived from the camera trapping data. Based on the findings, we formulated recommendation for the conservation of the species that include monitoring of key potential habitat, connecting habitat patches, decreasing poaching, and population monitoring.

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Jaguar Persistence in Fragments of the Atlantic Coastal Forest, Southeastern Brazil

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Brazil's Atlantic Coastal Forest is the second most endangered tropical forest in the world and only 5% of this ecosystem remains. Although 30% of this ecosystem is inside protected areas, only paper protects most of them and there are people and domestic animals living inside. The largest and best protected tract of the Atlantic Coastal Forest is found in southeastern Brazil, where the jaguar population was surveyed by the presence of tracks and scats during 1995-1997, giving a rough estimate of one jaguar per 100 km^2, and revealing local extinction of the species in some areas (e.g., Superagui National Park). The expectation made based on those surveys was that the jaguar population would not persist for the next 10 years. However, surveys realized 10 years later (2006) show that jaguars still persist in the area. We show through GIS data that during these 10 years other protected areas were created in the region, protection of existing protected areas was strengthened. These measures might be responsible for the persistence of jaguars in the area but are unlikely to be enough to ensure jaguar survival if specific measures are not implemented.

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Assessing the Power of a Monitoring Method for European Wildcats (*Felis silvestris silvestris*) Which Combines Lure Sticks and mtDNA Haplotyping

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Monitoring European wildcats (*Felis silvestris silvestris*) is difficult not only due to the elusive habits of this species, but also because a reliable distinction of wildcats and free-ranging domestic cats must consider cranial measurements or genetic information. We developed and tested a monitoring scheme for European wildcats which is based on systematic hair sampling by means of lure sticks, and wildcat identification by haplotyping the hair. The test was conducted during one year in a 66 km^2 area in northwestern Switzerland, where both wildcats and free-ranging domestic cats occur. Probability of detection was estimated with capture-recapture methods using more than 100 single lure stick«detection histories». Based on our findings we propose a efficient and robust monitoring scheme, where efficiency is the power to detect a 10% change in site occupancy within a given area compared to costs.

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Do Nature Reserves Adequately Protect Pallas' Cats in Central Mongolia?

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Nature reserves represent an important component of the protected area system in Mongolia. Their effectiveness, however, at conserving wildlife – especially carnivores, many species of which face declines from illegal hunting – remains largely unknown. We examined the effectiveness of a nature reserve in central Mongolia at protecting the Pallas' cat or manul (*Otocolobus manul*) – an IUCN *Near Threatened* species that ranges across the grasslands of Mongolia. We evaluated how well the reserve 1) reduces cat poaching by obtaining hunting information from herder families living in and around the reserve, and 2) protects cat habitats by tracking radio-collared cats and comparing habitats selected with habitats protected in the reserve. Interviews with families indicated that illegal hunting occurs commonly, wildlife laws are seldom enforced, and ranger activities provide little deterrent to poachers. Pallas' cats used a variety of steppe habitats during the study, favouring semi-shrub steppe, which is under-represented in the reserve's core protected area. Our results indicate that the reserve fails to reduce poaching or adequately protect cat habitats. Reducing poaching, however, may be accomplished by greater ranger training and community education. A simple, cost-effective modification of the reserve's core boundary would also protect key cat habitats.

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