

EARTHWATCH INSTITUTE FIELD REPORT

Project Title: Carnivores of Madagascar

Principal Investigator: Luke Dollar

Position/Affiliations: Doctoral Fellow, Nicholas School of the Environment, Duke University

Research Sites:
Ankarafantsika and Kirindy Mitea National Parks, Madagascar

Local Management Status of the Research Site(s): National Parks

Scientific names of primary species being studied:
Cryptoprocta ferox, *Eupleres goudotii major*, *Viverricula indica*, *Canis domesticus*, *Felis domesticus*, *Felis x*

Date this report was completed: 7 September 2005

Key Research Objectives:

The specific primary objectives of this research are to:

- 1) Continue trapping surveys to further monitor the carnivore populations and trends in the Ampijoroa Research Station area of Ankarafantsika National Park, Madagascar, collect anatomical and physiological data on each species of carnivore at this site, and to collect carnivore scat samples for analysis of diet composition/contents; For Kirindy Mitea, the same goals apply, but questions related to work at this new site include the provision of a comparative base for carnivore populations in Madagascar's dry forests (see also 2).
- 2) Continue to obtain baseline indices of relative abundance of *Cryptoprocta ferox* and additional carnivore and prey populations in the dry, deciduous forests of Ankarafantsika and Kirindy Mitea. For Ankarafantsika, a Malagasy M.S. thesis (by team member Harilala Rakotomanana) is almost complete on this subject, providing ongoing observation continuing towards this goal;
- 3) When possible, track captured fossa, narrow striped mongooses, and wildcats using radiotelemetry to determine their home ranges and activity patterns. A Malagasy M.S. thesis (by team member Pierrot Rahajanirina) completed in 2003 provides preliminary information leading to this goal;
- 4) Conduct extensive groundtruthing studies for ongoing remote sensing projects examining trends in fossa habitat. Separate M.S. theses by team members Po-Hon Liu and Jodie LaPoint, completed in 2005, focus on these issues and provide information for further investigations included in Dollar's Ph.D. thesis;
- 5) Continue conservation, development, and capacity building projects in & around Ankarafantsika and Kirindy Mitea.

Data Collection and Results

- a) Give a concise account of the data you have collected during the past field season.

We have continued to collect data on the carnivores of Ankarafantsika National Park, charting the changes in predator assemblages between the endemic and non-endemic carnivores in the area. We have also assisted the local park management in conducting a study on the impacts of road traffic through the park on local biodiversity. Finally, we have continued our projects examining the veterinary health and disease status of local domestic and endemic carnivores.

In Kirindy Mitea National Park, we have established a new research site for long-term carnivore work that will lead to an extensive biodiversity data set for that park and founding the basis for a comparative information set for Madagascar's dry forests. This year, we captured 12 individual *Cryptoprocta* in a single 10 day trapping study.

- b) What progress have you made towards achieving your original objectives?

We continue to achieve our research objectives in Ankarafantsika and are in the process of initiating a duplicate study in Kirindy Mitea, which will provide the basis for new

original data for this site and comparative bases for Madagascar's dry forests as a whole.

c) Please provide a summary of your results.

For Ankarafantsika:

- Endemic predator populations are diminishing substantially, owing to a fast increase in feral dog populations and a possibly related decrease in prey numbers.
- Local forests are becoming increasingly sparse and fragmented, with an overall loss of species density.
- Fragments of even more than 10-20 ha are too small to contain a representative subset of core forest species.
- Approximately 20,000 individual animals, comprised mainly of herpetofauna and micromammals, are killed annually on Ankarafantsika's 17.5 km stretch of the RN4 national highway.

For Kirindy Mitea:

- The highest density of Fossa (*Cryptoprocta*) in all of Madagascar may exist in Kirindy Mitea.
- Kirindy Mitea is one of the few areas in Madagascar showing any indication, much less a substantial amount, of forest regeneration.
- At least 8 primate and 85 bird species are found in Kirindy Mitea.
- Fossa in Kirindy Mitea are approximately 20% larger than those found in Ankarafantsika.

Significance/Benefits of Research

a) What is/are the significance/benefits of your research at the following levels?

Application of Results

Local Community Benefits

This project and its results have been shared with and have benefited the local communities in which the research is taking place in many ways. These include:

- Extensive biodiversity conservation education programmes in local villages and schools
- The founding of a village-based research camp, all proceeds from which enter into said community
- The founding of a formal ecological monitoring team comprised exclusively of local citizens
- The incorporation of more than a dozen Malagasy graduate students into research subportions of this project

- The development of a domestic animal husbandry and veterinary health outreach (and vaccination) project
- The creation of a fund to sponsor local students in continuing their education at secondary schools and national universities
- The formalization and training of villagers' activities/events to support future ecotourists to the area
- Tent-revival-style conservation "rallies" for fossa (and biodiversity) conservation
- Providing an alternate, sustainable (non-destructive) employment base for ~50 local citizens
- The initiation and development of a locally-staffed Center for Conservation and Research Training on-site

Over the course of the last three field seasons, our team has grown in both size and breadth of activities. We arrived at the Ampijoroa Research Station in 1999 specifically and solely to carry out research on the ecology and behavior of the fossa (*Cryptoprocta ferox*) and other carnivores in and around Ankarafantsika National Park. Since then, we have been successful in these pursuits and others, particularly as they apply in affecting the local communities in which our work is carried out. The depth and breadth of our projects in Ankarafantsika and Kirindy Mitea have been expanded to include additional research as well as conservation and development programs. Biological studies currently underway have been expanded to include several projects undertaken and conducted by Malagasy graduate students. Two have been completed and five more are underway in conjunction with an accord established between our research team and the University of Antananarivo. At the request of Park officials and following the immensely successful design for the development of Ranomafana National Park in southeastern Madagascar, we have also initiated a programme with local villagers in training to become Ankarafantsika's first ecological monitoring team.

In order to further promote conservation in and around Ankarafantsika, our teams spend a considerable amount of time engaged in education and outreach on wildlife and habitat preservation in local villages. If villagers are nearby when fossa are captured and anesthetized, they are given the opportunity to look at and in some cases touch this top predator that is the basis of such large amounts of folklore and unfounded fear. In addition, local villagers, tourist guides, and schools are given training sessions on animal husbandry and ecology by the PI or permanent members of the field staff. These conservation messages are then passed on to visitors, colleagues, classmates, or friends in and around Ankarafantsika. In this way, we are encouraging a sustainable balance between Ankarafantsika's wildlife and the human populations around the Park. Also, our field project co-sponsored a program to build a regulation-size basketball and volleyball court. This project, led by local Peace Corps volunteers, was logistically and financially assisted by our field team and funded by Earthwatch and Conservation International. The courts have artwork and numerous conservation messages painted on them by a local artist. This court is regularly used by uniformed sports teams from throughout the region.

Celebrations involving the entire research team and open invitations to the entire Ankarafantsika community are held at the end of each Earthwatch team. Multitudes of local villagers from all around Ankarafantsika gather together with members of the field

team and local officials in a spirit of friendly, open interaction. Several times each evening, all activities are halted for exercises involving all people present in which conservation messages are delivered and received. These celebrations provide excellent opportunities for dissemination of conservation education messages to local villagers. It is made very clear that these events, sponsored by the field team and Earthwatch are only made possible because of the group's presence – and that presence is owed to the remaining local forests and preservation of the research animals contained therein. Conservation-based messages such as those mentioned above were happily accepted by local villagers via this medium, exemplified by the common shout of “Arovy ny fossa!” (Save the fossa!), regularly used by villagers when greeting field team members and staff.

Several times weekly, our team members (students, researchers, volunteers, and veterinarians) visit villages in and around Ankarafantsika to conduct studies of domestic animals and their health status. During these visits, villagers receive assistance and education on animal husbandry and veterinary medicine. In addition, domestic animals may be spayed or neutered to help control the feral populations of cats and dogs. Finally, each domestic animal processed receives an identification tag and rabies vaccination.

As a part of our shared vision for collaborative development, conservation, and research expansion in Kirindy Mitea and the surrounding region, we have entered into a collaboration with the Madagascar National Park Service (ANGAP) for the development of a Center for Conservation and Research Training (CCRT). The CCRT will be established within Kirindy Mitea to serve as an educational and research center to be used in collaboration between educators, researchers, ANGAP trainees, students, and other relevant parties. It has been developed with the mission to promote more thorough research support and instruction for all agents of conservation, education, and research, including those active in the immediate region and throughout Madagascar. Facilities to be housed within this center will include classrooms, laboratories, computing facilities, dormitories for medium to long-term researchers, meeting areas, work areas, large multi-purpose tables, and secure storage areas.

Such an undertaking is not possible without the collaborative efforts of many organizations, groups, and agencies. Those involved include ANGAP, Duke University's Nicholas School of the Environment, Earthwatch, ICTE/MICET, and the University of Antananarivo, among others.

Public Policy Benefits of this Project

Our work continues to contribute to the formation of public policy by:

- Providing consultation and assistance to the local and national park management authorities
- Creating a long-term action plan for Madagascar's science and technology policy development, submitted to ANGAP
- Politically assisting with the process of establishing new protected areas
- Providing satellite analysis of conservation “problem areas” in Ankarafantsika, Kirindy Mitea, and Madagascar

- Consulting directly with foreign financiers (embassies) of regional management initiatives
- Participating in priority-setting and management planning workshops
- Formation of a collaborative management and development accord with park authorities
- Agreement to assist with confiscated lemur husbandry and care on-site
- Building of monitoring and fire towers within Ankarafantsika and Kirindy Mitea park boundaries

Educational and Economic Benefits of this Project

Educational and business communities benefit from our work in many ways as well. Our project incorporates:

- Malagasy graduate student support and development (more than a dozen to date)
- Local student educational support and financing (six students in secondary school at present)
- Formation of collaborative educational development accords with national universities
- Formal agreement to develop and logistically support the park's first village-run ecolodge and bungalows
- Formal agreement to logistically support a confiscated wild animal and tourism center
- Development and training for local marketing initiatives

To promote local business development, our team collaboratively established the Ambodimanga ("under the mango trees") campsite. Entirely village run with all profits being managed by the Ambodimanga village women's group for further development, the Ambodimanga campsite can now easily support up to 35 tourists and researchers long-term and 75 for short-term junkets. In addition, the village has just constructed bungalows for ecotourist use. Three national TV crews and three national newspaper / journalism teams have visited in the last three years for footage, photos, and interviews promoting and advertising the site within Madagascar. This project is an open collaboration between members of our team and the villagers of Ambodimanga. This site provides an additional facility for housing ecotourists and researchers – with 100% of the proceeds raised delivered directly into the village. Via this exemplary and immensely successful project, local people are immediately reaping the benefits of preserving the forests around them.

In addition, our Conservation and Research Team has developed a series of folklore dances with the women's groups of Ampijoroa and Ambodimanga. At these events, which can be put on with a half-day's notice, a number of traditional songs and dances are performed by the women's groups for ecotourists staying overnight in the Ampijoroa or Ambodimanga campgrounds. The profits from this one night's activity are the equivalent of a month's wages in other less-conservation oriented jobs available in the area. Team members have also helped test and critique the women's groups "dress rehearsals," assisting them to improve their performances.

We are also working to promote local and national education in other ways. Conservation cannot be readily enacted and the advance of a society as a whole cannot be achieved without first ensuring that the populations targeted for conservation and development input are reaping the benefit of improved education. Our team is comprised mainly of University of Antananarivo graduate students gaining a valuable field perspective of conservation biology, equipping them with the necessary experience to make efficient and correct conservation decisions when they become agents and authorities of conservation in Madagascar in the very near future. In addition, our team has joined our sister development group (the Madagascar Ankizy Fund) in developing and inaugurating a number of new primary and secondary schools throughout the Majunga basin. Finally, an accord of scientific cooperation with the University of Antananarivo has been made by our team on behalf of Duke University's Nicholas School of the Environment.

The Conservation and Research Team has conducted, developed, and funded a number of conservation-based commercial ventures within the villages of Ampijoroa, Ambodimanga, and Andranofasika. We also funded the construction of a glass-fronted display case at the Ampijoroa Station's Welcome Center. Specific ventures include embroidery training by an expert from Antananarivo, textile and batik making, stuffed animal design and creation, hand-made postcard artwork, and simple jewellery fabrication. Each of these ventures has been successful in marketing the conservation wares produced, turning a sustainable profit for citizens in and around Ankarafantsika.

Local educational and business communities will benefit from the establishment of the planned ecotourist education facility and visitor's center currently under completion on-site. Our field team actively assists ANGAP and the Department of Water and Forests in caring for, rehabilitating, and placing confiscated lemurs in credible zoos and educational centers. In the last year alone, we have been responsible for the care and placement of one *Eulemur mongoz* (currently at the Madagascar National Zoo, Tsimbazaza), two *Eulemur fulvus fulvus* (currently at the Ivoloina Zoological Park), and one (Critically Endangered) *Propithecus verreauxi coronatus* (returned to the wild at the Antrema Special Reserve). Representatives of the Department of Water and Forests have exclusively requested our help in establishing, funding, building and managing a large-scale center for confiscated animal rehabilitation and husbandry. This center will also be open to public visitors, further promoting ecologically sound educational and business development in the region.

The educational and business community continues to benefit from our extensive media outreach programs. Conservation and research efforts are more easily sustained and facilitated when they are well-known and well-publicized. To increase both national and international exposure, a number of media resources have been recruited in collaborative projects to report on our team's activities ongoing in Ankarafantsika. International film crews from Tierzeit (Germany), Leo Productions (France), Survival Anglia (UK) and National Geographic Television (USA) have visited and reported on our projects via film. International magazines Terre Sauvage, Discover, International Wildlife, Earthwatch, and Forbes have covered our Ankarafantsika projects in print. National TV crews from RTA, MaTV, TVM, M3TV have covered our activities via National TV news. Finally, numerous articles (including 3 front page) on our projects have appeared in L'EXPRESS, the leading national newspaper.

Ongoing and Future Data Collection and Benefits

With continued support from Earthwatch, those already received, and those likely to be obtained independently, our project has the following deliverables in the upcoming 3 years:

- Groundbreaking for the Kirindy Mitea Center for Conservation and Research Training (CCRT). This structure is to be used exclusively as a base of research (carnivore projects and others) operations and conservation training for Madagascar as a whole.
- We will continue ecological monitoring of all animal species at Ankarafantsika and Kirindy Mitea, with specific focus on carnivores and their prey.
- We will continue to expand on-site research, conservation and development activities for the indefinite future including the Earthwatch fossa team and several Malagasy graduate students.
- We will continue to provide high-profile media attention for research supported by Earthwatch and the Center for Field Research. Historically, these included film crews from *National Geographic* and from German and Japanese television companies. Magazines covering research projects by our team in Ankarafantsika include, *Discover*, *Terre Sauvage*, *International Wildlife*, *Wildlife Conservation*, and *Earthwatch*. We also continue to run an active website for the project at www.nicholas.duke.edu/madagascar.
- We will produce a series of high quality scientific papers. A habitat risk analysis for Ankarafantsika and other Madagascar Integrated Conservation and Development Projects, using satellite image analysis, is in its final stages. At least five Master's and undergraduate theses have also been completed as a part of this project in the past three years.

Continued long-term presence of our established field team will continue ongoing research pursuits and continue to provide logistical support to other projects otherwise unable to initiate or continue work in the Ampijoroa Station and surrounding areas. New and established projects incoming to Ankarafantsika already facilitated/assisted by the Duke team include a complete Madagascar primates population genetics project, a *Microcebus* behavioral ecology project (Hannover Primate Group), studies examining the impacts of forest fragmentation on primates in the region (Duke and SUNY @ Stony Brook), and long-term analysis of regional habitat trends and their effects on primate populations, using remote sensing (CERC), among others. In addition, we have entered into a regional research and conservation development accord with the Madagascar Ankizy Fund and Dr. David Krause to promote research and development in the Majunga Basin, using Ankarafantsika as the flagship for these efforts. Additional conservation development activities are continuing and extending in many forms as well.

Ongoing ecotourism programs have been expanded to include additional aspects. With the release of MADAGASCAR the movie, the ecotourism potential for Ankarafantsika and Kirindy Mitea has increased exponentially in the last year and has the potential for much more expansion. International and local mass media will continue to be used in encouraging additional tourists to the area. Facilities continue

to be upgraded in a collaborative effort involving local citizens, the Earthwatch Research Team, Madagascar authorities, and commercial interests. Ongoing conservation education efforts continue to be applied and expanded on a local, island-wide, and international level. Finally, additional conservation interests are being recruited to collaborate with us in continuing to assist in managing Ankarafantsika and Kirindy Mitea for effective conservation and development.

The additional deliverables of our ongoing plan include:

- Deforestation monitoring using remote sensing, including an island-wide comparison of ICDP success and carnivore habitat conservation.
- Facilities construction/improvement and research support staff in place – additional research support and logistical assistance.
- Continued development of ecotourist activities benefiting the local community.
- Place an expanded hotel on site in Ampijoroa. The first bungalows for Ambodimanga have been recently completed and plans for more are underway.

We have also spent quite a bit of time presenting the project and its preliminary results to public and scientific audiences around the world. The following is a list of recent large conference presentations on this project and its works in the last two years. At least two dozen small venue lectures and presentations have been given since 2003 as well:

- March 2005: Student Conference on Conservation Science, Durham, NC: Fragmentation and fossa populations in Ankarafantsika National Park (1); Lemur sensitivity to habitat loss and fragmentation in Ankarafantsika National Park (2), and Bushmeat Trade in Madagascar (3)
- June 2004: Society for Conservation Biology Meetings; New York, NY, USA; Preliminary observations of carnivores and their prey at a new dry forest reaserch site in Madagascar, Kirindy Mitea National Park. (1), Health assessment of domestic and free-ranging carnivores in Ankarafantsika National Park, Madagascar (2)

In addition to print journalists, we have also recruited a number of media interests to help promote this project. Recent film crews making features on our project are:

- *Tierzeit* (Earthwatch fossa project film; German TV Series; 30 mins),
- *Adventures Sauvages* (“Chasing the Fossa,” for a French TV Series; 60 mins),
- *Dungeons and Dragons, by Survival Anglia* (British Nature Filmfeaturing Madagascar Predators and Prey; 60 mins),
- *National Geographic Television’s “Out There” Explorer Series* (“Dangerous Creatures,” Fossa film, 30 mins.; “Maneaters of Madagascar,” Croc film with PI consulting on-film, 30 mins).

Perhaps the weakest aspect of this project in its first three years has been a lack of submission of papers to peer reviewed journals. We have spent a disproportionate amount of time and effort on capacity building and baseline data collection, data analysis, additional project development, and not enough time writing papers.

Six Masters and undergraduate Honors Theses have been completed under affiliation with this project over the past three years. These include two Malagasy DEA projects. This work and additional projects ongoing are slated for future publication.

Samples of data collected during these projects and to be included in these papers are presented here:

- Dollar, LJ, RA Andriandivoarivelo, J Pomerantz and A Vargas (in prep) Morphometrics and activity of Madagascar Wild Cats in Ankarafantsika National Park

Measures	Wild Cats			Domestic Cats		
	Female	Male	Overall	Female	Male	Overall
Weight (kg):						
Minimum	2.45	4.50	2.45	1.50	2.20	1.50
Maximum	3.90	6.60	6.60	3.30	4.20	4.20
Average	3.18	5.56	5.03	2.46	3.27	2.94
Body Length (cm):						
Minimum	52.60	61.80	52.60	37.70	43.60	37.70
Maximum	59.60	66.60	66.60	51.50	57.00	57.00
Average	56.10	64.16	62.55	42.68	51.67	48.07
Tail Length (cm):						
Minimum	29.10	30.70	29.10	20.50	21.50	20.50
Maximum	32.70	36.80	36.80	33.30	30.60	30.60
Average	30.90	34.15	33.50	27.60	27.65	27.63
Neck Circumference (cm):						
Minimum	13.30	18.50	13.30	13.00	13.00	13.00
Maximum	16.60	21.40	21.40	16.50	21.80	21.80
Average	14.95	19.66	18.61	17.55	17.55	16.27
Chest Circumference (cm):						
Minimum	21.50	28.70	21.50	20.20	20.00	20.20
Maximum	26.40	32.50	32.50	27.20	30.80	30.80
Average	23.95	30.94	29.39	22.78	26.08	24.67
Cranium Length (mm):						
Minimum	78.90	86.64	78.90	51.50	71.81	51.50
Maximum	85.69	89.93	89.93	94.93	102.55	102.55
Average	82.30	88.49	86.01	80.10	83.73	82.18
Cranium Width (mm):						
Minimum	49.73	51.81	49.73	44.68	50.48	44.68
Maximum	56.55	55.92	55.92	76.11	77.86	77.86
Average	53.14	53.58	53.40	63.71	58.96	60.99
Upper Right K9 Length (mm):						
Minimum	9.98	10.79	9.98	5.45	5.63	5.45
Maximum	10.92	14.58	14.58	8.94	11.60	11.60
Average	10.45	12.57	12.04	8.00	9.43	8.92
Upper Right K9 Width (mm):						
Minimum	4.81	5.04	4.81	3.31	3.41	3.31
Maximum	4.81	6.19	6.19	4.29	5.54	5.54
Average	4.81	5.54	5.42	3.86	4.58	4.17
Upper m1 Length (mm):						
Minimum	10.68	11.18	10.68	3.60	4.22	3.60
Maximum	11.29	12.42	12.42	4.41	4.58	4.58
Average	10.99	11.90	11.64	4.03	4.40	4.15
Right Hindlimb Length (cm):						
Minimum	31.80	33.30	31.80	17.20	20.20	17.20
Maximum	32.60	36.70	36.70	27.80	35.70	35.70
Average	32.20	35.40	34.76	21.97	29.22	26.32
Right Forelimb Length (cm):						
Minimum	26.50	28.20	26.50	10.80	15.60	10.80
Maximum	27.60	30.00	30.00	22.50	27.40	27.40
Average	27.05	28.89	28.48	16.98	21.36	19.61

- Dollar, LJ, C Jenkins, and SL Pimm (in prep) A quantitative analysis of Madagascar Integrated Conservation and Development Projects using remote sensing

This Table (Table 1) is from a completed manuscript in the process of submission. Due to the sensitive nature of the subject matter, the results are not presented here; merely a representation of the subject matter. See the following table of ongoing projects for

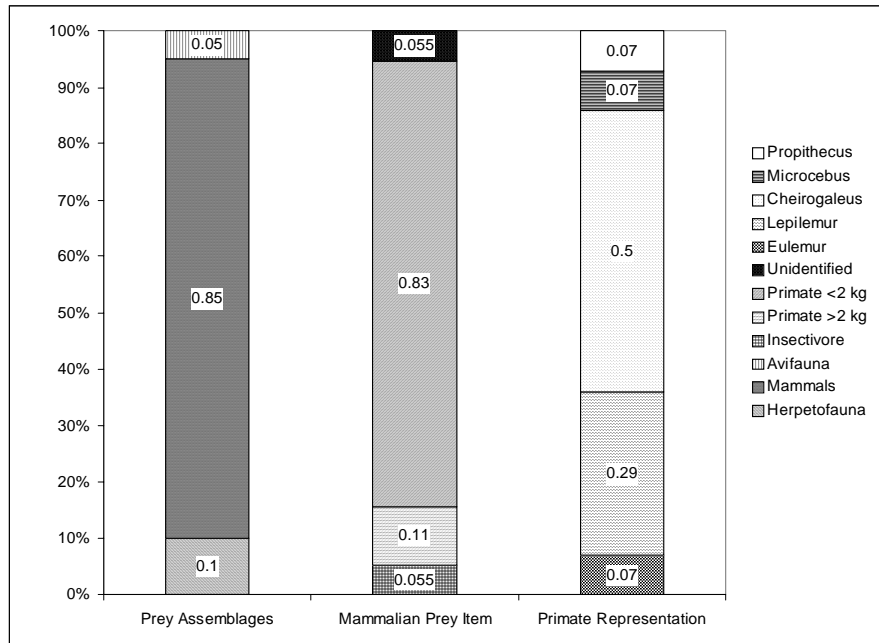
Protected Area	Montane d'Ámbre	Ankarafantsika	Bemaraha	Zahamena	Mantadia/Perinet	Ranomafana	Andohahela
Legal Designation	National Park	Integrated Natural Reserve	Integrated Natural Reserve	Integrated Natural Reserve	National Park	National Park	Integrated Natural Reserve
Management Group (1990-2000)	WWF	CI	ANGAP	CI	ANGAP	ICTE	WWF
Region	Antsiranana	Mahajanga	Mahajanga	Toamasina	Toamasina	Fianarantsoa	Toliara
Forest Type	Rain Forest	Dry Forest	Dry Forest	Rain Forest	Rain Forest	Rain Forest	Rain Forest
Year Established	1958	1927	1927	1927	1970	1989	1927

Table 1. Integrated Conservation and Development Project (ICDP) Protected Areas and their Regional Management Information.

additional information.

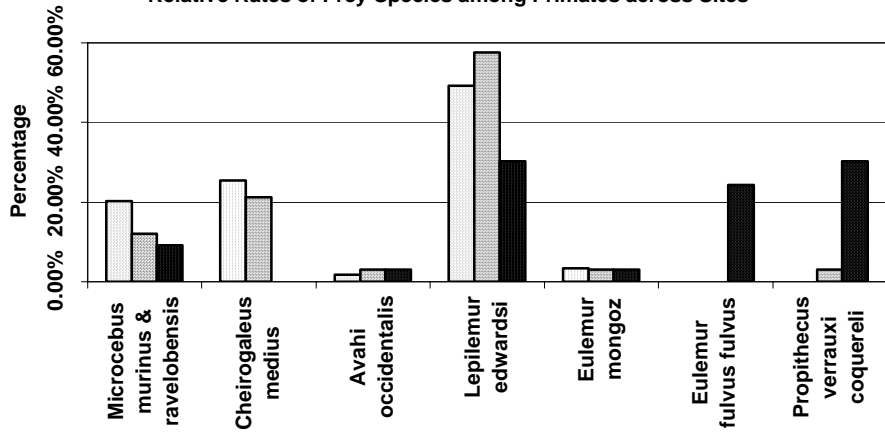
- Dollar, LJ SM Goodman, and LP Rahajanirina (in prep) Prey selectivity by the fossa (*Cryptoprocta ferox*) in Ankarafantsika National Park, Madagascar [RAHAJANIRINA MS THESIS]

- Dollar, LJ JU Ganzhorn, and SM Goodman (in press) Primates and other prey items

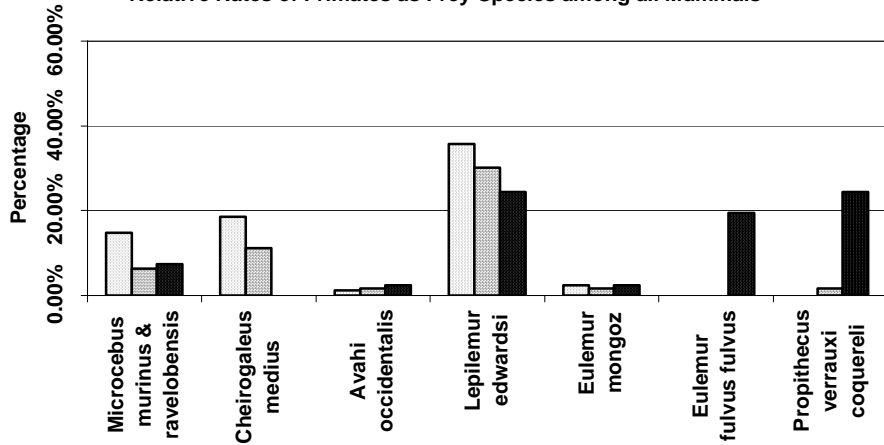


in the seasonal diet of *Cryptoprocta ferox* in Ankarafantsika National Park, Madagascar

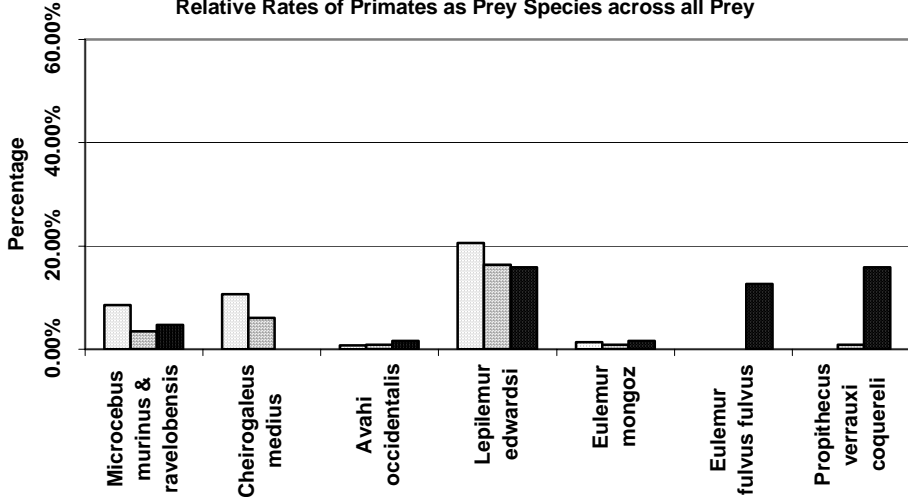
Relative Rates of Prey Species among Primates across Sites



Relative Rates of Primates as Prey Species among all Mammals



Relative Rates of Primates as Prey Species across all Prey



• HEALTH EVALUATION OF FREE-RANGING FOSSAS (*Cryptoprocta ferox*) AND SURVEY OF INFECTIOUS DISEASES AMONG INTRODUCED DOMESTIC CARNIVORES IN MADAGASCAR by Julie E. Pomerantz, D.V.M.^{1*}, Léon Pierrot Rahajanirina, D.E.A.², Andoniaina Radosoa Andrianaivoarivelo, A.E.A.², Harilala Rakotomanana², Edward J. Dubovi, Ph.D.³, Susan E. Wade, Ph.D.³, and Luke J. Dollar, B.S.¹

TABLE 3. Serological assays for infectious agents in fossas (*Cryptoprocta ferox*), domestic dogs (*Canis familiaris*), and domestic cats (*Felis catus*) in the vicinity of the Ampijoroa forestry station in Ankarafantsika National Park, Madagascar.

	Test type ^a	<i>C. ferox</i>		<i>C. familiaris</i>		<i>F. catus</i>	
		# positive/ #tested	titer range	# positive/ # tested	titer range	# positive/ # tested	titer range
Canine Coronavirus	SN	none tested	NA	4/35	1:10-1:60	none tested	NA
Canine Parainfluenza	SN	none tested	NA	5/25	1:10-1:20	none tested	NA
<i>Neospora caninum</i>	IHA	none tested	NA	3/18	1:50	none tested	NA
Canine Adenovirus	SN	0/7	0	2/35	>=1:1280	none tested	NA
Canine Distemper	SN	1/7	1:10	29/35	1:10-1:480	none tested	NA
Canine Herpesvirus	SN	0/7	0	7/35	1:10-1:320	none tested	NA
Canine Parvovirus	HAI	1/7	1:10	20/35	1:40-1:5120	none tested	NA
<i>Dirofilaria immitis</i>	antigen ELISA ^{b,c}	0/7	0	6/19	antigen positive	0/8	antigen negative
Feline Calicivirus	SN	3/7	1:10-1:20	none tested	NA	11/32	1:10-1:30
Feline Enteric Coronavirus	SN	0/7	0	none tested	NA	0/32	0
Feline Infectious Peritonitis	KELA	none tested	NA	none tested	NA	0/17	0
Feline Herpesvirus	SN	0/7	0	none tested	NA	0/32	0
<i>Toxoplasma gondii</i>	KELA/IHA ^d	3/3	1:2048-1:8192	none tested	NA	8/32	1:60-1:358
Feline Leukemia Virus	ELISA	none tested	NA	none tested	NA	0/32	antigen negative
Feline Immunodeficiency Virus	KELA/WB	none tested	NA	none tested	NA	1/32	0
Feline Panleukopenia Virus	HAI	none tested	NA	none tested	NA	18/32	1:160-1:10240

^a SN = serum neutralization, IHA = indirect hemagglutination, HAI = hemagglutination inhibition, ELISA = enzyme linked immunosorbent assay, KELA = kinetic enzyme linked immunosorbent assay, WB = western blot

^b DiroCHEK, Synbiotics Corp., 16420 Via Esprillo, San Diego, CA 92127, USA

^c *F. catus* samples were also tested for antibodies to *D. immitis* (Witness FHW Feline Heartworm Antibody Test Kit, Synbiotics Corp., 16420 Via Esprillo, San Diego, CA 92127, USA) all samples tested negative

^d *C. ferox* samples were tested with IHA, *F. catus* samples were tested with KELA

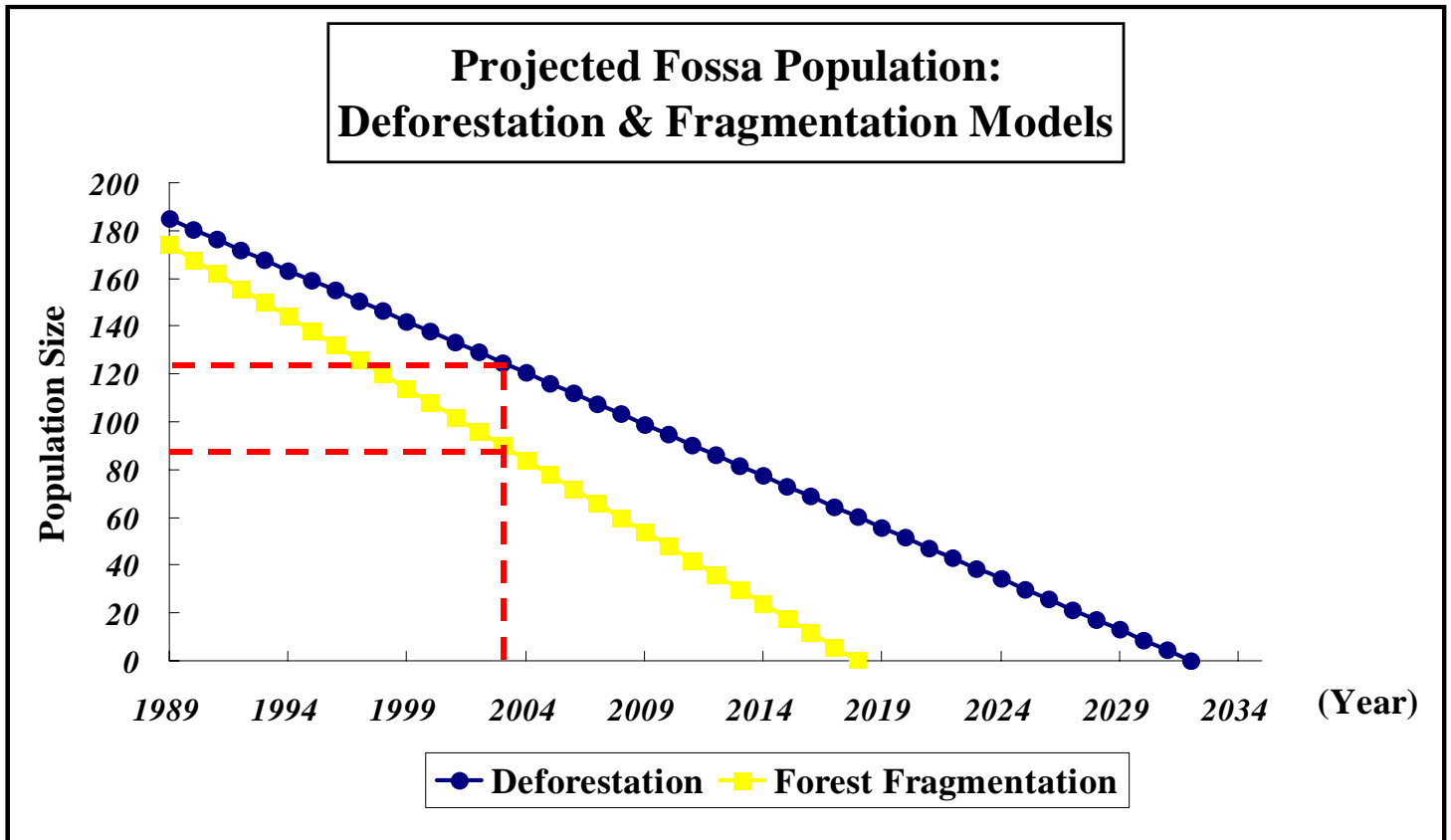
TABLE 4. Serological assays for infectious agents in fossas (*Cryptoprocta ferox*) from all sites (n=18)

	#positive/ # tested	titer range
Canine Coronavirus	none tested	NA
Canine Parainfluenza	none tested	NA
<i>Neospora caninum</i>	none tested	NA
Canine Adenovirus	2/18	1:60
Canine Distemper	6/18	1:10
Canine Herpesvirus	0/18	0
Canine Parvovirus	1/18	1:10
<i>Dirofilaria immitis</i>	0/18	0
Feline Calicivirus	8/18	1:10-1:20
Feline Enteric Coronavirus	0/18	0
Feline Herpesvirus	0/18	0
<i>Toxoplasma gondii</i>	10/11	1:256-1:8192
Feline Leukemia Virus	none tested	NA
Feline Immunodeficiency Virus	none tested	NA
Feline Panleukopenia Virus	none tested	NA

TABLE 5. Endo and ectoparasites found in fossas (*Cryptoprocta ferox*), domestic dogs (*Canis familiaris*), and domestic cats (*Felis catus*) in the dry deciduous forests of western Madagascar

<i>C. ferox</i>	<i>C. familiaris</i>	<i>F. catus</i>
Endoparasites:		
<i>Capillaria</i> sp.	<i>Ancylostoma caninum</i>	<i>Aeurostrongylus abstrusus</i>
<i>Isospora</i> sp.	<i>Dipylidium caninum</i>	<i>Ancylostoma tubaeforme</i>
<i>Spirurida</i> sp.	<i>Sarcocystis</i> sp.	<i>Isospora felis</i>
"Strongyles"	<i>Spirocerca lupi</i>	<i>Isospora rivolta</i>
	<i>Spirometra</i> sp.	<i>Joyeuxiella</i> sp.
		<i>Mammomonogamus</i> sp.
		<i>Physaloptera</i> sp.
		<i>Spirometra</i> sp.
Ectoparasites:		
<i>Amblyomma</i> sp.	<i>Amblyomma</i> sp.	<i>Ctenocephalides felis</i>
<i>Boophilus microplus</i>	<i>Boophilus microplus</i>	<i>Echidnophaga gallinacea</i>
<i>Ctenocephalides felis</i>	<i>Ctenocephalides felis</i>	
<i>Echidnophaga gallinacea</i>	<i>Echidnophaga gallinacea</i>	
<i>Listrophoridae</i> sp.	<i>Rhipicephalus sanguineus</i>	
<i>Menoponidae</i> sp.		
<i>Otodectes</i> sp.		

- Dollar, LJ and PH Liu (in prep) Fragmentation and habitat loss for fossa (*Cryptoprocta ferox*) populations in Ankarafantsika National Park, Madagascar. [LIU MS THESIS]



b) How do your findings contribute to issues of sustainability?

See descriptions in the applications section above.

Dissemination of Results

a) Have you provided details of results from your research to or within:

- Scientific papers (indicate status; e.g., peer reviewed or in progress/press)

Two published or in press since last field season:

HEALTH EVALUATION OF FREE-RANGING FOSSAS (*Cryptoprocta ferox*) AND SURVEY OF INFECTIOUS DISEASES AMONG INTRODUCED DOMESTIC CARNIVORES IN MADAGASCAR by Julie E. Pomerantz, D.V.M.^{1*}, Léon Pierrot Rahajanirina, D.E.A.², Andoniaina Radosoa Andrianaivoarivelo, A.E.A.², Harilala Rakotomanana², Edward J. Dubovi, Ph.D.³, Susan E. Wade, Ph.D.³, and Luke J. Dollar, B.S.¹

Dollar, LJ JU Ganzhorn, and SM Goodman (in press) Primates and other prey items in the seasonal diet of *Cryptoprocta ferox* in Ankarafantsika National Park, Madagascar

- Management plans and reports (in progress or completed)

Global Mammal Assessment, Madagascar, Carnivore Section, Held by the IUCN, from the meetings held in April 2005, Antananarivo, Madagascar.

- Presentations (given or planned)

More than 12 public lectures in the past year, plus additional scientific lectures given by team members at the Student Conference on Conservation Science, Duke University, 2005, on:

- 1) Fragmentation & habitat status for *Cryptoprocta* in Ankarafantsika National Park, Madagascar
- 2) Fragmentation & habitat status for primates in Ankarafantsika National Park, Madagascar
- 3) Bushmeat trades in Madagascar.

- Popular articles or films (in progress or completed)

Children's book: The Secret Lives of Animals (featuring Luke Dollar and his fossa research)

- Books, chapters, illustrations

The Dollar et al paper listed above is appearing as a book chapter.