Amur Tigers and Far Eastern Leopards in Russia:

Research, Training, and Capacity Building

in the Russian Far East

FINAL REPORT

TO

21ST CENTURY TIGER

FROM THE

WILDLIFE CONSERVATION SOCIETY (WCS)

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PROJECT SUMMARY

In October 2006, the Wildlife Conservation Society's (WCS) Russia Program began a telemetry-based field research project designed to collect ecological and biomedical data on Amur tigers and Far Eastern leopards in southwestern Primorsky Krai (Primorye). The goal of this project is to develop an ecological and biomedical database on the ecology of these felids in Southwest Primorye for use in conservation planning. Most importantly, data are needed to identify movement corridors (or the lack thereof) between this tiger population and the main population to the north, and between Russia and important habitats in China; and to identify problems associated with inbreeding and disease for both tigers and leopards in the area. There are several reasons why this study area was selected, and why this project is vital for understanding the ecology and informing long-term conservation strategies for both tigers and leopards:

1. Here, Amur tigers exist at the southern end of their current range, along the border with China, as a subpopulation isolated from the main population of tigers to the north. This population of tigers is the source population for recovery of tigers in Northeast China, a landscape that could hold up to 100 individuals. WCS is engaged in ongoing efforts to identify suitable habitat in Northeast China, and to develop land-use plans that will allow the tiger population in Southwest Primorye to re-colonize lands across the border.
2. Southwest Primorye is the focus of a number of ongoing development programs, including expansion of the road and rail networks, extension of the electricity grid, mineral/coal extraction, and construction of a gas pipeline. An assessment of the impacts of these development projects are urgently needed to inform conservation plans for the creation of protected areas with sufficient corridors to enable movement of tigers and leopards between Russia and China, and between north and south tiger populations.
3. Small isolated populations, such as the tiger and leopard in this region, are particularly vulnerable to the effects of chronic inbreeding and stochastic extinction events which can be precipitated by infectious disease. The only way to assess the clinical, reproductive and genetic health and to identify disease threats is by hands-on evaluation by capturing individuals.
4. In Southwest Primorye, Amur tigers coexist with the critically endangered Far Eastern leopard population of about 30 individuals. Very little is known about leopard ecology in the Russian Far East, and there are too many unanswered questions to effectively move forward with leopard recovery plans, evaluate the impacts of ongoing conservation activities, or define additional conservation planning priorities. Current plans for leopard recovery include continued protection of current habitat, construction of a captive breeding centre, and establishment of a second population. However, the relationship between tigers and leopards in the Russian Far East is poorly understood, and tigers may have a significant negative impact on leopards. It

is crucial that any areas of conflict between conservation of these two species are identified to enable successful conservation of both tigers and leopards in this area.

5. Lastly, as scientists with a real understanding of tiger and leopard ecology and conservation needs, we will have the credibility to address bureaucrats and politicians on development and other conservation issues.

Our research is focused on the eastern portion of the Leopardovyi Federal Zakaznik (Wildlife Refuge) and the multiple-use lands of the Neshinoe Hunting Lease. Field methodology is similar to that used for the Siberian Tiger Project in the Sikhote-Alin Biosphere Zapovednik (SABZ). We conduct captures to collect blood, tissue, and other samples necessary to identify problems associated with disease and inbreeding for these small populations of tigers and leopards, and to fit animals with tracking devices. Adult tigers and leopards are fitted with VHF collars to collect data on a variety of ecological and biomedical parameters, e.g., identifying movement corridors between subpopulations and countries, sources of conflict between human activities and tiger and leopard conservation, and areas of conflict and compatibility between tiger and leopard conservation.

This project also includes an important training and capacity-building component. In an attempt to produce the next generation of conservation biologists in the Russian Far East, WCS has established an intensive program to support talented Russian and international graduate students in the fields of wildlife and conservation biology. Together with the Siberian Tiger Project, our research program on tigers and leopards serves as a vehicle to train such graduate students.

This report describes field research on Far Eastern leopards and Amur tigers in Southwest Primorsky Krai and training and capacity-building efforts for the period from July 1, 2009 to June 30, 2010. During the report period we collected a total of 289 locations on four radio-collared leopards, bringing our total number of locations up to 843. We continue to see that our male leopards have much larger home ranges (182 and172km^2 FK 95%) than our females (149 and102km^2 FK 95%), but the female home range size is larger than previous estimates for Far Eastern leopards. Unfortunately we did not capture any tigers or leopards during the autumn 2009 capture season, and we were unable to obtain permits to conduct capture activities in spring 2010. Over the report period we collected 37 tiger and leopard scats, and we now have a total of 192 scats for diet analysis, which we hope to commence soon. In addition, we found six kills; three leopard kills, two tiger kills and one from either a leopard or tiger. Finally, three Russian graduate students and one prospective Ph.D. student from the UK received training on the project while collecting materials for their dissertations.

During summer and winter 2009 the project suffered from a number of transportation, personnel and permitting issues. However, some of these issues have been resolved, data collection is moving at a new pace and we are hopeful of obtaining permits to conduct captures in autumn 2010 and spring 2011.

This project is conducted under a cooperative agreement with the Institute of Biology and Soils (IBS), Far Eastern Branch of the Russian Academy of Sciences.

PROJECT OBJECTIVES

Our objectives under this grant were as follows:

- Capture and collar animals to maintain a study size of four tigers and four leopards.
- Conduct biomedical evaluations of tigers and leopards to identify potential inbreeding and disease-related problems in Southwest Primorsky Krai; collect blood samples for disease and genetic analyses.
- Monitor captured tigers and leopards, through radio-tracking and snow-tracking, to collect data on:
    - annual and seasonal home range size, daily and seasonal movements, land tenure system, and social structure;
    - reproduction (timing of breeding and birth, litter sizes, interval between litters);
    - rates and causes of mortality;
    - dispersal and long range movements, particularly in the Russia/China border area;
    - food habits and prey biomass requirements to estimate tiger pressure on prey;
    - habitat use;
    - relationship between tigers and leopards, including interactions and avoidance, and overlap in space, habitat, and diet.
- Continue our training and capacity building activities for this project, including training and support of existing personnel (one biology student, one senior scientist from IBS, and two field assistants), and attempt to identify other biology students to work on the project.

PROGRESS

Ecological and Biomedical Research

Field research for this project takes place in the Neshinoe Hunting Lease and the eastern part of Leopardovyi Federal Zakaznik, or wildlife refuge (Figure 1), which represents some of the best remaining habitat for tigers and leopards in Southwest Primorsky Krai, Russia.

Figure 1. Southwestern Primorsky Krai, including location of protected areas (eastern part of Leopard Refuge rose colored, and study area shaded in red diagonal hash-marks).

Capture activities. Fall capture activities were conducted from September 17 through November 15, 2009. A total of 30 foot snares were set throughout the capture site; some snares were reset and moved during the capture season. The capture team consisted of John Goodrich, Ph.D. (WCS), Alexander Rybin (WCS), John Lewis, Ph.D. (Wildlife Vets International), Samantha Earle (WCS), Viktor Starozhuk (WCS), Deena Matyukhina (WCS), and Alyona Salmanova (WCS, graduate student). We also provided training to several veterinarians and international colleagues who participated in our capture activities: Misha Goncharuk, a recent graduate in wildlife medicine from the local Ussuriisk Agricultural Academy, who has worked with the Zoological Society of London; Tammy Peterson, a veterinary assistant from the United States; Kholis, a Malaysian veterinarian working on human-tiger conflicts for WCS, and Joe Smith, a tiger biologist working for the NGO Panthera.

Unfortunately, we did not capture any tigers or leopards; a female Asiatic black bear and two sika deer were captured. We began using slightly modified snares this past fall to increase safety, but this may have inadvertently led to our difficulty capturing leopards, whose paws are significantly smaller than those of tigers. We estimated that we may have had more than ten incidences when leopards stepped into snares, but the snares did not tighten sufficiently, and the animals continued onward. We found several deer carcasses that we attempted to use as bait, surrounding them with snares, but although one leopard fed on the deer carcasses, we were nonetheless unsuccessful in capturing her.

We were unable to obtain permits to conduct captures in the spring of 2010.

Year-round Data Collection (Radio-tracking, Snow-tracking, Tracking on foot)

The project currently has four leopards, two males and two females, fitted with standard VHF collars (table 1).

Species	ID	Sex	Estimated Age (years)	Capture Date	Weight at Capture (kg)
leopard	Pp01	male	14-16	29-Oct-2006	45
leopard	Pp02	male	10-11	02-Nov-2006 18-Oct-2007 08-Oct-2008	57 56 61
leopard	Pp03	female	4-5	15-Oct-2007	30
leopard	Pp04	female	9-10	18-Oct-2008	39

Table 1: *Notes on current study animals.*

Between July 1 2009 and June 30, 2010 we took a total of 289 locations for our four study animals (table 2). From the location data taken during the report period and previous locations we are able to ascertain the home ranges within our study area. We used minimum convex polygon (MCP) and fixed kernel (FK) methods to map (figures 2 and 3 respectively) and measure the home ranges for each individual within our study area (table 2). These home ranges are the minimum estimates, as it is likely that our leopards move outside the range of our radio telemetry activities; in particular, Pp02 probably moves further west of our study area towards the border with China, and it is not uncommon to lose his signal for days at a time. As expected, our male leopards have much larger home ranges (182 and172km^2 FK 95%) than our females (149 and102km^2 FK 95%); however, the data indicate that female home ranges are much larger than previous estimates for Far Eastern leopards. However, seasonal movements or shifts in home range during the study period could result in slight overestimates as the home range sizes presented in this report are derived from all locations for each individual. We are conducting further analyses of this data to better understand home range sizes, overlap and seasonality.

Leopard ID	Sex	# Locations July 2009-June 2010	Total # Locations	Home Range Size		
				FK (km^2)		MCP 100% (km^2)
				95%	50%	
Pp01	**male**	69	250	182	50	217
Pp02	**male**	78	167	172	45	167
Pp03	**female**	62	249	149	46	149
Pp04	**female**	89	177	102	22	120
Total		**289**	**843**			

Table 2: *Number of locations and home range sizes of leopards within study area.*

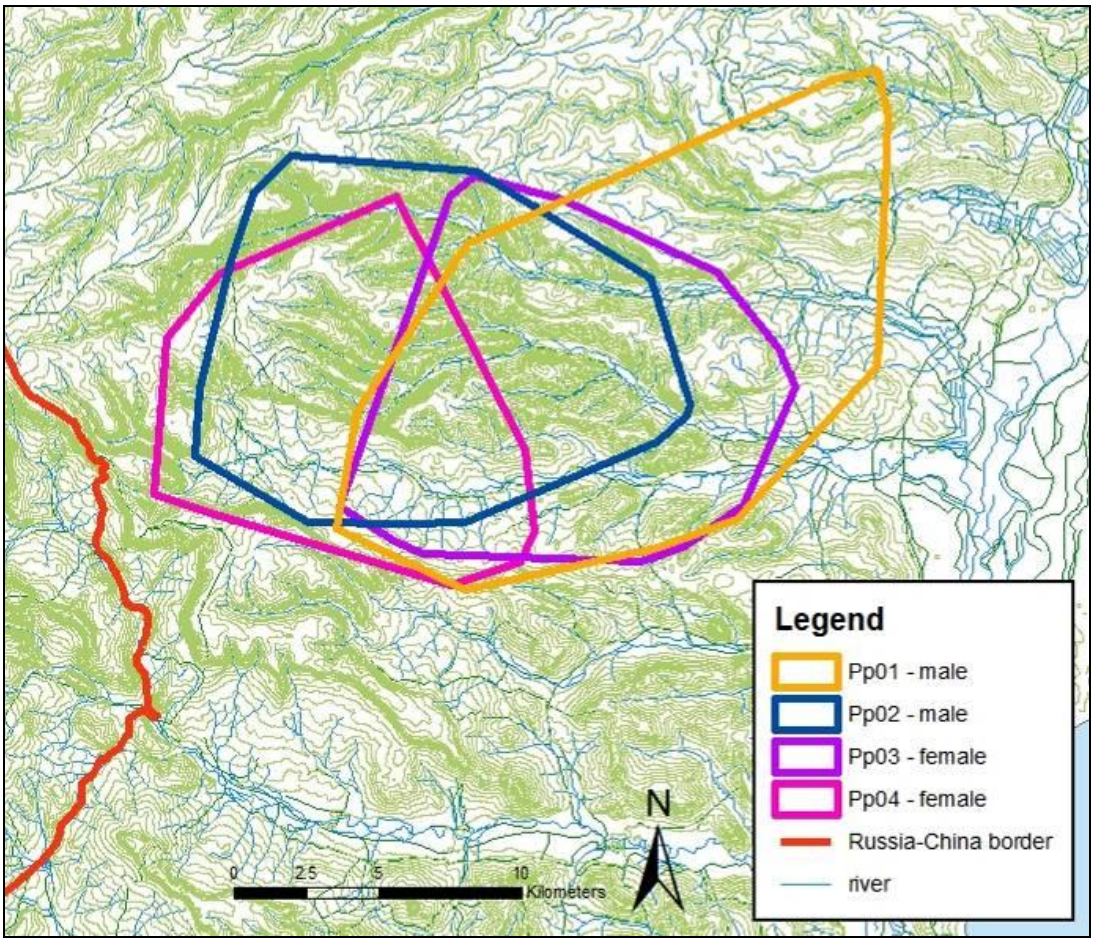

Figure 2. *Home ranges of leopards mapped using MCP*

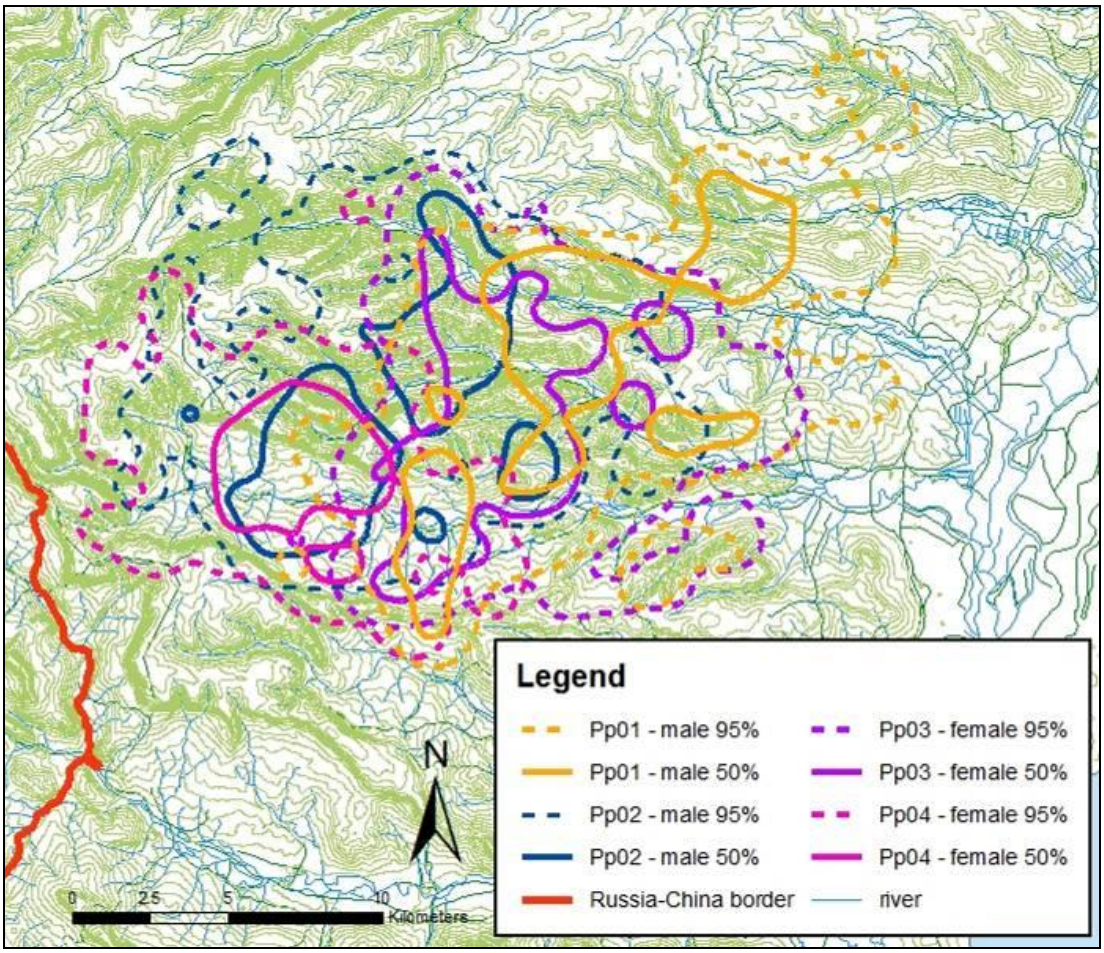

Figure 3. *Home ranges of leopards mapped using FK*

During the winter of 2009-10 we conducted snow tracking on foot as well as continuing radio-telemetry to collect locations. For the first time we had a visual sighting of a leopard, as we unexpectedly came across female leopard Pp03 at a distance of 80-100m. Radio signals indicated that male leopard Pp01 was also close by. The two leopards remained at close proximity to each other for a total of five days; this is unusual for solitary animals unless they are mating. This gives us reason to hope that Pp03 may have a litter in early summer 2010.

In February we saw another leopard, but this individual was not one of our collared study animals. We were able to observe this leopard long enough to see that he was a young, healthy-looking male.

In addition to our four study animals, we believe there are three leopards (one female and two males) and several tigers that regularly use our study area. This includes tracks of an un-collared male leopard alongside tracks of our female leopard Pp04. Furthermore, throughout the winter we regularly saw tracks of adult male and female tigers, and we frequently saw tracks of a female tiger with one or two cubs in the southern portion of our study area. Therefore we remain hopeful that in the near future our inventory of collared study animals will include tigers.

As a result of the unusually high snowfall in the winter of 2009-10, we observed more than 20 sika deer that died from presumed starvation or exhaustion.

Finally, during the report period we collected 37 tiger and leopard scats. We have a total of 192 scats stored in the freezer, which will be used firstly for genetic analyses to distinguish between tiger and leopard scat, and then for diet analyses to determine food habits. In addition, we positively identified 6 kills made by tigers or leopards. We found two tiger kills (one sika deer, one wild boar), three leopard kills (all sika deer) and one roe deer that could have been killed by a tiger or leopard.

Training and Capacity Building: Supporting Young Russian Scientists

During the reporting period, we supported three Russian graduate students:

- Alexander (Sasha) Rybin has been working with us for 12 years and completed a second Bachelor's degree in biology in 2008, focusing on camera-trapping of Far Eastern leopards. In the fall of 2009 Sasha entered a Ph.D. program at the Institute of Biology and Soils, Russian Academy of Sciences Far Eastern Branch, where he is continuing his research on monitoring the Far Eastern leopard population. Sasha leads organization and implementation of our camera-trapping studies on leopards and tigers in Southwest Primorsky Krai each spring and participates in tiger and leopard captures and radio- and snow-tracking. As one of our best Russian capture and immobilization specialists, over the past two years Sasha has also led WCS's response to several tiger-human conflict situations in the southern part of tiger range in the RFE.

- Alyona Salmanova began working with WCS while an undergraduate at Far Eastern State University, where she completed her undergraduate thesis research on the application of radio-tracking in studies of Amur tiger ecology. In 2007 she enrolled in a Master's program and joined WCS's field crew studying tigers and leopards in Southwest Primorsky Krai. Alyona defended her Master's thesis in the spring of 2009, and subsequently enrolled in a Ph.D. program at Far Eastern State University in the fall, where for her dissertation she will seek to expand her research on Far Eastern leopard habitat use. While gathering material for her dissertation, Alyona works as a field technician on our project, where she is engaged in radio-tracking, snow-tracking and camera-trapping of leopards and tigers, and has now participated in two fall capture seasons (in 2008 and 2009).

- Deena Matyukhina began working as a field assistant on our tiger and leopard research project in Southwest Primorsky Krai at the end of 2008, and in the summer of 2009, she enrolled in a Master's program in environmental monitoring at Far Eastern State University. For her Master's research, Deena is using data from the Amur Tiger Monitoring Program to assess anthropogenic impacts, particularly logging, on tiger and prey densities, as well as reproductive rates. Before beginning her collaboration with WCS, Deena had been engaged in conservation projects, but

never in scientific field research. She continues to work with us full time as a field assistant while we collaborate on her Master's research, which is allowing her to learn radio-tracking, snow-tracking and camera-trapping techniques, as well as GIS and new statistical approaches. Deena gave her first presentation at a scientific conference this spring when she presented a comparison of tiger and ungulate densities between protected areas and adjacent territories. Along with other students working with WCS, she gave a professional presentation that was well received. In the summer of 2010, Deena was accepted to the prestigious WildCru Diploma in International Conservation Practice program at Oxford University, where she will study from January – August 2011.

In addition to the students described above, a young British biologist, Samantha (Sam) Earle, began working with us as a field technician on our tiger-leopard project at the beginning of 2009. Sam completed her M.Sc. in Conservation Science at Imperial College London in 2008 with a thesis focused on the European captive population of Far Eastern leopards. With her energy, enthusiasm, and easy-going nature, Sam has been an invaluable addition to our field team. She plans to enroll in a Ph.D. program at Durham University in the fall of 2010, focusing her research on leopard-prey relationships, and we look forward to supporting the research efforts that will be a part of her dissertation.

Other Activities

Although the activities related to population monitoring and tiger recovery planning were not proposed as part of this grant, we include a brief description of these activities below, as we believe they provide useful information on the status of tigers and leopards in Southwest Primorye, and furthermore represent an important part of our overall efforts in this region.

Population Monitoring: Camera trapping. WCS has used camera trapping to monitor the leopard and tiger populations in our study site in Southwest Primorye annually since 2002. In 2009 and 2010, our field team conducted camera-trapping from late February-May. We set up 21 pairs of camera traps (42 cameras total) throughout our study area, which are visited approximately once every 2 weeks in order to check film and replace batteries. We identified 9 leopards and 5 tigers in 2009; in 2010, 12 leopards and 8 tigers were photographed. Leopard numbers are up in 2010 after two years of lower counts in our study area (Figure 2).

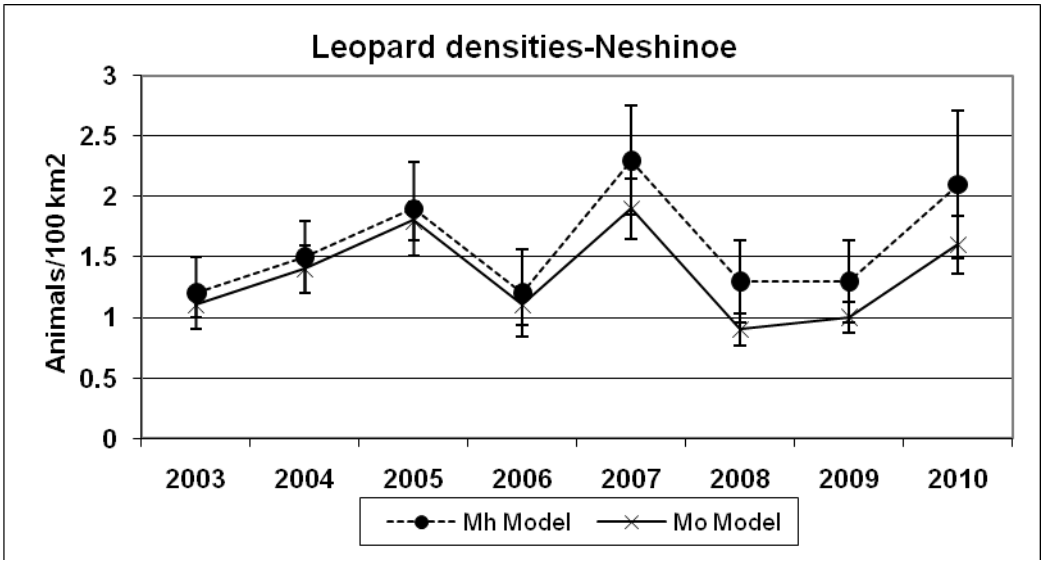

Figure 4. Leopard densities in our Neshinoe study area in Southwest Primorye from 2003-2010, based on 8 years of camera trap data. In 2010 we identified 12 individuals, an encouraging sign.

Meanwhile our photographs of 8 tigers in 2010 represent the highest number of individual tigers ever recorded in our study area through camera trapping, following a previous high of 5 individuals in 2009. Most importantly, this figure includes two females, which were identified in 2008 results as well (suggesting residency for both), and represents an important increase over previous years. Although there are commonly reports of poaching in this population, the data from our relatively small study area suggests that at in least where we are working, numbers are holding steady. The addition of a second adult female has the potential to double reproduction in the region.

Table 2. Numbers of tigers photographed in Neshinoe camera trapping study site, Southwest Primorye, 2003-2010.

	Year							
Sex	2003	2004	2005	2006	2007	2008	2009	2010
Males	2	2	3	2	1		3	4
Females	1	1	1	1	1	2	2	2
Unknown adults		1			1	2		2
Cubs	1							
Total	4	4	4	3	3	4	5	8

Tiger Recovery Planning in Northeast China. Since 1998, the WCS Russia Program has been collaborating with Chinese colleagues to recover tigers in Northeast China. Although there is no evidence that a stable, reproducing population of Amur tigers exists in Northeast China, there are regular reports of tigers in this region, and confirmed reports of tigers regularly crossing the border between Russia and China. Moreover, there still exist vast tracts of forests – the essential base of good habitat for the Amur tiger - situated throughout Northeast China's Jilin and Heilongjiang provinces. Therefore, re-

colonization of previously occupied Amur tiger habitat in China is a very real possibility if steps are taken to identify and manage these landscapes in an appropriate manner.

For the past 10 years, WCS has been collaborating with a number of partners to develop a landscape conservation strategy and action plan for tigers in Northeast China's Changbaishan landscape, which is adjacent to Southwest Primorye. The goals of this project include:

- Defining potential tiger habitat as tiger conservation priority areas for short-term, medium-term, and long-term effective protection and management to recover tigers;
- Identifying ecological corridors between large patches of potential tiger habitat;
- Identifying critical priority areas for immediate actions to address the main threats as the base for tiger recovery in the Changbaishan landscape;
- Providing basic recommendations to guide development of a full tiger conservation strategy and action plan.

In 2010, we completed a joint modeling exercise incorporating ecological niche factor analysis, resource selection functions, and expert opinion. Results of this exercise suggest that there are approximately 38,500 km^2 of potential tiger habitat remaining in the Changbaishan landscape, which can be divided into nine distinguishable Tiger Conservation Priority Areas (TPA) that could hold up to 80 tigers. A tiger conservation priority area is a set of quality habitat patches surrounded and connected by lesser quality habitat that allows movement between patches, ensuring an interbreeding population of tigers will exist within the unit. Potential ecological corridors linking these tiger conservation priority areas have been identified, but ground-truthing must be done to assess their feasibility. This process is already underway.

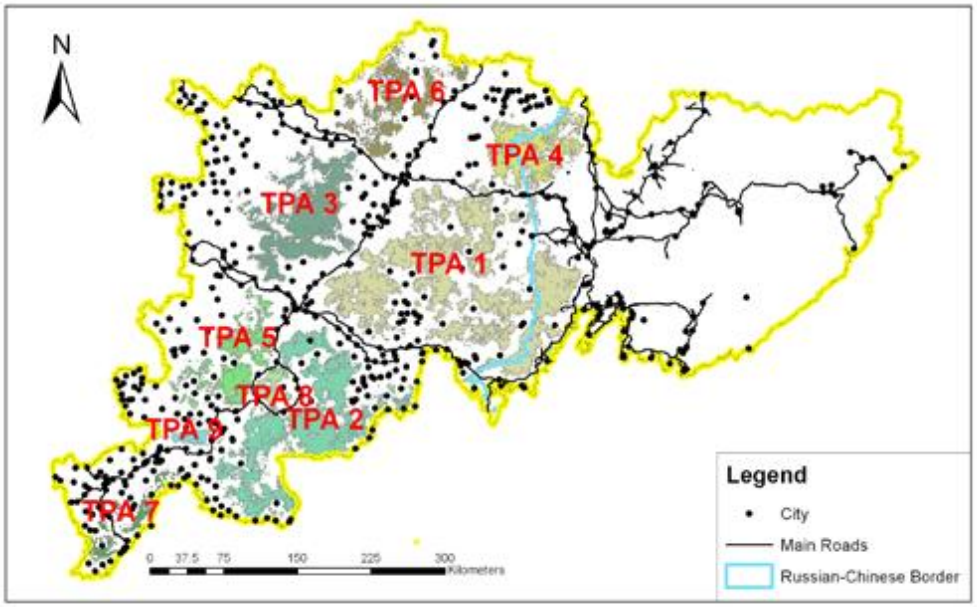

Figure 5. The nine largest Tiger Conservation Priority Areas (TPA) in Northeast China, identified by least-cost pathway analysis.

We feel very optimistic about the opportunity to recover tigers in Northeast China. The Chinese government has demonstrated significant buy-in to the landscape conservation and prioritization exercise described above, and after years of focus on the South China tiger, now extinct in the wild, China appears ready to commit resources to recovering Amur tigers in the north. To that end, WCS is working with partners and the government to implement recommendations to protect habitat, recovery tiger prey, and include "tiger friendly" management guidelines in development plans.

CONCLUSION

We sincerely appreciate 21st Century Tiger's role as a key partner in our ongoing efforts to protect the remaining Siberian tigers in the Russian Far East. Our training activities continue apace, and our field research program in Southwest Primorye is providing important data needed for conserving Amur tigers and leopards and understanding interactions between tiger and leopard populations. We are grateful to 21st Century Tiger for its long-term partnership in our conservation programs.

PHOTOS

Photo 1: *Graduate student Alexander Rybin measuring the size of a tiger scrape and collecting a scat sample.*

Photo 2: *Graduate student Deena Matyukhina radio-tracking a leopard.*

Photo 3: *Field technician Viktor Starozhuk clearing snow from one of our snares during the autumn capture season.*

Photo 4: *Graduate student Samantha Earle measuring a tiger track.*

SELECTED RECENT PUBLICATIONS

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