EXCLUSIVE

NEPAL TAKING THE LEAD ON CONSERVATION GENETICS

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Technology, when accessible and used well, can be a great equalizer. Here in Nepal a single conservation effort, the Nepal Tiger Genome Project, has not only helped the country leap to a globally competitive place in molecular studies of biodiversity, it has in fact pushed Nepal to the fore in conservation genetics.

The Nepal Tiger Genome Project (NTGP) used an innovative genetic technology to build a comprehensive national DNA database of the endangered Bengal tigers living in Nepal's Terai Arc Landscape—one of the few remaining tiger habitats on the earth—by collecting and recording a unique genetic fingerprint from each adult tiger's scat (the term used for feces of carnivores). In a course of two years, multiple teams spent 216 days collecting 1,200 samples of scat from four national parks even though the project itself was designed to create a database of only 700 samples.

"This is the first USAID-supported use of genetics for wildlife conservation in the Asia region," Tahalia Barrett, Deputy Director of USAID/Nepal's Social, Environmental, and Economic Development Office explained. "Supporting Nepal to conserve biodiversity is an important part of USAID/Nepal's development strategy, and tiger conservation is a priority of the Government of Nepal."

The Center for Molecular Dynamics in Nepal (CMDN) was already established as a leading center for molecular studies, focusing primarily on public health. When Dibesh Karmacharya, its International Director, presented the idea for the NTGP to USAID, it did not take long for both parties to realize their partnership would be crucial and timely.

"Knowing more accurately about how many tigers are in the wild, their location and corridors they are using between parks, and what their habitat and prey needs are critically important to protecting them and their habitats at national, regional and global levels," Bronwyn Llewellyn, Environment Officer at USAID/Nepal said. "This project offered the potential to address most of these questions in a non-invasive way that was potentially more cost-effective than the existing conventional practices (e.g., camera trapping, counting pug marks, etc.). Indeed, collecting tiger scats for DNA analysis and creating a geo-spatial database was itself something very innovative, scientific and exciting."

Keepers of the Tiger's Secrets:

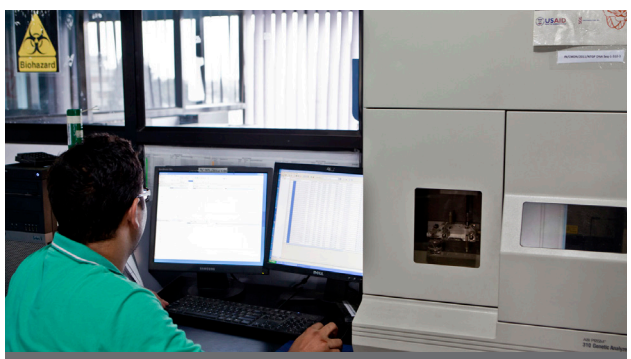
With a detailed study of this nature, how safe are the tigers' secrets? To understand this, it is important to understand the kind of data that is being collected and created, and the process in which the samples to produce that data was collected.

Three categories of data are collected and shared through the NTGP. First is the general data that is shared as public information, and also through an interactive website: ntgp.org.np. The second category of data is directly related to conservation policies and efforts and is shared with related agencies through the government. Finally, there is the core data that is only shared with the government. There is only one person at the Department of National Parks and Wildlife Conservation who has access to this data through a special computer that is connected to a local server through a secure link.

The CMDN maintains three backups of the data, but nothing is stored in a 'cloud backup.' "The most sensitive parts of the data might be the ones related to areas in which a tiger lives," Mr. Karmacharya explained. "But will people need to hack into our system and get that data to poach a tiger? I don't know. Our GIS is based on where we found tiger scat, and that's knowledge that all the rangers who helped us collect the samples have."

Indeed, the data, in its crude form, is something that the locals in buffer zones and living around national parks have always had. "If someone really wanted to find a tiger, a local villager in a buffer zone would be more informative. And I don't know how we can stop that villager's mind from being hacked," Mr. Karmacharya added.

Fortunately, official records indicate that poaching in Nepal's national parks has gone down significantly in recent years.



The Applied Biosystems' (USA) ABI 310 Genetic Analyzer was acquired through the NTGP as part of enhancing the laboratory capacity of CMDN to perform comprehensive genetic analysis of tiger scat samples. It allows NTGP team to identify individual tigers from scat DNA.

Hard Data and the Software:

In May, citing Lisette Waits, a professor in the Department of Fish and Wildlife at the University of Idaho, Kate Sheppard of Mother Jones magazine wrote this in her article about NTGP: "This type of genetic evaluation started back in the early 1990s with research on bears, and has also been used on tigers in India. But it's still a relatively rare method—there are only about 20 labs in the world doing this work, according to Waits—and this is one of the largest and most comprehensive surveys of its type to date."

Indeed, what is unique about NTGP is not the way the samples are collected, but rather the way in which the data from those samples have been cataloged. The software developed for NTGP is extremely detailed.

"The NTGP developed protocols for field sample collecting and for the use of 10-17 genetic markers for sample comparisons, as well as useful and user-friendly software to input data, which standardizes, compares, geo-locates, and stores all the genetic data," Bronwyn added .

Most similar work, according to Mr. Karmacharya, normally uses nine genetic markers. In India, where genetic conservation work is being conducted by a handful of labs, there appears to be inconsistency in the way the data is cataloged.

"These protocols for field sample collecting, the choice of genetic markers for sample comparisons and the customized software all do have potential applicability beyond Nepal to other tiger countries," Ari Nathan, the U.S. State Department's Regional Environment Officer for South Asia (based in Kathmandu), said. "In addition, the software has potential applicability not just to tigers, but to other species as well."

Finding the software an international market has been something CMDN had in mind from the start and is rooted in both CMDN's approach to making genetic research work feasible and sustainable in Nepal, and their drive to establish themselves as a global leader in the field.

Globally, poaching has become ever more violent and wildlife parts smuggling increasingly sophisticated. A regionally shared database would not only help conservationists and researchers with their field of work, but also law enforcement agencies to better understand where confiscated parts might have originated, or even the specific animal they belonged to. For this, standardization is integral. And software developed in Nepal might just help do that. But the software could also prove to be an important part of how CMDN continues to keep its conservation genetics work financially sustainable.

"If we don't integrate the business aspect of things and just rely on the goodwill of donors, we won't be sustainable," Mr. Karmacharya said as his team worked on wrapping up the NTGP report in June. "But what NTGP has done is become an example of what is doable in Nepal in terms of using modern technology for conservation."

Now that the example has been set, CMDN has established itself as a natural partner for several international researchers in Nepal, like Stanford University.

"I am interested in how animals respond to climate change," Prof. Elizabeth Hadly of Stanford University said of her research. "I work in the past, using fossils I excavate from the last 20,000 years or so, to the present, using extant animals I live-trap in the wild, in order to understand how animals will react to our world of the future." Her team has been researching the impact of climate change on the Himalayan Pikas.

Later this year, the CMDN will start working on a massive genetic catalog of Nepal's biodiversity. All of this seems to fit right in with The Ministry of Forest and Soil Conservation's 'Forestry for Prosperity 2030' plan, which envisions Nepal as an international hub for research that helps make conservation work more feasible.

The CMDN itself hopes to establish a formal learning center in the country. In the meantime, where does the NTGP go now?

"A potential next step following the work of the NTGP could be the development of a regional platform of tiger genetic fingerprints for conservation management and wildlife enforcement in the South Asia region," Mr. Nathan said.

Back at the CMDN, the lab was buzzing with young scientists hunched over computers and other equipment on a recent stormy monsoon afternoon. A scene promising unprecedented innovation for conservation or beyond, given a nudge from a tiger project, poised to take on a lot more. ■

Read more on the topic:

Tracking Tigers for Conservation published in **USAID's Impact Blog** by Stuti Basnyet | *April 16, 2013*

Technology and the Tiger: DNA Study of Wildlife in Nepal published in **Republica** national daily's weekend edition, The Week and sustainablenepal.org by Kashish Das Shrestha | *May 3, 2013*

Scientists use DNA From Poop to Track Rare Tigers published in **Mother Jones** by Kate Sheppard | *May 3, 2013*

DNA from Tiger Scat Aids Conservation Efforts in Nepal by Andrew C. Revkin, **The New York Times, Dot Earth** | *May 3, 2013*