



October 2008

## The Navigator: Philip Nyhus directs the Chinese government to the places where tigers may once again roam free

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### Recommended Citation

Jacobs, Ruth (2008) "The Navigator: Philip Nyhus directs the Chinese government to the places where tigers may once again roam free," *Colby Magazine*: Vol. 97 : Iss. 3 , Article 7.  
Available at: <https://digitalcommons.colby.edu/colbymagazine/vol97/iss3/7>

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A person in silhouette, wearing a cap and holding a smartphone, stands in a lush, mountainous landscape. A large, semi-transparent compass overlay is positioned in the upper right, with its needle pointing towards the top. The background features steep, forested hills under a blue sky with some clouds. The title 'the navigator' is overlaid on the image, with 'the' in a smaller font and 'navigator' in a large, bold font.

# the navigator

Philip Nyhus directs the Chinese government to the places where tigers may once again roam free.

By Ruth Jacobs



It was an unusual phone call about a secret meeting. Philip J. Nyhus, assistant professor of environmental studies, was on the line with longtime colleague Ronald Tilson, from the Minnesota Zoo, a leading expert on tigers.

Recalls Tilson, "I called up Philip and I said, 'You want to go to Beijing?' And he said, 'Sure ... what for?' and I said, 'Well, I don't know.' 'What are we going to do?'" [Nyhus asked], and I said, 'I don't know.' 'What's the agenda?' I said, 'I don't know.' He says, 'Well, who are you going to meet?' and I said, 'Other than Weisheng, I don't know.'"

Wang Weisheng, director of the wildlife management division of China's State Forestry Administration (SFA), wouldn't divulge what the meeting, in 2005, was about. Nor would he put it in writing. Tilson and Nyhus just needed to trust him. "He says, 'You have to come to Beijing, and you have to come soon. Please come,'" Tilson said.

Nyhus and Tilson had worked with Wang before. Prior to this phone call, the team had been tapped by the Chinese government, specifically the SFA, to determine if any South China tigers existed in the wild. They published a 2004 paper indicating that the subspecies that once roamed China's countryside (an estimated 4,000 in 1950) was most likely extinct in the wild. "That was the first time it was stated," said Nyhus, "the first major survey since the World Wildlife Fund did it about a decade before."

Then things got quiet. Until the mysterious phone call.

Despite the challenges of raising money for plane tickets and getting visas on two weeks' notice, Nyhus and Tilson made the trip to Beijing in 2005.

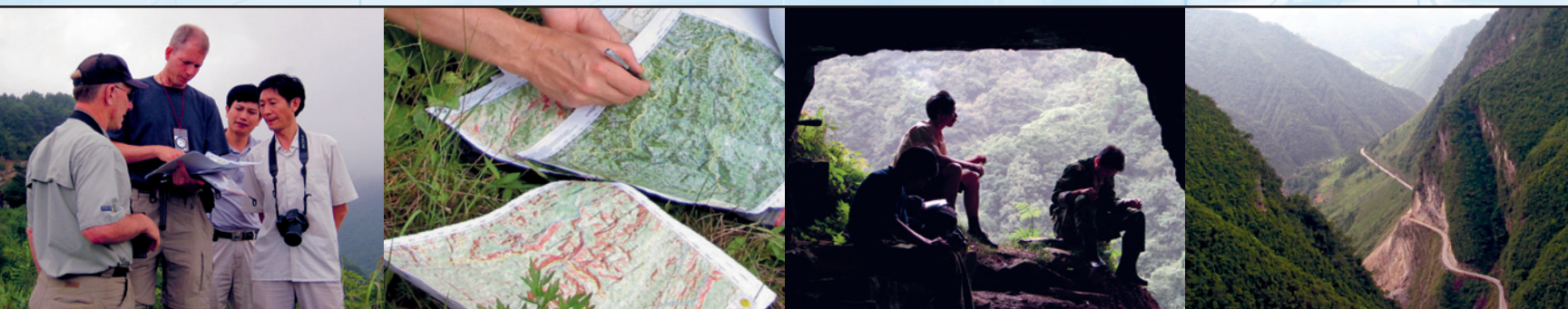
The secret?

"They basically invited us to come back and look for potential areas where we could restore the South China tiger," said Nyhus. Finding and fully evaluating those areas, though, would be a monumental task. "Everything else," Tilson said, "finding the tigers, finding the prey, finding the habitat, that all can come with time, it can be recreated in a sense. But unless you have that actual place, it won't happen. And so that was where Philip became the key to this whole project."

So began the quest to determine if China possessed a suitable area where South China tigers (of which about 70 exist—almost all, except for nine in Africa, in Chinese zoos) could be reintroduced into the wild. Nyhus, a specialist in the use of Geographic Information Systems (GIS) mapping, would spend the next three years (and counting) working with Tilson and biologist Jeff Muntifer of the Minnesota Zoo, the Chinese government, Colby environmental studies majors, and many others to attempt an unprecedented



*Left: Deep inside Hoube National Nature Reserve (NNR), Philip Nyhus takes a reading with a Global Positioning System (GPS) unit as part of his research to evaluate and map potential tiger habitat. Below, left to right: Nyhus, with collaborator Tom Dahmer (left) and staff from Hubei NNR, evaluates potential tiger habitat using Geographic Information System (GIS) maps created by Colby students; Nyhus marks his location and makes notes about the habitat in Hupingshan NNR; Chinese and American team members accompanying Nyhus rest in a cave overlooking a valley; a road cuts through steep terrain near Hoube and Hupingshan NNRS.*





conservation effort. “As with any scientific endeavor,” he said in May, “it could come to a screeching halt. But if it does move forward, and if we do find ... a place that we could think about restoring the tigers, this would be the first large-scale reintroduction of tigers ever undertaken in the world.”

The world’s population of wild tigers has been in steady decline for decades. At the beginning of the 20th century, according to Nyhus, about 100,000 existed; today, the number is about 4,000. Nyhus and Tilson write about the path to extinction in their forthcoming book, *Tigers of the World (2nd Edition): The Science, Politics, and Conservation of Panthera tigris* (William Andrew, 2009). “Official government eradication campaigns, uncontrolled hunting, extensive deforestation, and large-scale relocations of urban populations to rural locations all led to the decline and fragmentation of wild tiger populations,” they write.

As soon as Nyhus returned from the 2005 trip to Beijing, he brought Colby students into the project. In order to determine if a suitable area existed, the team would need maps of possible locations within the tigers’ historic range with details about elevation, slope, land cover, types of vegetation, protected areas, people, and boundaries. Summer research assistants Brendan Carroll ’05 and Carolyn Hunt ’05 went to work on maps of the areas: Hupingshan and Houhe National Nature Reserves (NNRs), in northern Hunan



PHOTO COURTESY OF MUNTIFERING AND TILSON, MINNESOTA ZOO

*One of only 72 living South China tigers. This photograph was taken at a captive breeding facility during a visit in 2001 by Philip Nyhus and his collaborators Ronald Tilson and Jeff Muntifering. Below, view of the core area of Hupingshan NNR at close to 2,000 meters (about 6,600 feet) above sea level.*

and southern Houhe provinces, and Mangshan and Nanling NNRs in southern Hunan and northern Guangdong. “They developed base maps that were useful for that initial field reconnaissance. And that wouldn’t have been possible if they hadn’t worked here at Colby,” Nyhus said. These preliminary maps provided rough

information about things like boundaries, rivers, and roads.

When Nyhus returned to China, he and his colleagues used the maps as they explored the area. And so began the work that continued through the summer of 2008: advanced environmental studies students work on maps, and Nyhus and the team of biologists and SFA officials use the maps both in the field and in meetings with Chinese officials. “It’s funny,” said Courtney Larson ’08, one of the students who worked on the maps this summer. “On the field maps we have to maintain everybody’s names that have worked on them. It’s becoming a longer and longer chain. We wrote something like, ‘Maps created by Courtney Larson, Jeff Carroll [’08], modified from maps created by Greg LaShoto [’07], Katie Renwick [’07], Brendan Carroll, Carolyn Hunt....’” She laughs. But this is pretty serious stuff.

In 2006 a memorandum of understanding established the South China Tiger Advisory Office (SCTAO) through the Minnesota Zoo and with support from Colby. The advisory office will determine if the reintroduction is feasible and, if so, will recommend to the Chinese government where and how to put China’s tiger back into the wild. Following a trip to China this summer, Nyhus was optimistic. “From the highest levels, SFA in Beijing, Wang Weisheng, to the provincial level, to the park level, there was enormous excitement,



interest, sharing of information, and it was a really positive experience,” he said. “I think the Chinese have already decided they want their tigers back. The tiger is an important part of China’s history and culture, and I think this is something that a lot of people within China want to happen and I think it will happen.” Whether it happens through this project or another, Nyhus said, China seems determined.

Cautious optimism aside, years of work still must be done if tigers are to

years, if and when a location is finalized.

But it all comes back to the maps.

The area under extensive evaluation is about 1,000 square kilometers (about 400 square miles), large enough for roughly a dozen tigers. “I can’t tell you how many now, because we don’t know,” said Nyhus. “We recognize [the area is] not ideal; it’s not that big compared to other areas in Asia that have tigers. It has a lot of really rugged topography that’s going to make it difficult logistically and make some of the area

and the students incorporated the data when Nyhus returned.

Cliffs weren’t the only things Nyhus helped the students fill in. “At the waypoints he would take notes just describing what the location was like and then also comparing it to those maps,” said Larson. Upon his return, Nyhus and the students compared the notes to the maps. “He said, you know, ‘The land-cover layer is good for the forest pixels, but it doesn’t pick up agriculture well’—like it doesn’t

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## “I think the Chinese have already decided they want their tigers back. ... And I think it will happen.”

—Assistant Professor of Environmental Studies Philip Nyhus

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roam free. While finding the location is key—and Nyhus and his colleagues may have done so this summer, in the northern Hupingshan-Houhe location—big questions remain. Where would the tigers come from? How much prey can the area support? Since the population of South China tigers is highly inbred, will they breed and survive, or will they need to be hybridized with healthier tigers? What effects might reintroduction have on other living creatures in the area? These are some of the topics being researched and discussed, and exploration will become far more detailed over the coming months and

unavailable,” he said. Though tigers lived in this area historically, they don’t like steep slopes, and this area includes cliffs that shoot up thousands of feet.

Those cliffs were the subject of a GIS mystery this summer, before Nyhus explored the area on foot. The information from the Shuttle Radar Topography Mission (SRTM) that the students were using to decipher the topography didn’t recognize these “no data zones.” “When he was out in the field he’d be hiking around and then he’d stop and take GPS waypoints,” said Larson. Nyhus found the cliffs, took GPS points and elevation notes,

differentiate grassland and agriculture very well. So that was a big thing that we had to work on once he came back, ‘cause we really do want to know where the agriculture is—it’s pretty important.”

Evaluations are still underway, but Nyhus was able to describe—and indicate on the map—an area thought to be suitable. “We think it’s probably one of the two best places within the historic range of the South China tiger to bring it back,” he said, despite that only a small number of tigers could live there. Still, Nyhus is optimistic about the broader implications. “It will be a foothold in the beginning of what could





be a larger process of restoring natural, wild ecosystems in South Central China."

Tilson says it wouldn't have happened without Nyhus, whom he calls the navigator. "The navigator is the one who uses maps and finds the way, and ... the maps that he and his students have created have allowed us to see where we want to go and to arrive over there and be able to show this picture to our Chinese counterparts," he said. "The navigator is always the most important person in any voyage."

Part of what makes Nyhus so crucial, says Tilson, is his ability to show rather than just tell. "They all have sort of a sense of what this place looks like, but, at best, it's just photographs. And Philip now has this three-dimensional map that he can project and it's like being a bird flying over the park, and he can turn it any way you want it and he can spin it on an axis, and all of a sudden you see the entirety of this whole place, and you can talk about here is where tigers can live, and here and here and here," he said, his voice rising with excitement.



**MAPS AND MORE:** To see the maps created by Philip Nyhus and his students — including the three-dimensional version — and more photos from China, go to [www.colby.edu/mag](http://www.colby.edu/mag), keyword: tigers.



PHOTO BY TOM BOLLIER '11



*Courtney Larson '08 and Charles (Jeff) Carroll '08 work on maps of China in the GIS lab.*

As Nyhus stands before groups of government officials, academics, and scientists in China, he is more than just the map guy. "I do the spatial analysis, but I'm also very interested in policy and the human dimension," he said. And while a primary concern is finding an area that's suitable for tigers in terms of topography and prey, other factors exist.

## GIS AT COLBY: PUTTING DATA ON THE MAP

GIS (Geographic Information Systems) technology has been part of the curriculum at Colby since long before Google Earth.

A mapping tool that allows researchers to visualize spatial data for analysis, GIS first appeared at Colby in the 1990s. In their senior capstone course Problems in Environmental Science, professors F. Russell Cole (biology) and David H. Firmage (environmental studies) introduced the technology to students analyzing nearby lakes.

In the lakes project the technology allows students to combine the data they gather on-site with historical maps to analyze how water quality has changed based on changes in land use. "With these maps, you're not just plotting something," said Cole. "Because the data is connected to the imagery, you're actually seeing patterns you might not observe otherwise."

Colby students have analyzed the potential impact of catastrophic sea level rise, the expected visibility of proposed wind turbines on Cape Cod, the carbon emissions of the Red Sox, and where moose-vehicle collisions are likely to occur in Maine.

While much of the GIS work is focused around the sciences, professors in other disciplines integrate it into their work. Economics Professor Michael Donihue '79 (currently associate vice president for academic affairs and associate dean of faculty) and his students used GIS to study the impact of migrant workers on Maine and the economic impact of hospitals on greater Waterville. "We're trying a big push to get social scientists involved in it," said Cole. "It's a

technology that's really important in a variety of fields."

Assistant Professor of Environmental Studies Philip J. Nyhus, an interdisciplinary scholar trained in GIS and remote sensing (analyzing spatial data), agrees. "One of the reasons I think GIS is an incredibly powerful tool ... is just about everybody can see themselves in a map. So it's inherently very interdisciplinary. You can be a geologist or an economist or a historian or a biologist, and everybody can see something in a map."

When Nyhus first came to Colby in 1999, as a postdoctoral fellow through a National Science Foundation grant supporting undergraduate research, one of his charges was to advance GIS. "The fellow position that we hired Philip for was designed to provide some teaching experience for him mentored by experienced teachers, but for him to provide the momentum in the initial stages of bringing GIS to Colby," said Cole. He did just that.

Fast forward to 2005, when Nyhus (having returned as a tenure-track professor) was tapped by the Chinese government to research the potential for reintroducing tigers into the wild. At that time Colby had the industry-standard software (arcGIS) but only a small space for GIS work.

The opening of the Diamond Building, in 2007, brought a GIS lab, thanks in part to funding from the Oak Foundation. "It has absolutely transformed our ability to teach students GIS and for students to use GIS," said Nyhus. "It's a world-class facility."



Because this land was converted into national park within the last 30 years, people still live there. “If we are going to consider putting tigers back, we need to understand both the biology of the park but also the people of the park,” he said. The area they’re considering most seriously now, in Hunan and Hubei provinces, includes homes abandoned as people fled for cities. “We talked to many families that expressed a strong desire to have other opportunities. It’s a really rough, rugged life when you’re up at eighteen-hundred meters, far from any village, market, roads, electricity.” Tiger-human conflict, mainly caused by tigers eating agricultural animals, is also a concern. Such conflict has, in the past, led to people hunting wild animals—endangered or not.

Nyhus also is involved in securing financing for the project, which he considers a primary challenge. This is an expensive endeavor that has received support from many sources already. Currently Nyhus and Tilson, along with their colleague Thomas Dahmer, a Hong Kong-based consultant, and others, are working with Gijsbert (Bart) Nollen of International Consultancy Europe, a firm that helps develop, fund, and implement sustainability projects, to secure the funds necessary to continue the travel and research the project demands. (Ultimately, the reintroduction would be funded in partnership with the government of China.) “We are serving as sort of principal scientific advisors,” Nyhus said, “but, as this project is growing, we’re bringing more and more people along.”

And as the scope expands, Nyhus remains at the core. “In many ways he’s like the glue to our project,” said Tilson.

Nyhus, who jokingly calls himself an “interdisciplinarian,” maintains focus on the detailed endeavor but relishes the larger implications, namely the role of this project in promoting biodiversity conservation in China. Tigers may be the primary reason for this effort, but Nyhus also expects the project to aid in conservation of other threatened plant and animal species. “There’s a rapid and growing nature conservation ethic ... in China that wasn’t there, and we think that the tiger could serve as sort of an additional lever to help encourage this,” he said. “And as more and more Chinese are becoming educated, as more and more are living in urban areas, I think the same kind of thing that happened here in the United States in the Fifties and Sixties—where we have basically a growth of a wildlife conservation ethic and wildlife laws—is happening in China.”

This could have far-reaching effects. “[This] could potentially serve, I think, as a motivator to encourage China as a nation to become a positive source of conservation in China and Asia,” he said.

If so, the environmental future of the world’s most populous continent will have been shaped by the work of student researchers on Mayflower Hill and their navigator. **C**

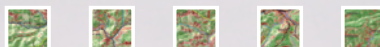


PHOTO BY TOM BOLLIER '11

*Nyhus checks in with Eric Hansen '08 as he works on his research project during Introduction to GIS and Remote Sensing class. Hansen was trying to predict snow deposition and snow and ice melt in Grand Canyon National Park.*

The College also added a GIS and quantitative analysis specialist who works with faculty to integrate GIS into coursework and with students to make sense of the sometimes-overwhelming software. “It’s one thing to take spatial data and throw it into the software

and then just visualize it, and it’s another to make sense out of it and to know how to use the various tools that are accessible,” said Manuel Gimond, who came from NASA in 2007 to fill the new position. “They’re quite complex, very overwhelming, and can also be misused—much like statistics.”

For Courtney Larson '08 and Charles (Jeff) Carroll '08, who worked on the maps of China this summer, Gimond was indispensable, offering ideas if not answers when they hit a stumbling block. “We wanted to calculate surface area of the park,” said Carroll—not the square footage, but the actual surface area. “When you put elevation in, topography, then it gets stretched out. So we were trying to figure out a good way to calculate that. There’s no tool,” he said.

Gimond got them started, and the students worked it out. “We figured out the geometry behind it and it was pretty straightforward after that,” said Carroll. “But without him, it would have been really difficult to figure out that you could even go about it that way.”

Professionals like Nyhus and Gimond can spend years working with GIS and still discover solutions to new problems, yet students can learn to create maps in a few weeks, sometimes even hours. Nyhus encourages his students to move beyond the creation of simple maps into developing an understanding of the complexities of cartography. “Students almost always want to spend more time just playing with the software,” said Nyhus, “and I tell them that just because you know how to type doesn’t mean you know how to write a really good poem.”