A USER'S GUIDE

Setting Priorities for the Conservation and Recovery of

WILD TIGERS: 2005-2015

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EXECUTIVE SUMMARY

Wild tigers are in a precarious state. Our best approximation concludes that tiger habitats throughout India, Indochina, and Southeast Asia are now 40 percent less than what we estimated in 1995. As the Economic Tigers of Asia leap onto the world stage, wild tiger populations in those countries are in steep decline; today tigers occupy a mere 7 percent of their historical range and the threats are mounting, rather than diminishing.

A world without tigers is hard to imagine, but red flags are being hoisted across the tiger's range. In India, poaching in what were thought to be well-protected Tiger Reserves has been so intense recently that it has become a national issue eliciting an investigation by a Prime Ministerial Commission. In Indochina, widespread poaching of tigers and wildlife continues to create empty forests, and the development of the proposed transnational economic corridors in the region will further fragment Indochina's remaining forests and create dispersal barriers. In Sumatra and Malaysia, vast oil palm and acacia plantations are predicted to result in complete conversion of some of the richest lowland rain forests on Earth, habitats that were populated by tigers only a few years ago. The increasing demand for tiger parts for folk medicines in China and Southeast Asia and for costume adornment among Tibet's growing middle-class has intensified threats to tigers across the range. Despite these setbacks, this is hardly the time for inaction or retreat. To paraphrase E. O. Wilson, tigers can't afford another century, or even another decade like the last one. Indeed, we must rededicate and galvanize our efforts to make tigers and tiger habitats a conservation imperative in the remaining landscapes of Asia.

Tigers are a conservation dependent species. They require protection from killing, an adequate prey base, and adequate habitat area. While the tiger as a species may not go extinct within the next two decades, the current trajectory will surely cause wild populations to disappear in many places, or shrink to the point of "ecological extinction"—where their numbers are too few to play their role as the top predator in the ecosystem. Therefore, now, more than ever, tigers need homeland security.

There are two possible strategies to ensure the future of wild tigers. One calls for securing a few tiger populations in increasingly isolated reserves while ignoring the retreat of forests outside. However, the natural history features of tigers—their need for large areas as top predators and their extreme territoriality—make this a poor option. The recent spate of killings in Tiger Reserves—regarded as the crown jewels of India's protected areas system—suggest that providing adequate protection to insular reserves is not enough.

A second approach—one which we endorse—is to create tiger landscapes, where core areas are linked with habitat corridors that allow the ecological requirements of wild tigers to be conserved as well. Such a strategy will require the support of the people living in the region. Although seemingly a difficult task, the successes of the Terai Arc Landscape Project being implemented in the foothills of Nepal and Northwestern India—in the midst of some of the densest human populations in South Asia—shows that creating corridors and eliciting the support of local people for tiger conservation is indeed possible. The successes are predicated on the reality that tiger conservation also results in conservation of ecological services that support and enhance local economies and livelihoods and so are in their self-interest. Another important aspect is to keep landscapes intact for tigers, best illustrated in the Russian Far East, which not only ensures the persistence of tigers into the future but leads to natural recolonization of neighboring areas, which has happened in China.

Large mammals, including tigers, have coexisted for centuries with dense human populations. The release of the 1997 Tiger Conservation Unit Analysis (TCU 1.0) identified where tigers can live in the future. During the decade since, experiences from implementing field conservation projects have confirmed that the future of wildlife conservation in Asia depends on judicious land use planning—zoning—of human use areas, core wildlife habitat, buffer zones, and corridors in large conservation landscapes to restore the harmony that once existed in the wildland-village interface of rural Asia.

This document, based on the concept of Tiger Conservation Landscapes (TCL 2.0), improves on the original analysis by: 1) compiling more accurate satellite imagery to improve mapping of potential tiger habitat; 2) building a new spatial database of tiger status and distribution; 3) incorporating new knowledge gained about tiger biology to create a standard for measuring the quality of tiger landscapes; 4) employing a systematic measure of human influence on tiger habitat (the "human footprint"); 5) automating the process of landscape delineation to make updates more rapid, rigorous, and transparent; 6) analyzing the sensitivity of results to assumptions made about tiger dispersal and minimum area size to support breeding tigers; and 7) updating priorities that move tiger conservation forward emphasizing representation and resilience. TCL 2.0 is truly a "living document" that has benefited

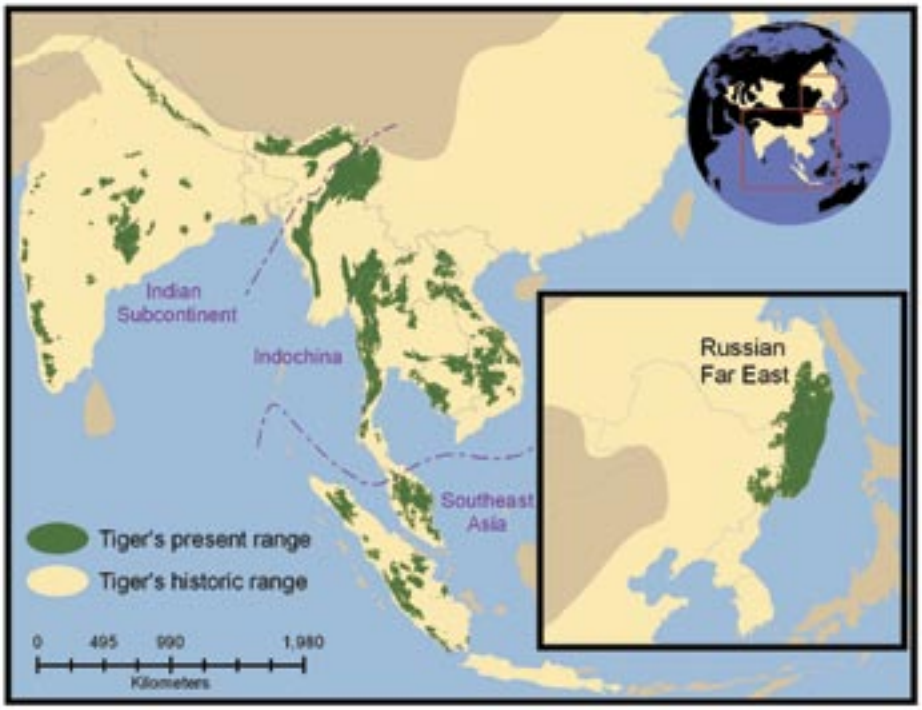
from open peer-review and that can continue to guide conservation efforts into the future. To learn more about the analysis and results, please refer to *Setting Priorities for the Conservation and Recovery of Wild Tigers: 2005–2015. The Technical Assessment*.

In this *User's Guide,* we highlight the remaining tigerlands—the large landscapes of habitat, often anchored by protected areas—that are Global Priorities for conservation. In order to go beyond the current state of tigerland, we also focus on those places where habitat restoration or improved conservation measures could bring tiger populations back from the brink of extinction. All are dependent on local, regional, national, and international support to sustain them, and must be integrated into national and regional resource and land management programs. Only such efforts can redirect the current downward trajectory to ensure survival of wild tiger populations. For this generation to deprive future generations of the chance to see or track a wild tiger or to hear its royal roar is a travesty.

We have identified 76 Tiger Conservation Landscapes (TCLs) across the tiger's current range (see map). Each landscape is classified into a "taxonomy" measuring their contribution to current tiger conservation and further prioritized in terms of their contribution to representation of tigers across the range. Global Priority landscapes were identified in all major biomes and bioregions where tigers occur. Investing in these global priorities will ensure conservation of not just tigers, but "tigerness," the suite of adaptations tigers have evolved to live in habitats as different as mangrove swamps and boreal forests.

Our results show that the Indian Subcontinent bioregion has the largest number of TCLs (40, of which 11 are of Global Priority). The Northern Forests of Nepal-India-Bhutan-Myanmar, Western and Eastern Ghats, Sundarbans, and the tall grasslands and riparian forests of the Terai Arc set the foundation for tiger conservation across a diverse array of habitats in this bioregion. Yet, this bioregion also has the most questionable habitats, where we were unable to assess or determine if tigers still do, or can, persevere in small, isolated habitat patches.

The Indochina bioregion supports 20 TCLs, but these account for the largest total area (~540,000 km^2) among the four bioregions, primarily because they represent vast swathes along the mountain regions of Myanmar and Thailand (notably the Tenasserim mountains range) and the Annamite Mountains of Laos and Viet Nam. Six are Global Priorities. The large areas of dry forest mosaics in Cambodia are likely the best such forest habitats for tigers across its range. Unfortunately tigers have largely been extirpated from many of the lowlands within this bioregion, and restoring tigers to



MAP 1. The tigers' historic and present range

these areas will require a sustained, long-term effort. Please note that TCL 37 spans both the Indian Subcontinent and Indochina bioregions and was intentionally double counted (thus included in the total number of TCLs in the Indian subcontinent and Indochina bioregion) due to the large amount of habitat present in both bioregions.

The Southeast Asia bioregion includes 15 TCLs, with three being Global Priorities. The latter are primarily in the montane regions, centered on Malaysia's Taman Negara National Park, and Sumatra's Kerinci National Park. In Sumatra's large Leuser ecosystem the status of tigers is unknown, but it overlaps with critical habitat for the orang-utan and Sumatran rhinoceros and has been designated as both a World Heritage Site and Man and Biosphere reserve, confirming the importance of this ecosystem to Sumatra's natural heritage.

The Russia Far East bioregion contains two TCLs, including the world's largest, which is 270,000 km^2. This TCL is primarily in Russia, but extends into northeast China, which has recently recorded tigers on its side of the border. Although this vast mixed temperate forest TCL has approximately 10 percent of its area under protection, the rest is unprotected wilderness in which the tiger is still able to persist. Rapid changes due to privatization and leasing of this forest to timber industries may constrain the future of the Amur tiger.

Our findings show that in each of the first three bioregions, the range of the tiger has contracted dramatically since 1995. Much of this change undoubtedly rests with changes in methodology and improvements in the underlying datasets, but it is also true that most of the signs we do have point to continuing declines in tiger habitat and numbers. How many wild tigers remain is impossible to know without systematic surveys across the range. Moreover our assessment is limited by the quality of available land cover maps, lack of range-wide measurements of prey numbers, our poor understanding of tiger dispersal, and incomplete information on other aspects of tiger biology. Though we understand tigers better than before, we still have much to learn.

Tiger conservation over the next decade will require building Tiger Conservation Landscapes into the development agenda of range states and regional plans, and we suggest several impor¬tant areas for funding to define a holistic strategy, which includes: 1) recruiting global and regional spokesperson(s) of great stature to speak for tiger con¬servation, 2) mainstreaming

A WWF-Russia Udege anti-poaching team member.

tiger conservation into national and regional development plans, 3) making TCL 2.0 broadly accessible and actively promoting its conclusions within Tigerland, 4) continuing attention to curtailing the trade in tiger parts from TCLs, 5) issuing periodic, public report cards on the status of tigers in TCLs, 6) financing of case studies demonstrating how TCLs can be linked to ecosystem services and zoned as part of the entire resource management program in a country, and 7) continuing to advance the science of tiger conservation.

The same factors that endanger tigers could be brought to bear to save them if the political will can be found. Asia's economic wealth creates new resources that can be invested in Asia's natural patrimony. And few species inspire an increasingly affluent, conservation-minded public like the tiger. Economic development depends on transboundary cooperation—so does tiger conservation.

Conservation of tigers will help conserve ecosystems and landscapes that provide human populations with essential ecological services to ensure necessities such as food and water, and for maintaining a high-quality environment for health and economic reasons; it is not just tigers, but people who require conservation in tigerland. We must act now, not just to preserve this awe-inspiring creature, but to ensure the health of ecosystems that also subsidize our own well-being.

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PROLOGUE

Whether the tiger is viewed with awe and fear because of its massive power, or admired for its flaming beauty, the shadowed presence of this great cat permeates the forests where it still endures, and echoes hauntingly in those forests from which it has recently gone extinct. The species has a small but worldwide core of persistent advocates concerned about its future, not only because of its sheer magnificence, but also as an icon of conservation, symbolizing the imperative of protecting all animals and plants within its realm. As this report points out, 93 percent of the tiger's original range has been lost in the past 150 years. And the decline in numbers and distribution continues. The situation is grave. On the Indian subcontinent, with the largest remaining tiger population, only 11 percent of original habitat remains, and the remainder is increasingly fragmented and often degraded. Tigers also face threats other than loss of habitat, competing with local communities for deer, wild pigs, and other natural prey. On the positive side, tigers are resilient and adaptable, needing only ample space, natural prey, cover, and water, and they are able to reproduce rapidly.

In 1997 the World Wildlife Fund and Wildlife Conservation Society, with financial and programmatic support from the Save the Tiger Fund, produced an important report that identified areas where tigers still lived or could live, and suggested various conservation initiatives to prevent the extinction of fragmented breeding populations. Much new information on status and distribution has become available during the past decade, various important ideas on how best to conserve tigers have broadened, and technological advances have greatly improved how data and ideas can be used to set conservation priorities. This new report, farsighted in concept and elegant in analysis, offers timely and essential information. The approach to conservation amplifies the ecological focus of the original report on preserving tigers in their various distinct habitats from coastal mangroves and open woodlands to rain forest. The goal is to preserve whole landscapes with the cats managed in large tracts of habitat that include core areas, buffer zones, and dispersal routes.

The vision is grand, the task difficult and expensive—but essential. It involves gathering more knowledge at each site about tigers and their prey, as well as about the local communities; it requires realistic policies and laws; it means protecting key areas with a trained and active guard force; and, above all, it must have the involvement of local peoples who recognize the spiritual and cultural values of tigers and treasure an ecological integrity upon which their livelihood depends. India is currently debating whether to give land title to the many families that are settled within government forests. What long-term effect would this have on managing landscapes for tigers?

Too few investigators are in the field to collect ecological information, monitor wildlife, and actively resolve conflicts between tigers and people. However, knowledge alone will not assure the tiger's survival. It is a matter of sadness and apprehension that during the past several years, tigers in several of India's reserves have been decimated by poachers: Tigers have been wiped out in Sariska and Namdapha, and severely reduced in Panna and Ranthambore, to name just four reserves, in spite of a large guard force and much money for conservation. Tiger bones and hides are smuggled principally into China, the former for medicine and the latter to be worn by Tibetans as a statement of status and fashion.

Better international cooperation is necessary on issues such as this. A knowledge gap must be closed, as the report notes, but so too must a protection gap. Tiger habitat extends across national borders. Russia and China already collaborate in a trans-frontier effort at protection and management, as do Nepal and India, and a similar initiative is needed, for example, between China and India, Myanmar and India, Myanmar and Thailand, and among Laos, Vietnam, and Cambodia.

This thorough report provides compelling data that also represents a strong call for action. Priorities are clear and options still remain open in all tiger countries. In the final analysis, saving the tiger is a moral issue, an act of conscience, to which each country must make a sincere national commitment.

George B. Schaller

The Tiger Conservation Landscape Analysis Version 2.0:

A USER'S GUIDE

The Rationale for a New Framework

Fair questions to ask of any new strategy, prioritization, or framework for nature conservation include: How does it help us? How does the new approach simplify a complex biological world so that decision-makers can allocate scarce resources, staff, and effort in a cost-effective manner? Where are the places where tiger conservation programs are most likely to be sustainable? The same questions are even more appropriate for a revision of our previous analysis. Aren't the results from TCU1.0 rigorous enough to continue to guide investments for the next decade as they have the previous one?

The TCU 1.0 was a breakthrough in many ways, but in one aspect it was lacking. It was not repeatable. The data for habitat assessments, poaching levels, and tiger trajectories relied heavily on expert opinion and inadequately captured in a systematically designed database or GIS. The current analysis eclipses the TCU 1.0 by being more data-driven and objective. Where data are lacking, we at least know much better what to target and where we need a more accurate picture of the greater tiger landscape. Perhaps even more important, the automated methods developed in Version 2.0 allow us to monitor the "state of Tigerland," both on the ground and remotely using the latest satellite information. To this end, we accompany a number of illustrative applications with targets and milestones that, if agreed to, can easily be measured by the tiger conservation community in the years ahead.

As we consider applications of this revised framework, we first revisit our guiding principles. We reiterate that our goal is to ensure that the concept of "tigerness" (representation of the suite of adaptations by tigers to different habitats) stays central to the conservation investment portfolio. This means ensuring that adequate resources and effort are spread across the tiger's range. It also means avoiding gravitation toward the protected area with the largest, most visible tiger population or where a given constituency lobbies loudest for funding. In suggesting the following applications, we do not mean to be overly prescriptive. We recognize that sovereign nations will look first to their own priorities and that some donors might be geographically focused in their investments. Other potential donors will focus more on the types of investments that can be made, separating out by funding field projects as diverse as tiger camera-trap surveys to community forestry programs designed to enhance connectivity across landscapes.


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METHODS

The delineation of tiger conservation landscapes is based on three primary datasets: the most recent land cover data available, new tiger data, and human influence data (Figure 1).

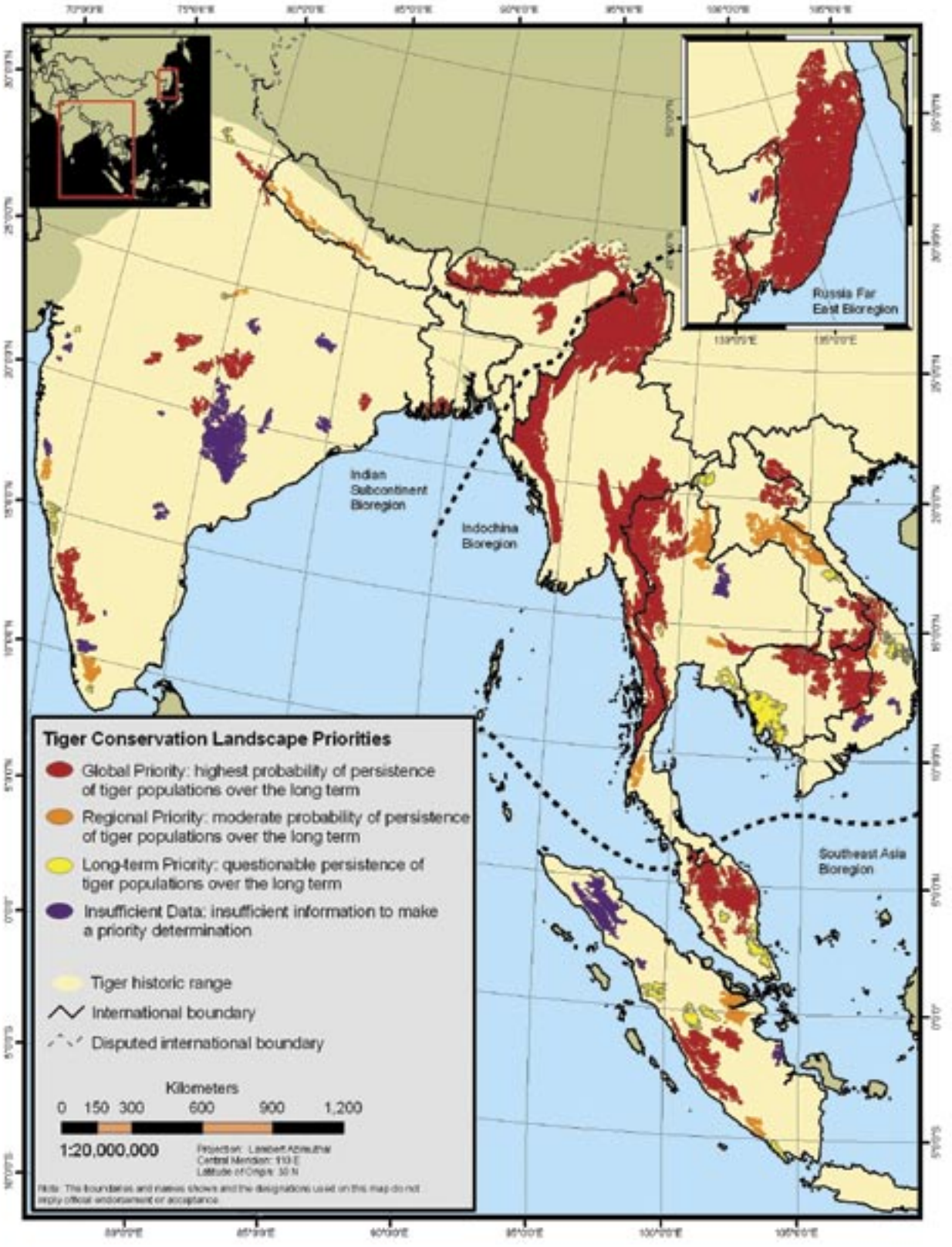
First, we joined together the most recent map of land cover across the tiger's original geographic range and assessed each land cover type for its ability to provide security, prey species, and breeding areas for tigers. Based on this assessment, we classified the land cover types as either "structural land cover" or "non-habitat." The latter classification was then removed from any further analysis.

We developed a comprehensive tiger distribution database by obtaining data (over 3,000 points across the range) furnished by tiger specialists from government agencies and non-governmental organizations; journal publications; reports from Save the Tiger Fund and the U.S. Fish and Wildlife Service that have been archived over the past decade, and other published sources (Sanderson et al. 2006).

We are well aware that habitat for tigers consists of both suitable land cover and an adequate prey base (Schaller 1967). Because we lacked range-wide data on prey, however, we used the human footprint (Sanderson et al. 2002) as a proxy, assuming that where human influence is high, preferred prey abundance is low. We also assumed that high human influence correlates with other factors such as direct persecution, thereby decreasing the probability of tigers inhabiting a given area. To estimate the level of human impact deemed 'too high' from the perspective of tiger presence, we examined tiger distribution data against a human influence index, a global map of human impact. Areas of high human influence overlapping structural habitat in the land cover map were assigned as "non-habitat" in addition to those lacking suitable land cover.

Second, we used these three datasets to create a map showing areas, or landscapes, of potential tiger habitat (Figure 1). These landscapes were categorized as five "Tiger Landscape Categories," defined as follows:

Tiger Conservation Landscape (TCL)–areas where there is sufficient habitat for at least five tigers, and tigers have been confirmed to occur in the last ten years.



MAP 2. Tiger Conservation Landscape Priorities

Tiger Survey Landscapes–areas where the status of tigers is unknown to this study, but there is some reason to believe that tigers might still be present. These areas are large enough to support at least five tigers.

Tiger Restoration Landscapes–areas that have been surveyed in the past 10 years with no tigers found. These areas are large enough to support at least five tigers.

Fragments with Tigers–areas where tigers have been confirmed to be present, but do not meet a minimum core area size large enough to support five tigers. These areas are too small to conserve a long-term population of tigers on their own.

Tiger Extirpated Areas–areas where habitat exists but tigers have been extirpated. These areas include large areas of habitat in China and Central Asia, and small habitat blocks on the island of Java.

Third, we prioritized the TCLs, the most important of the five tiger categories, into four classes (Figure 1), based on their ecological and social potential for tiger conservation, as follows:

Class I TCLs are landscapes that have habitat to support at least 100 tigers, evidence of breeding, minimal-moderate levels of threat, and effective conservation measures in place.

Class II TCLs are landscapes that have sufficient habitat for 50 tigers, moderate levels of threat that can be mitigated in the next 10 years, and a basis for conservation that needs to be improved.

Class III TCLs are landscapes that have habitat to support some tigers, but with moderate-high levels of threat, and minimal conservation investment.

Class IV TCLs are landscapes for which we lack sufficient information with which to make a classification.

These Classes provide the donor community with clear guidelines regarding which areas are most important for conservation based on spatial requirements to support large tiger populations, those with at least some presence or the ability to support tigers, and moderate human threats.

Fourth, we created a final classification—termed TCL Priority —as a prioritization of each TCL across the tiger's range based on its Class and the desire to represent the best examples of tiger landscapes across habitat types and bioregions within a conservation portfolio. As with the TCU 1.0, this classification serves to ensure the principle of representation in prioritization (Map 2).

The priority categories (Figure 1) are as follows:

Global Priority: A TCL offering the highest probability of persistence of tiger populations over the long term. They are the best representatives of tiger habitats across realms.

Regional Priority: A TCL offering a moderate probability of persistence of tiger populations over the long term. They are important for a bioregional tiger conservation strategy. The goal for regional priority TCLs is to restore to Class I status in ten years.

Long-term Priority: A TCL that will require a sustained long-term effort to restore to Class I status. In the near term, they will be important areas for most national tiger conservation strategies.

Insufficient Data: A TCL that does not have sufficient information upon which to make a priority determination. This is likely due to a lack of information on threats or conservation measures.

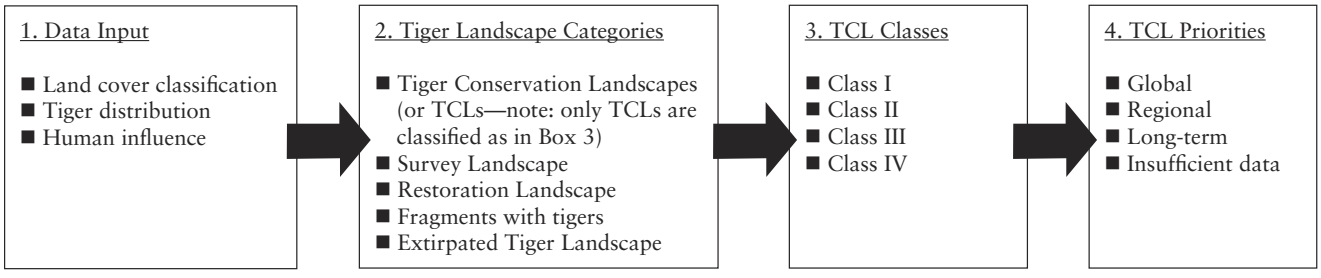


FIGURE 1. A visual summary of steps taken to delineate, classify, and prioritize tiger conservation landscapes (TCLs), organized in four boxes.

RESULTS

Our analysis identified 76 Tiger Conservation Landscapes, 491 Survey Landscapes, 34 Restoration Landscapes, and in the least favorable scenario, 543 "Fragments" that still harbor tigers. The TCL total area is 1,185,000 km^2, approximately 7 percent of the historical range of tigers. The Survey and Restoration landscapes, where the status of tigers is unknown, add an additional 750,000 km^2, roughly 4.5 percent of the historical range. These spatial results are by far the most accurate snapshot we have ever had on the status of wild tigers and tigerlands.

We present the results of our TCL 2.0 assessment on the status of tigers in three ways. First, we offer the headlines of our study, summarizing progress and losses over the past decade. Second, we highlight some of the key results of the TCL 2.0 analysis. Third, we offer a set of recommendations of where to invest scarce resources to protect and restore tigers and their habitat. (See maps showing the TCL Classification and Prioritization results on pages 28–35; Sanderson et al. 2006.)

I. SUMMARY OF FINDINGS

Good News:

1. Representation of "tigerness" is still possible. At least one Class I Tiger Conservation Landscape (TCL) exists in every major biome type except Mangroves, and for the Mangroves biome there is still representation provided by the Sundarbans complex on the border of India and Bangladesh. In the wake of the devastation wrought by the 2004 tsunami, the role of mangroves as storm and surge buffers is receiving greater documentation. The need to restore mangroves along the coastal zone of Asia for economic and humanitarian reasons might offer a few opportunities for restoring tiger habitat in this limited biome type.

2. Strongholds for tigers. There are two large TCLs (the Russian Far East and the Northern Forest Complex-Namdapha-Royal Manas) where investment to maintain tigers will provide representation across several biomes. These are complemented by tropical mountainous TCLs—the Tenasserims and Southern Annamites—and the grasslands and other habitats represented by the Corbett-Sonandi and other Terai Arc TCLs. Together, they create potential strongholds to anchor tiger conservation across the range.

3. Many landscapes are still big. Roughly half of all TCLs are big enough to support an estimated 100 tigers or more, with the largest seven TCLs offering the potential to support 1,000 or more tigers. Even if tiger populations in these landscapes are below capacity, these areas provide opportunities to increase tiger populations with appropriate conservation measures.

4. Many areas for future investments. There are a number of Class II TCLs where conservation investment can help return tigers back to Class I ranking. These areas, and to a lesser extent, the Class III TCLs form the basis for establishing multiple populations and eventually linking up areas if these places are incorporated into longer-term zoning plans by governments.

Bad News:

5. Tigers are losing over the long term. Tigers are estimated to occupy only about 7 percent of their historical range. In fact, this percentage is believed to be an overestimate based on peer-review from field experts and from our datasets.

6. . . . and the short term. Most alarming is that this assessment determined that tigers are restricted to

Tiger habitat is increasingly becoming fragmented and degraded due to human pressure. Strengthening zones of poor connectivity is a key conservation strategy, in that large functioning conservation landscapes for tigers are created and maintained.

significantly less area in Asia than original estimates implied. Indeed, we see that current estimates of overall area occupied by tigers is an astounding 41 percent less than the 1995 estimate, revealing a far more critical scenario for tigers and tiger habitat than was revealed by the first assessment (Table 1). A breakdown by bioregions is provided below showing the change to be greatest in the Indian Subcontinent followed by Southeast Asia and Indochina (note however, that the Southeast Asia estimate includes a 21 percent increase of estimated habitat in Peninsular Malaysia, about 10,000 km^2, correcting a 1995 underestimate). Differences between the results from 1995 and this

Bioregion	Remaining Habitat (km^2)	Total Area of Bioregion (km^2)	Percent Habitat Remaining	Percent Habitat Change vs. TCU1.0
Russia Far East	3,319,334	6,897,494	48.1%	NA
Indian Subcontinent	327,061	2,969,805	11.0%	-54%
Indochina	820,486	1,990,858	41.2%	-34%
Southeast Asia*	125,508	560,190	22.4%	-36%

TABLE 1. Remaining habitat by bioregion

analysis are attributed to: 1) an improved understanding of where tigers live as a result of field studies; 2) improved rangewide datasets on land cover and human impact; 3) higher resolution of the analysis from version 1.0; 4) a revised methodology; and 5) habitat loss in some parts of the range. The amount of area affected by habitat loss is difficult to discern within the past ten years because this estimate varies across the range. However, published rates of forest and habitat decline indicate that there may have been a 15-20 percent reduction in tiger habitat over the past 10-15 years. Since the current assessment stems from knowledge gained during and since the first assessment, we suggest that the current delineation presents an improvement upon the first version for estimating area occupied by tigers.

7. Too many eggs in too few baskets. Beyond the two most common biomes containing tigers—Tropical Moist Forests and the Tropical Dry Forests—we found it impossible to replicate conservation of tigers in more than one place in the same biome. Furthermore, regional representation within one of the three tropical bioregions is not possible except in scattered instances; there are too many biomes where there is only one place to invest, and in some cases, even that TCL is not optimal.

8. What we don't know: numbers of tigers and prey. Even though our classification system is an important advance, giving us a yardstick to measure conservation progress, we still lack vital data to make meaningful comparisons across the range: systematic tiger population data and assessments of prey.

Mixed News:

9. Management is improving, but in increasingly isolated places. In many of the key landscapes identified in this study, tiger habitat is better managed than it was ten years ago; in fact, about 23 percent of the Tiger Conservation Landscapes is covered by protected areas. Of the 33 TCLs identified as Global or Regional Priority, all but one contains a protected area. However, most of the protected areas have been established in montane or pre-montane regions (i.e., typically above 1,000 m). In many lowland regions, the protected areas are now isolated, and therefore restoration of tigers in lowland areas will require linking and expanding lowland habitat and the protected area system.

	Number of Tiger Conservation Landscapes	Total TCL Area (km^2)	Median Size of TCL (km^2)
TCL Priority			
Global	20	924,791	9,056
Regional	13	89,963	3,970
Long-term	21	66,960	1,486
Insufficient data	22	103,197	1,691
Bioregion			
Indian Subcontinent	40	227,569	2,154
Indochina	20	540,758	5,288
Southeast Asia	15	145,285	3,884
Russian Far East	2	271,298	135,649

TABLE 2. Median size of Tiger Conservation Landscapes by Priority and Bioregion

Sambar, or Asia Deer, are an important prey species for tigers and have a wide distribution across Asia. However, systematic prey population data are still lacking and are desperately needed in order to effectively conserve the tiger.

10. Everything that remains is important. Tigers have lost so much of their range that their remaining habitats are all very important. Fortunately, many of these are still quite large, where conservation efforts can expand the existing populations. But the number of options for tiger conservation is declining, not increasing.

11. What we still don't know: are tigers going extinct? The two most frequently asked questions about the status of tigers is 1) How many are there in the wild? and 2) Are they going extinct? Our study was not

an attempt to address the first question, which may be impossible to answer. What we do know is that tigers occupy less area than they did a decade ago, and surveys indicate that there are likely fewer tigers throughout their range. This decline is somewhat balanced by greater awareness of the needs for their conservation, and the potential for rapid recovery. As to the second question, there was a widespread assumption that tigers would be extinct in the wild by 2000. Tigers are resilient and are not expected to go extinct in the short-term. What we may witness over the coming decade, however, is the winking out of tiger populations in some sections of three of the bioregions if habitat continues to be degraded or converted, if tiger prey is decimated, and if poaching pressure on tigers and their prey is not eliminated.

II. TIGER CONSERVATION LANDSCAPES—HIGHLIGHTS OF RESULTS

- Only 16 of the 76 TCLs were ranked as Class I. This classification indicates that a majority of the remaining tiger landscapes require substantial effort and investment to ensure long-term tiger conservation and population persistence. We also identified 15 Class II TCLs; 23 Class III TCLs; and 22 Class IV TCLs.

- We identified 20 TCLs as Global Priority. Sixteen of the 20 Global Priorities were already ranked as Class I TCLs. Thus, to achieve our stated goal of at least one TCL represented as a Global Priority for each biome and bioregion required elevating a total of four Class II or Class III TCLs. In other words, the Sundarbans were elevated to achieve representation of Mangroves. Three dry forest biome TCLs were elevated to achieve replication in the India and Indochina bioregions. These were India's Melghat TCL, Thailand's Thap-Lan-Pang Sida TCL, and Cambodia's Northern Plains TCL. We also identified 13 Regional Priority TCLs; 21 Long-term Priority TCLs; and 22 Insufficient Data TCLs.

- The median size of the Global Priority TCLs was at least twice the size of Regional and Long-term TCLs. Global Priority TCLs contain sufficient habitat for at least 100 tigers, and the median size of Global Priority TCLs confirm the need for large landscapes for tigers to persist (Table 2). Among the three southern bioregions, the Indochina bioregion has the largest median size for TCLs (Table 2), primarily because of the large swathes of tropical forests along the montane regions of Myanmar and Thailand and the relatively intact expanses of dry forest habitats in Cambodia. This result suggests that this region holds great promise for conserving tigers provided the populations can be restored and poaching stopped. Ironically the Indian Subcontinent, which supposedly harbors most of the world's wild tigers, has the smallest median size for TCLs. Thus, it is important to link the smaller core areas to create larger landscapes to conserve tiger ecology and population persistence into the future.

- 41 of 76 TCLs contain habitats representing more than one biome. This finding highlights the need to conserve a suite of diverse habitats, often in the same landscape, to enable tigers to exploit a wide range of prey and habitat types.

- Fifteen TCLs are transboundary in nature. This finding remains from the original analysis that regional cooperation becomes a critical feature for effective tiger conservation and provides a platform for the work of regional burning questions about the status of tigers.

III. RECOMMENDATIONS FOR INVESTING RESOURCES

If the intent is to rapidly improve the situation for wild tigers, then the overall goal must be to develop as many Class I TCLs as is feasible. This would require enhancing the integrity and protection within Class I TCLs, while elevating the status of Class II, III, and IV TCLs.

To achieve the second goal we must secure breed-

ing populations, provide them protection, and expand movement of tigers across the landscape. We propose the following overarching goals for investing resources in tiger conservation:

- Secure the breeding population of all Global Priority TCLs over the next decade. We need to invest in securing breeding populations within TCLs because they serve as the source populations for the recovery of tigers and their prey across the TCL landscape. This is a critical investment regardless of the priority level.

- Identify ten unprotected breeding populations and push for reserve gazettement within ten years. Designation could range from proposed World Heritage Sites to state or provincial reserves. For example, Tesso Nilo National Park, the most recently created reserve within the tiger's range, was established in Sumatra's lowland rain forest to conserve some of the last remnants of lowland rain forest on the island.

- Expand the area of breeding tigers in at least five Class I TCLs within five years. Expanding breeding populations across TCLs will require appropriate land use designations and incentives. We need a number of field experiments to apply lessons learned about tiger habitat recovery to larger areas surrounding core breeding populations and linking them.

- Enhance five zones of poor connectivity among Class I or Class II TCLs within ten years. Another important goal identified by this framework is to strengthen zones of poor connectivity between and among TCLs. By strengthening zones of poor connectivity among TCLs, we hope to create large functioning conservation landscapes for tigers and the species that fall under their umbrella. The Terai Arc Landscape in Nepal has made great strides in identifying and improving the connectivity of habitat, often through community forestry efforts.

Left: A camera trap in Huai Kha Khaeng (HKK), Thailand 2005, captures a mother and her cubs seeking shelter from the midday sun. HKK and Thung Yau Wildlife Sanctuary make up the core area of the Western Forest Complex, one of the largest tracks of remaining tiger habitat in Thailand. These sanctuaries were awarded UNESCO's Natural World Heritage status in 1991, based on the areas rich and unique biodiversity. Below: Investment is needed in securing breeding populations of all Global Priority TCLs.

Towards a Holistic Tiger Conservation STRATEGY

Tiger conservation over the next decade will require building Tiger Conservation Landscapes into the development agenda of range states and regional plans. Following are recommendations for funding in order to define a holistic strategy:

1) recruit global and regional spokespersons of great stature to speak for tiger conservation;
2) mainstream tiger conservation into national and regional development plans;
3) make TCL 2.0 broadly accessible and actively promote its conclusions throughout the tiger's range;
4) continue to work to curtail human-tiger conflict and trade in tiger parts:
5) issue periodic, public report cards on the status of tigers in TCLs;
6) finance case studies that demonstrate how TCLs are linked to ecosystem services and can be zoned as part of the entire resource management program in a country.
7) continue to advance the science of tiger conservation through investment in acquiring the critical data needed to monitor the success or failure of tiger conservation efforts.

Some of these recommendations might go beyond the purview of the Save the Tiger Fund (STF) Council or other donors. Yet they are critical in order to reverse the trajectory of tiger populations and their habitats. Many of the activities suggested are linked or build on each other. We suggest that STF devote perhaps one-third of its annual grant expenditures to the suggestions described below.

RECRUIT GLOBAL AND REGIONAL SPOKESPERSONS

Tigers are among the most charismatic of all species on Earth. Our recommendation is to identify credible spokespeople who are also charismatic, recognized by the public, and reliable to reach out to a much larger audience of potential tiger conservationists. An endorsement by Jackie Chan, Michele Yeow, several of the top stars of Bollywood, regionally famous cricketers, and other A-List Asian celebrities could go far to promote the cause of tiger conservation.

Recommendation: STF should hire a PR firm or use the contacts of its Council and others to identify, screen, and select the best roster of top celebrities to promote conservation, provide them with talking points and background materials, and line up target audiences to reach. The program should be evaluated after the first year of operation.

Another important aspect is to muster political will for tiger conservation. This is needed at the highest levels of government and in regional and local centers

where political power is highly decentralized.

Recommendation: STF should appoint a team of regional senior ambassadors who can lobby the most senior government officials in range states to endorse and implement conservation programs for the TCLs identified by this study. Ideally, this team would consist of representatives within each range state and a senior conservation diplomat who would report to the STF Council Chair. A retreat to identify first year goals of this program should be held as soon as the ambassadors are selected.

MAINSTREAM TIGER CONSERVATION INTO NATIONAL AND REGIONAL DEVELOPMENT PLANS

A serious gap in the first analysis was lack of engagement with the sectors of development that drive land-use change in the tiger range. We cannot repeat that mistake. It is imperative that the STF Council and the NGOs contributing to this report combine efforts to ensure that the TCLs identified by this study are mainstreamed into national and regional development plans. Land-use planning or zoning at landscape scales can be integrated into national and regional development plans, as illustrated by the accompanying box (see Box 1) to counter ad hoc development and land clearing and prevent encroachment. Core areas that provide refuges for biodiversity and habitat linkages and that 1) support ecological processes and 2) have characteristics needed by wide-ranging or migratory species should be identified and appropriately zoned. We emphasize that these refuges and linkages need not be strict protected areas, but should allow for conservation-friendly land use that brings economic and livelihood benefits to people while being compatible with conservation goals. This can only be achieved with the support and involvement of the local communities.

Recommendation: There are clear opportunities to pursue this approach in the tiger's range and the STF should pick a few projects to promote mainstreaming (see Box 1 as an example). These projects should be reviewed biannually in a symposium held in the range state(s).

MAKE TCL 2.0 BROADLY ACCESSIBLE AND ACTIVELY PROMOTE ITS CONCLUSIONS THROUGHOUT THE TIGER'S RANGE

The alarming statistics provided by this analysis with regard to reduced range estimates for tigers must be broadcast widely. The previous analysis, compiled in 1995, when the Internet was in its infancy, was limited by the inability to disseminate the information gathered as widely as was needed. Now the precarious state of wild tigers and their habitats can be communicated more easily and every outlet possible should be used to promote the results of the study and its recommendations.

Recommendation: STF should convene a one-day workshop for communications staff from the participating groups to develop and coordinate a launch strategy for the document. A second related point is that, even though participation in this study was much higher than in the previous assessment, there are still

In a human dominated landscape, Protected Area's are needed; but what is needed even more is a system of corridors linking habitat in order to allow ecological processes to function on a larger scale.

BOX 1. Greater Mekong Subregion (GMS) biodiversity corridors initiative: opportunities for tiger conservation in Indochina.

One of the best examples for mainstreaming tiger conservation into the regional development agenda is the The Greater Mekong Subregion (GMS) corridors initiative. The GMS comprises parts of Cambodia, Lao People's Democratic Republic, Myanmar, Thailand, Viet Nam, and two provinces of the People's Republic of China (PRC) (Yunnan and Guangxi Zhuang Autonomous Region). In 2001, these GMS countries adopted a Strategic Development Framework (SDF) to guide regional development over the next decade. Over $10 billion of investment is envisaged during this period to develop transnational economic corridors that will transform the subregion's economies, communities, and, inevitably, the environment. As a result of this economic transformation, gross domestic product (GDP) per capita in the subregion is expected to double by 2015, and the population to increase by 40 million.

The economic corridors are centered along transnational highways that will link the countries. These highways, and the accompanied developments along them, will fragment and degrade the few remaining patches of intact forests that harbor biological diversity of global importance. The tiger occupies the apex of these ecosystems, being the largest predator in the region. Some of these economic corridors will also impinge on important tiger habitat, further compromising the long term survival of the species in the region.

However, in order to mitigate the impacts of the economic corridors on critical ecosystems and biodiversity, the GMS countries commissioned a study to identify a system of biological corridors or landscapes that would help to conserve important conservation areas. Because agriculture, energy, fisheries, tourism, and transport are all key economic sectors of the GMS that depend on the maintenance and contribution of healthy natural systems, these biological corridors have economic and livelihoods-related significance as well.

For instance, agriculture and fisheries provide livelihoods for at least half the human population in the GMS and make significant contributions to GDP. The water necessary for agriculture, domestic water supplies, and increasingly, electrical power and industry, comes from the rivers flowing through the subregion and from its groundwater. The flow and quality of water depends on the integrity of the watersheds. When forest cover is removed, loss of natural water regulation leads to increased floods and droughts and reduced water quality and accessibility. Therefore conservation of hydrological processes is essential to provide continued ecological services to economic sectors and the human communities that depend on them. Thus, it is important to maintain intact and functioning ecosystems for the well-being of the people as well as wildlife; a realization that has not been missed by the region's decision-makers in their quest for economic development.

The system of 'biological corridors' is designed to alleviate the threats to the natural ecosystems through land-use and management regimes for sustainable use and conservation to protect, maintain, and restore connectivity of ecosystems at landscape scales. The nine high-priority landscapes also include over 50 protected areas, many of which are contiguous across national borders and form complexes of regional significance for biodiversity conservation. While these protected areas provide core refuge for wildlife, the habitat linkages will allow ecological processes to function at larger spatial scales. Where necessary, habitat rehabilitation and restoration is envisaged to facilitate species dispersal between core populations in the protected areas.

These conservation plans, built into the long-term regional economic development plans, provide a good opportunity to ensure that the tiger populations can be restored in the region's forest landscapes, now emptied of most wildlife due to rampant hunting.

major gaps in knowledge about tigers and the quality of their habitats.

Recommendation: The constituent NGOs and the team of "tiger ambassadors" identified by the STF should disseminate this study and provide updates to improve the knowledge of the status of tigers and their habitats.

CONTINUE TO WORK TO CURTAIL THE HUMAN-TIGER CONFLICT AND TRADE IN TIGER PARTS

Human-Tiger Conflict

As tigers begin to use corridors managed under regimes that provide natural resources to people, conflict will become inevitable (Box 2). Human deaths and injuries because of unexpected encounters between people and tigers can most certainly occur. Tigers will also attack domestic livestock, which tend to be easy prey. If such conflicts reach intolerable levels, tigers may be killed, negating any advances and gains made in landscape conservation. Resolving the problems and appeasing the affected parties after the fact is invariably more difficult. As such it is essential that any restoration and management programs are paralleled with appropriate preemptive mitigation programs that can raise awareness about the value of tigers, and need for tiger conservation.

Recommendation: We suggest that STF support a collation or development of conflict mitigation options for human-tiger conflict. STF is encouraged to engage in a process to test these across the tiger range, and make recommendations on best practices. A forum (list-serve) where managers and scientists can discuss mitigation measures and conflict issues would also be useful.

Trade in tiger parts

The status of tiger trade in 2005 was as grim as the news about habitat decline. This was the year that the world learned that poachers had taken every last tiger in India's Sariska Tiger Reserve. It was also the year that photographs of Tibetans in robes laden with tiger skins hit the international press and China began discussing reopening legal trade in tiger bones for use in medicine.

(continued on page 21)

Top left: Palm plantations are changing the face of the island of Sumatra, the only place where the Sumatran tiger lives. Bottom left: Tiger poaching continues to be a major threat. Here in the Russian Far East, two WWF-supported, anti-poaching team members hold up a confiscated skin of an Amur, or Siberian, tiger.

BOX 2. Human-Tiger Conflicts: A Conservation Challenge for Coexistence

The growing human population has led to extensive loss, degradation, and fragmentation of forested landscapes that support tigers and their prey. Although protected areas provide some refuge for tigers, the multiple-use forests where human activities are dominant comprise more than 75 percent of the tiger habitat across the tiger range. Spillover of dispersing tigers lead to inevitable conflict with people. Now, with the necessity to treat these multiple-use areas as extensions of protected areas to provide additional space and dispersal conduits, there is an urgency to move from conflict to coexistence, and reconcile tiger conservation and human needs.

Today, conflict tends to be highest in areas where the interface between tiger habitat and humans live and work is blurred—as in the multiple-use areas. People in multiple-use areas often graze cattle and over-exploit the land as to exclude most of the tiger's natural prey. As such, tigers may begin to switch to livestock as their primary prey species. For example, the recent initiation of community forest management in the buffer zone of Royal Chitwan National Park in Nepal has also demonstrated a notable increase in human-tiger conflict. Records show that between 1979 and 1998, a total of 22 persons were killed (59 percent inside the park and 41 percent outside). However between 1998 and–March 2004, 54 persons were killed (22 percent inside the park and 78 percent in the buffer zone).

Human-wildlife conflicts are not a recent phenomenon. In the early part of the last century, Jim Corbett's "Man Eaters of Kumaon" described the terror stories from man-eaters in northern India, where one tigress killed 434 people before it was shot dead. However, it is rare that individual tigers turn into man-eaters. A much more common cause for human killings is the result of a surprise encounter between tiger and human, whereby the tiger may attack in self-defense or a tigress may attack for the safety of her cubs. The challenge for landscape conservation efforts is to reduce or minimize conflicts to below tolerance thresholds.

Under these circumstances, is there any possibility of coexistence between humans and tigers, especially in human-dominated landscapes? Such coexistence is unlikely until tigers are no longer perceived as a threat to the domestic animals and human lives, and thus living amongst tigers is not considered a liability. Therefore, the tiger's presence in multiple-use areas will depend on adequately addressing the conflicts, reducing the animosity and hostility towards tigers, and establishing incentives that make a live tiger worth more than a dead one for the local communities.

There is no single solution to all human-tiger conflicts. Situation specific details that trigger tigers to attack livestock and humans are critical for finding a solution. Some interventions already attempted include special emergency response teams, translocation of the problem tiger, relocation of the individual to a zoo, aversive conditioning, improvement in livestock husbandry, lethal measures, and incentive schemes, compensation and insurance to local communities.

Future interventions should also focus on managing tigers in the periphery of reserves or in multiple-use areas, so that is possible to meet the needs of local people, and minimize potential conflicts. Timely response to any conflict is necessary to avoid further incidences, potential revenge killing of tigers, and maintain the public support. Engaging local communities to develop an early warning system to avoid potential threats is likely to reduce some conflicts. There is also a clear lack of a proactive policy framework describing a process of dealing with problem tigers in every tiger range country. More studies testing interventions, sharing of mitigation measures already tested, and wider discussions with stakeholders particularly with those living in the neighborhood of tiger habitat are necessary for continued coexistence of tigers and humans.

Tigers are in trouble throughout most of the range in part due to conflicts with humans. Tigers can be saved by partnering with local communities who live side-by-side with tigers to develop a shared vision that tigers are worth more alive than dead. Ultimately, the value humans place on tigers roaming free in the wild will decide whether tigers persist in the future.

BOX 3. Synergies between tiger conservation and ecosystem services: conservation for nature and people.

Tigers are adaptable animals that can be found in a wide variety of habitats, including grasslands, tropical rain forests, dry forests, mountainous areas, and boreal forests. Each of these different types of natural systems provides a wide variety of goods and services that benefit not only tigers but also humans. These "ecosystem services," such as the variety of wild fruits and nuts that can be collected from forests, or the forage that grasslands provide for livestock, can be a significant source of local peoples' incomes, particularly for the poorest segments of society. Since tigers could coexist with people, given an adequate prey base and appropriate mitigations to reduce conflict to tolerable levels, what opportunity is there for the conservation of tiger habitat to also benefit people? If conservation of tiger habitat results in tangible economic benefits for at least some groups of people, support for tiger conservation is likely to be higher among stakeholders and governments.

Two ecosystem services that span the range of tiger habitats, including montane, lowland and riparian areas, are carbon storage and sequestration, and maintenance of a stable water supply. Carbon services are important because carbon dioxide (CO2) is a greenhouse gas that is strongly linked to global climate change and all of its associated negative consequences. Water is of critical importance to human health and livelihoods, and diminishing availability of freshwater is of serious concern.

Focusing first on carbon, forests provide two different types of services: sequestration and storage. Carbon sequestration refers to the fixing of atmospheric carbon into the biomass of growing trees. The science behind carbon sequestration is dynamic and evolving, with variable rates of sequestration found among forest types and among species within forest types. Nevertheless, it is generally thought that young, fast-growing trees sequester the most carbon, and are therefore a low-cost mitigation strategy against rising atmospheric CO2 levels. In the context of tiger conservation, reforestation initiatives that aim to connect existing tiger habitats through the establishment of forested corridors are not only creating benefits for tigers, but are benefiting people as well, by reducing the harmful effects of carbon emissions. This economic value provided by restoration of tiger habitats should be considered by policy-makers when assessing the costs and benefits of tiger restoration.

Carbon storage is a similar concept to sequestration, except that it refers to the amount of carbon currently stored in a tree's biomass. Unlike carbon sequestration, carbon storage values are highest in old forests that have large trees with high biomass. The amount of carbon stored in primary lowland rain forests is typically 20-50 times greater than in the agricultural systems to which they are often converted. Preserving rain forest tiger habitat as parks or limited-use areas is therefore again beneficial in the battle against global climate change, and this economic value of preservation due to carbon storage is important to consider when making land-use policy.

While carbon storage and sequestration are services that benefit the global community as a whole, water services of ecosystems are most important to people living in or near the habitat that provides the service. Natural habitats may contribute in a variety of ways to water flows,

including the provision of flow volumes that are more consistent and of higher quality than in degraded areas. In the case of mountainous areas, clearing of forests can result in a disruption of the water flow to downstream areas, causing reduced water flows in dry seasons, flooding in wet seasons, and general increase in the unpredictability of water availability for human use. In riparian areas adjacent to streams, destruction or degradation of natural habitat can reduce the buffering capacity of ecosystems, resulting in increased sedimentation and pollutant loads, thereby decreasing the quality of drinking water. Preserving forested watersheds in mountainous areas, and restoring or enhancing forest riparian corridors will benefit both the tigers that use these habitats and the people who depend on the water flowing through them. Recognizing these complementary services to both tigers and people can result in win-win situations for both groups.

Woman of Samjhana Community Forest User Group planting seedlings, Terai Arc, Nepal. Opposite page: Old growth forests are being replaced by oil palm plantations, Tesso Nilo, Indonesia.

Recognition of these potential win-win areas for people and tigers is necessary, but more is needed to ensure that ecosystem service values are counted in decision-making. Financial mechanisms that result in tangible payments to those who provide an ecosystem service must exist or be created.

For example, under the Clean Development Mechanism of the Kyoto Protocol, developed countries may offset some of their own carbon emissions by investing in forestry projects that sequester carbon in developing countries. In terms of tiger conservation, a forest restoration project for a tiger corridor may also provide "carbon credits" that could be sold, thereby financing the project and providing income to local people who are providing the sequestration service on their restored forest lands.

In addition, negotiations regarding whether to count "avoided deforestation" in carbon accounting are underway; the outcome of these negotiations is uncertain but it is possible that in the future, countries that establish a protected area in a region that otherwise would have been deforested may be able to sell resulting carbon credits and therefore benefit financially from conservation.

In the case of water, a number of innovative payment schemes that reward people whose land provides watershed services have been devised. These range from the very large-scale (e.g., New York City restoring forested land in the Catskills watershed, the source of their drinking water) to local levels (e.g., US$10/ha payments by a Costa Rican hydroelectric company to individual landowners to maintain or restore forest cover on their properties). Managers of tiger conservation projects in highland forested watersheds should consider which downstream users would benefit from tiger habitat preservation and what mechanisms could be used to compensate local stewards of water services.

In summary, opportunities exist for synergies between tiger habitat conservation and ecosystem services. In order to realize this potential, tiger conservationists need to: i) Highlight geographically where these complementary areas occur; ii) Take advantage of existing mechanisms that would finance the conservation of tiger habitat while simultaneously benefiting local people; and iii) Work hard to encourage the development of institutions that can capture ecosystem services that currently fall outside of existing payment mechanisms. Under this paradigm the expansion of tigerland could occur to the benefit of both tigers and the people who live there.

BOX 4. The Terai Arc Landscape: A New Paradigm for Conservation

The grassland and savanna ecosystem along the foothills and inner valleys of the Himalayas is among the most productive in Asia, capable of rapid regeneration and supporting high densities of ungulates—tiger prey—and tigers. Here, tigers occupy some of the smallest known territories. Less than half a century ago, these grasslands extended almost uninterrupted along the Himalayan foothills, allowing tigers and other large animals such as rhinoceros and elephants to roam freely. Since the early 1960s, however, the eradication of malaria has made the Terai safer for humans, prompting many to migrate, settle, and cultivate in this productive ecosystem. Today the habitat is mostly cleared, and the few small remnant patches of natural forests and grasslands lie scattered, like strewn beads of a once-intact necklace that garlanded the Himalayan range.

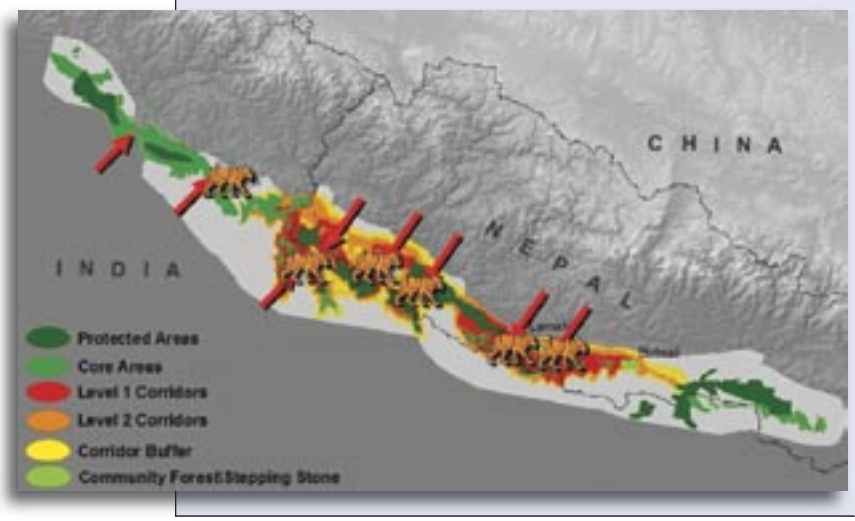
Consequently, the tigers, rhinos, elephants and other wildlife are largely confined to these small patches of habitat, most now declared protected areas. Despite the current protection in these refuges, they face an uncertain future because many of these patches are too small to support populations of a size needed to withstand the consequences of genetic inbreeding.

It is not just the wildlife and natural biodiversity that is at risk. Large-scale land clearing for agriculture, settlements, and timber by these settlers has led to soil erosion and low water tables, affecting the agricultural viability of the Terai. Already the tube wells that have been sunk to extract ground water to augment the lack of surface water have been contaminated with high levels of arsenic. Erosion along the fragile Churia slopes has become an issue of grave concern. Unless conservation actions are undertaken to restore and reverse this trend of ecological degradation, the economy of this productive region and the livelihoods of the millions of people now living in the Terai, as well as its rich biodiversity, will be in jeopardy.

The Terai Arc Landscape program, one of the most ambitious conservation programs undertaken in Asia, seeks to address these issues by linking the 12 protected areas and other intact natural habitats to create a landscape that extends for over 1,000 km. While the existing protected areas—some of which are world renowned and recognized as World Heritage Sites—will represent core areas to meet the biological needs of some of Asia's largest endangered species, outside of these protected areas, 'conservation-friendly' land-uses, such as community forests, will provide sustainable natural resources and economic benefits to local people while facilitating wildlife population dispersal, especially for tigers.

These conservation actions are being undertaken in partnership with the local communities. Already in Nepal and India, restoration of eight degraded corridors has begun, and in only four years of implementation, tigers have begun to use six such corridors (Figure 2). The support of the local communities is reflected in the fact that these communities have begun community-based anti-poaching units to prevent tiger poaching and have apprehended poachers. Local community groups have also negotiated with and removed illegal settlers from critical corridors.

These successes achieved over a relatively short period of time indicate that creating large conservation landscapes for tigers and other iconic species of Asia's wildlife is possible, even in human-dominated landscapes. But it is evident that to do so requires building partnerships and gaining the trust of the local communities.



MAP 3. Restoration of tiger corridors in the Terai Arc Landscape

Tiger trade is clearly not in check. In fact, some tiger experts fear that Sariska could become the template for the future—protected tiger habitat emptied of tigers—where wild tigers were poached to supply a soaring demand for tiger skins and the possibility of a resurgent demand for tiger bones.

While the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) still prohibits international commerce in tiger parts and derivatives, enforcement of the ban is at the discretion of each country. Poachers, smugglers, and traffickers are winning the day because they are organized and their crimes well paid, and they risk little chance of detection and punishment along the chain from supply to demand.

Economics are also not on the tiger's side. The value of a tiger's parts continues to be a windfall in the context of the economies of tiger range and consuming countries. Growing wealth from tourism and other industries in the pan-Tibetan region of China has prompted an increase in the purchase and use of tiger skin to decorate traditional robes worn at special events such as weddings and festivals. Recent arrests in India have revealed a direct link between tiger poachers in India, and Nepalese and Tibetan traffickers transporting tiger skins from India, through Nepal, directly into Tibetan areas of China.

Although illegal in most countries, medicines and health tonics made from tiger bone are still desired to treat arthritis and other rheumatic pain as prescribed by traditional Chinese medicine (TCM). Fast-growing tiger populations in China's tiger farms have prompted the government of China to consider reopening a limited legal trade in bones from farmed tigers for sale directly to Chinese medicine manufacturers, which would then send their tiger-based medicines directly to hospitals for use. Unfortunately, trade of tiger parts from any source will increase pressure on wild tigers since TCM places higher value—in terms of medical effect and price—on wild ingredients. Even a well-controlled legal trade will confuse consumers and reignite demand, which the world's wild tigers cannot withstand for long.

Meanwhile, some influential Chinese are touting tiger farming as the panacea for simultaneously saving wild tigers and satisfying demand for their parts as medicine and clothing. As a first step, China is investing time, money, and political capital to relocate captive South China tigers now in South Africa to southeast China. Most tiger experts agree that this would be a step backward for conservation since true tiger conservation will require not just saving any tigers but saving wild tigers along with the complex web of plant and animal life needed to sustain them.

Recommendation: The conservation community should mount and sustain an organized response to stop tiger trade, working in collaboration with Save The Tiger Fund's Campaign Against Tiger Trafficking (CATT), which works with partners to catalyze, build, inform, and support alliances among civil society, governments, and consuming groups to scale up efforts to stop the trade, including any and all legalized trade in tiger parts and derivatives from any source, including captive populations.

Recommendation: China, Nepal and India, along with other tiger range and consuming countries, should immediately begin joint international law enforcement operations to stop cross-border trafficking in tigers and their parts and derivatives, linking success of these measures to all present and future bilateral and multilateral trade agreements in the region.

Recommendation: India should immediately activate the national Wildlife Crime Bureau already proposed by its prime minister.

In the winter of 2005, WCS coordinated an extensive winter survey of the Amur tiger. The last such coordinated effort was done 10 years ago. Fieldworkers traversed 1000 routes, a total of 10,000 km, to report the exact location of tiger tracks. Measurements of those tracks allowed biologists to estimate the total number of animals remaining in the Russian Far East, and the results were promising—the tiger population appears to be stable.

ISSUE PERIODIC, PUBLIC REPORT CARDS ON THE STATUS OF TIGERS IN TCLS

One of the most obvious lessons learned from TCL Version 2.0 is that we cannot wait a decade to update the status of tigers and their habitats. The region they occupy is too dynamic. More than five years ago, a team from WWF and WCS explored the idea of issuing TCL report cards to monitor the status of tigers and make corrective measures where needed. This concept is still valid and would be valuable. It was never launched for lack of funding and, equally important, a simple way of measuring some of the variables. The variables that went into this current analysis are objective, transparent, and repeatable, and, therefore, provide the basis for a rigorous approach to such a report card.

Recommendation: We suggest that STF finance a workshop to assess the status of tigerlands on a biannual basis. The report cards can then be the subject of press announcements and used by the team of roving and national tiger ambassadors to promote conservation measures.

FINANCE CASE STUDIES

Finance case studies that demonstrate how TCLs can be linked to ecosystem services and zoned as part of the entire resource management program in a country.

Many communities in Tigerland still depend heavily on forest products and the ecological services from intact ecosystems for their livelihoods and economic sustainability. Thus, conservation of these tiger landscapes is not only important for harboring tigers and other forms of biodiversity, but also to conserve these ecological processes and provide sources for forest resources that sustain local and national economies, and provide healthy living conditions (Box 3).

Another example is the Terai Arc Landscape, illustrating how such a tiger landscape can be created in a human-dominated environment to provide such benefits to the local communities and elicit their support for conservation (Box 4). The backbone of the landscape is the Churia Hills—the lower, outer hills of the Himalayas—that run the length of the landscape. While the forests along the lower hills represent a habitat link for tigers dispersing between core areas, these forests are also critical for maintaining the water towers for the region. Numerous rivers flow down from these hills, providing water for the people and supporting the agricultural productivity—and thus the national economy—in the foothills and the lowland Terai region, which is widely regarded as the 'rice bowl' of the region. Should these forests become cleared or degraded, the consequences would be dire due to extreme hydrological events (either floods or droughts) and erosion.

ADVANCE THE SCIENCE OF TIGER CONSERVATION

The success of TCL 2.0 is based on advances in tiger conservation biology during the last decade. Although our methods and data have advanced to the point that we can now take a rangewide perspective on tiger conservation, based on real data from where the tigers are, there is still much to be learned about the state of tigers in the wild. In this vein we recommend the following to make TCL 3.0 even more rigorous and valuable:

- Create a consistent and accurate map of remaining tiger habitats that also provides estimates on habitat conversion rates for different areas. Habitat loss, fragmentation, and degradation are major threats to tiger populations. Habitat extent and the rate at which remaining habitat are disappearing are among the conservation measurements that could be determined fairly consistently and easily. These data would benefit a wide range of other important species across Asia.

- Develop a central clearinghouse for current, rangewide tiger distribution information. In this analysis, we have placed increased importance on our current knowledge of the distribution of tigers, and on the distribution of breeding populations of tigers across the tiger range. In large measure, we were able to highlight the importance of tiger location and breeding data because of the investment in surveys, and the development of better monitoring techniques (Carbone et al; Karanth et al. 2004a, 2004b; Miquelle et al. 1999). However, capturing published and, more importantly, unpublished information in a standardized format is essential. Capturing unsuccessful tiger surveys (if there is such a thing) is equally important to learn where tigers are absent. Finally, recognizing the efforts of tiger researchers is important in order to foster a spirit of cooperation among tiger biologists and to promote the exchange, rather than the sequestering, of important data.

- Develop monitoring protocols for tigers and their prey and put them to use across the tiger range. In developing our priorities for tiger conservation, we identified a lack of well-stratified, statistically robust

Top right: Dr. Ullas Karanth, WCS, sets up a camera trap in Nagarahole National Park, India. Top left: 3 tigers in a road in Nagarahole. Bottom right: WCS Russia Tiger Team affixes a radio collar to a young female, and performs a routine check up, as part of the 13-year long Siberian Tiger Monitoring project. Following page: Tiger habitat in the Hukaung Valley Tiger reserve, Myanmar.

monitoring programs as a continuing problem in assessing the status of tigers, understanding trends in numbers (either relative or absolute), and in assessing the effectiveness of our conservation efforts over the long term. Perhaps the most ambitious program is that conducted under the Amur Tiger Monitoring Program, a program that has received strong and consistent support of STF and other donors. Initiated in 1997, the program monitors trends in the population of tigers and their prey (Hayward et. al 2002). Sixteen monitoring sites are distributed across the range of Amur tigers to ensure representation of parameters relevant to tiger abundance (protected status, north-south and east-west gradients). The program aims to provide a mechanism that will assess changes over the long-term in the density of tigers, as well as other potential indicators of population status, within their current range. The surveys in the RFE provide exceptional clarity on the status and trends in tiger numbers in that region. While it is probably unrealistic to assume that such systems can be developed range-wide, establishing a few gold-standard baseline monitoring programs that are stratified across habitat, eco-region, and political boundaries would greatly enhance both scientific knowledge about the status of tigers, and the ability to focus conservation efforts. Such a system would help develop the best practices by enabling scientists to assess the effectiveness of tiger conservation actions, and to serve as an early-warning system for the tiger population trends range-wide.

- Conduct surveys into unknown areas to ascertain the status of tigers. This effort will ensure that funds and efforts are invested in places that offer the best long-term hope for tigers. The first Framework document highlighted the extent of ignorance about tiger status and distribution. To remedy this, many large and critically important areas have been surveyed and assessed for the status of tigers and the threats they face. In Cambodia, Myanmar, Malaysia, Vietnam, Lao PDR, South China, Indonesia, and elsewhere in tiger range, new surveys have provided an insight into the true state of tiger populations across the range of the species. While many of these areas will no doubt prove a disappointment, some may harbor critical populations of tigers. For instance, the vast expanse of the Gunung Leuser Reserve in northern Sumatra is, no doubt, some of the best habitat available for Sumatran tigers. While the political situation in the region is daunting, a lack of systematic surveys of the area leaves the status, and importance, of this TCL uncertain.

- Capture existing information on prey density and abundance, and develop a large-scale, stratified survey to estimate and monitor prey levels across the range of the tiger. For decades, tiger biologists have known that a healthy prey base is a necessary, if not sufficient, criterion for a health tiger population (Seidensticker 1987). From India (Karanth et al 2004b) to the Russian Far East (Miquelle et al. 1996; 1999) to Indonesia (O'Brien et al 2003), studies have shown the critical importance of tiger prey in sustaining healthy tiger populations. With the exception of Russian studies that look across a range of land-use types, most surveys of prey that have been conducted have tended to focus on studies on prey densities in protected areas. While a critical and important first step, the lack of well stratified data from outside areas of full protection makes it very difficult to extrapolate those few data we have in any meaningful way to show conditions for tigers outside of reserves. Furthermore, data on prey availability outside of protected areas is critical to developing an understanding of connectivity and landscape-level processes.

- Promote the concept that healthy tiger populations are a clear indicator of ecosystem health. A range state or a tiger landscape that has lost most of its tigers likely will have also lost sufficient forest cover to protect against environmental catastrophe related to seasonal floods, soil erosion, and coastal storms. The right incentives need to be offered to restore degraded habitats and dispersal corridors as part of an effort to tie tiger conservation to the conservation of environmental services and rural natural resource management.

Above: WCS embarks on tiger surveys in the Hukaung Valley Tiger Reserve, Myanmar.

EPILOGUE

The tenuous relationship between tigers and humans has pushed the wild tiger to the brink of extinction. Poised at the top of the ecosystems where it lives, the endangered tiger is an indicator of ecosystems in crisis. People continue to kill tigers and to overwhelm landscapes where tigers live. Tigers are under constant threat from poaching to satisfy the unremitting demand for tiger parts used in folk medicine and for ornamentation. To save wild tigers, we must devise strategies to eliminate the consumption of tigers. People continue to destroy, fragment, and degrade existing and potential tiger habitats. Over-harvesting of the tiger's prey causes injury to the cycle of human-wildlife coexistence in most of the remaining forests of Asia where tigers still survive. To save wild tigers, we must create landscapes friendly to both tigers and humans. We have insufficient knowledge of what tigers need to survive in the changing landscapes of Asia and inadequate tools to meet these needs. To save wild tigers, we must catalyze efforts to increase knowledge, skills, and cooperation to support wild tiger conservation. Wild tigers suffer from a lack of recognition and visibility to mobilize multi-sector support. To save wild tigers, we must gain recognition, visibility, and support to make wild tigers valuable to people.

Incomplete knowledge of the state of tiger populations has made it difficult to set priorities and agendas for action. We will never have all the information we need, but the powerful images, evidence, and narrative in the 1997 Framework Document (TCU 1.0) established the first baselines on which to establish a common agenda and set of priorities for conservationists striving to save wild tigers across Asia. TCU 1.0 brought an unprecedented degree of information together for the first time and began to translate the many different languages used in tiger conservation into the common language and science of conservation biology. It instilled hope that with concerted effort the resilient tiger could be brought back from the brink of extinction by people working together with a common vision and understanding of the tiger's needs in human-dominated landscapes. Because it addressed tiger conservation at a range-wide scale never attempted before, it showed how enduring partnerships among governments, non-government organizations, businesses, and social and religious institutions are necessary to secure a future for wild tigers.

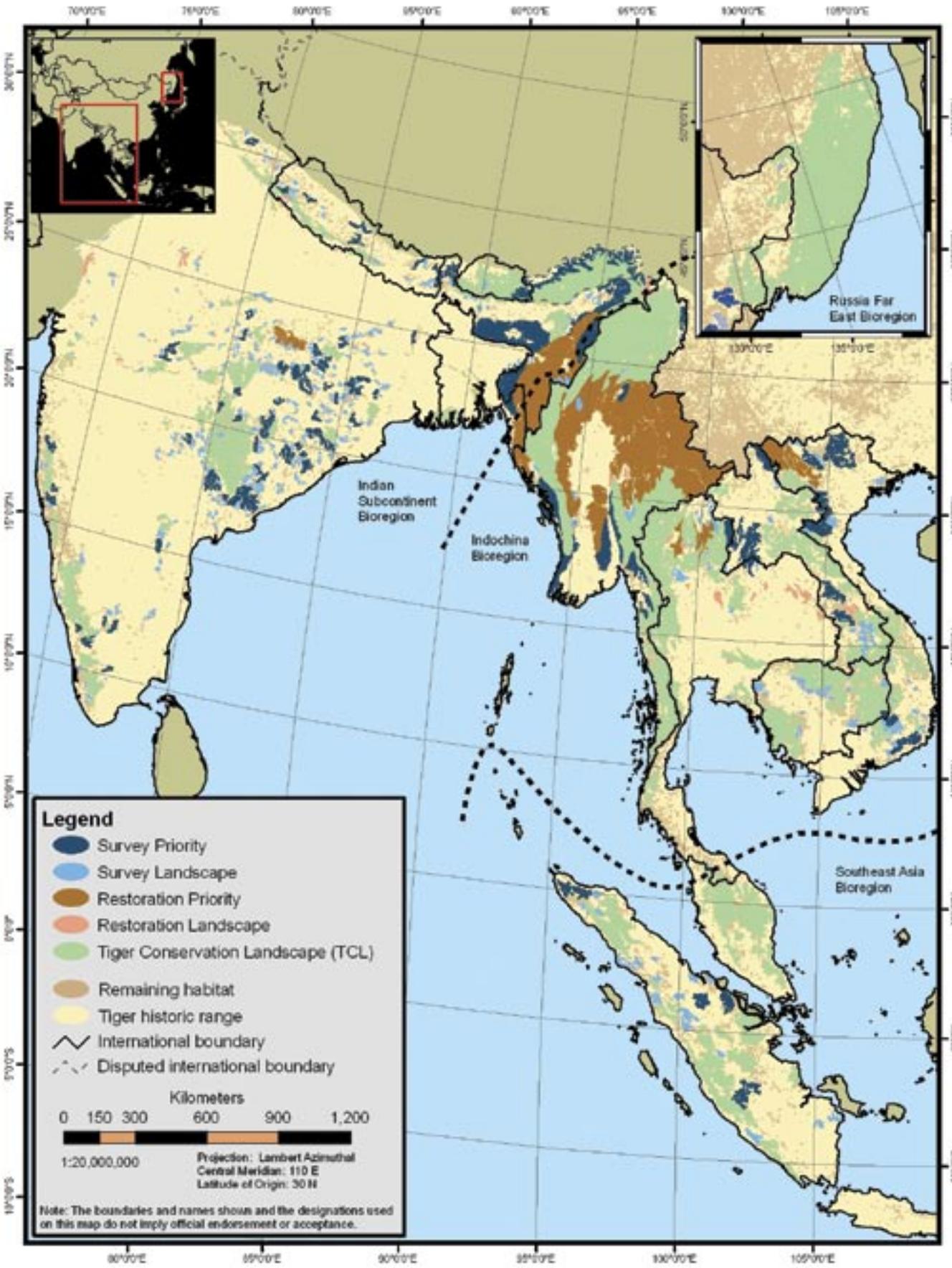
A principal lesson from TCU 1.0 was the need to move from a reactive to a proactive tiger conservation agenda. But TCU 1.0 is a static document. In the face of continually shifting natural and political landscapes in Asia, TCU 1.0 was being outflanked by new emerging threats and changing conditions on the ground and internationally. In 2003 the Save The Tiger Fund and its partners—the Wildlife Conservation Society, World Wildlife Fund-US, Smithsonian's National Zoological Park, U.S. Fish and Wildlife Service, UN Foundation, and Zoological Society of London—commissioned this project Setting Priorities for Conservation and Recovery of Wild Tigers: 2005–2015 and worked with tiger conservationists across the tiger's range to catalyze efforts to increase knowledge, skills, and cooperation to support wild tiger conservation. This is a "living document" and will continue to be updated, which is essential to enable us to predict emerging changes and threats to wild tigers and rapidly communicate these to our partners so we can develop our strategic solutions together. Sustained conservation of wild tigers in ever-changing environments requires strategic and flexible allocations of resources to key tiger landscapes, anchored by new leadership capacity, sound sciences, best business practices, and public awareness.

Our vision is a world in which wild tigers thrive in natural habitats across their Asian range in harmony with people. People save what they value. To secure a place for wild tigers in our world, live tigers must be worth more to people than tiger parts, and landscapes with tigers must be worth more to people than landscapes where tigers are extinct. Wild tigers can be indicators of achieving large-scale conservation and improved human livelihoods. The tiger is a conservation-dependent species and isolated efforts are not enough to address today's threats to tigers. Saving the tiger requires continuous and concerted vigilance and effort. There is no universal formula for saving wild tigers, but by building on the foundations of earlier efforts, such as the national park, wilderness, and biodiversity conservation movements; by fostering a global commitment to tiger conservation; and by linking conservation and human welfare, we can harness flexible strategies to secure the tiger's long-term survival.

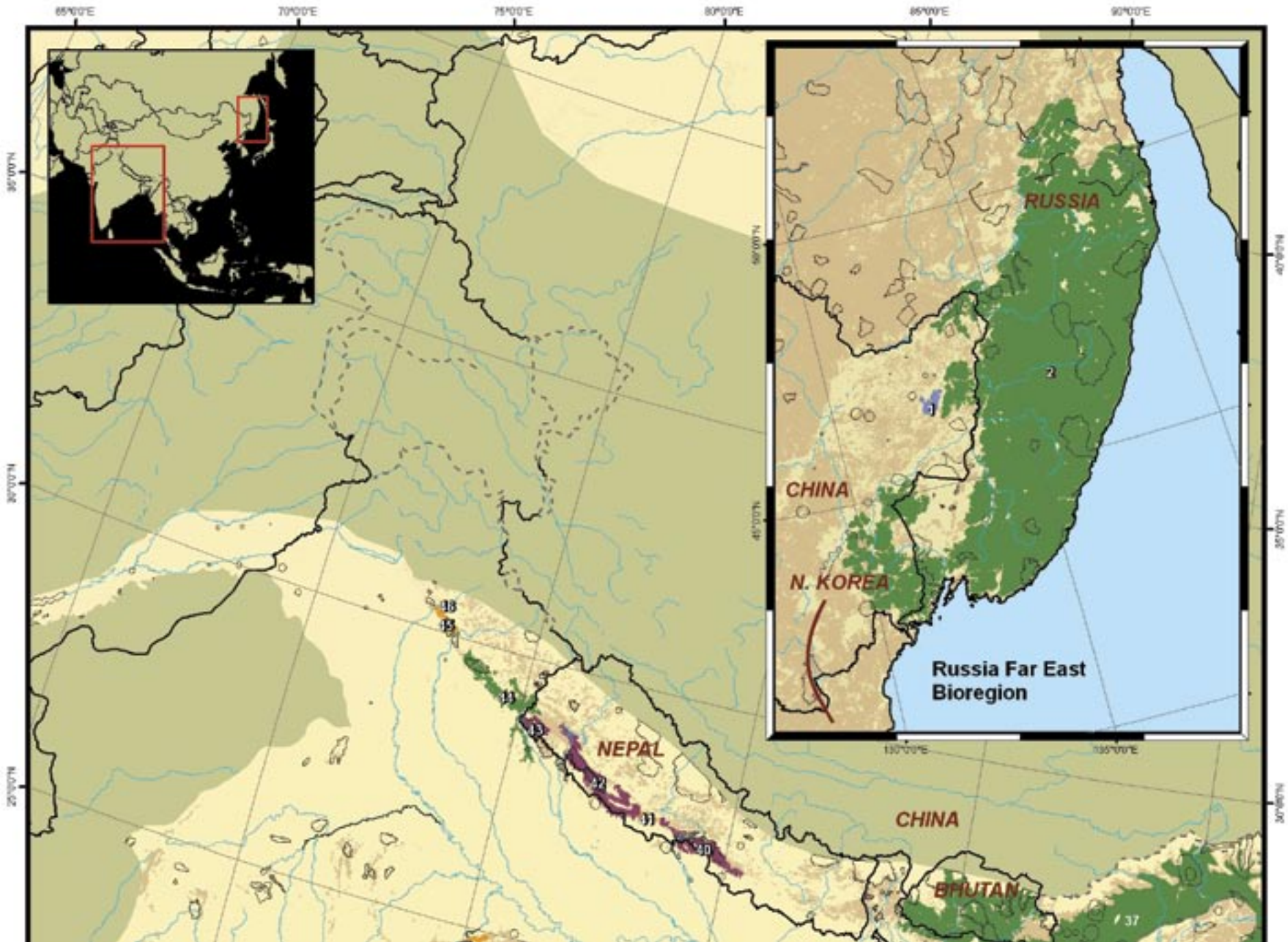
The challenge of saving the tiger is the heart of conservation. A world without tigers is a world without hope—like a clear night sky without stars. A world without tigers would be a terrible loss, symbolizing a morbid disregard for natural places and our natural heritage. Help us to save wild tigers. We see saving the tiger as a test: if we pass, we get to keep the planet.

John Seidensticker, Ph.D.
Chairman, Save the Tiger Fund Council

MAP 4. Tiger survey locations and results



MAP 5. Survey and restoration area prioritization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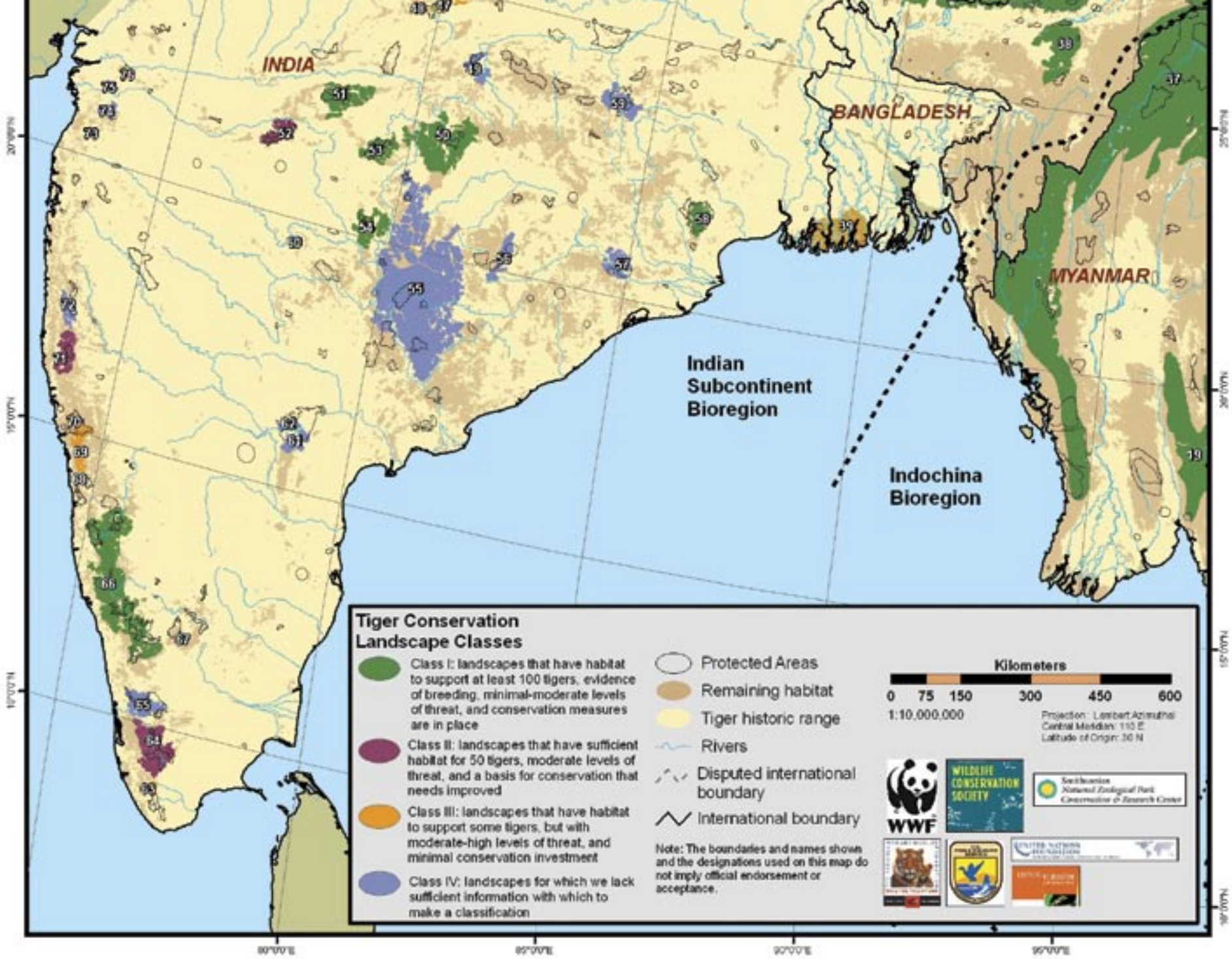
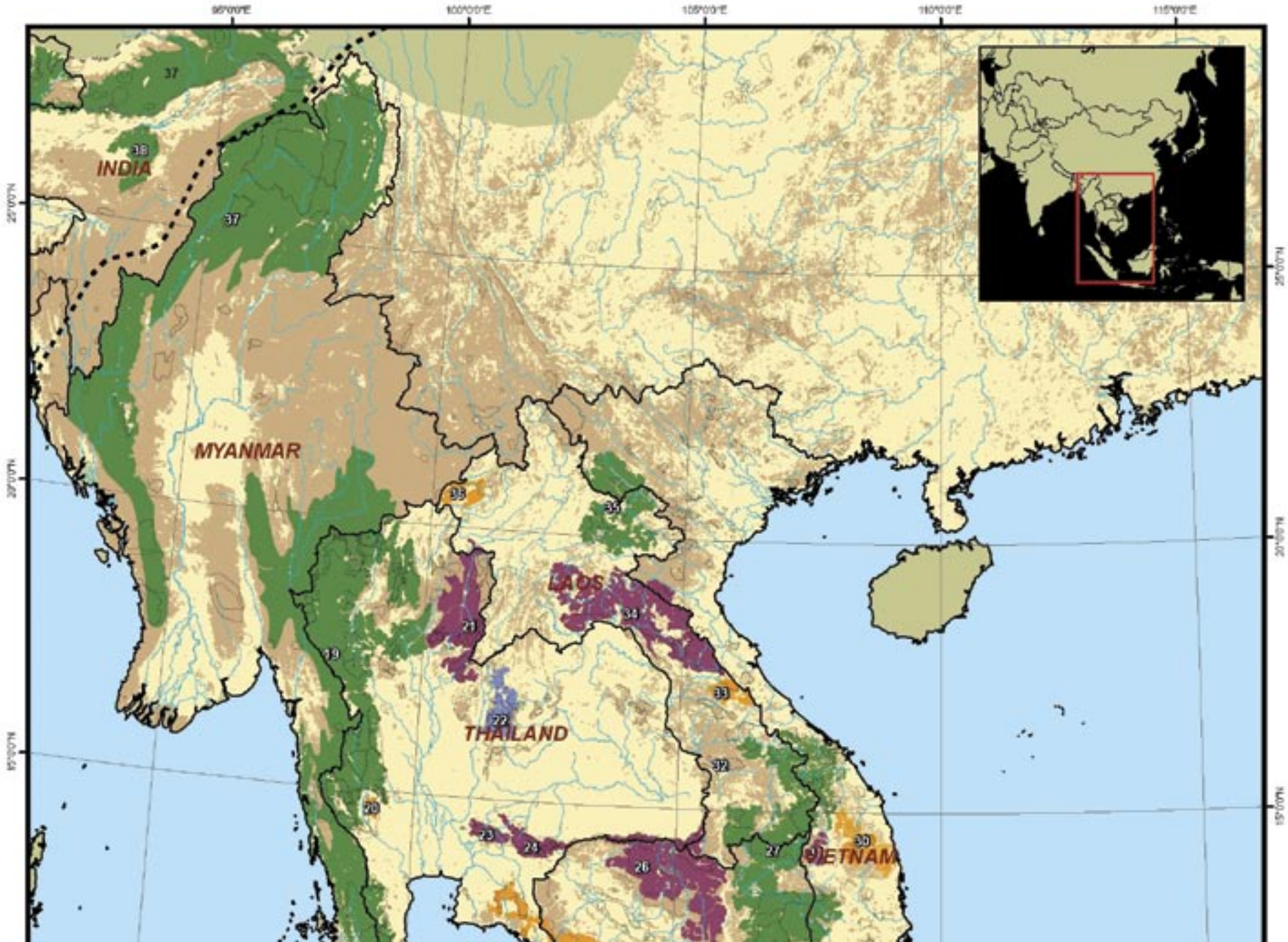
NEPAL
CHINA
BHUTAN



MAP 6. Tiger Conservation Landscape Classification (Indian Subcontinent, China, and Russia)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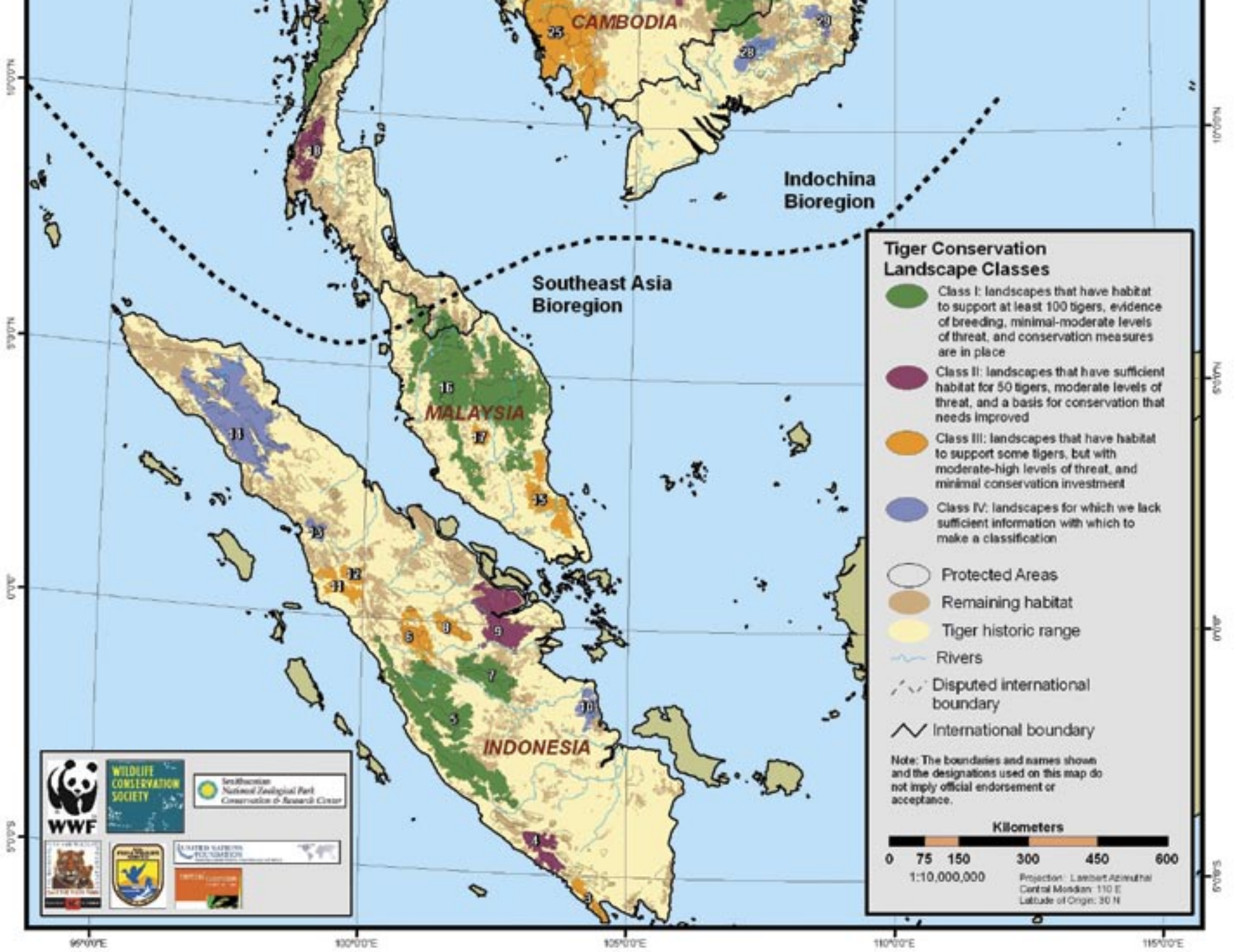
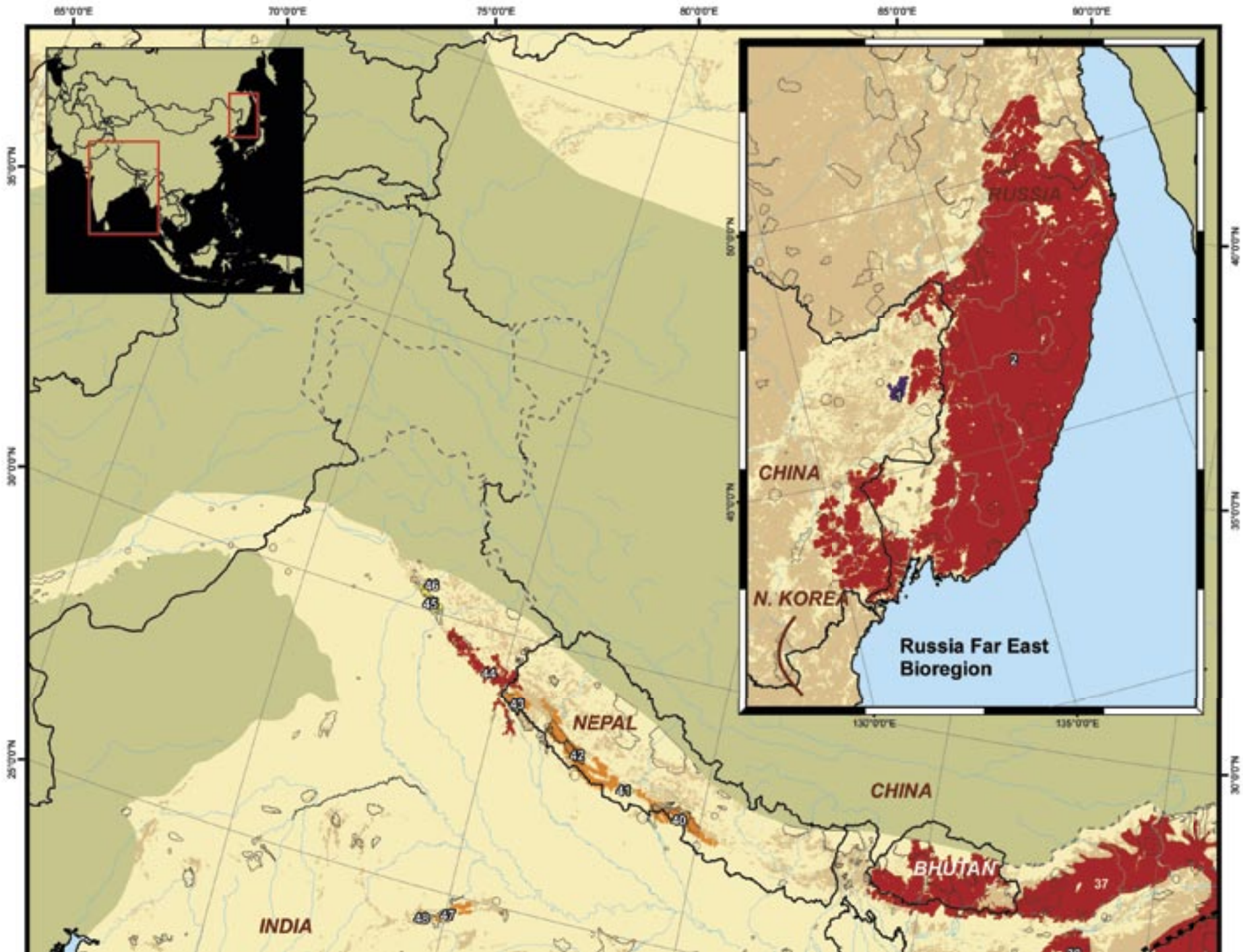


MAP 7. Tiger Conservation Landscape Classification (Mainland Southeast Asia and Sumatra)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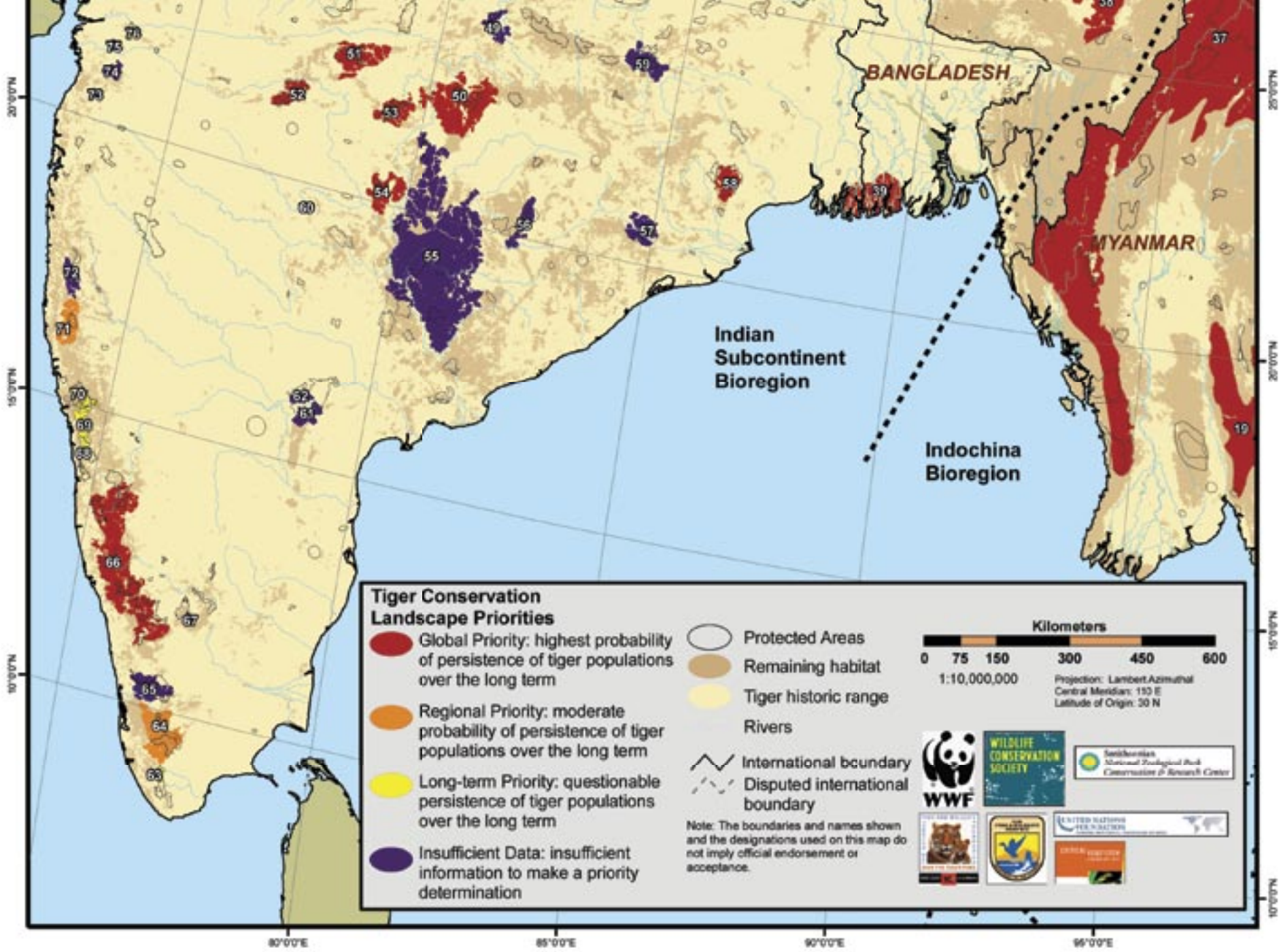
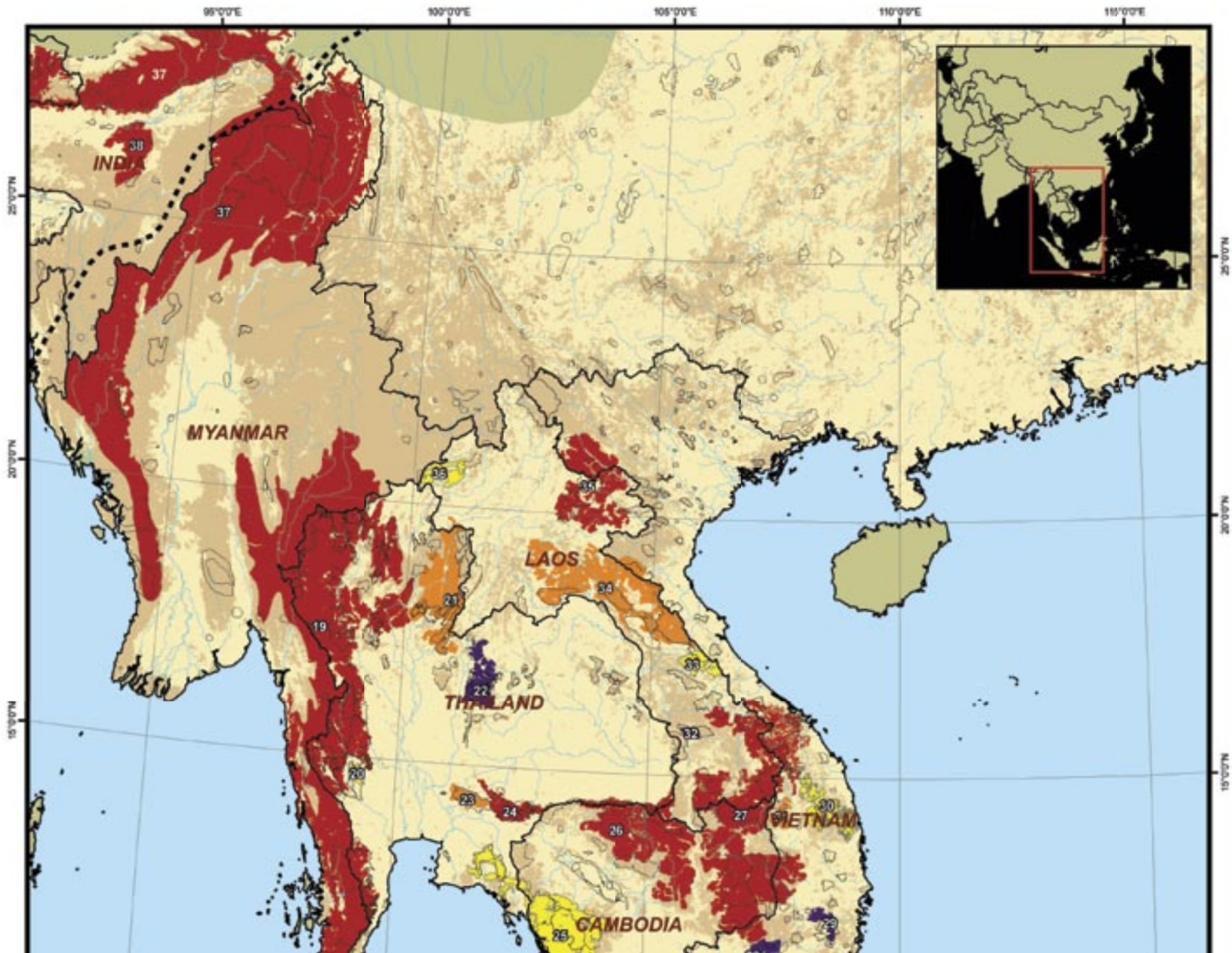


MAP 8. Tiger Conservation Landscape Prioritization (Indian Subcontinent, China, and Russia)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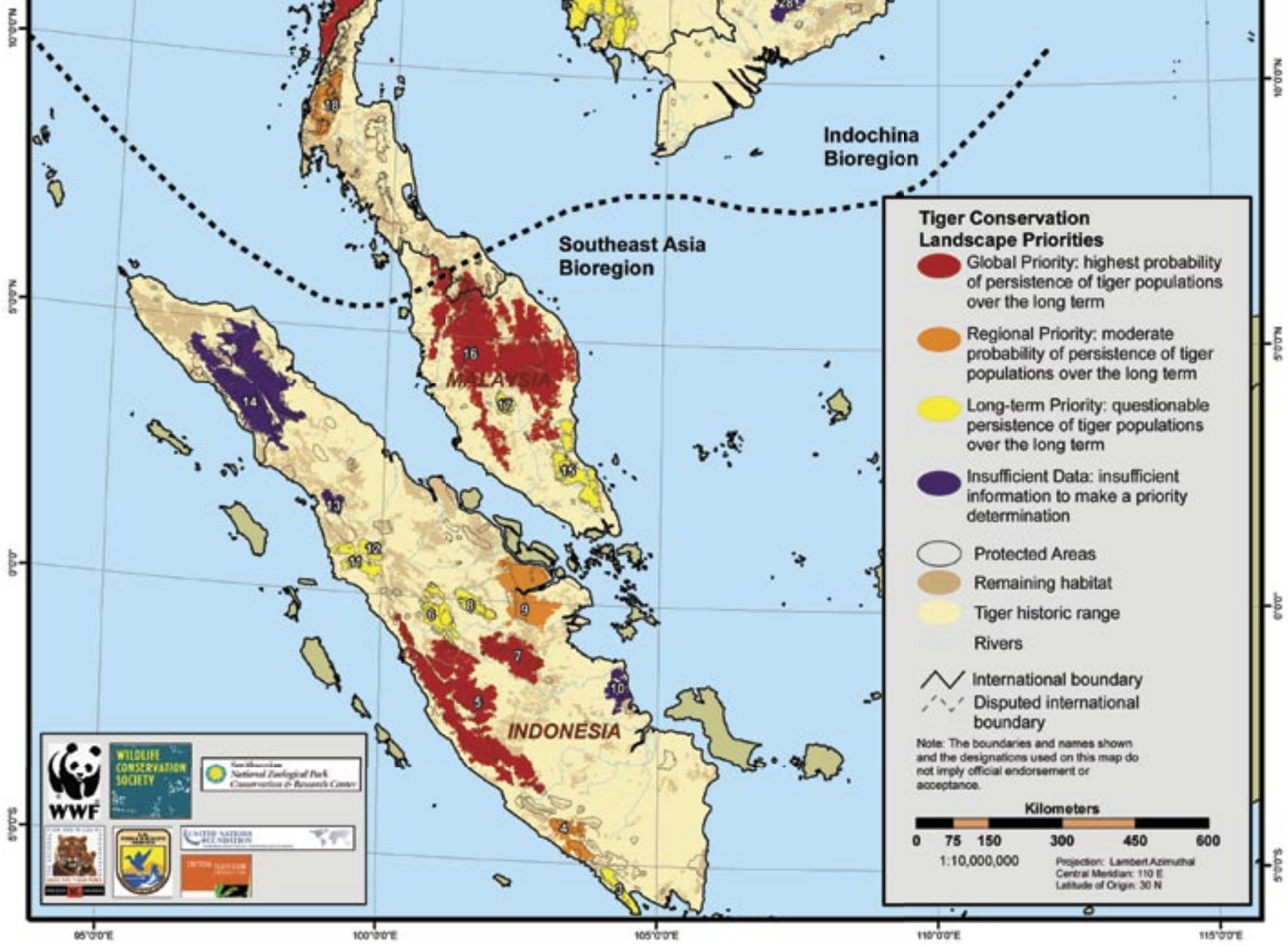

MAP 9. Tiger Conservation Landscape Prioritization (Mainland Southeast Asia and Sumatra)

TCL Number	TCL Name	Number of Biomes	Number of Countries	Total TCL Area (km²)	Habitat Area (km²)	Area of Largest Habitat Patch (km²)	Relative Area	Habitat as % of Landscape Area
1	Heilongjiang	2	1	1,315	703	660	3	53.46
2	Russian Far East - China	3	2	269,983	216,578	183,237	866	80.22
3	Bukit Barisan Selatan South	1	1	2,107	1,115	962	4	52.92
4	Bukit Balai Rejang - Selatan	1	1	3,884	2,670	2,665	11	68.74
5	Kerinci Seblat	2	1	28,162	19,653	10,928	79	69.79
6	Bukit Rimbang Baling	1	1	4,395	2,298	1,563	9	52.29
7	Bukit Tigapuluh Landscape	1	1	7,106	5,417	5,213	22	76.23
8	Tesso Nilo Landscape	1	1	2,332	1,121	525	4	48.07
9	Kuala Kampar-Kerumutan	2	1	9,835	4,895	2,447	20	49.77
10	Berbak	2	1	2,543	1,604	1,286	6	63.08
11	Rimbo Panti-Batang Gadis East	1	1	2,890	1,713	1,116	7	59.27
12	Rimbo Panti-Batang Gadis West	1	1	1,486	889	843	4	59.83
13	Sibologa	1	1	1,292	856	654	3	66.25
14	Leuser Ecosystem	2	1	22,319	16,000	7,817	64	71.69
15	Endau Rompin	1	1	6,505	1,552	629	6	23.86
16	Taman Negara - Belum	2	2	49,181	26,727	12,908	191	54.34
17	Krau	1	1	1,248	471	469	2	37.74
18	Khlong Saeng	2	1	4,816	1,828	1,545	13	37.96
19	Tenasserims	3	2	162,726	128,238	113,993	1,832	78.81
20	Salak-Phra	1	1	647	383	379	2	59.2
21	Phu Miang - Phu Thong	2	2	16,273	13,254	12,934	189	81.45
22	Phu Khieo	2	1	5,760	3,637	2,315	52	63.14
23	Khao Yai	2	1	2,253	1,717	1,668	25	76.21
24	Thap Lan - Pang Sida	1	1	4,445	3,027	2,778	43	68.1
25	Cardamoms	3	2	26,345	14,883	11,470	213	56.49
26	Cambodian Northern Plains	1	3	26,835	16,188	8,526	231	60.32
27	Southern-Central Annamites	2	3	61,252	37,521	30,063	536	61.26
28	Cat Tien	2	1	3,359	2,579	2,567	37	76.78
29	Bi Dup-Nui Ba	2	1	1,660	798	792	11	48.07
30	Kon Ka Kinh	2	1	6,389	1,274	796	18	19.94
31	Chu Mom Ray	1	1	1,787	993	885	14	55.57
32	Xe Bang Nouan	1	1	657	436	427	6	66.36
33	Hin Nam Ho	1	1	2,727	1,718	1,236	7	63
34	Northern-Central Annamites	1	2	28,826	19,160	11,191	137	66.47
35	Nam Et Phou Loey	1	2	17,866	11,961	6,958	85	66.95
36	Nam Ha	1	1	3,217	1,767	1,268	7	54.93
37	Manas	6	3	237,820	213,018	196,851	7,101	89.57
38	Kaziranga - Garampani	1	1	7,514	5,609	4,648	187	74.65
39	Sundarbans	1	2	5,304	1,196	334	5	22.55

40	Royal Chitwan	3	2	4,055	1,257	560	42	31
41	Royal Bardia South	3	1	499	206	83	7	41.28
42	Royal Bardia	3	2	6,777	3,272	740	109	48.28
43	Royal Suklaphanta	3	2	1,144	467	300	16	40.82
44	Corbett - Sonanadi	3	2	5,996	1,758	251	59	29.32
45	Rajaji	2	1	1,044	301	172	7	28.83
46	Yamuna	3	1	322	120	82	3	37.27
47	Panna East	2	1	1,390	613	178	14	44.1
48	Panna West	1	1	539	171	103	2	31.73
49	Bandhavgarh - Pangatha	2	1	2,020	905	249	20	44.8
50	Kanha - Phen	2	1	10,598	5,605	690	125	52.89
51	Pachmarhi - Satpura - Bori	2	1	4,924	2,403	299	53	48.8
52	Melghat	1	1	2,398	1,277	503	18	53.25
53	Pench	2	1	2,918	1,280	205	28	43.87
54	Andhari - Tadoba	2	1	3,680	1,455	331	32	39.54
55	Indravati	2	1	44,238	24,775	1,576	551	56
56	Sunabeda-Udanti	2	1	2,287	1,445	603	32	63.18
57	Satkosia-Gorge	1	1	2,699	1,513	643	34	56.06
58	Similipal	2	1	2,412	1,391	739	31	57.67
59	Palamau	2	1	3,209	1,859	727	41	57.93
60	Paingunga	1	1	442	162	148	2	36.65
61	Nagarjunasagar South	1	1	1,699	832	337	12	48.97
62	Nagarjunasagar North	1	1	915	406	217	6	44.37
63	Shendurney	1	1	603	336	257	7	55.72
64	Periyar - Megamala	2	1	5,978	3,667	1,567	81	61.34
65	Anamalai-Parambikulam	1	1	3,071	1,611	831	36	52.46
66	Western Ghats - Bandipur - Khudremukh - Bhadra	2	1	18,973	8,679	831	193	45.74
67	Biligiri Range	2	1	278	136	136	3	48.92
68	Western Ghats - Sharavathi Valley	1	1	321	188	188	1	58.57
69	Dandeli South - Anshi	1	1	2,316	1,265	411	9	54.62
70	Dandeli North	1	1	517	291	177	2	56.29
71	Radhanagari	2	1	2,945	1,669	708	24	56.67
72	Chandoli	1	1	1,682	915	433	7	54.4
73	Mahabaleshwar Landscape - South	1	1	344	177	177	1	51.45
74	Purna	1	1	1,002	560	560	4	55.89
75	Mahabaleshwar Landscape - North	2	1	406	250	249	6	61.58
76	Shoolpaneswar	2	1	511	259	180	6	50.68

TABLE 3. Characteristics of individual TCLs

Notes: Total landscape area is the total area of the TCL, including both habitat and non-habitat. Habitat area is structural land cover for tigers with low human impact. Area of la
habitat-type in which it is found. One unit of Relative Area represents enough habitat for approximately five tigers.

REFERENCES & CREDITS

Carbone C, Christie S, Conforti K, Coulson T, Franklin N, Ginsberg JR, Griffiths M, Holden J, Kawanishi K, Kinnaird M, Laidlaw R, Lynam A, Macdonald DW, Martyr D, McDougal C, Nath L, O'Brien T, Seidensticker J, Smith DJL, Sunquist M, Tilson R, Shahruddin WNW. 2001. The use of photographic rates to estimate densities of tigers and other cryptic mammals. **Animal Conservation.** 75-79.

Hayward, G., D. G. Miquelle, E. N. Smirnov, and C. Nations 2002. Monitoring Amur tiger populations: characteristics of track surveys in snow. Wildlife Society Bulletin 29: 553-542.

Karanth K.U., Chundawat RS, Nichol JD, Kumar NS. 2004a. Estimation of tiger densities in the tropical dry forests of Panna, Central India, using photographic capture-recapture sampling. **Animal Conservation** 7: 285-290.

Karanth, K. U., J. D. Nichols., N. S. Kumar., W. A. Link and J. E. Hines. 2004b. Tigers and their prey: Predicting carnivore densities from prey abundance. **Proceedings of the Natural Academy of Sciences.** 101: 4854-4858.

Miquelle, D.G., E.N. Smirnov, H.G. Quigley, M.G. Hornocker, I. N. Nikolaev, and E.N. Matyushkin. 1996. Food habits of Amur tigers in Sikhote-Alin Zapovednik and the Russian Far East, and implications for conservation. **Journal of Wildlife Research** 1:138-147

Miquelle, D.G., Smirnov, E.N., Merrill, T.W., Myslenkov, A.E., Quigley, H.B., Hornocker, M.G., Schleyer, B. 1999. Hierarchical spatial analysis of Amur tiger relationships to habitat and prey. In: Seidensticker, J., Christie, S., Jackson, P. (Eds.), *Riding the Tiger: Tiger Conservation in Human-dominated Landscapes*. Cambridge Universtiy Press, Cambridge, pp. 71-99.

O'Brien, T.G., Kinnaird, M.F., and H.T. Wibisono. 2003. Crouching tigers, hidden prey: Sumatran tiger and prey populations in a tropical forest landscape. **Animal Conservation** 6: 131-139.

Sanderson, E., J. Forrest, C. Loucks, J. Ginsberg, E. Dinerstein, J. Seidensticker, P. Leimgruber, M. Songer, A. Heydlauff, T.O'Brien, G. Bryja, S. Klenzendorf and E. Wikramanayake. 2006. *Setting Priorities for the Conservation and Recovery of Wild Tigers: 2005-2015. The Technical Assessment*. WCS, WWF, Smithsonian, and NFWF-STF, New York – Washington, D.C.

Sanderson, E.W., M. Jaiteh, M. A. Levy, K.H. Redford, A.V. Wannebo, and G. Woolmer. 2002. The human footprint and the last of the wild. **BioScience** (10):891-904.

Schaller, G.B. 1967. *The Deer and the Tiger—A Study of Wildlife in India*. Univ. Chicago Press, Chicago, IL, USA.

Seidensticker, J. 1986. Large carnivores and the consequences of habitat insularization: ecology and conservation of tigers in Indonesia and Bangladesh. Pp. 1–41 in S.D. Miller and D.D. Everett (eds.) *Cats of the World: Biology, Conservation, and Management*. National Wildlife Federation, Washington, D.C.

Seidensticker, J. 1987. Bearing witness: observations on the extinctions of *Panthera tigris balica and Panthera tigris sondaica*. In *Tigers of the world: the biology, biopolitics, management and conservation of an endangered species:* 1–8. Tilson, R. L. & Seal, U. S. (Eds). Park Ridge, NJ: Noyes Publication.

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