A Framework for Identifying High Priority Areas and Actions for the Conservation of Tigers in the Wild

Part I

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Eric Dinerstein ■ Eric Wikramanayake
John Robinson ■ Ullas Karanth
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Part II

Controlling Trade in and Reducing Demand for Tiger Products: A Preliminary Assessment of Priority Needs

Ginette Hemley ■ Dorene Bolze

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World Wildlife Fund-US
and
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Acronyms and Abbreviations

ABC	Asian Bureau for Conservation
AVHRR	Advanced very high resolution radiometer
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
GIS	Geographic Information System
ICDP	Integrated Conservation and Development Project
IUCN	The World Conservation Union (formerly the International Union for the Conservation of Nature and Natural Resources)
NGO	Nongovernmental organization
PVA	Population viability analysis
TCM	Traditional Chinese medicine
TCU	Tiger Conservation Unit
USAID	United States Agency for International Development
USFWS	United States Fish and Wildlife Service
WCS	The Wildlife Conservation Society
WWF	World Wildlife Fund

Executive Summary

The tiger, *Panthera tigris*, is threatened with extinction in the wild. The combination of rampant poaching of tigers and their prey and unabated habitat loss due to fragmentation and conversion has intensified the threats to the survival of healthy wild populations. Responding to this crisis, conservation groups, donors, and national government agencies have distributed funds to halt the decline of tiger populations, but in an *ad hoc* manner. Most of the funding has been earmarked for a few protected areas, and in some cases for activities that will do little to rectify the current crisis. Many important sites and activities have been overlooked for funding, largely because there has been no method to systematically identify areas of high conservation potential.

The ideal conservation strategy would be to protect all blocks of natural habitat containing tigers and to stop all illicit trade of tiger products. But due to limited financial and human resources, the timing, sequence, and level of effort allocated to tiger conservation must be prioritized for the next few years. These priorities must also be set in a rational, transparent manner based upon the best data available.

This project provides that method. In Part I, we identify priority areas for long-term tiger conservation across the tiger's range; in Part II, we identify international trade control needs. The assessment is intended to bring to the attention of international donors, conservation biologists, and policy makers the areas in which their investments and efforts can yield the biggest dividends in conserving tigers and their habitats.

Part I. Our approach to identifying priority conservation areas is *ecology-based*, rather than *taxonomy-based*, in that it recognizes that tigers are uniquely defined by the ecological conditions in which they live. Therefore, instead of seeking to conserve putative subspecies, we capture the ecological, demographic, genetic, and behavioral differences of tigers in a suite of wild areas that best represents the range of ecological conditions in which tigers occur.

The approach has a hierarchical framework to ensure that the ecological and biological characteristics of tigers living in distinct habitat types throughout their extensive range are represented in a prioritized portfolio of conservation areas. We first divided the tiger range into five distinct bioregions: the Indian Subcontinent, Indochina, Southeast Asia, Central and Southern China, and the Russian Far East (Amur-Sakhalin bioregion). This analysis focuses primarily on the first three in South and Southeast Asia because extensive conservation planning has already been completed in the Russian Far East and major gaps in knowledge about tigers in southern China preclude a fair analysis at this point. We recommend appropriate

conservation activities to determine the current status of tigers in southern China.

Each bioregion was then divided into tiger habitat types, which represent the major habitat types where tigers are known to play distinct ecological roles and are members of distinct ecological communities. The tiger habitat types represent a second layer of stratification that enables the representation of ecological, behavioral, and demographic differences of tiger populations throughout their extensive range.

We then delineated Tiger Conservation Units (TCUs) within the bioregions and scored them for conservation potential based on three indices relevant to the survival of tigers: habitat integrity, poaching pressure, and population status. Each TCU was then assigned a score for each of the three variables and the three scores were summed to arrive at a single rank score.

The rank score was used to categorize each TCU in one of the following four categories: Level I, Level II, Level III, or Immediate Surveys. A Level I TCU offers the highest probability of persistence of tiger populations over the long term, and is considered essential for a global tiger conservation strategy. A Level II TCU offers medium probability of persistence of tiger populations over the long term and contributes best to a bioregional tiger conservation strategy. A Level III TCU offers low probability of persistence of tiger populations over the long term due to its small size, isolation from other habitat blocks containing tigers, and fragmentation; but, with intensive management and protection, Level III TCUs can harbor small populations of tigers. TCUs that potentially contain extensive blocks of appropriate tiger habitat but lack habitat quality data were identified as TCUs requiring immediate surveys.

Using this hierarchical method, we compared and ranked together only those TCUs that shared the same tiger habitat type within the same bioregion. For instance, TCUs from the Indian Subcontinent bioregion were not compared with TCUs from the Southeast Asia bioregion, nor did we compare TCUs from different tiger habitat types within the Indian Subcontinent bioregion. This approach ensured better representation of biological differences of tigers, tiger-related predator-prey dynamics, and regional patterns of biodiversity across the extensive tiger distribution.

We identified a total of 159 TCUs across the three bioregions, of which 25 TCUs were Level I (16% of all TCUs), 21 were Level II (13%), and 97 were Level III (61%). Sixteen TCUs (10%) were identified for immediate surveys.

The Level I and II TCUs are recommended as highest priority areas and should be the primary focus for a regional tiger conservation strategy. We also urge the

financing of surveys in TCUs identified for immediate surveys to determine their potential contribution to a regional tiger conservation strategy. Although we stress a biogeographic rather than a country approach to setting priorities, we point out that all tiger range states contain at least one Level I TCU.

The results provide important insights relevant to tiger conservation efforts:

1) Virtually all of the Level I TCUs straddle or lie near international boundaries. The exceptions are a few units in central and southern India and Sumatra.

2) Strict protected areas typically cover only a fraction of a TCU. Thus, a landscape ecology approach, where conservation efforts do not stop at protected area boundaries, is imperative.

3) Several Level I and II TCUs are very large, and we recognize that they will not receive complete protection. Since tiger habitat is being rapidly lost, this study can serve as leverage for more "conservation-friendly" land use options and improved landscape management within these high-priority TCUs. If proper use is planned and enforced, habitat linkage zones, effective core areas, and buffer zones can be better maintained before these large habitat blocks become fragmented.

4) The habitat integrity index used in this study provides only a snapshot in time as to habitat quality within each TCU. The length of this study was too short to assess the trajectory of tiger habitats over the next 10-20 years. However, we point out that some of the most intensive, large-scale logging in the Indochina bioregion is occurring or is slated to occur in many of the Level I TCUs, and many of these same areas suffer from intense poaching of tigers and tiger prey. We urge finer-scale studies focusing on Level I and Level II TCUs to assess trajectories.

5) The only prime example of a TCU that conserves a representative unit of tigers living in mangrove ecosystems is the Sunderbans TCU on the border of India and Bangladesh. Other TCUs containing mangroves in Indochina or Southeast Asia are mere remnants of mangrove habitat and tiger populations are severely depleted. Thus, the Sunderbans TCU emerges as a global priority for tiger conservation.

6) There was no significant relationship between the size of a TCU and its rank score. Thus, one cannot simply select the largest blocks of habitat and assume to have identified the most important units in which to conserve tigers because some large blocks are quite degraded across most of the TCU or are not considered prime habitat.

Part II. Poaching remains a major threat to tigers. Tiger parts are highly valued in the East Asian traditional medicinal markets, so trade controls are urgently

needed. This preliminary assessment identifies immediate trade control needs and offers specific actions to address them in two principal areas: a) strengthening capacity of countries to control the trade, and b) reducing demand for tiger products. We identified 11 priority tiger range countries and four priority consumer nations in which to target efforts to improve trade control capabilities, and we recommend five specific activities to address training and technical needs.

Strengthening the capacity of countries to control the illicit trade in tiger parts and products requires, in many cases, support in strengthening their law enforcement infrastructure, including specific laws with meaningful penalties, government agencies with clearly defined responsibilities, trained manpower, and intelligence-gathering networks. Effective legislation, essential to controlling trade in tiger parts and products, is lacking in almost every tiger range state and major consumer nation. In response to international pressure, several consumer nations have recently enacted specific domestic measures to control the tiger trade, but it is too early to determine their long-term effectiveness.

Reducing demand for tiger products is also critical to long-term conservation of tigers in the wild. Currently, little is known of the demographics of tiger product users, or of possible substitutes for tiger products and associated market dynamics. Efforts that target these issues should focus primarily on the East Asian markets of China, Hong Kong, Taiwan, Singapore, South Korea, and Japan, as well as large Asian communities in the United States, Canada, and Europe.

It is critical to build general public support for conserving tigers, and an understanding of the links between tiger product consumption and the decline of the species in the wild. We recommend specific activities that target the traditional Chinese medicine (TCM) practitioners, users of tiger products, and the general public of the priority consumer countries. It is essential to design and implement these activities within the cultural contexts of the different target audiences.

The recent international symposium on traditional Chinese medicine and wildlife conservation—sponsored by TRAFFIC, WWF, and the Hong Kong government—underscored working with the TCM community as a top priority. Efforts should focus on educating the TCM community about the relationship between the decline of tiger populations and the off-take of tigers for use in traditional medicines, exploring possible substitute products, and enlisting support of trade control efforts and collaboration on consumer education efforts.

Specific activities to address trade control include:

1) Conducting detailed reviews of tiger trade control laws and regulations and making recommendations for strengthening provisions.

2) Conducting detailed reviews of capacity-building needs as a basis for developing enforcement and trade control plans.

3) Establishing tiger trade monitoring networks to collect and disseminate information.

4) Developing identification guides on tiger parts and products to improve enforcement.

5) Conducting independent market surveys to determine levels of trade, monitor trends, and assist in trade control efforts.

6) Holding workshops to address enforcement communication, information, and collaborative training issues, particularly in cross-border areas.

7) Providing appropriate assistance to Bhutan, Cambodia, Laos, and Myanmar to encourage formal participation in CITES.

8) Launching public awareness and education campaigns in key consumer countries, including enlisting corporate advertising and marketing support to disseminate tiger conservation messages, and designing school curricula and teacher training programs on tiger conservation.

Overall, this analysis should help guide international donors and conservationists to those areas and activities requiring immediate attention and help them make more cost-effective investments in tiger conservation.

PART I. A Framework for Identifying High Priority Areas for the Conservation of Free-Ranging Tigers

I. Introduction

Threats to free-ranging tigers have intensified over the past five years due to rampant poaching of tigers and their prey (Nowell and Jackson 1996). Intensive logging and rapid expansions of human populations in and around remaining natural habitats over most of the tiger range suggest a grim future for tigers unless we act now (Nowell and Jackson 1996).

Because tiger habitat is dwindling throughout the range, all potential tiger habitats across Asia are worthy of conservation. Unfortunately, funds and trained personnel remain inadequate to protect them all. We must identify which of the remaining habitats and populations have the highest probability of long-term persistence so that the limited resources can be used on a priority basis. To save wild tiger populations across Asia, it is essential that we choose the most cost-effective projects, basing them on sound science and, more specifically, on principles of conservation biology and landscape ecology.

Several important fora—including the Species Survival Commission's Cat Specialist Group of the IUCN, the Global Tiger Forum, and the Wildlife Conservation Society (WCS)—have already begun the process of identifying priorities for tiger conservation (Norchi and Bolze 1995, Nowell and Jackson 1996). To accelerate this process, the National Fish and Wildlife Foundation, through its Tiger Council, asked World Wildlife Fund-US and the Wildlife Conservation Society to provide a framework for evaluating funding proposals for conserving tigers in the wild. Both organizations have a long history of financing basic research, reserve establishment, anti-poaching efforts, habitat protection, and innovative approaches to tiger conservation across Asia. Most importantly, WWF and WCS maintain close links with tiger experts or actually employ field staff who are monitoring tiger populations and habitats across the range.

II. The Priority-Setting Framework for Tiger Conservation

A. Approach

The approach that we developed is *ecology-based* rather than *taxonomy-based*. The traditional taxonomy-based approach focuses on populations of threatened subspecies classified on the basis of "adequate" genetic variability among populations across their range. For tigers, a taxonomic approach to conservation would focus on the five extant subspecies, which have been classified on the basis

of external morphological characteristics, namely body size, pelage characteristics, and cranial morphometrics (Herrington 1987). We suggest that a comprehensive tiger conservation strategy must also account for the behavioral, demographic, and ecological variation present among populations across their range distribution. Our ecology-based approach ensures that, in addition to the genetic variation inherent in putative subspecies, these other biological characteristics of tigers inhabiting different ecosystems across the biogeographic range are also represented in a portfolio of prioritized conservation units.

An underlying principle of this approach is the recognition that tigers are ecologically, behaviorally, demographically, and genetically adapted to the ecological conditions where they live. For instance, a tiger population in the boreal taiga of Russia will have different demographic, genetic, and behavioral characteristics than a population living in the subtropical alluvial grasslands of Nepal. Therefore, by conserving examples of tiger populations in distinct bioregions, ecosystems, and habitat types, we meet a fundamental goal of conservation biology—*maintaining representation*—while also conserving the range of communities in which tigers occur. Instead of seeking to conserve subspecies of tigers *per se*, we seek to conserve a suite of wild areas across the entire extant range distribution that represents the array of ecological conditions in which tigers occur.

We also depart from other approaches that base priorities largely on the perceived viability of a population (Lande and Barrowclough 1987). These population viability analyses, or PVAs (Gilpin and Soule 1986, Boyce 1992), typically assume a certain minimum population size based upon maintenance of a certain number of breeding adults (Franklin 1980), even though how this number will vary by species remains unknown. PVAs typically make the assumption that populations remaining below a certain critical threshold size for a given length of time may be doomed, even though it remains unclear how this phenomenon relates to large carnivores, such as tigers, that live at low densities and have evolved behaviors to avoid inbreeding. Moreover, PVAs lack much of the essential life history data required to properly conduct computer simulations of the viability of tiger populations (Nowell and Jackson 1996).

Our approach does not assume that tiger populations currently below a certain number are no longer viable, or that there is even a clearly established number that serves as a defining indicator of long-term viability. We recognize that the probability of long-term persistence is determined in part by factors intrinsic to the population (population size, reproductive success, demographic structure), but also in part by factors extrinsic to the population (trends in habitat fragmentation, loss of prey base, human impact, local development, and commitment to conservation). Consequently, we have adopted a convenient and biologically sound alternative to

the PVA. We assess the population status of tiger populations based on demographic trends over the previous decade, rather than attempting to determine viability from absolute numbers. This approach takes on added ecological significance because, as top predators, tigers play a significant role in structuring biological communities.

In the ecology-based approach we:

- Achieve ecological, genetic, behavioral, and demogaphic representation of tigers by stratifying the analysis by biounits and habitat types.

- Consider even small tiger populations to be important and base our priorities on population trends rather than on absolute numbers. Past experience has shown that given adequate ecological resources (habitat, water, prey) and protection, small populations can recover.

- Consider all suitable tracts of habitats within a tiger range as potentially containing tigers until proven otherwise by available information or future surveys. Habitats lacking reliable information on tiger presence or absence will be flagged for ground surveys rather than being disregarded during the initial assessment stage.

- Emphasize the intrinsic biodiversity value of tigers, the ecological value of tigers as top predators in ecosystems, and the importance of tigers as "umbrella species" for conservation.

B. Principles Underlying the Approach

Several basic principles underlie our approach to this priority-setting initiative:

1. Tigers are ecologically, behaviorally, demographically, and genetically adapted to the ecological conditions and biogeographic realm in which they live.

2. The root causes of the decline of tigers across their range are habitat fragmentation, degradation, and eventual loss, and intensive poaching of tigers and their prey. These threats affect the integrity of the habitat, impoverish the biological communities in which tigers live, and reduce tiger populations.

3. Most existing protected areas containing tigers are relatively small. Conservation management should extend beyond protected areas to cover larger landscape units. In some instances, creation and protection of buffer zones, dispersal corridors, core

areas, and seasonal refugia may be essential to maintain tiger populations with a high chance of persistence.

4. The reclamation or restoration of tiger habitat in many areas of its historic range is unlikely in the near future. Therefore, to ward off local extinctions, our immediate responses must be to protect remaining habitats and reduce poaching pressure on both tigers and their prey. These goals are often best achieved by a combination of enforcing protection measures, managing protected areas, and extending conservation measures beyond protected areas. These tasks call for financing and support of anti-poaching information networks, adequate staffing and training for managing protected areas and reserved forests, and implementation of Integrated Conservation and Development Programs (ICDPs) in and around protected areas.

5. The historical demography of many tiger populations—particularly in India, Nepal, and the Russian Far East—has shown that reducing or eliminating poaching pressure and protecting relatively large tracts of prime habitat can lead to a relatively rapid increase in tiger numbers. We should not assume that tiger populations currently at low levels or below carrying capacity are in long-term demographic jeopardy, or "doomed."

C. Logistics of the Ecology-based Framework

Our framework is hierarchical (Figure 1), to ensure that it includes: a) representation of all extant tiger populations throughout their range; b) the full spectrum of habitat types found across Asia and the Russian Far East; and c) the distinct species assemblages, predator-prey dynamics, and ecological processes associated with these diverse ecosystems.

Hierarchical Structure

To adequately capture the variation of tigers throughout their range, we first divided Asia and the Russian Far East into five bioregions: Indian Subcontinent, Indochina, Southeast Asia, Russian Far East, and South China (Box 1). This first layer of stratification will ensure that tiger populations from different bioregions will not be ranked together. The demarcation of the Indian Subcontinent, Indochina, and Southeast Asia bioregions are based on MacKinnon and MacKinnon (1986).

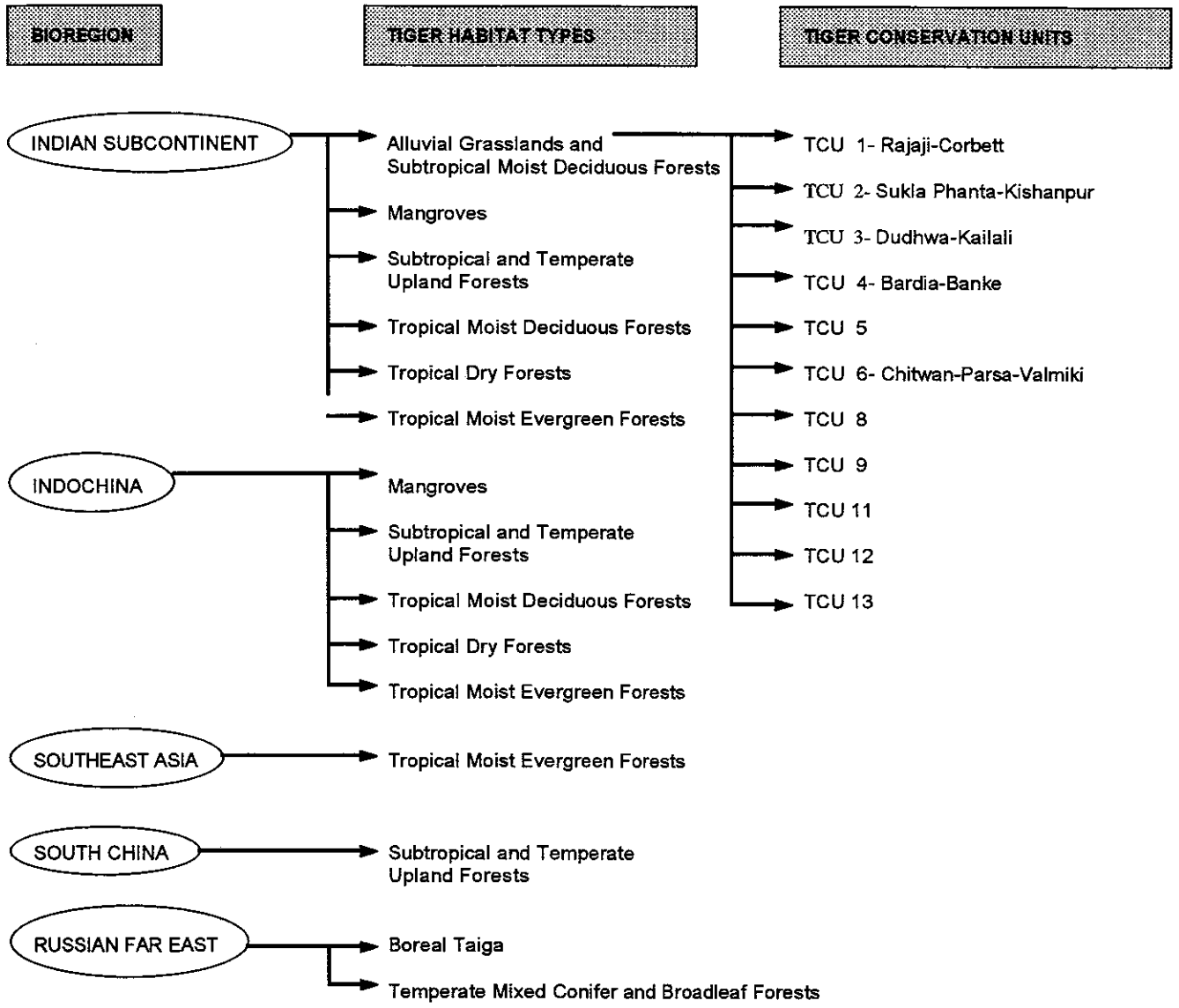

Figure 1. Hierarchy for maintaining representation of tiger-dominated ecosystems across Asia. Bioregions are stratified by Tiger Habitat Types containing one or more Tiger Conservation Units (TCUs). Only the TCUs from the Alluvial Grasslands and Subtropical Moist Deciduous Forests Tiger Habitat are shown. For setting priorities, we compared only those TCUs sharing the same THT and Bioregion. For example, only the TCUs that belong to the Alluvial Grasslands/Subtropical Moist Deciduous Forests were compared with one another.

Box 1. The geographic boundaries of the five bioregions. Also see Figures 1 & 2.

I. **The Indian Subcontinent:** From South India to the Indian and Nepalese Himalaya and foothills and east to the Burmese transition zone.

II. **Indochina:** From the Burmese transition zone into southern China and south to the Isthmus of Kra.

III. **Southeast Asia:** From south of the Isthmus of Kra to the southern tip of Sumatra.

IV. **Northern Temperate and Taiga Zone:** Manchurian China, North Korea, northward into Khabarovsk Krai of the Russian Far East.

V. **South China:** Low-lying areas where tigers still persist.

As a second layer of stratification, we identified eight tiger habitat types:

- Alluvial Grasslands & Subtropical Moist Deciduous Forests
- Tropical Dry Forests
- Tropical Moist Deciduous Forests
- Tropical Moist Evergreen Forests
- Mangroves
- Subtropical and Temperate Upland Forests
- Temperate Mixed Conifer and Broadleaf Forests
- Boreal Taiga

Tigers are considered to play different ecological roles in each of these habitat types. We emphasize that tiger habitat types do not represent biological diversity *per se*.

Delineating Tiger Conservation Units

In a third layer of stratification, within each bioregion we identified Tiger Conservation Units (TCUs). A TCU is defined as "a block or a cluster of blocks of existing habitats that contain, or have the potential to contain, interacting populations of tigers."

A TCU has the following attributes:

- It can consist of several adjacent blocks of habitat among which tigers can disperse. We consider adjacent habitat blocks to comprise a TCU if they are linked by degraded scrub forests, tall crops, plantations with dense growth or canopy cover, or river and stream courses, since tigers can disperse across these altered habitats or along river courses. We also consider adjacent habitat blocks a TCU if they are separated by less than 5 km, since field studies in India indicate that 5 km is about the threshold of open land that tigers will cross. Thus, habitat blocks separated by more than 5 km of open land were delineated as distinct TCUs.

- A TCU need not be restricted to nor contain protected areas, but instead includes the entire landscape of natural habitats over which tigers may disperse and become established.

TCUs were delineated using vegetation maps that represent the most up-to-date digital maps of remaining habitat across the range of the tiger in the Indo-Malayan realm. These data were provided by the Asian Bureau for Conservation (ABC) and the World Conservation Monitoring Centre (WCMC). For the Russian Far East, we used one kilometer resolution AVHRR data classified for us at Woods Hole Research Center by Thomas Stone.

We also overlaid man-made features available from the global Geographic Information System (GIS) database, Digital Chart of the World (ESRI 1992), to assess the spatial relationship between habitat blocks and potential dispersal barriers, such as roads and settlements. If habitat blocks were completely separated by roads, railroads, settlements, or villages, these blocks were placed in different TCUs.

Protected areas are shown in Figures 2-5, and protected areas names are given in Figures 6 and 7.

Although TCUs are shown on 1:3,000,000 scale vegetation maps (Figures 2 and 3), the actual delineation was done at smaller scales, ranging from 1:1,000,000 to 1:50,000, using other available maps. To calculate the total intact area of a TCU,

we subtracted the polygons of altered habitat within TCUs from the total area using ARC/INFO.

Scoring Tiger Conservation Units

The root causes of the decline of tigers are habitat loss and poaching pressure. These threats affect the integrity of the habitat, impoverish the biological communities in which tigers live, and reduce tiger populations. To index these changes (see Appendix 1a-c), we chose the following three variables:

1) Habitat Integrity -- which indexes the size, degree of degradation, fragmentation, and connectivity of tiger habitat blocks;
2) Poaching Pressure -- which indexes the intensity of illegal hunting of tigers and their prey, and the potential for its control; and
3) Population Status -- which indexes tiger abundance and recent population trends within each tiger habitat type.

We suggest that these three variables are powerful predictors of the long-term persistence of tiger populations. These nonlinear indices were used to assess, score, and rank each TCU. We solicited regional and local expertise to assess and score TCUs, and corroborated these evaluations with published and unpublished reports reviewed during this study.

The scores from the three indices were then combined in a weighted fashion, reflecting the reversibility of the primary threats to tiger conservation. We considered loss of habitat integrity to be the most difficult to reverse, and so weighted this variable twice as high as poaching pressure, which can be turned around more easily. Poaching pressure, in its turn, was weighted twice as high as population status, reflecting the observation that tiger populations can rebound quickly if they and their habitat and prey are protected over sufficiently large areas. In this way, each TCU was assigned a rank score comprised of the sum of habitat integrity, poaching pressure, and population status weighted according to a 4:2:1 ratio. These rank scores reflect the probability of persistence of the resident tiger population over the long term in the respective TCUs. Then, each TCU was categorized as Level I, II, or III based on its rank score and the contribution of each variable to the rank score (see Box 2).

Because the TCUs were nested by tiger habitat types, which were in turn nested within bioregions (Figure 1), the scores and category levels for TCUs were compared only within tiger habitat types of the same bioregion. For instance, we did not compare TCU scores from the Indian Subcontinent bioregion with TCUs from the Southeast Asia bioregion, nor did we, within the Indian Subcontinent bioregion, compare TCUs from the alluvial grasslands & subtropical moist deciduous

forests tiger habitat type with TCUs from the tropical dry forest tiger habitat type. This approach ensures better representation of the biological differences of tiger populations, tiger-related predator-prey dynamics, and regional patterns of biodiversity across the tiger's range.

Box 2. Classification of Tiger Conservation Units
Level I TCU: A TCU offering the highest probability of persistence of tiger populations over the long term. They are essential for a global tiger conservation strategy. Level I TCUs share the following attributes: large blocks of habitat suitable for tigers and prey, with adequate core areas; low to moderate poaching pressure on tigers and prey species either as a result of remoteness or vigilant protection. (45-70 points)
Level II TCU: A TCU offering medium probability of persistence of tiger populations over the long term. They are important for a bioregional tiger conservation strategy. These TCUs share the following attributes: moderate to large-sized blocks of habitat suitable for tigers, with adequate core areas; moderate to high poaching pressure on tigers and prey species, but with potential for implementing effective anti-poaching measures in the near future. (32-44 points)
Level III TCU: A TCU offering low probability of persistence of tiger populations over the long term due to its small size, isolation from other habitat blocks containing tigers, and fragmentation within its respective tiger habitat type. With intensive management and protection, Level III TCUs can harbor small populations of tigers. They are most important to national tiger conservation strategies. Level III TCUs share the following attributes: small blocks of habitat suitable for tigers, with small or no core area; high poaching pressure on tigers and prey species that endangers conservation efforts. (<32 points)
TCUs requiring immediate surveys: Any TCU that potentially contains extensive blocks of appropriate tiger habitat, with or without protected core areas, but for which we lack data on habitat quality, poaching pressure, or population status.

We created the following guidelines for scoring TCUs:

- TCUs that could not be scored due to lack of information on habitat integrity were flagged for surveys and/or information verification. The index scores for unknown population status and poaching pressure for a TCU were placed at slightly above the median value of the respective index (Appendix 1b,c). This ensured that any TCU with good habitat was not rated low on the priority list during the first round of scoring. These TCUs were flagged in the database as requiring surveys (data table in Appendix 2). Following surveys, these TCUs can be rescored for population status and poaching pressure and re-ranked.

- TCUs were assigned to the dominant tiger habitat type represented in the TCU. If more than one tiger habitat type was included in a TCU, the tiger habitat type which consisted of >50% of the TCU area was considered to be the primary tiger habitat type, and the tiger habitat type represented by <50%, but >30%, was considered a secondary tiger habitat type. In cases of 50:50 representation, the TCU was evaluated under both tiger habitat types.

- We considered three TCUs in each tiger habitat type for each bioregion to be the minimum number necessary to maintain representation. If fewer than three TCUs were categorized as Level I, II, or Immediate Surveys for a particular tiger habitat type, Level III TCUs with the highest scores in that tiger habitat type were elevated to Level II.

When scoring TCUs for habitat integrity, we took into account the following:

- If a habitat block included extensive roads, railroads, settlements, etc. (as indicated by the Digital Chart of the World overlays), we considered it to be degraded, and scored it in the appropriate category (5a, 6a of Appendix 1a).

- If the TCU was long and narrow in shape, such that it would not contain adequate core areas, we considered it to represent suboptimal habitat.

Level I, II, and Immediate Survey TCUs were named after significant protected areas. For example, TCU number 113 was named Virachey-Xe Piane-Yok Don. If the TCU contained one or more protected areas, it was named according to the largest or "most significant" protected area. Similarly, TCUs that straddled one or more international boundary were listed first under the country that contained the largest or best quality block of habitat within the TCU. If there were no protected areas within the TCUs, they were given names to signify regional distribution (e.g., TCU 43 is Orissa Dry Forests).

D. Scope of the Ecology-Based Framework

This priority-setting framework is based on a rapid assessment of tiger habitats, population trends, and threats across the tiger range in Asia and the Russian Far East. It is meant to be a coarse assessment that identifies and ranks tiger conservation areas in order to:

- bring to the attention of international donors places where investments in tiger conservation activities might yield the biggest dividends;
- bring to the attention of conservation biologists and policy makers the important areas for tiger conservation on a regional scale and highlight general conservation activities; and
- allow conservationists to develop tiger conservation strategies with regional and global perspectives.

This assessment is *not* meant to:

- provide detailed conservation activities or plans at local or site-specific levels;
- supplant detailed conservation planning at the national level that is already being conducted in some range states (although this framework will allow for local conservation plans to be integrated into regional strategies).

The intended audience for this framework is:

- international conservation donors, particularly bilateral and multilateral agencies;
- conservation organizations and individuals interested in tiger conservation;
- policy makers, donors, and conservation organizations and biologists who may find it useful to base land-use planning options on conservation and sustainable-use principles; and
- conservation biologists who may find the approach we designed for tigers applicable to other endangered species with wide geographic ranges.

To make the process as transparent as possible for planners, we include the complete databases. However, these databases will continue to be updated as more feedback and updates are received from local and regional experts. We welcome responses in this regard from our colleagues across the range states. The database is available on request[1].

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[1] Send requests to: Dr. Eric Dinerstein, Conservation Science Program, World Wildlife Fund, 1250 24th Street, NW, Washington DC 20036, USA.

Overall, this assessment is meant to bring to the attention of international donors, conservation biologists, and policy makers the areas in which their investments and efforts can yield the biggest dividends in conserving tigers and their habitats. We do not suggest that the maps or the information we have presented here are accurate enough to develop local or site-specific conservation plans. Instead we suggest that the next logical steps from this assessment are to focus on the highlighted priority areas at the regional level, and scale down to enable on-the-ground conservation at the TCU level. The information presented here can be better refined to increase accuracy at these smaller scales (e.g., 1:50,000 or less), which would be more suitable for developing conservation management plans. However, we urge that any such plans be based on landscape-ecology principles and be developed within a regional or global conservation framework. We hope that by more carefully and scientifically directing limited and valuable resources in time, space, and sequence, the tiger populations with the highest probabilities of long-term persistence will be protected and allowed to flourish.

III. Assessment of Priority Tiger Conservation Units Across Asia: The Results

A. Priority Sites for Tiger Conservation

The results of our rapid assessment are presented in four maps (Figures 2-5). Among the three bioregions and six tiger habitat types portrayed on the maps, we identified 25 TCUs as Level I (16% of all TCUs), 21 as Level II (13%), and 97 as Level III (61%). Although we stress a biogeographic rather than a country approach to setting priorities, we note that all tiger range states contain at least one Level I TCU. The Level I TCUs are recommended as highest priority areas and should be the target of international and regional conservation efforts. We have greatest confidence in our ability to designate TCUs as Level I and II. Even after extensive field reviews of the TCUs, we suspect that few, if any, Level III TCUs will be elevated to Level I or II.

We also identified 16 TCUs (10%) as Immediate Surveys. The potential for long-term tiger conservation in these TCUs may be on par with some Level I or II TCUs, but we lack data to confidently rank them. We urge the immediate financing of surveys in these TCUs to better rank them and to better determine their contribution to a regional tiger conservation strategy.

Some of the Level I and II TCUs we have identified are extremely large in size (e.g., TCU 73 in Indochina; Figure 5) and more information on the distributions of tigers is essential for good management. Extensive ground-truthing surveys may break these big units into smaller TCUs, but using our criteria for habitat integrity (see Appendix 1A), any fragment of good habitat larger than 5,000 km^2 would automatically receive the same score as the existing, much larger, TCU.

Furthermore, according to our definition of a TCU, areas that are even narrowly connected should still be considered as a single TCU if at least one tiger per generation successfully disperses to and breeds in an adjacent block of habitat.

We therefore prefer, at this juncture, to present these large TCUs to emphasize the large spatial requirements for tigers and to urge that any land-use options in these areas be planned with tiger conservation in mind. These options will include establishing networks of core areas and corridors, encouraging ecotourism as revenue sources, and using tigers as umbrella species for conservation plans.

Below we present the results of our assessments, stratified by bioregion and tiger habitat type.

1. Indian Subcontinent Bioregion

We identified eleven Level I TCUs and seven Level II TCUs among the six tiger habitat types in the Indian Subcontinent (Table 1; Figure 4). Three of the six tiger habitat types—alluvial grasslands & subtropical moist deciduous forests, tropical moist deciduous forests, and tropical dry forests—have adequate replication of a combination of three Level I or II TCUs. We elevated to Level II a Level III TCU in tropical moist evergreen forests (TCU 58-Parambikulam). There was only one TCU in the mangroves, so increased representation was not possible.

Brief descriptions of tiger habitat types are provided below (refer to Figure 4 to locate TCUs). The information on tiger habitat types and TCUs was gleaned from the collective personal experience of the authors; from personal communication by Bijay Kattel; and from information in Seidensticker (1983, 1986, 1987), Khan (1986), Mishra et al. (1987), Panwar (1987), Sanyal (1987), Rogers and Panwar (1988), the Review of Project Tiger (1993), WWF (1996), WWF-Bhutan Programme (undated), and Bookbinder et al. (In Prep).

Table 1. Classification of Tiger Conservation Units for the Indian Subcontinent Bioregion. TCU numbers correspond to those in the maps.

Level of TCU	Alluvial Grasslands & Subtropical Moist Deciduous Forests	Mangroves	Subtropical and Temperate Upland Forests	Tropical Dry Forests	Tropical Moist Deciduous Forests	Tropical Moist Evergreen Forests
I	6 - Chitwan-Parsa-Valmiki (Nepal,India) 4 - Bardia-Banke (Nepal) 1 - Rajaji-Corbet (India)	18 - Sunderbans (Bangladesh, India)	10 - Manas-Namdapha (India, Bhutan)	27 - Bagdara-Hazaribagh (India) 52 - Nagarjuna Sagar (India)	31- Kanha-Pench (India) 39 - Simlipal (India)	59 - Periyar-Kalakad (India) 55 - Dandeli-Bandipur (India)
II	3 - Dudwa-Kailali (India, Nepal) 2 - Sukla Phanta-Kishanpur (Nepal,India)			40 - Kanha-Indravati Corridor (India) 43 - Orrisa Dry Forests (India) 47 - Sitapani-Udanti (India)	46 - Indravati-Navegaon (India) 51 - Papikonda (India)	
III	11, 5, 9, 8, 12, 13		7	56, 44, 54, 53, 20, 42, 22, 21, 36, 57, 23, 38, 26, 25, 19	45, 48, 37, 14, 15, 41, 32, 50, 34, 33, 49, 35, 30	58, 17
Immediate Survey				29 - Ratapani-Singhori (India) 28 - Melghat (India) 24 - Panna-Son Gharial (India)	16 - Kaziranga-Meghalaya (India)	

Table 2. Classification of Tiger Conservation Units for the Indochina Bioregion. TCU numbers correspond to those in the maps.

Level of TCU	Mangroves	Subtropical and Temperate Upland Forests	Tropical Dry Forests	Tropical Moist Deciduous Forests	Tropical Moist Evergreen Forests
I			113 - Virachay-Xe Piane-Yok Don (Cambodia, Laos, Vietnam) 122 - Kulen Promtep-Thap Lan (Cambodia) 101 - Phu Khieo-Nam Nao (Thailand, Laos)	61 - Chin Hills (Myanmar) 72 - Pegu Yoma (Myanmar)	73 - Huay Kha Khaeng-Thung Yai Naresuan (Thailand) 62 - Arakan Yomas (Myanmar) 121 - Khao Yai (Thailand) 125 - Phnom Bokor-Aural (Cambodia) 99 - Nam Theun Nakai-Vu Quang (Laos, Vietnam)
II		64 - Maymo (Myanmar) 95 - Bu Huong-Nam Xam (Vietnam, Laos)	102 - Phu Phan (Thailand) 100 - Phu Kao-Phu Kham (Thailand)	81 - Thung Salaeng - Nam Poui (Thailand, Laos)	107 - Bach Ma-Nui Thanh (Vietnam) 93 - Song Da forest (Vietnam) 104 - Xe Bang Nouane (Laos)
III	126	75, 92, 80, 97, 66, 65, 84, 88, 69, 91, 67, 68	79, 127, 120, 103, 78, 76, 77, 109, 118	94, 116, 96, 117, 70	98, 114, 124, 110, 108, 106, 111, 74, 89, 105, 112, 119, 86, 85, 87, 115
Immediate Survey	71 - Irawaddy Delta (Myanmar) 128 - Hat Chao Mai (Thailand)	60 - Northern Triangle (Myanmar) 63 - Shan Plateau (Myanmar) 90 - Nui Hoang Lien (Vietnam)		83 - MuangXaignabouri (Laos) 82 - Louangphrabang (Laos)	123 - Khao Ang Ru Nai-Khao Soi Dao (Thailand)

Table 3. Classification of Tiger Conservation Units for the Southeast Asia Bioregion. TCU numbers correspond to those in the maps.

Level of TCU	Tropical Moist Evergreen Forests
I	145 - Gunung Leuser-Lingga Isaq (Sumatra) 148 - Kerinci Seblat-Seberida (Sumatra) 129 - Taman Negara-Belum-Halabala (Malaysia-Thailand) 158 - Bukit Barisan Selatan-Bukit Hitam (Sumatra)
II	130 - Selama (Malaysia) 150 - Kerumutan-Istana Sultan Siak (Sumatra) 147 - Siak Kecil-Padang Lawas (Sumatra) 152 - Berbak-Sembilang (Sumatra) 159 - Way Kambas (Sumatra) 139 - Endau (Malaysia)
III	140, 133, 142, 153, 156, 143, 149, 157, 136, 134, 135, 144, 137, 141, 131, 132, 138
Immediate Survey	151 - Air Sawan (Sumatra) 146 - Sibolga-Dolok Surungan (Sumatra) 155 - Padang Sugihan (Sumatra) 154 - Dangku (Sumatra)

1a. Alluvial Grasslands & Subtropical Moist Deciduous Forests

The alluvial grasslands & subtropical moist deciduous forests tiger habitat type once encompassed a huge swath of grasslands and riverine and moist semi-deciduous forests along the major river systems of the Gangetic and Brahamaputra plains (Map 1 inset). Today the best examples of this tiger habitat type are limited to a few blocks of habitat at the base of the outer foothills of the Himalayas known as the Siwaliks (Map 1). This tiger habitat type contains TCUs that support the highest recorded densities of tigers in Asia. High densities of tigers are in part a response to the extraordinary biomass of ungulates that constitute the tiger's prey base. Also, the deposition of heavy annual silt loads in alluvial grasslands during monsoon floods recharges nutrient levels and maintains the world's tallest grasslands. Some grassland associations are dominated by grasses that exceed seven meters in height by the end of the monsoon.

Chitwan (TCU 6), besides having high densities of tigers, contains the second largest population of greater one-horned rhinoceros in Asia—450 individuals (Dinerstein and Price 1991). Bardia (TCU 4) has at least 40 rhinos, all translocated from Chitwan, and Dudhwa (TCU 3) has at least 10, including 4 founders from Chitwan and the rest from Kaziranga (TCU 16) (Dinerstein and Jnawali 1991). Both Sukla Phanta (TCU 2) and Dudhwa are important because both contain large populations of endangered swamp deer which have disappeared from Chitwan and are rare in Bardia.

1b. Mangroves

Mangroves are limited to the interface between land and the marine environment in deltas and fringe parts of the coastline. The best example in this bioregion (and one of the best in the world) is the Sunderbans TCU, reported to have the largest population of tigers in Asia.

Although mangroves are not often thought of as typical tiger habitat, tigers survive in this area, swimming between islands in the delta to hunt prey. The Sunderbans are under increasing pressure from wood cutters. Because extensive tracts of mangroves have largely disappeared or tigers have disappeared from them across tropical Asia, the Sunderbans TCU stands as the last best chance to conserve mangrove ecosystems containing tigers. The Sunderbans TCU plays other important ecological roles as a major buffer from cyclone damage for densely populated South Bengal and as a nursery for a globally important fishery. The Sunderbans has been recognized as a Man and Biosphere Reserve and a World Heritage Site.

1c. Subtropical and Temperate Upland Forests

Tigers are not naturally restricted to flat terrain. Rather, the loss, fragmentation, and degradation of upland forests in the Himalayas has truncated the distributions of tigers and limited them to low-lying habitats in western India and Nepal. The one major exception to this trend is the sprawling Manas-Namdapha TCU. Tigers have been recorded above 3,000 m in Bhutan. The areas stretching from the Black Mountains of Bhutan to Namdapha represent the last chance to conserve the movements of tigers from alluvial grasslands into forests bordering on alpine areas. The conservation of these altitudinal corridors is also vital to many other species of vertebrates that move seasonally along elevational zones.

This TCU offers the last opportunity to conserve an intact example of temperate Himalayan forests. The steep terrain and heavy precipitation over much of the TCU precludes large-scale development of core areas. The most critical areas to protect are the slivers of land that contain alluvial grasslands on the lowland edges of the TCU. Namdapha and the surrounding forests of Arunachal Pradesh contain some of the most biologically interesting habitats of all the TCUs in Asia.

We chose not to elevate TCU 7 to Level II to improve replication of TCUs because this TCU was assessed as too degraded.

1d. Tropical Dry Forests

Tropical dry forests and thorn scrub (here treated as one tiger habitat type) once covered large tracts of central and western India. Today, much of it is reduced. Tigers are distributed across the extreme edges of the dry forests and thorn scrub, from Sariska and Ranthambore in Rajasthan, across to Bihar, and south to the Nagarjuna Sagar TCU.

These forests are more open than the moist deciduous forests to the north and east. Harsh, long dry periods force tigers to concentrate near perennial sources of water. Tropical dry forest TCUs are not as productive for tigers as some of the more mesic habitats, but do include some of the largest blocks of remaining habitats left in India. In some of the TCUs in this tiger habitat type, surveys are required to assess the distribution and reproduction of tigers outside protected areas.

1e. Tropical Moist Deciduous Forests

Tropical moist deciduous forests are probably some of the most productive habitats in the subcontinent for tigers and their prey. The extensive loss of this habitat type across India calls for vigilant protection of the remaining blocks. The forests of this

tiger habitat type and the species assemblages they support are similar to subtropical moist semi-deciduous forests but are not driven by the dynamics of flooding as are the subtropical forests to the north. They have dense undergrowth of bamboo in some areas, a feature not seen in the subtropical moist deciduous forests to the north. This tiger habitat type contains some of the most famous tiger reserves in Asia, most notably Kanha National Park.

We placed the Meghalaya-Kaziranga TCU in this category even though Kaziranga is certainly an alluvial grassland. The rationale for this decision was that most of the TCU is far from the river course, extending into the Assan hills.

We also suggest elevation of the Meghalaya-Kaziranga TCU (number 16) to high priority in this tiger habitat type if surveys warrant such a decision.

1f. Tropical Moist Evergreen Forests

Tropical moist evergreen forests represent one of the less common tiger habitat types in the Indian Subcontinent, being largely limited to the upland areas and wetter parts of the Western Ghats. Tigers once ranged along the entire Western Ghats, but recent reports suggest that fragments of moist evergreen forests north of 16° no longer contain tigers. Tropical moist evergreen forests support a different prey base than moist deciduous forests, and thus they support lower densities of tigers. Alternatively, tigers in moist evergreen forests serve as umbrella species for an area of the subcontinent with high endemism of plants, small vertebrates, and invertebrates. Only three TCUs remain, all relatively large.

We suggest that TCU 58, Parambikulam, be elevated from Level III to Level II to achieve better representation of TCUs within the tiger habitat type.

2. Indochina Bioregion

We identified ten Level I and eight Level II TCUs among the five tiger habitat types in this bioregion (Table 2; Figure 5). Three tiger habitat types—tropical dry forests, tropical moist deciduous forests, and tropical moist evergreen forests—have the minimum number of TCUs required to achieve adequate representation, as dictated by our scoring guidelines.

Of the other two tiger habitat types, the subtropical and temperate upland forests tiger habitat type is represented by two Level II TCUs, whereas the mangrove tiger habitat type does not have any TCUs at Levels I and II. We therefore urge that TCUs 128, 71, 60, 63, and 90 be surveyed immediately, so that these TCUs can be assessed for suitability as Level I and Level II TCUs in these tiger habitat types.

Two other TCUs identified as requiring immediate surveys--TCU 82 and 83--are small and the habitat around them appears to be degraded. We recommend that any surveys in these TCUs be extended to include the surrounding habitat to determine if this secondary habitat still support tigers and prey.

Brief descriptions of tiger habitat types are provided below (refer to Figure 5 to locate TCUs). The information on tiger habitat types and on TCUs was obtained from the collective personal experience of the authors; personal communication by Chris Wemmer; and from information in Rabinowitz (1993), Wikramanayake (1995a,b), Berkmuller et al. (1995), Cambodia Tiger Action Plan (undated), Myanmar National Tiger Action Plan (undated), WWF-Indochina Programme (undated).

Although tigers have been confirmed from the forests included within the priority TCUs in this bioregion, very little is known about their population status. Urgently needed actions for many of these TCUs include basic surveys and efforts to curb the heavy poaching pressure on tigers and prey. Conservation management plans are needed for the priority TCUs.

2a. Mangroves

Little of the once extensive mangroves of the Irrawady and Mekong deltas remains, so it may be impossible to achieve good representation of tiger populations in the mangrove habitat in the Indochina bioregion. We have identified three mangrove TCUs. Even though none achieve a Level I or II, we encourage immediate surveys for two—71 and 128—to determine if they can be classified as Level I or II TCUs.

2b. Subtropical and Temperate Upland Forests

These forests along the southern slopes of the Himalayas are not prime habitat for tigers compared with the lowland forests; nevertheless, because of the different ecological role of tigers in these montane ecosystems and the different prey assemblages, these habitats are represented as a distinct tiger habitat type. Because tigers occur less densely in upland montane habitats, larger areas are needed to support tigers. Since only two TCUs are represented in this tiger habitat type, those identified for immediate surveys should be evaluated so that they can be assigned to Level I or II if warranted.

2c. Tropical Dry Forests

The tropical dry forests that once covered much of central and eastern Thailand and parts of central Myanmar have now been degraded or cleared (see Figure 3). But fairly extensive areas of tropical dry forest still exist in Cambodia—although with

the granting of extensive logging concessions to foreign corporations these forests are now threatened. Two large, Level I TCUs cover much of Cambodia (Figure 5). TCU 113 is particularly significant, as it extends over Cambodia, Laos, and Vietnam. It will be of special concern to the recent transboundary conservation and protected areas management initiatives underway in the region.

2d. Tropical Moist Deciduous Forests

Tropical moist deciduous forests once covered much of central Myanmar, with smaller tracts of forests in northern Thailand and Laos (see inset in Figure 3). Today, only fragments of these forests remain. We have identified two Level I TCUs (Myanmar) and one Level II TCU (northern Thailand and Laos) in this tiger habitat type.

2e. Tropical Moist Evergreen Forests

Several longitudinal bands of these forests once extended throughout the Indochina bioregion (see inset in Figure 3). Although now fragmented, relatively large extents of this tiger habitat type still exist, especially along the Arakan Yomas in western Myanmar, the Myanmar-Thailand border, the Lao-Vietnamese border, and in southwestern Cambodia. We have identified five Level I TCUs and three Level II TCUs from this tiger habitat type. One TCU has been identified for immediate survey.

3. Southeast Asia Bioregion

Southeast Asia covers a much larger region than just Peninsular Malaysia and Sumatra but, since the loss of tiger populations in Java and Bali, these are the only two geographic areas in Southeast Asia that still contain tigers.

Information on the tiger habitat type and TCUs came from the collective personal experience of the authors; from personal communications by Margaret Kinnaird, Sukianta Lusli, Tim O'Brien, John Seidensticker, Zaaba Zainal; and from information in Ashby and Santiapillai (1987), and Santiapillai and Ramono (1987).

3a. Tropical Moist Evergreen Forests

Much of the lowlands throughout Peninsular Malaysia and Sumatra that were once prime tiger habitat have been lost (Figure 3). What remains is often peat swamp forest, which harbors interesting biodiversity but contains few tigers. Tigers are now more or less restricted to upland areas consisting of tropical moist evergreen forests. Because other forest types (mangroves, tropical moist deciduous forests) are so limited, we classified all remaining habitat as tropical moist evergreen

forests. Some of the TCUs are quite extensive in this bioregion, but in general tropical moist evergreen forests tend to be poorer quality habitat for tigers than other forest types.

We identified four Level I and six Level II TCUs in this bioregion (Table 3). Of these, two Level II TCUs and one Immediate Survey TCU–150, 152, and 155–consist mostly of peat swamp. Although these three TCUs are large (see Appendix 2), the habitat integrity was scored in the >50% degraded category.

4. Russian Far East Bioregion

We did not include the Russian Far East in this analysis because detailed plans for tiger conservation are available for this bioregion (see Miquelle 1995, WWF 1995).

Furthermore, with the exception of two smaller blocks of habitat on the Russian-Chinese border, the Russian Far East remains a single TCU and is the only unit in its bioregion. It is the only area containing tigers where the connectivity still exists for tigers to move across a large landscape. The choice of emphasizing conservation in the single large TCU versus the two smaller fragments is obvious.

5. South China Bioregion

The lack of knowledge regarding the status of free-ranging tigers in the Central and South China Bioregion hinders conservation efforts. Koehler (1991) provides a status report on tigers in South China. We recommend that surveys to gather information begin immediately.

B. Priority TCUs for Immediate Surveys

The TCUs identified for priority surveys include those for which no reliable data are available for habitat integrity. Some large Level I and II TCUs have also been identified for immediate surveys to ascertain whether or not these large areas can be designated as single TCUs.

Indian Subcontinent

A total of eleven TCUs in the Indian Subcontinent require immediate surveys to obtain more up-to-date information on the status of tiger habitats, their degree of connectivity (i.e., validity as a single TCU), or population status. Note that several of these were scored and categorized as Level I TCUs in the analysis, but sufficient data on population status was unavailable to make coarse-level assessments by local experts (see Appendix 2).

TCUs categorized as Immediate Survey units:

16 Kaziranga-Meghalaya
28 Melghat
24 Panna-Son Gharial
29 Ratapani-Singhori

TCUs categorized as Level I, but requiring population status evaluation:

10 Manas-Namdapha
31 Kanha-Pench
55 Dandeli-Bandipur
52 Nagarjuna Sagar
59 Periyar-Kalakad
27 Bagdara-Hazaribagh

Parambikulam was a Level III TCU that was elevated to Level II to maintain representation.

Indochina

All of the TCUs in this bioregion require population surveys and virtually all require more information on the extent of poaching (see Appendix 2). The larger TCUs in Myanmar, parts of Thailand, and Cambodia require more detailed surveys to assess habitat quality, and the following have been prioritized for immediate surveys since they are potential Level I or Level II TCUs.

TCUs categorized as Immediate Survey units:

60 Northern Triangle
63 Shan Plateau
83 MuangXaignabouri
82 Louangphrabang
71 Irawaddy Delta
128 Hat Chao Mai

Surveys in TCUs 83 and 82 should include the surrounding scrub habitat to determine its capacity to support tigers and their prey. If the scrub habitats are deemed suitable for tiger conservation, these two TCUs may be amalgamated to form a single unit and reclassified appropriately.

TCUs 71 and 128 appear to be highly fragmented. But because they represent the only mangrove habitats in Indochina, these TCUs require surveys to determine

whether they still represent large enough habitats for tiger conservation.

Southeast Asia

Loss of habitat in Sumatra clearly defines where tigers will be conserved over the long term.

Several TCUs in this bioregion require surveys to determine population status and poaching pressure (Appendix 2). The following TCUs need surveys for habitat evaluation:

151 Air Sawan
146 Sibolga-Dolok Surungan
155 Padang Sugihan
154 Dangku

Recommendations

1. Among the bioregions, we urge that Indochina TCUs be given highest priority for surveys. Relatively speaking, data on habitat integrity, poaching pressure, and population status is much better for Indian Subcontinent TCUs than for Indochina. The restricted nature of TCUs in Sumatra requires less effort (other than those few TCUs listed above).

2. Based on the results of the surveys, we urge that technical assistance be provided to government agencies in Indochina to:

    - update information and clarify delineation of the large TCUs in Indochina;
    - help in formulation of conservation plans for a cluster of Level I TCUs.

IV. Discussion

Because natural habitat for tigers is limited throughout the entire tiger range, the ideal conservation strategy would be to protect all remaining natural habitat containing tigers. But the financial and human resources available for tiger conservation are limited, forcing us to prioritize the place, time, and sequence of conservation efforts for the next few years. This exercise enables us to objectively focus on tiger range areas where conservation potential is greatest and investments in tiger conservation will have the most effect. From a total of 159 TCUs we were able to identify 16% as being Level I and 13% as Level II.

We reiterate the scope and limitations of this exercise. This was a coarse-grained analysis, done on a regional scale. Our primary goal in the analysis was to identify the important tiger conservation areas on which international donors and conservation biologists can focus their activities in a strategic manner. Therefore, the priorities emerging from this study focus on *where to invest* rather than on what specifically should be done at any given site. Site-specific activities are considered to be the logical next step.

We also reiterate that this priority-setting exercise is not meant to supplant national tiger conservation plans, which may give different weight to conservation efforts in some of the TCUs delineated in this study. However, we urge that such national-level plans adopt a regional context to fit into and contribute to a broader strategy.

We do *not* advocate that only those units that still contain tigers are worthy of conservation. Over the past few decades, tigers have disappeared or become severely depleted over large tracts of habitat across Asia. Some of these larger blocks and fragments are still very important for biodiversity, even though the role that tigers might play as umbrella species for conservation of these units is greatly reduced or lost. Blocks of habitat that do not contain tigers may be significant for conservation of other species, and should not be considered to be unimportant for conservation. *It is important to conserve biodiversity throughout Asia.*

Tiger Conservation Units can contain many other endangered species or rare habitats that are worthy of protection in their own right, regardless of the size of the tiger population. An essential future analysis is to determine how investment in tiger conservation provides dividends in conserving other species or rare habitats.

The analysis emphasizes the need for a landscape approach to tiger conservation that extends beyond the boundaries of protected areas. Strict protected areas typically cover only a fraction of TCUs, and several TCUs do not have any protected areas. Several Level I and II TCUs are very large and do not, and likely will not, receive complete protection. But tigers are territorial and have relatively large home ranges (see Smith et al. 1987, Miquelle et al. 1995, Seidensticker 1996); consequently, protecting large populations of tigers will entail managing large habitat areas for tigers and their prey (Karanth and Sunquist 1995, Nowell and Jackson 1996, Karanth and Stith, in prep).

By highlighting these large areas as significant tiger conservation areas, we emphasize the need for appropriate land-use planning that includes establishing a network of interconnected core protected areas before these large habitat blocks become fragmented. Because protected areas provide essential refuge for tigers (Karanth 1991, 1995), all high priority TCUs should have protected areas. Where possible, protected areas should be expanded, added, and linked. A well-designed

network of interconnected protected areas set in an expansive matrix of other land-use options will provide a better long-term conservation strategy for tigers than would protection in small, insular protected areas (Seidensticker 1986, Karanth 1991, Rabinowtiz 1993). This goal will require increased cooperation among multiple sectors of national and state governments, and will promote better land-use planning.

The analysis also indicates that many Level I and II TCUs straddle international borders (Tables 1-3). Over the past few years, there have been several fora where transboundary conservation strategies have been discussed (Dinerstein et al. 1995, Ji and Rabinowitz 1995, WWF-Indochina Programme 1996). The tiger can be used as a flagship species to promote such regional strategies and as an umbrella species to plan such strategies (Rabinowitz 1995).

Three other activities essential for tiger conservation go beyond site-specific recommendations. The first is the recycling of ecotourism revenues into local development initiatives, an effort that requires national level policy changes. Tiger Conservation Units have the potential to generate revenues from ecotourism, if properly managed. Areas containing tigers typically contain other charismatic species and are major travel destinations for tourists. The problem with ecotourism, however, has been that the profits rarely remain in the immediate area. If local residents are to be swayed by arguments for the long-term value of tiger conservation, legal mechanisms will have to be created at the national level to channel some portion of these revenues back to local development around tiger conservation areas. We urge that the model in Nepal be carefully studied (see Box 3) and, where appropriate, be adapted to provide local residents with greater financial incentives to conserve endangered wildlife.

Box 3. Ecotourism policy changes in Nepal.

Perhaps the single most positive development in tiger conservation in the past few years is the February 1996 ratification of new conservation by-laws by the Nepalese Parliament. For the first time, 30-50% of all tourism revenues collected in national parks are to be reinvested in buffer zone conservation and development projects. The recycled revenues law allows village groups who live adjacent to tiger habitat to profit from this living arrangement, rather than only experience penalties, as in the past (Bookbinder et al. in prep).

For example, prior to the ratification of the by-laws, villagers around Chitwan National Park (TCU 6) received virtually none of the profits from tourism, despite the high number of tourists (>60,000/yr) visiting the park. Instead, most of the money, estimated at about US$5,000,000 per year, was earned by a small handful of tour operators and owners based elsewhere.

But under the present laws, much of the revenue from tourism will be used to better the lives of the local people. Steering committees, led by park wardens, are to be established to evaluate proposals submitted by the local administrative units—the Village Development Committees—to access the recycled revenue. Grants will be made to village groups, rather than to individuals, to ensure that funds are used for the betterment of the community. Typically, investments will be used to meet basic needs, such as fuelwood, fodder, and timber plantations, and to improve schools, roads, health care, and livestock. Such benefits from wildlife will, it is hoped, bring about a better relationship between the people and the park.

A second need is for the establishment of tiger conservation trust funds in each of the range states to meet the recurrent costs of protecting tiger populations and habitats, population monitoring, and implementing participatory village development projects in appropriate areas. These recurrent costs often swamp national conservation budgets and are not given a high priority. For instance, Project Tiger Reserves began with high expectations for the long-term conservation of tigers in India. But, with a few exceptions, most reserves have fallen on hard times, lacking sufficient personnel, equipment, or funds for enforcement to protect tigers and their habitats. While staff have remained committed to their objectives, annual budgets have become inadequate to deal with severe threats.

The Trust Fund for Tiger Conservation in the Russian Far East can serve as a model (Box 4).

Box 4. Trust fund for tiger conservation in the Russian Far East.

Conservation trust funds have become a successful mechanism through which donors can make significant contributions that provide long-term benefits to regions of the world that require an external source of funding to support conservation activities. The conservation trust fund for the Russian Far East (see WWF 1995 for details), was established with assistance from USAID and WWF, and will focus primarily on the conservation needs of the Amur tiger.

The fund will be incorporated under Russian law, either at the national level or in one of the krais (states), as a nonprofit organization. It will be guided by an honorary board of trustees, and managed by a Russian executive director.

The initial capital of one million dollars will be invested and used to fund conservation programs either by using the income from the invested capital, or by drawing on the principal and income over a 10- to 15-year period.

Proposals will be accepted from both government and nongovernment Russian organizations. These proposals will be reviewed by a technical review committee. High priority will be given to conservation activities for Amur tigers, including those addressing anti-poaching activities, protected areas management, and integration of sustainable community development with tiger habitat conservation. Through careful use of these trust funds, it should be possible to sustain tiger conservation activities through the next decade or longer.

The third need, controlling the trade in illegal tiger parts, is the subject of Part II of this document.

V. Summary

In summary, this assessment indicated the following:

- The framework was successful in selecting a representative portfolio of tiger conservation areas where conservation efforts would be most effective. We were able to identify a total of 159 TCUs in three biounits–Indian Subcontinent, Indochina, and Southeast Asia–of which 25 (16%) rated as Level I, 21 (13%) as Level II, and 97 (61%) as Level III. Sixteen TCUs (10%) were identified for immediate surveys to verify their status.

- Virtually all of the Level I TCUs straddle or lie near international boundaries. This is essential information for organizations like the Global Tiger Forum as

they work to ensure that transboundary conservation activities are given high priority, and to support transboundary initiatives already under way in Asia.

- Strict protected areas typically cover only a small fraction of a TCU, and some TCUs do not have protected areas. Tiger conservation requires a landscape conservation management approach that transcends protected areas boundaries. This goal will require increased cooperation among multiple sectors of national and state governments.

- Several Level I and II TCUs are very large, and we recognize that they will not receive complete protection. But they are presented as priority candidates for landscape management before they become too fragmented. Land-use planning options in these TCUs should include creation of habitat linkage zones, effective core areas, and buffer zones.

- Some of the most intensive logging in the Indochina bioregion is occurring in or slated for many of the Level I TCUs, and many of these same areas suffer from intense poaching of tiger prey. We urge immediate finer-scale studies focussing on Level I and Level II TCUs.

- The only prime example of a TCU that conserves a representative unit of tigers living in mangrove ecosystems is the Sunderbans TCU on the border of India and Bangladesh. Other TCUs containing mangroves in Indochina or Southeast Asia are mere remnants of the original extent, and tiger populations are severely depleted. Thus, the Sunderbans TCU emerges as a global priority for tiger conservation.

- The relationship between the size of a TCU and its rank score was relatively low ($r^2 = 0.35$). The largest blocks of remaining habitat may not always be the best areas to conserve tigers. Some large blocks are quite degraded across most of the TCU or are not considered prime habitat. In other words, one cannot simply select the largest blocks of habitat and assume to have identified the most important units.

This assessment provides new perspectives relevant to tiger conservation. It also provides a viable, ecology-based method for selecting areas for tiger conservation, while maintaining genetic, demographic, behavioral, and ecological representation of tigers across their range within the portfolio of priority sites. We encourage the adoption of this approach as an alternative to the taxonomy-based method for other wide-ranging, endangered species.

Part II. Controlling Trade in and Reducing Demand for Tiger Products: A Preliminary Assessment of Priority Needs

I. Introduction

The most immediate threat to wild tiger populations today is poaching, particularly for the trade of tiger parts to medicinal markets in East Asia. Until very recently, tiger conservation efforts focused almost exclusively on activities associated with protected areas and reserves, but it is clear that these initiatives have not been sufficient to stem the decline of tigers in most areas. It has become critical to address the trade issue as an important element of a comprehensive tiger conservation strategy. This need is bolstered by the growing requests for assistance from tiger range and consumer nations in their tiger trade control efforts and the numerous regional and international conservation fora that have made trade a priority issue.

Virtually all range states and consumer countries have officially banned trade in tiger products and derivatives, but commerce continues because of weak enforcement structures and domestic trade control laws, and persistent demand associated with long-standing medicinal practices. At the Ninth Meeting of the Conference of the Parties to CITES in November 1994, over 100 countries, including key tiger range and consumer nations, pledged to redouble their tiger trade control efforts (see Appendix III). The CITES tiger resolution specifically addresses the needs associated with trade control, enforcement, and reduction of demand for tiger products. While most governments have made an official commitment to carry out the activities required by CITES, many lack the resources and expertise to do so. The present challenge is to ensure that the necessary structures are put in place and the tools and resources provided to enable full implementation of the CITES tiger resolution and related national policies and plans.

Because the tiger resonates strongly in many cultures--both east and west--the international response to the current conservation crisis has generally been more immediate than with species suffering similar trade threats such as rhinoceroses and bears. Yet many of the weaknesses in trade controls for tigers are common to much of the trade in endangered species. Improving tiger trade controls can have benefits for multiple species, by strengthening the overall enforcement capacity of wildlife trading nations and increasing the attention to general wildlife trade problems.

The needs associated with tiger trade control fall into two principal categories: strengthening capacity to control trade, and reducing demand for tiger products. Part II outlines immediate priorities for addressing these categories.

II. Strengthening the Capacity of Countries to Control Trade

The trade in tiger parts (particularly bones) and derivative products appears to have increased enormously in the last decade, as evidenced by available trade statistics, government CITES reports, and anecdotal field information. The reasons for this increase are not fully clear, but are generally thought to be linked to increased purchasing power and demand associated with growing East Asian affluence; the exhaustion of tiger bone stockpiles held by countries such as China; ineffectual enforcement structures in range and consumer nations; and lack of political will to address the problem. In the early 1990s, as the tiger crisis alarm sounded, international pressure and media exposure prompted some countries to respond positively. Many others still lack the means, and in some cases the will, to effectively address the tiger trade problem.

Controlling the illicit trade in tiger parts and products requires enforcement infrastructure: specific laws with meaningful penalties; trained manpower to enforce laws and apprehend violators (ideally through dedicated wildlife enforcement units); clear delineation of enforcement responsibilities among government agencies; provision of equipment for investigation, communication, and transportation; and communication and intelligence-gathering networks and channels.

Wildlife trade control and enforcement are clearly government responsibilities, but many countries, especially developing nations, have relied heavily on international support and cooperation to enhance their enforcement capacity and to raise the level of attention to wildlife conservation and enforcement needs within their own governments. International support for training workshops and programs has had dual benefits. Some support for such efforts has come through CITES, which in turn has relied on outside governmental and nongovernmental (NGO) financial assistance. Additional enforcement assistance has been provided directly by conservation organizations and foreign government aid agencies. To date, however, enforcement-related support has been mostly ad-hoc and inconsistent.

The priority assigned to tiger trade control and enforcement in many consumer nations has increased markedly in the last three years, in response to international publicity on tiger trade problems and related CITES pressure. For example, new enforcement or legislative measures have been enacted in Taiwan, Hong Kong, China, Singapore, and South Korea, the United States, Australia, and the United Kingdom. At the same time, it is unclear whether newly enacted policies will become full-fledged tiger trade control programs. Ensuring this requires continual interaction and information exchange among governments and NGOs, as well as technical and financial assistance from government and nongovernment donor institutions.

Trade control and enforcement needs in tiger range states can be divided into two categories: efforts around Tiger Conservation Units (TCUs), as defined in Part I of this assessment, and national efforts to control the export of tiger products and combat broad-scale illicit commerce. Efforts to control trade around priority TCUs are generally linked to protected areas management and anti-poaching programs and need to be addressed as a component of overall conservation needs at priority TCUs. The following analysis focuses primarily on the complementary trade control needs at the national level for range states with priority TCUs.

A. Training and Technical Assistance for Trade Control and Enforcement

Priority tiger range countries: *Bangladesh, Bhutan, Cambodia, India, Indonesia, Laos, Nepal, Myanmar, Thailand, Russia, Vietnam*
Priority consumer countries: *China, Japan, South Korea, Taiwan*

Tiger range and consumer nations alike have requested support through CITES and from developed country governments and NGOs for training and technical assistance on basic wildlife trade enforcement and trade control initiatives. In response, a handful of training workshops have taken place in Asia in the last two years targeted mostly at general wildlife trade control and CITES enforcement. While useful, they have not as a whole dealt specifically with tiger trade issues. Because the ultimate responsibility for trade control and enforcement lies with governments, any needs assessment must logically be undertaken on a country-by-country basis.

Due to the international nature of the tiger trade, development of regional enforcement programs and information networks has become a priority among many countries. This was recognized in the 1994 CITES tiger resolution and is further underscored by the Tiger Conservation Unit analysis in Part I of this report, which reveals a disproportionately high number of Level I TCUs straddling or lying near international boundaries. Recent protocols concluded through the Global Tiger Forum (Delhi, 1994), the Workshop on the Control of Wildlife Trade in the Asian Region (Beijing, 1995), and bilateral agreements between China and India (1995) and China and Vietnam (1995) have emphasized the importance of international cooperation and called for assistance from international agencies and organizations.

National and regional training workshops have been identified as priorities in many tiger range countries as valuable fora for establishment of mechanisms of cooperation; exchange of information on tiger conservation and trade control problems and techniques; development of cooperative trade control and enforcement efforts; exchange of intelligence on illegal trade; training on forensic and tiger product identification techniques; establishment of communication

networks; and clarification of roles of different enforcement agencies.

Both Wildlife Conservation Society (WCS) and World Wildlife Fund (WWF) have recently assisted with successful transboundary conferences and training workshops in Indochina, Southeast Asia, and China to discuss a variety of conservation needs, including issues associated with tigers and tiger trade control. Additional initiatives are needed but should set clear goals in connection with priority TCUs and relevant national boundaries, specific trade problems, follow-up mechanisms, and enforcement support needs.

Some suggested activities:

- Hold national- and regional-level wildlife trade and CITES training workshops to bring together enforcement officials from relevant national and international agencies, including wildlife, customs, military, and border personnel, to share information and techniques, establish formal and informal communication channels, establish specific enforcement plans, and determine associated infrastructure, funding, and follow-up needs.

- Undertake detailed reviews of the capacity-building requirements of priority tiger range countries, to design enforcement and trade control plans that address specific staffing, training, communication, and equipment needs.

- Establish or strengthen tiger trade monitoring networks to collect and disseminate trade information at the local, national, and international level. An example is "Tiger Link" in India, an affiliation of conservation organizations and specialists which meet regularly to exchange information on tiger trade and conservation issues, identify priority policy actions, and publicize tiger conservation problems. The group produces a regular newsletter to disseminate information on the most significant current issues. The TRAFFIC network also monitors the tiger trade in East Asia, Southeast Asia, India, and at the international level, and supports governments in their own trade monitoring initiatives.

- Develop identification manuals and forensics guides in a user-friendly format with information on tiger parts and products, to improve trade interdiction efforts. Techniques and materials under development in such countries as the United States, United Kingdom, and Taiwan should be adapted for tiger range states.

- Undertake independent market surveys to determine levels of trade in tiger products, monitor trends, and assist national trade control efforts.

B. Strengthening Legislative Measures to Control Tiger Trade

Priority tiger range countries: *Bangladesh, Bhutan, Cambodia, India, Indonesia, Laos, Myanmar, Nepal, Russia, Thailand, Vietnam*
Priority consumer countries: *China, Japan, South Korea*

Effective legislation, including meaningful penalties for violators, is essential for successful tiger enforcement and illegal trade control. The 1994 CITES tiger resolution called for several specific actions, including the adoption of comprehensive legislation to implement CITES where it does not now exist, internal tiger trade controls, specific trade prohibitions covering any product purporting to contain tiger derivatives, and penalties adequate to deter illegal trade. In addition, the resolution urged all tiger range and consumer countries not yet party to CITES to join the Convention.

In 1992 the CITES Conference of the Parties began the CITES Legislation Project, a formal assessment of CITES-implementing legislation in member countries. TRAFFIC USA and the IUCN Environmental Law Centre are carrying out the project on behalf of the CITES Secretariat. Although still in progress, the project already provides valuable information on the status and effectiveness of national laws affecting the trade in tigers and other endangered species.

As part of the CITES Legislation Project, laws of select member nations were analyzed and evaluated for compliance with the convention's basic requirements (see Doc. 9.24, Ninth Meeting of the Conference of the Parties to CITES). Because the tiger is a CITES Appendix I species, it is generally protected by the conservation laws of CITES countries. The following ratings were given to tiger range and consumer CITES parties, with "1" the rating reflective of the most comprehensive laws and "4" denoting the weakest laws.

Not all tiger range and consumer nations were covered in the initial review, in part because several were not CITES members. Reviews are currently under way for South Korea and Vietnam. Although a review was undertaken for Taiwan, no formal evaluation was completed because Taiwan is not a member of CITES.

It is important to note that even though no tiger range state or Asian consumer country received the highest provisional rating during this exercise, some Asian countries have specific tiger trade control legislation that is more stringent than that of non-Asian countries which received higher overall CITES ratings. The legislation to control tiger trade in Hong Kong stands out in this regard.

Range Country	Provisional CITES Legislation Rating	Consumer Country	Provisional Rating
Bangladesh	3	China	3
India	2	Hong Kong	2
Indonesia	4	Japan	3
Malaysia (Peninsular)	2	Singapore	2
Nepal	4		
Russian Federation	3		
Thailand	3		

Rating definitions:

Category 1: Legislation generally meets the requirements for the implementation of CITES.
Category 2: Legislation meets many requirements for CITES implementation, while additional legislation is needed in some areas.
Category 3: Legislation meets some requirements for CITES implementation, while additional legislation is needed in many areas.
Category 4: Legislation does not generally meet the requirements for CITES implementation.

[Note: The CITES Conference of the Parties subsequently consolidated the four rating categories into three for simplification, but this information was not readily available.]

It is useful to point out that, while most countries have officially banned the import and export of tiger products, some have recently enacted specific measures to strengthen laws or policies affecting the trade in tiger parts. **China** specifically prohibited the trade and manufacturing of tiger (and rhino) products and medicines in 1993. **Hong Kong** significantly increased the penalties for illegal trade, sale, and possession of tiger parts and products in 1995. **Singapore** banned the domestic trade and sale of all tiger parts and products in 1994, while **South Korea** enacted a similar measure in 1995. **Taiwan** enacted various strengthening domestic and international trade measures in 1994 and 1995, including the adoption of significant penalties for illegal trade of tiger and other endangered species products.

All of these countries report that they have undertaken market inspections to ensure compliance with the new measures, and some have carried out numerous successful prosecutions (see reports to the CITES Secretariat as prepared for the 36th Meeting of the Standing Committee). It is in some cases, however, too early to determine the effectiveness of many of these new legislative measures, and few formal reviews have been undertaken.

Some suggested activities:

- Review specific national laws and legislative measures that apply to tiger trade control in priority countries, and assess for the adequacy of trade prohibitions and penalties, and for the success of legal measures as

demonstrated by formal law enforcement actions and the response of judicial processes to violations. Such reviews might be carried out through national workshops that would allow country-specific assessments of legislative needs and legal processes and the development of recommendations. WWF-India, for example, has worked for several years through the Centre for Environmental Law to identify weaknesses in India's legislative process and ensure effective judicial action in wildlife trade law enforcement cases.

- Provide appropriate technical assistance and information to Bhutan, Cambodia, Laos, and Myanmar to encourage formal CITES participation.

C. Brief Summaries of Trade Control and Capacity-Building Needs of Tiger Range and Consumer Countries

Range Countries

(Note: Many Tiger Conservation Units straddle political boundaries and therefore are counted more than once in the country breakdowns.)

Indian Subcontinent

Bangladesh: Shares with India one of the most globally significant TCUs, the Sunderbans. At the national level Bangladesh is in need of greatly strengthened CITES enforcement capacity and legislative measures. Bangladesh received a provisional #3 rating in the CITES legislation review. The U.S. government (USAID/USFWS) sponsored a CITES training workshop in Bangladesh in 1995 which recommended strengthened coordination between the national wildlife agency and customs officials on trade matters, and focused regional discussions on wildlife trade control with India, Nepal, Bhutan, Pakistan, and Sri Lanka.

Bhutan: Has one Level I TCU, shared with India, which includes the highest-altitude subtropical upland forest tiger habitat (up to 3,000 m). Recent management and training initiatives have enhanced the infrastructure in protected areas. Bhutan is not a CITES member and Bhutanese individuals have been implicated in the illegal trade of endangered species, including both rhino and tiger parts.

India: Has ten Level I and seven Level II TCUs. The Indian government released a National Tiger Action Plan in 1994, which provides a very general framework of tiger conservation priorities. Specific trade-related needs identified include an assessment of enforcement capability in protected areas and reserves; establishment of an effective communication system within and among reserves; establishment of "rapid action forces" in reserves to combat poaching; and enhancement of existing training facilities and programs. India received an

"adequate" rating in the CITES legislation analyses. Assessment of enforcement and capacity-building needs must now be undertaken in association with priority Tiger Conservation Units.

It is worth noting that NGOs play an increasingly important role in tiger conservation in India, with the support of the Indian government. They have been instrumental in the monitoring and exposure of illicit tiger trade and in strengthening state and national tiger conservation policies. NGOs increasingly work with state governments to more directly target tiger conservation needs.

Nepal: Has two Level I and two Level II TCUs. While Nepal has a relatively strong *in situ* tiger conservation record, the country has had serious problems at the national level with endangered species trade control and CITES enforcement, serving as an important conduit in the illegal trade of tiger parts. The government has recently made commitments to strengthening enforcement, but infrastructure and manpower are still lacking. Nepal received a provisional #4 rating in the CITES legislation review.

An important new national law provides for the recycling of a significant portion of tourist revenues directly to park management, which has significant implications for tiger conservation.

Indochina

Cambodia: Has three Level I TCUs. The country is not a party to CITES. The Cambodia Tiger Action Plan identifies trade as a major threat (along with large-scale timber extraction), and notes that an estimated 10-15 tigers are "sold" per month in the country, mainly to military personnel for export to Thailand and Vietnam. The plan further notes major weaknesses in enforcement capacity and legislation for tiger protected areas management and trade control, and emphasizes as basic priorities the need for trained personnel, information and data, appropriate legislation, and funds for protected areas.

Laos: Has three Level I and three Level II TCUs. Laos is not a party to CITES and, like most countries in the region, has requested international assistance to increase its enforcement capacity. The trade in wildlife is growing in the country, and the poaching pressure on tigers and their prey is intense according to recent field reports.

Myanmar: Has three Level I and one Level II TCUs. The country is not a party to CITES. The National Tiger Action Plan released in December 1995 indicates that tiger trade has been a significant problem. The plan emphasizes collecting scientific data on tiger status and distribution; strengthening protected areas and establishing

corridors; increasing law enforcement and institutional capabilities through regular training and information seminars and better interagency coordination; increasing ecological monitoring, public awareness and participation; and building international cooperation through scientific exchanges, funding, and participation in global conventions such as CITES.

Thailand: Has three Level I and three Level II TCUs, most of which lie along the vast Thai-Burmese border. The country's Tiger Conservation Action Plan for 1996-1999 includes projects on improving management of the most important tiger protected areas; community-based monitoring of tiger populations; educational campaigns around important protected areas and wildlife trade hotspots; and tiger trade monitoring. Thailand received a provisional #3 rating in the CITES legislation review.

Vietnam: Has two Level I and three Level II TCUs. Vietnam recently joined CITES and is greatly in need of strengthened enforcement capacity and legislation. Illegal tiger trade has been a significant problem; the country serves as both a source of tiger products and a transit point for trade to China. The wildlife trade is growing.

Southeast Asia

Indonesia (Sumatra): Has three Level I and four Level II TCUs. The country received a provisional #4 rating in the CITES legislation review. The 1994 Sumatran Tiger Conservation Strategy targeted the following as among the highest priorities: more effective legislation and stricter enforcement; improved training; better integration of conservation, development, and enforcement policies; and mobilization of anti-poaching teams in major tiger protected areas. Indonesia has a long record of wildlife trade problems, even though the country has been a CITES member since 1979.

Malaysia (Peninsular): Has one Level I and two Level II TCUs. Malaysia is a longstanding CITES party with a relatively good wildlife trade control record and wildlife trade legislation in most parts of the country.

Russian Far East

Tigers in the Russian Far East occur in one large contiguous population in temperate forest and boreal taiga habitat, except for an isolated number on the border with China. The Russian Federation received a provisional #3 rating in the CITES legislation review. Wildlife trade, and tiger trade in particular, has increased enormously in the last four years. The 1995 draft national strategy and action plan to conserve the Amur tiger lists the following measures as among immediate priorities: better regulation of the hunting of tiger prey; equipping tiger protection

patrols with firearms, petrol, and efficient communication means; negotiations with the Chinese government to coordinate tiger conservation efforts in the border region; improving coordination and communication among all government departments involved in tiger conservation and wildlife trade control; elevation of prosecutorial attention to tiger poaching and illegal trade cases and investigations; and increasing the salaries for protected areas management and wildlife trade control.

Priority Consumer Countries

China: Considered a consumer country in this assessment, as China's role as an importer is probably the most significant of all tiger trading countries. China has a vast border with several tiger range countries--India, Nepal, Bhutan, Myanmar, Laos, Vietnam, and Russia--which is clearly in need of enhanced enforcement and infrastructure for wildlife trade control. Training of forest guards and customs officials has been identified as a high priority by the central government. China received a provisional #3 rating in the CITES legislation review. The Chinese government has made a commitment to improve enforcement (and seek medicinal alternatives to tiger parts) but has requested international assistance and cooperation to do so.

Japan: Appears to be a significant consumer of patented tiger medicines and tiger bone from China in recent years, and is a country with notoriously weak wildlife trade legislation and enforcement infrastructure. Japan received a provisional #3 rating in the CITES legislation review. The country's role in the tiger trade needs to be clarified.

South Korea: Has been a major consumer of tiger bone in the last two decades. The country joined CITES in 1993 and has enacted new wildlife trade control legislation, but the delineation of enforcement and wildlife trade responsibilities among government agencies needs to be clarified. Korea has recently enacted internal trade prohibitions on tiger trade, but the impact of these are yet to be determined.

Taiwan: Has also been a major consumer of tiger bone in recent years, but new measures enacted as a result of international pressure and U.S. trade sanctions have led to important improvements. Taiwan has yet to establish a national wildlife enforcement unit, however. The principal challenge for Taiwan is to ensure that recent steps taken to control the tiger trade are sustained over the long-term; this necessitates close monitoring.

Other countries: As stated earlier, a number of consumer countries, including Hong Kong and Singapore, have recently enacted new and strengthened legislative and enforcement measures. The effectiveness of these must be closely monitored. The

role of Malaysia, North Korea, and Mongolia as consumers or as tiger trading countries should also be examined. In addition, secondary consumer countries such as the United States, Canada, and several in the European Union must continue to enhance their enforcement activities and should likewise be monitored closely.

III. Reducing Demand for Tiger Products and Building Public Support for Conserving Tigers in the Wild

Reducing the demand for tiger products is critical to successful long-term conservation of tigers in the wild, as consumption of tiger products is clearly the primary force behind the rampant poaching now threatening many tiger populations. Efforts to reduce consumer demand should focus primarily on East Asian markets, where tiger medicinal products are used and valued in a variety of ways, and on the large Asian populations in countries outside of the region. Mechanisms to reduce use are clearly needed, but appropriate tactics and approaches have yet to be defined on a broad scale.

Little is known of the demographics and motivation of tiger product users and associated market dynamics. The extent to which demand is reduced in consumer countries will depend on understanding these issues as well as the role and motivation of the medical practitioners and specialists prescribing and promoting tiger products for medicinal and health purposes.

In addition, the level of general public support for tiger conservation will ultimately affect any efforts to reduce demand. Clearly, there is an immediate need to begin broad public education efforts in key consumer countries to build a general understanding of tiger conservation issues and their link to trade and consumption. Furthermore, strong public support is needed in tiger range states, in communities living in and near priority tiger conservation areas, and at the broader public level in range countries to influence national measures to protect tigers.

It is essential that all activities aimed at raising public awareness and educating consumers are designed and implemented within the cultural context of the different target audiences. Various NGOs such as WWF, WCS, and TRAFFIC, as well as many government agencies, have begun such efforts although most of these initiatives are in their early stages and need to be greatly expanded as new approaches are tested and evaluated. Public awareness and education activities offer many promising opportunities for joint government/NGO efforts, as already witnessed in Taiwan, Hong Kong, and the United States. Below is a general framework of priority activities and the audiences they aim to influence.

A. Targeting Consumers of Tiger Products

Priority countries: *China, Hong Kong, Japan, Singapore, South Korea, Taiwan, and Asian communities in the United States, Canada, and Europe.*

Conservationists have learned that stopping the trade and use of endangered species such as the tiger is not as simple as imposing trade bans or calling for sanctions against countries which do not enforce wildlife trade laws. While these measures may serve some useful purposes, effective long-term change will be accomplished from within the societies in question. Messages about the need to conserve tigers and reduce demand must be developed within the context of specific cultures if they are to be embraced.

Traditional Chinese Medicine Practitioners and Specialists

Tiger parts have been used in traditional Chinese medicine (TCM) for over a thousand years as ingredients in a variety of treatments prescribed by TCM practitioners. More recently, so-called "patented" medicines containing or purporting to contain tiger parts have been mass-produced, mainly in China, for global markets. It is vital to work with TCM communities to understand their perspective and industry dynamics, share information on the decline of the tiger and the relationship to trade and use of tiger parts, explore possible alternative products and appropriate means of promoting them, undertake joint trade monitoring initiatives, and collaborate on consumer education efforts.

Until recently, many TCM specialists have felt victimized by international trade bans because they have been largely excluded from any dialogue with their national governments as well as with much of the international conservation community. To bridge the communication gap between conservation concerns and medicinal specialists, organizations such as WWF, TRAFFIC, WCS, and others have collaborated with government agencies to work directly with TCM communities on the activities listed above.

An international symposium cosponsored by TRAFFIC, WWF, and the Hong Kong government in October 1995, the first of its type, concluded that working with TCM communities is feasible and of immediate importance. TCM practitioners and specialists, academics, government officials, and conservationists from China, Hong Kong, Taiwan, Japan, South Korea, and Singapore convened to begin a dialogue aimed at finding solutions to problems associated with endangered species in the medicinal trade. Among the key conclusions: 1) there is a significant lack of understanding among TCM specialists on the status of tigers and other endangered species, and the link of the medicinal trade to conservation problems; 2) there is a widespread lack of information available in relevant Asian languages on endangered

species trade problems; 3) there are misunderstandings in the conservation community about TCM and its role in Asian culture; 4) there is a lack of understanding in some parts of the TCM community about the role, aims, and rules of CITES; and 5) there is interest among some TCM specialists, particularly in China, in developing and advocating alternatives to endangered species products such as tiger. The conclusions from this symposium provide the foundation for a number of initiatives that might be undertaken with TCM communities in priority consumer countries.

Some suggested activities:

- Organize symposia and workshops to bring TCM leadership from different countries together with international conservation institutions to address tiger conservation and trade issues, determine needs associated with identifying and promoting alternative products, discuss the demographics of tiger product and other endangered species users, develop conservation messages and educational materials for consumers and practitioners, and establish information distribution channels.

- Compile and translate into appropriate Asian languages existing publications and information on the conservation needs of the tiger, and disseminate through relevant public and TCM channels (journals, meetings, television, membership mailings, etc.).

- Establish tiger public awareness coordinators in target countries, ideally with or through local conservation organizations, to liaise with TCM communities and government agencies to address tiger trade and other conservation issues. Activities could include coordinating the development of educational materials for TCM practitioners, government officials, and the general public. Specific product examples include basic brochures on tiger trade laws and CITES in relevant languages, and general manuals on TCM products to assist customs and wildlife officials.

Users of Tiger Products

Virtually nothing is known of the demographics of tiger product use. To most effectively employ consumer messages, it is essential to identify user groups and understand the motivations behind their use of tiger products. This knowledge will also help in targeting *potential* users of tiger products--those consumers who may not rely currently on tiger health treatments and who could be persuaded to do otherwise given the right information and motivation.

Some suggested activities:

- Undertake targeted demographic reviews of users of tiger and other endangered species products, using standard demographic survey techniques appropriate for individual countries. Such a review is currently under way in Hong Kong through TRAFFIC East Asia.

- Hold workshops and focus groups to determine the level of conservation knowledge and role of consumption of tiger products. Assess results and trends on a periodic basis in target East Asian cities, to evaluate the success of public awareness efforts.

General Public

Broad scale public awareness efforts in key consumer nations must aim to build general support for the need to conserve tigers in the wild. Until very recently, the threats facing the tiger were largely unknown to the Asian public. Publicity over the plight of the tiger has stemmed mostly from media associated with CITES pressure and from the 1994 U.S. import embargo of Taiwan, which resulted from that country's role in the illegal trade in tiger and rhino products. This exposure has led to important trade control and enforcement changes in a number of consumer countries such as Taiwan, Hong Kong, Singapore, China, and South Korea, and has helped broaden public awareness through government-sponsored education campaigns. The present challenge is to ensure that these efforts are continued and expanded.

Broad public awareness efforts are important to reducing demand for tiger products as well as securing permanent improvements in government wildlife trade control and related conservation programs. Culturally appropriate messages and approaches employed should be linked as much as possible with specific projects targeting the traditional Chinese medicine communities and tiger product user groups.

Some suggested activities:

- Use tiger public awareness coordinators in priority consumer countries to explore and develop educational opportunities with different public sectors, institutions, and government agencies. Coordinators could give talks about tiger conservation at schools, zoos, and other local institutions including community and religious groups. Coordinators could assist with translating and adapting existing print and television tiger conservation materials, work with government ministries, identify dissemination channels, conduct informal/formal interviews with tiger user groups, and explore the feasibility and effectiveness of a variety of efforts.

- Enlist corporate and international advertising and marketing support to disseminate tiger conservation messages through print and broadcast ads and other marketing channels. Target all appropriate media outlets, including popular magazines, newspapers, television, and in-flight videos. An effective advertising campaign would draw from the work and research undertaken with traditional Chinese medicine audiences to assure the cultural relevance of messages.

- Design tiger conservation curricula for teachers for use in primary and secondary schools of target consumer nations. A number of existing projects can serve as useful models, including several developed in China, India, and the United States.

- Design a basic educational kit that addresses the range of tiger conservation issues, for use in classrooms, government training courses, and other group and institutional settings. If designed appropriately and amenable to customizing, such a kit could be used around the world.

B. Building Public Support for Tiger Conservation in Range Countries

Building public support for tiger conservation in range countries is critical to the long-term success of tiger protection efforts and is especially important for countries with high priority tiger populations. Numerous public outreach and educational activities are already under way in range countries. Initiatives that target local communities living around top priority tiger areas need to be addressed within an overall strategy for Level I TCUs.

In addition, broad-scale public awareness activities are also needed to build broad public support for conservation efforts, which in turn will help ensure the necessary political support for long-term tiger conservation initiatives. Elevating tiger conservation on the political agendas of governments is a top priority and is needed to bolster programs to control poaching and illegal trade, build enforcement and general conservation capacity, and improve the infrastructure for tiger protected areas.

Efforts can most effectively be undertaken through national and local NGOs, but often require international assistance. Examples of successful educational campaigns are those launched in India and Thailand. The types of activities that are needed in range countries to build public support are the same as those suggested for targeting the general public in consumer countries.

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APPENDICES

Appendix 1. Indices for ranking TCUs

A. Index for Habitat Integrity

The habitat integrity index takes into consideration the size and spatial configuration of habitat blocks containing tigers, the quality of the habitat within the forest blocks and intervening areas, and the extent to which a TCU contains one or more protected areas that will provide effective refuge to tigers and prey (Figure 8).

When scoring note the following:

- For criteria 5 and 6, degraded habitat is defined as either: 1) forest in which the understory or the forest has been impacted by livestock grazing, firewood collection, swidden agriculture, or man-made fires; 2) grasslands or savannas in which the tall grass cover has been impacted by livestock grazing, collection of fodder/thatch, or man-made fires.
- Criteria 5b and 6b will be flagged for surveys to determine the status of habitat quality. No scores will be assigned.

1. TCU consists of small ($\leq$200 km^2), isolated fragment or fragments with low potential for tiger dispersal. *1 Point*

2. TCU consists of isolated fragment or fragments, with at least one being >200 but $\leq$500 km^2, but with low potential for tiger dispersal among them. *2 Points*

3. TCU consists of several isolated fragments >200 but $\leq$500 km^2, with potential for tiger dispersal among them, forming a network of tiger habitat which adds up to >1000 km^2. *5 Points*

4. TCU consists of one or more isolated, mid-sized fragments (>500 and $\leq$1000 km^2) of tiger habitat with low potential for tiger dispersal among the larger habitat blocks. *10 Points*

5. TCU consists of one or more isolated mid-sized fragments (>500 and $\leq$1000 km^2) of tiger habitat with potential for natural tiger dispersal (existing or potential for restoration) among the larger habitat blocks.

5a. but with >50% of habitat known to be degraded (but not cleared) and/or not prime tiger habitat. *10 Points*

5b. but with habitat quality unknown across most of TCU. (Flag TCU for surveys.)

5c. and >50% of TCU is considered to be good quality habitat suitable for tigers. *16 Points*

5.1 If >50% tiger habitat of TCU for category 5 consists of effectively protected areas, add *2 points* to score.

6. TCU consists of one or more habitat blocks >1000 km^2 with potential for natural tiger dispersal among them (existing or potential for restoration),

6a. but with >50% of habitat known to be degraded (but not cleared) and/or not prime tiger habitat. *14 Points*

6b. but with habitat quality unknown across most of TCU. (Flag TCU for surveys.)

6c. and >50% of TCU is considered to be good quality habitat suitable for tigers. *24 Points*

6.1 If >25% tiger habitat of TCU for category 6 consists of effectively protected areas, add *4 points* to score.

7. TCU consists of contiguous habitat throughout and exceeds 5000 km^2; is relatively intact; contains the full range of habitat types necessary for tigers that is expected to occur in the tiger habitat type and/or bioregion. *36 Points*

7.1 If >20% tiger habitat of TCU for category 7 consists of effectively protected areas, add *4 points* to score.

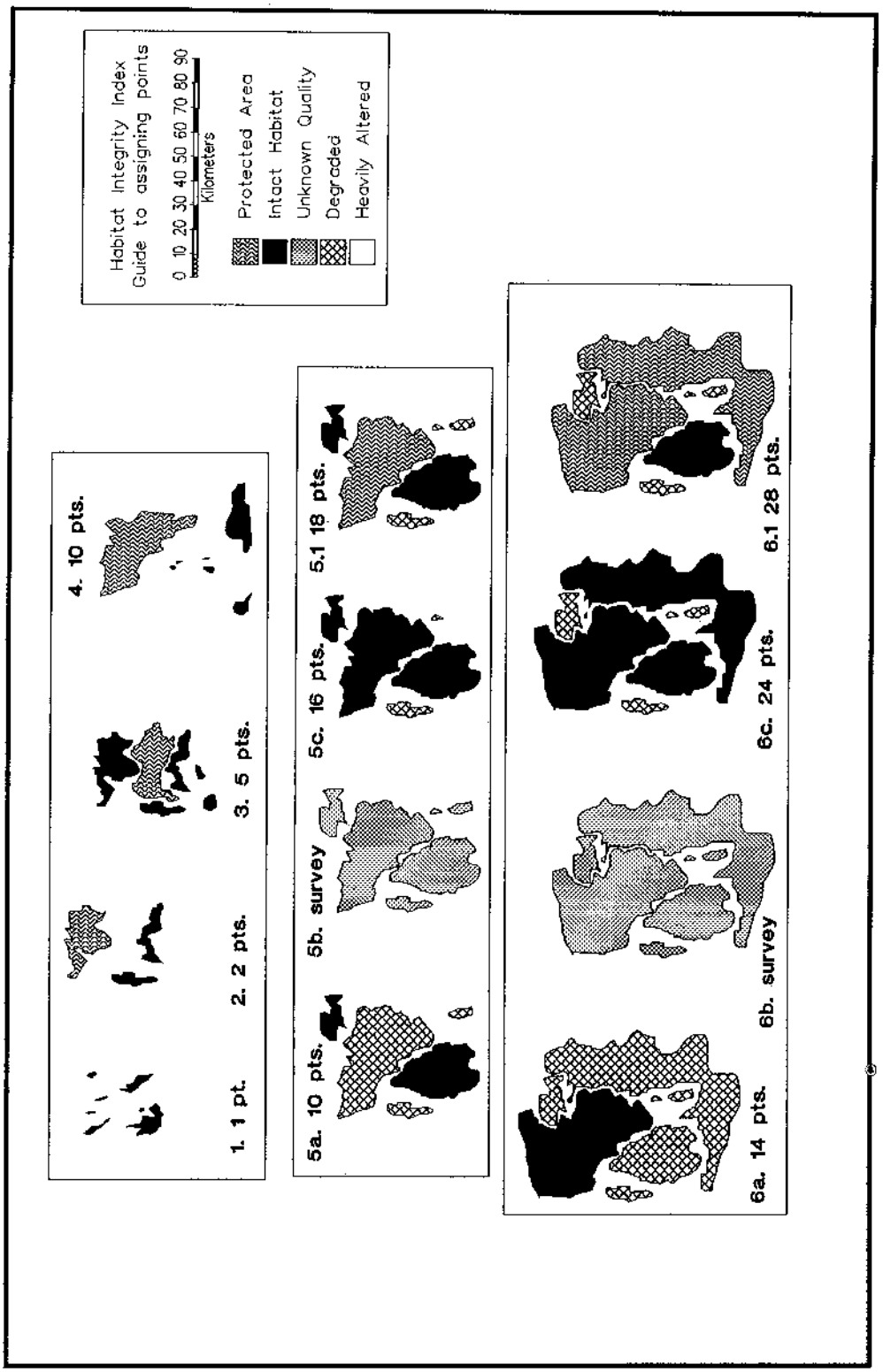

Habitat Integrity Index
Guide to assigning points
0 10 20 30 40 50 60 70 80 90
Kilometers
Protected Area
Intact Habitat
Unknown Quality
Degraded
Heavily Altered
1. 1 pt.
2. 2 pts.
3. 5 pts.
4. 10 pts.
5a. 10 pts.
5b. survey
5c. 16 pts.
5.1 18 pts.
6a. 14 pts.
6b. survey
6c. 24 pts.
6.1 28 pts.

Figure 8

B. Index for poaching pressure

1. Low poaching concentrated in a few areas and/or sporadic; prey base relatively intact; effective anti-poaching program and network in place. *20 Points*

2. Low to medium poaching concentrated in a few areas and/or sporadic; poaching on prey relatively high, but on tigers low; anti-poaching program relatively effective; potential for reversing poaching pressure. *19 Points*

3. Medium poaching pressure widespread, but low intensity; tigers and/or prey poached; potential for anti-poaching measures. *17 Points*

4. Medium poaching pressure widespread, but low intensity; tigers and/or prey poached; no potential for anti-poaching measures in near future, but tigers not severely threatened. *14 Points*

5. Medium to high poaching pressure; poaching pressure on tigers and/or prey; but potential for anti-poaching measures. *11 Points*

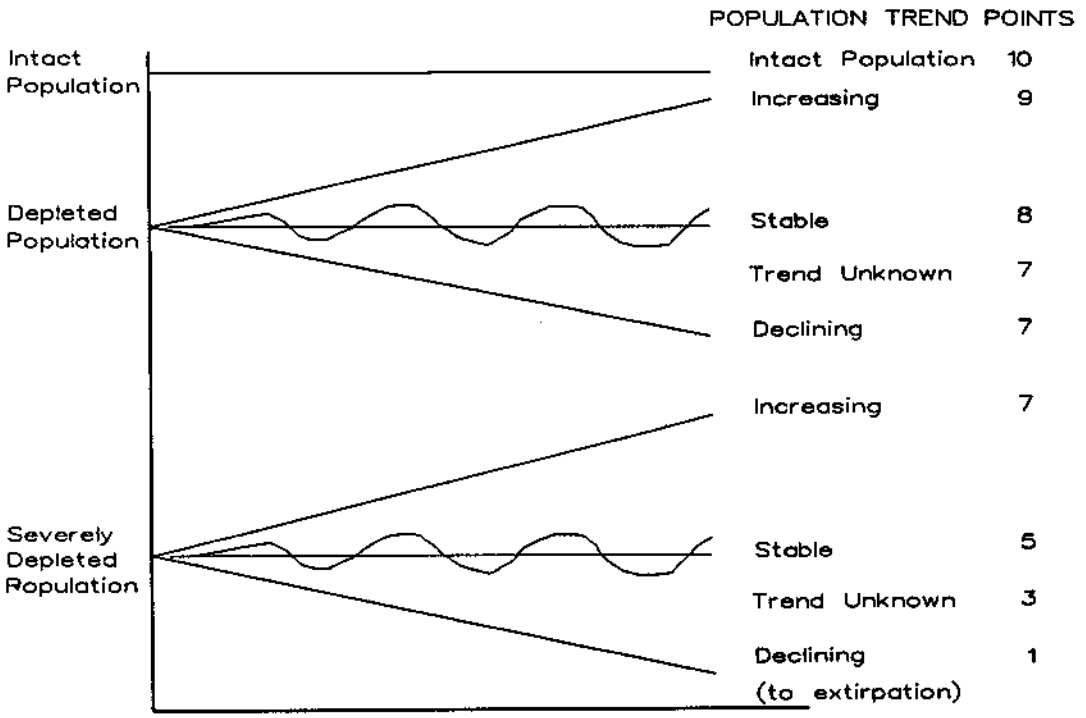
6. High poaching pressure; poaching on tigers and/or prey; but potential for effective anti-poaching measures. *8 Points*

7. Medium to high poaching pressure; poaching pressure on tigers and/or prey; no potential for anti-poaching measures. *4 Points*

8. High poaching pressure; poaching on tigers and/or prey; no potential for effective anti-poaching measures. *1 Point*

9. Extent of poaching pressure unknown. *13 Points*

C. Population Status



The population status will be evaluated from the broad 10-year trends depicted above (Figure 9).

A 10-year period was chosen because many park staff, local people, and scientists would likely remember the relative status of the present tiger population compared with 10 years ago. Many park staff are also rotated periodically, and are unlikely to be familiar with the status of tiger populations before their arrival. However, any information which is available from a longer period can be so noted and evaluated in assigning scores.

An *intact population* is considered to be one which is "minimally affected" and will represent the best possible situation. An intact population will neither be in decline, nor increasing; therefore only the stable trend is shown on the graph.

A *moderately depleted population* can be evaluated as a population known to be affected by habitat loss, loss of prey density, poaching, etc., but where tigers, or their signs, are still encountered "rather frequently" for this habitat type.

A *severely depleted population* is one known to be highly affected by poaching, habitat loss, lack of prey, etc., where tigers, or their signs, are very rarely encountered for this habitat type.

These are subjective and relative measures, but it is likely that any person who has been residing or working in the area of a TCU will be able to differentiate and make approximate judgments on whether a population is "intact," "moderately depleted," or "severely depleted" on the basis of information, encounters, etc.

The population trends over the past 10 years are broad changes reflecting population increases, declines, and stability. These are also relative and subjective; however, our field experiences suggest that a person familiar with the area and/or tiger populations will be able to assign a trend to the status of tigers. (For example, "there are fewer tigers in the area than before" suggests a declining population.)

Note that a population can fluctuate about the mean as depicted for the stable population trend.

Furthermore, population trends that do not fit into any one of these categories should be considered individually and assigned points on the basis of how they compare with the trends presented here, rather than forcing a trend to conform to any of the above categories.

Appendix 2. Database for Scoring Tiger Conservation Units

Data Dictionary. (The highlighted fields are shown in the data table which follows the data dictionary)

(C = Character, N = Numeric; Database is in FoxPro 2.5)

BIORE C 2
Bioregion. Coded as : IC = Indochina; IS = Indian Subcontinent; SA = Southeast Asia; RF = Russian Far East; SC = South China

TCU_ID N 4
TCU code

TCU_ID_A C 5
Old TCU code

TCU_NAME C 40
TCU name (for Level I, II, and Immediate Surveu TCUs)

LEVEL C 3
TCU level

AREA_KM N 9.2
TCU area in square kilometers

PRIM_MHT C 3
Primary tiger habitat type represented in TCU (>50% of the TCU area)

RANK_SC N 3
Sum of index scores. A score of 999 is assigned to TCUs that require immediate surveys.

HAB_INT N 2
Habitat integrity score. A score of 99 is assigned to TCUs that require immediate surveys.

POACH N 2
Poaching pressure index score

POP_ST N 2
Population status score

TIGER C 3
Tiger presence/absence confirmed: YES = confirmed

SEC_MHT C 3
Secondary tiger habitat type represented in TCU (<50, >30% of the TCU area)

TMF_AREA N 9.2
Area (sq km) of tropical moist evergreen forests in TCU

TMD_AREA N 9.2
Area (sq km) of tropical moist deciduous forests in TCU

TDF_AREA N 9.2
Area (sq km) of tropical dry forests in TCU

SUF_AREA N 9.2
Area (sq km) of subtropical and temperate upland forests in TCU

MAN_AREA N 9.2
Area (sq km) of mangrove forests in TCU

AGD_AREA N 9.2
Area (sq km) of alluvial grassland & sub-tropical moist deciduous forests in TCU

AREA_PROT N 9.2
Area (sq km) of TCU within protected areas

LAR_FRA N 3
Number of large (>1000 sq km) blocks of habitat in TCU

MID_FRA N 3
Number of mid-sized (500-1000 sq km) blocks of habitat in TCU

SML_FRA N 3
Number of small (<500 sq km) blocks of habitats in TCU

COMMENTS: Memo

HAB_SUR C 2
Flag for habitat surveys; Enter 6b or 5b

POP_SUR C 2
Flag for population surveys; Enter "Y" if surveys are needed

POA_SUR C 2
Flag for poaching pressure surveys; Enter "Y" if surveys are needed

UPDATE Date 8
Last update

PICK C 2
Flag field for query routine; do not enter data here

biore	tcu_id	tcu_name	level	prim_mht	sec_mht	area_km	rank_sc	hab_int	poach	pop_st	tiger	tmd_area	tdf_area	suf_area	man_area	agd_area	area_prot	lar_fra	hab_sur	pop_sur	poa_sur
IS	1	Rajaji-Corbett	I	AGD	SUF	4357	48	28	13	7	YES	0	0	1625	0	2732	1498	1		Y	Y
IS	2	Sukla Phanta-Kishanpur	II	AGD		1897	34	16	11	7	YES	0	0	176	0	1721	439	1		Y	
IS	3	Dudwa-Kailali	II	AGD		567	36	16	13	7	YES	0	0	0	0	567	567	0		Y	Y
IS	4	Bardia-Banke	I	AGD		2231	54	28	17	9	YES	0	5	383	0	1843	1437	1			
IS	5		III	AGD		4277	28	14	13	1	YES	0	118	1842	0	2317	0	1			Y
IS	6	Chitwan-Parsa-Valmiki	I	AGD		3549	57	28	20	9	YES	0	310	51	0	3188	2075	1			
IS	7		III	SUF	AGD	230	30	14	13	3	YES	0	0	156	0	0	0	1		Y	Y
IS	8		III	AGD		258	21	1	13	7	YES	0	0	0	0	122	135	0		Y	Y
IS	9		III	AGD		472	22	2	13	7	YES	0	0	40	0	432	0	0		Y	Y
IS	10	Manas-Namdapha	I	SUF	AGD	59901	55	40	8	7	YES	1835	0	47611	0	0	13181	4		Y	
IS	11		III	AGD		609	30	10	13	7	YES	0	0	0	0	609	491	0		Y	Y
IS	12		III	AGD		115	12	1	4	7	YES	0	0	0	0	115	115	0		Y	
IS	13		III	AGD		170	12	1	4	7	YES	0	0	0	0	170	170	0		Y	
IS	14		III	TMD		2677	25	14	4	7	YES	0	0	4	0	0	37	1		Y	
IS	15		III	TMD		1622	25	14	4	7	YES	0	0	397	0	0	78	1		Y	
IS	16	Kaziranga-Meghalaya	S	TMD	AGD	18984	999	99	4	7	YES	0	0	587	0	0	488	1	6b	Y	
IS	17		III	TMF		1664	21	14	4	3	YES	0	8	0	0	0	201	1		Y	
IS	18	Sunderbans	I	MAN		6624	65	40	17	8	YES	0	0	0	6624	0	873	1			
IS	19		III	TDF		1023	9	2	4	3	YES	0	1023	0	0	0	549	0		Y	
IS	20		III	TDF	TMF	2494	25	14	8	3	YES	0	1633	0	0	0	338	1		Y	
IS	21		III	TDF		5709	19	14	4	1	YES	0	5709	0	0	0	884	1			
IS	22		III	TDF		18170	19	14	4	1	YES	0	18110	0	0	0	1029	1			
IS	23		III	TDF		505	16	5	8	3	YES	0	505	0	0	0	0	0		Y	
IS	24	Panna-Son Gharial	S	TDF		8599	999	99	11	7	YES	0	8599	0	0	0	733	1	6b	Y	
IS	25		III	TDF		324	9	2	4	3	YES	0	324	0	0	0	0	0		Y	
IS	26		III	TDF		433	9	2	4	3	YES	0	412	0	0	0	0	0		Y	
IS	27	Bagdara-Hazaribagh	I	TDF		61172	55	40	8	7	YES	0	59204	0	0	0	6042	2		Y	
IS	28	Melghat	S	TDF		25287	999	99	11	7	YES	0	23127	3	0	0	2415	1	6b	Y	
IS	29	Ratapani-Singhori	S	TDF		14089	999	99	8	3	YES	0	14089	0	0	0	406	1	6b	Y	
IS	30		III	TMD		989	8	1	4	3	YES	0	0	0	0	0	0	0		Y	
IS	31	Kanha-Pench	I	TMD		13223	54	36	11	7	YES	13162	61	0	0	0	2138	0		Y	
IS	32		III	TMD		824	17	10	4	3	YES	0	0	0	0	0	0	0		Y	

biore	tcu_id	tcu_name	level	prim_mht	sec_mht	area_km	rank_sc	hab_int	poach	pop_st	tiger	tmd_area	tdf_area	suf_area	man_area	agd_area	area_prot	lar_fra	hab_sur	pop_sur	poa_sur
IS	33		III	TMD		408	9	2	4	3	YES	0	0	0	0	0	0	0		Y	
IS	34		III	TMD		214	9	2	4	3	YES	0	0	0	0	0	0	0		Y	
IS	35		III	TMD		922	9	2	4	3	YES	0	0	0	0	0	102	0		Y	
IS	36		III	TDF		1491	17	10	4	3	YES	0	1491	0	0	0	0	1		Y	
IS	37		III	TMD		2893	25	14	4	7	YES	0	37	0	0	0	0	1		Y	
IS	38		III	TDF		1409	13	2	4	7	YES	0	1407	0	0	0	82	1		Y	
IS	39	Simlipal-Kotgarh	I	TMD	TDF	7709	46	28	10	8	YES	4740	2969	0	0	0	2980	2			
IS	40	Kanha-Indravati Corridor	II	TDF		1377	32	14	11	7	YES	70	1306	0	0	0	0	1		Y	
IS	41		III	TMD		1074	20	5	8	7	YES	0	0	0	0	0	239	0		Y	
IS	42		III	TDF		1303	21	14	4	3	YES	0	1303	0	0	0	0	1		Y	
IS	43	Orrisa Dry Forests	II	TDF	TMD	6763	32	14	10	8	YES	2731	4032	0	0	0	0	1			
IS	44		III	TDF		4387	29	14	8	7	YES	0	4387	0	0	0	578	1		Y	
IS	45		III	TMD		4307	25	14	8	3	YES	0	164	0	0	0	1057	1		Y	
IS	46	Indravati-Navegaon	II	TMD	TDF	31413	42	24	11	7	YES	19003	12410	0	0	0	4678	3		Y	
IS	47	Sitapani-Udanti	II	TDF	TMD	5743	32	14	11	7	YES	2744	2999	0	0	0	1521	1		Y	
IS	48		III	TMD	TDF	11550	25	10	8	7	YES	8647	2844	59	0	0	1169	3		Y	
IS	49		III	TMD		377	9	2	4	3	YES	0	0	0	0	0	0	0		Y	
IS	50		III	TMD		513	9	2	4	3	YES	0	0	0	0	0	0	0		Y	
IS	51	Papikonda	II	TMD		7293	39	24	8	7	YES	0	13	0	0	0	770	1		Y	
IS	52	Nagarajunasargar	I	TDF		13127	51	40	4	7	YES	0	13127	0	0	0	3862	1		Y	
IS	53		III	TDF		2439	25	14	4	7	YES	0	2439	0	0	0	0	1		Y	
IS	54		III	TDF		5495	25	14	4	7	YES	0	5495	0	0	0	0	1		Y	
IS	55	Dandeli-Bandipur	I	TMF	TMD	23881	55	40	8	7	YES	6608	0	0	0	0	7013	3		Y	
IS	56		III	TDF		7243	29	14	8	7	YES	0	6115	0	0	0	1003	1		Y	
IS	57		III	TDF		899	17	10	4	3	YES	0	899	0	0	0	0	0		Y	
IS	58		III	TMF		2349	29	14	8	7	YES	0	0	156	0	0	336	1		Y	
IS	59	Periyar-Kalakad	I	TMF	TMD	5440	55	40	8	7	YES	0	0	0	0	0	1493	1		Y	
IC	60	Northern Triangle	S	SUF		33884	999	99	20	7		0	185	33699	0	0	109	2	6b	Y	
IC	61	Chin Hills	I	TMD	TMF	82464	66	36	20	10		50170	3217	3557	0	0	3078	1			
IC	62	Arakan Yomas	I	TMF		52353	57	36	14	7		1368	0	11651	1840	0	446	2		Y	
IC	63	Shan Plateau	S	SUF		41075	999	99	11	7		3	0	36667	0	0	153	1	6b	Y	
IC	64	Maymo	II	SUF	TMD	1114	42	24	11	7		376	0	622	0	0	28	1		Y	

biore	tcu_id	tcu_name	level	prim_mht	sec_mht	area_km	rank_sc	hab_int	poach	pop_st	tiger	tmd_area	tdf_area	suf_area	man_area	agd_area	area_prot	lar_fra	hab_sur	pop_sur	poa_sur
IC	65		III	SUF		287	16	2	11	3		0	0	287	0	0	0	0		Y	
IC	66		III	SUF		541	16	2	11	3		0	0	541	0	0	0	0		Y	
IC	67		III	SUF		72	12	1	8	3		0	0	72	0	0	0	0		Y	
IC	68		III	SUF		33	12	1	8	3		0	0	33	0	0	0	0		Y	
IC	69		III	SUF		152	15	1	11	3		0	0	152	0	0	0	0		Y	
IC	70		III	TMD		325	12	1	8	3		325	0	0	0	0	0	0		Y	
IC	71	Irawaddy Delta	S	MAN		1733	999	99	13	3		0	0	0	1733	0	122	0	6b	Y	Y
IC	72	Pegu Yomas	I	TMD		12600	64	40	17	7		8955	22	0	0	0	4600	1		Y	
IC	73	Huay Kha Khaeng-Thung Yai Naresuan	I	TMF		155829	58	40	11	7		29605	29742	7537	855	0	32459	4		Y	
IC	74		III	TMF		325	16	2	11	3		0	0	0	0	0	0	0		Y	
IC	75		III	SUF		8984	30	14	13	3		0	0	8984	0	0	0	1		Y	Y
IC	76		III	TDF		110	17	1	13	3		0	110	0	0	0	0	0		Y	Y
IC	77		III	TDF		212	17	1	13	3		0	212	0	0	0	0	0		Y	Y
IC	78		III	TDF		159	17	1	13	3		0	159	0	0	0	0	0		Y	Y
IC	79		III	TDF		3784	28	14	11	3		906	2878	0	0	0	409	1		Y	
IC	80		III	SUF		1017	28	14	11	3		0	0	1017	0	0	94	1		Y	
IC	81	Thung Salaeng-Nam Poui	II	TMD	TMF	13823	32	14	11	7		6463	3487	247	0	0	2977	2		Y	
IC	82	Louangphrabang	S	TMD		1067	999	99	0	0		1067	0	0	0	0	0	1	5		
IC	83	Muang Xaignabouri	S	TMD		689	999	99	0	0		689	0	0	0	0	0	0	5		
IC	84		III	SUF		496	16	2	11	3		0	0	496	0	0	0	0		Y	
IC	85		III	TMF		153	15	1	11	3		0	0	0	0	0	0	0		Y	
IC	86		III	TMF		165	15	1	11	3		0	0	0	0	0	0	0		Y	
IC	87		III	TMF		354	15	1	11	3		0	0	0	0	0	0	0		Y	
IC	88		III	SUF	TMF	145	15	1	11	3		0	0	91	0	0	0	0		Y	
IC	89		III	TMF		248	16	2	11	3		0	0	0	0	0	0	0		Y	
IC	90	Nui Hoang Lien	S	SUF		1550	999	99	11	3		0	0	1550	0	0	395	0	6b	Y	
IC	91		III	SUF		137	15	1	11	3		0	0	137	0	0	0	0		Y	
IC	92		III	SUF		581	28	10	11	7		0	0	581	0	0	0	0		Y	
IC	93	Song Da Forest	II	TMF		1079	32	14	11	7		0	0	0	0	0	0	1		Y	
IC	94		III	TMD		475	20	2	11	7		475	0	0	0	0	0	0		Y	
IC	95	Bu Huong-Nam Xam	II	SUF		1121	32	14	11	7		0	0	1121	0	0	316	1		Y	
IC	96		III	TMD		246	16	2	11	3		246	0	0	0	0	0	0		Y	

biore	tcu_id	tcu_name	level	prim_mht	sec_mht	area_km	rank_sc	hab_int	poach	pop_st	tiger	tmd_area	tdf_area	suf_area	man_area	agd_area	area_prot	lar_fra	hab_sur	pop_sur	poa_sur
IC	97		III	SUF		512	20	2	11	7		0	0	455	0	0	0	0		Y	
IC	98		III	TMF		1924	30	12	11	7		108	0	4	0	0	1493	1		Y	
IC	99	Nam Theun Nakai-Vu Quang	I	TMF		24626	46	28	11	7		790	2513	137	0	0	6830	1		Y	
IC	100	Phu Kao-Phu Kham	II	TDF		3579	32	14	11	7		777	2169	0	0	0	299	1		Y	
IC	101	Phu Khieo-Nam Nao	I	TDF	TMF	5702	52	28	17	7		1164	1711	0	0	0	3325	1		Y	
IC	102	Phu Phan	II	TDF	TMF	4384	42	24	11	7		296	2974	0	0	0	716	1		Y	
IC	103		III	TDF		473	20	2	11	7		0	473	0	0	0	0	1		Y	
IC	104	Xe Bang Nouane	II	TMF		2196	32	14	11	7		1336	154	0	0	0	1260	1		Y	
IC	105		III	TMF		442	16	2	11	3		0	0	0	0	0	0	0		Y	
IC	106		III	TMF		441	20	2	11	7		0	0	0	0	0	0	0		Y	
IC	107	Bach Ma-Nui Thanh	II	TMF		2081	38	24	11	3		0	49	0	0	0	188	1		Y	
IC	108		III	TMF	TMD	1129	23	5	11	7		501	0	0	0	0	0	1		Y	
IC	109		III	TDF	TMF	305	16	2	11	3		0	207	0	0	0	0	0		Y	
IC	110		III	TMF	TMF	1726	28	10	11	7		0	0	0	0	0	0	1		Y	
IC	111		III	TMF		1486	19	5	11	3		4	38	63	0	0	201	0		Y	
IC	112		III	TMF		275	16	2	11	3		0	0	0	0	0	0	0		Y	
IC	113	Virachay-Xe Piane-Yok Don	I	TDF	TMF	52643	54	36	11	7		4251	29722	598	0	0	13897	1		Y	
IC	114		III	TMF		1138	30	14	13	3		0	0	0	0	0	221	1		Y	Y
IC	115		III	TMF		150	15	1	11	3		0	0	0	0	0	0	0		Y	
IC	116		III	TMD	TDF	982	20	2	11	7		717	265	0	0	0	0	0		Y	
IC	117		III	TMD	TDF	341	16	2	11	3		303	38	0	0	0	0	0		Y	
IC	118		III	TDF	TMD	325	16	2	11	3		137	188	0	0	0	0	0		Y	
IC	119		III	TMF		404	16	2	11	3		0	44	0	0	0	33	0		Y	
IC	120		III	TDF		7930	25	14	8	3		1054	4888	0	0	0	1599	1		Y	
IC	121	Khao Yai	I	TMF		1945	56	28	20	8		287	129	0	0	0	1852	1			
IC	122	Kulen Promtep-Thap Lan	I	TDF	TMF	45880	51	36	8	7		1896	24958	713	0	0	11311	3		Y	
IC	123	Khao Ang Ru Nai-Khao Soi Dao	S	TMF		4751	999	99	11	7		1097	86	0	0	0	1798	1	6b	Y	
IC	124		III	TMF		678	28	10	11	7		0	0	0	0	0	745	0		Y	
IC	125	Phnom Bokor-Aural	I	TMF	TDF	31715	51	36	8	7		0	10551	179	389	0	10833	1		Y	
IC	126		III	MAN		449	16	2	11	3		0	0	0	368	0	89	0		Y	
IC	127		III	TDF	TMF	5641	26	10	13	3		0	0	0	658	0	2886	2		Y	Y
IC	128	Hat Chao Mai	S	MAN		1971	999	99	13	7		0	0	0	1313	0	226	0	5	Y	Y

biore	tcu_id	tcu_name	level	prim_mht	sec_mht	area_km	rank_sc	hab_int	poach	pop_st	tiger	tmd_area	tdf_area	suf_area	man_area	agd_area	area_prot	lar_fra	hab_sur	pop_sur	poa_sur
SA	129	Taman Negara-Belum-Halabala	I	TMF		27469	56	28	19	9	YES	0	0	0	0	0	7135	1			
SA	130	Selama	II	TMF		1684	38	14	17	7	YES	0	0	0	0	0	0	1		Y	
SA	131		III	TMF		181	13	1	11	1	YES	0	0	0	0	0	0	0			
SA	132		III	TMF		150	13	1	11	1	YES	0	0	0	0	0	0	0			
SA	133		III	TMF		428	27	2	20	5	YES	0	0	0	0	0	0	0			
SA	134		III	TMF		242	15	1	11	3	YES	0	0	0	0	0	0	0		Y	
SA	135		III	TMF		364	14	2	11	1	YES	0	0	0	0	0	0	0			
SA	136		III	TMF		348	16	2	11	3	YES	0	0	0	0	0	1	0		Y	
SA	137		III	TMF		382	14	2	11	1	YES	0	0	0	0	0	0	0			
SA	138		III	TMF		147	13	1	11	1	YES	0	0	0	0	0	0	0			
SA	139	Endau	II	TMF		788	32	10	17	5	YES	0	0	0	0	0	0	0			
SA	140		III	TMF		496	30	2	20	8	YES	0	0	0	0	0	0	0			
SA	141		III	TMF		190	14	1	8	5	YES	0	0	0	0	0	89	0			
SA	142		III	TMF		1108	23	10	8	5	YES	0	0	0	0	0	46	0			
SA	143		III	TMF		84	14	1	8	5	YES	0	0	0	0	0	0	0			
SA	144		III	TMF		43	14	1	8	5	YES	0	0	0	0	0	0	0			
SA	145	Gunung Leuser-Lingga Isaq	I	TMF		36530	60	40	13	7		0	1435	0	0	0	11423	2		Y	Y
SA	146	Sibolga-Dolok Surungan	S	TMF		4685	999	99	13	7		0	345	0	0	0	594	2	5b	Y	Y
SA	147	Siak Kecil-Padang Lawas	II	TMF		2235	34	14	13	7		0	0	0	233	0	1995	4		Y	Y
SA	148	Kerinci Seblat-Seberida	I	TMF		50884	60	40	13	7		0	641	0	4	0	16605	5		Y	Y
SA	149		III	TMF		112	17	1	13	3		0	0	0	0	0	0	0		Y	Y
SA	150	Kerumutan-Istana Sultan Siak	II	TMF		11816	34	14	13	7		0	0	0	0	0	1742	2		Y	Y
SA	151	Air Sawan	S	TMF		2444	999	99	13	7		0	0	0	0	0	605	1	6b	Y	Y
SA	152	Berbak-Sembilang	II	TMF		6671	34	14	13	7		0	0	0	0	0	2196	2		Y	Y
SA	153		III	TMF		444	18	2	13	3		0	0	0	0	0	0	0		Y	Y
SA	154	Dangku	S	TMF		3431	999	99	13	7		0	0	0	0	0	106	1	6b	Y	Y
SA	155	Padang Sugihan	S	TMF		2505	999	99	13	7		0	0	0	0	0	652	1	6b	Y	Y
SA	156		III	TMF		599	18	2	13	3		0	0	0	0	0	28	0		Y	Y
SA	157		III	TMF		154	17	1	13	3		0	0	0	0	0	133	0		Y	Y
SA	158	Bukit Barisan Selatan-Bukit Hitam	I	TMF		6594	48	28	13	7		0	0	0	0	0	4784	1		Y	Y
SA	159	Way Kambas	II	TMF		1300	34	14	13	7		0	0	0	0	0	1300	0		Y	Y

Appendix 3. CITES Resolution on Conservation and Trade in Tigers

CONVENTION ON INTERNATIONAL TRADE IN ENDANGERED SPECIES OF WILD FAUNA AND FLORA

Ninth Meeting of the Conference of the Parties
Fort Lauderdale (United States of America), 7 to 18 November 1994

RESOLUTION OF THE CONFERENCE OF THE PARTIES

Conf. 9.13

Conservation of and Trade in Tigers

AWARE that three subspecies of tiger, *Panthera tigris,* have become extinct within the last 50 years and that the surviving populations of the species have declined sharply within the last five years;

NOTING that wild populations of tigers are threatened by the combined effects of poaching and of habitat loss caused by disturbance, fragmentation and destruction;

AWARE also that the tiger is listed in Appendix I and international commerce in the species is prohibited;

NOTING that, despite inclusion of the species in Appendix 1, illegal trade in tiger specimens has escalated, and could lead to extinction in the wild;

NOTING further that the Standing Committee has called upon all Parties and non-Parties to the Convention to take such measures as are required to halt the illegal trade in tigers and tiger parts and derivatives;

RECOGNIZING that strengthened technical co-operation between range and non-range States, and financial support, would contribute to more effective tiger protection;

RECOGNIZING also that long-term solutions to the protection and conservation of the tiger and its habitat require the adoption of bold and unprecedented actions;

ACKNOWLEDGING that increased political will, financial resources and expertise in some range and consumer States will significantly improve the control of the illegal killing of tigers, trade in their parts and derivatives, and protection of their habitat;

APPRECIATING the recent positive actions taken by some consumer States to

address the illegal trade in tiger parts and derivatives;

COMMENDING the recent initiatives by some range Parties to facilitate co-operation in tiger conservation, including:

a) India, which, with co-sponsorship from the United Nations Environment Programme (UNEP), convened the first meeting of tiger range States, in March 1994, to establish a Global Tiger Forum; and

b) Thailand, which convened a workshop in October 1994 to map distribution of tigers and the status of their forest habitat in a Geographic Information System and to initiate regional co-operative action in this regard;

THE CONFERENCE OF THE PARTIES TO THE CONVENTION

URGES

a) those Parties and non-Parties, especially tiger range and consumer States, which currently lack legislation to properly control illegal killing of tigers and/or the trade in tigers and tiger parts and derivatives, to adopt such measures as a matter of urgency, and that such measures should address the requirements of the Convention and include penalties adequate to deter illegal trade;

b) the Secretariat, where possible, to assist those Parties seeking to improve their legislation, by providing to them technical advice and relevant information;

c) all Parties seeking to improve their legislation controlling the trade in tigers and tiger parts and derivatives, or to adopt such legislation, to consider introducing national measures to facilitate implementation of CITES, such as voluntarily prohibiting internal trade in tigers and tiger parts and derivatives and prohibiting the sale of illegally traded tiger parts and derivatives;

d) all Parties to treat any product claiming to contain tiger specimens as a readily recognizable tiger derivative and therefore subject to Appendix-I provisions, as provided for in Resolution Conf. 9.6;

a) those Parties and non-Parties in whose countries stocks of tiger parts and derivatives exist to consolidate and ensure adequate control of such stocks;

f) all range States and consumer States that are not party to CITES to accede to the Convention at the earliest possible date; and

g) tiger range and non-range States to support and participate in international tiger conservation programmes including joining the Global Tiger Forum;

RECOMMENDS

a) that the governments of tiger range States and, where appropriate, non-range States, establish co-operative bilateral and multilateral arrangements for the management of shared wildlife species and protected habitats with common boundaries in order to achieve more

effective control of illegal transborder movement of tigers and tiger parts and derivatives; and

b) that all range and consumer States strengthen communication and sharing of information by designating at least one contact person in order to establish a regional network to assist in the control of the illegal trade in tiger parts and derivatives;

REQUESTS

a) countries with the relevant expertise to assist range and consumer States in the establishment of forensic facilities and to provide other technical assistance to aid the detection and accurate identification of tiger parts and derived manufactured products; and

b) that, given that biological and distribution data are essential for the implementation of the Convention, donor nations assist in funding the infrastructure and the provision of expertise to develop computer databases and mapping, as well as any other necessary conservation management and enforcement techniques;

RECOMMENDS that the governments of tiger-consumer States:

a) work with traditional-medicine communities and industries to develop strategies for eliminating the use and consumption of tiger parts and derivatives;

b) carry out appropriate education and awareness campaigns making use of indigenous knowledge and traditional wisdom, directed at appropriate rural and urban communities and other targeted groups in range States, on the ecological importance of the tiger, its prey and its habitat; and

c) introduce programmes to educate industry and user groups in consumer States

in order to eliminate the use of tiger-derived substances and promote the adoption of alternatives;

DIRECTS the Standing Committee to continue its review of tiger trade issues in range and consumer States and to report to the Parties on progress made, with a view towards identifying additional legislative and enforcement measures that may be necessary to stop the illegal trade in tigers and tiger parts and derivatives; and

CALLS UPON all governments and intergovernmental organizations, international aid agencies, and non-governmental organizations to provide, as a matter of urgency, funds and other assistance to stop the illegal trade in tigers and tiger parts and derivatives and to ensure the survival of the tiger in the wild.

g) tiger range and non-range States to support and participate in international tiger conservation programmes including joining the Global Tiger Forum;

RECOMMENDS

a) that the governments of tiger range States and, where appropriate, non-range States, establish co-operative bilateral and multilateral arrangements for the management of shared wildlife species and protected habitats with common boundaries in order to achieve more

effective control of illegal transborder movement of tigers and tiger parts and derivatives; and

b) that all range and consumer States strengthen communication and sharing of information by designating at least one contact person in order to establish a regional network to assist in the control of the illegal trade in tiger parts and derivatives;

REQUESTS

a) countries with the relevant expertise to assist range and consumer States in the establishment of forensic facilities and to provide other technical assistance to aid the detection and accurate identification of tiger parts and derived manufactured products; and

b) that, given that biological and distribution data are essential for the implementation of the Convention, donor nations assist in funding the infrastructure and the provision of expertise to develop computer databases and mapping, as well as any other necessary conservation management and enforcement techniques;

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CALLS UPON all governments and intergovernmental organizations, international aid agencies, and non-governmental organizations to provide, as a matter of urgency, funds and other assistance to stop the illegal trade in tigers and tiger parts and derivatives and to ensure the survival of the tiger in the wild.

1:7,000,000

Projection: Lambert Azimuthal
Central Meridian: 90 E
Latitude of Origin: 10 N

Figure 6a. Protected areas of the Indian Subcontinent Bioregion (northern section).

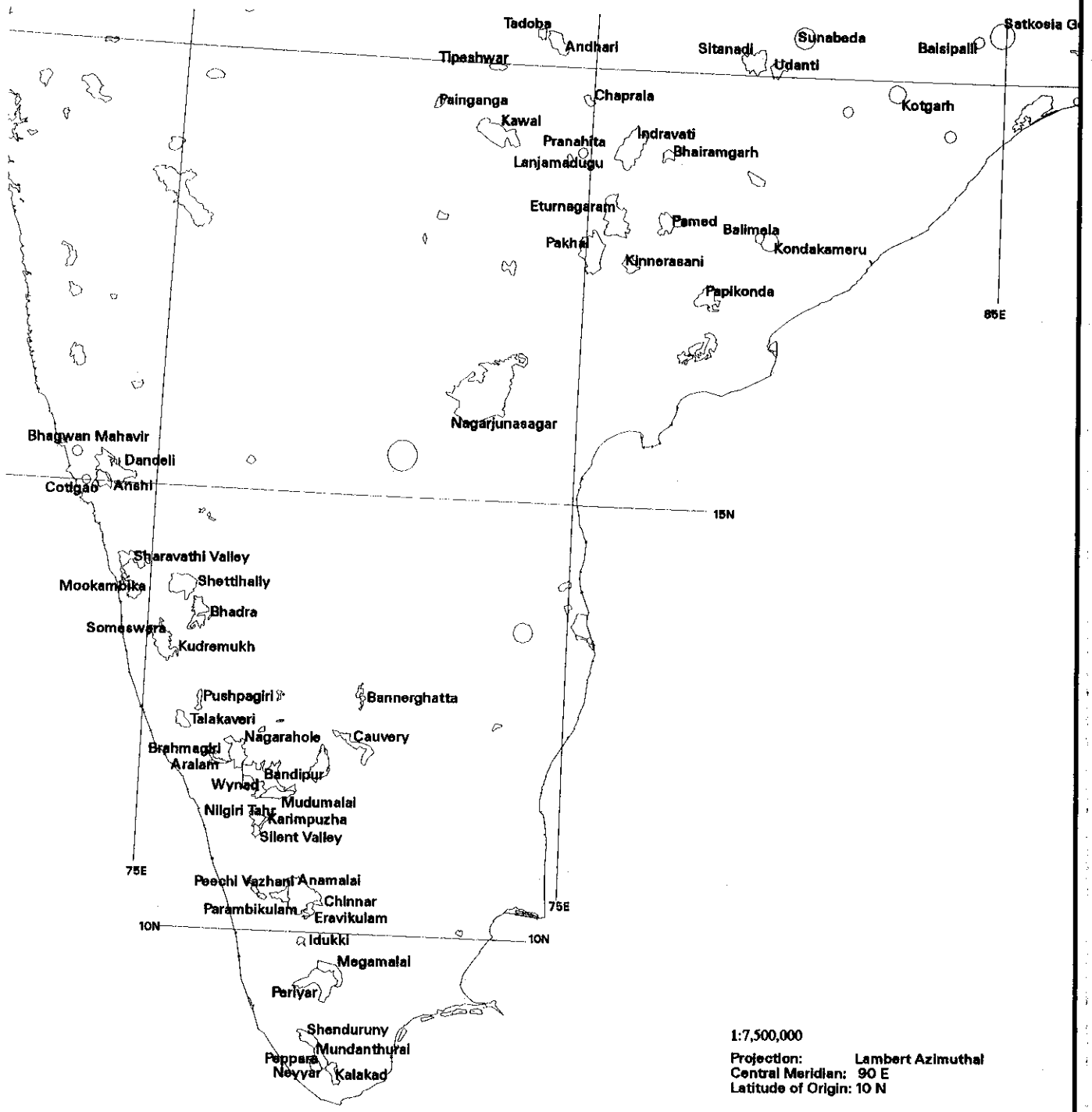
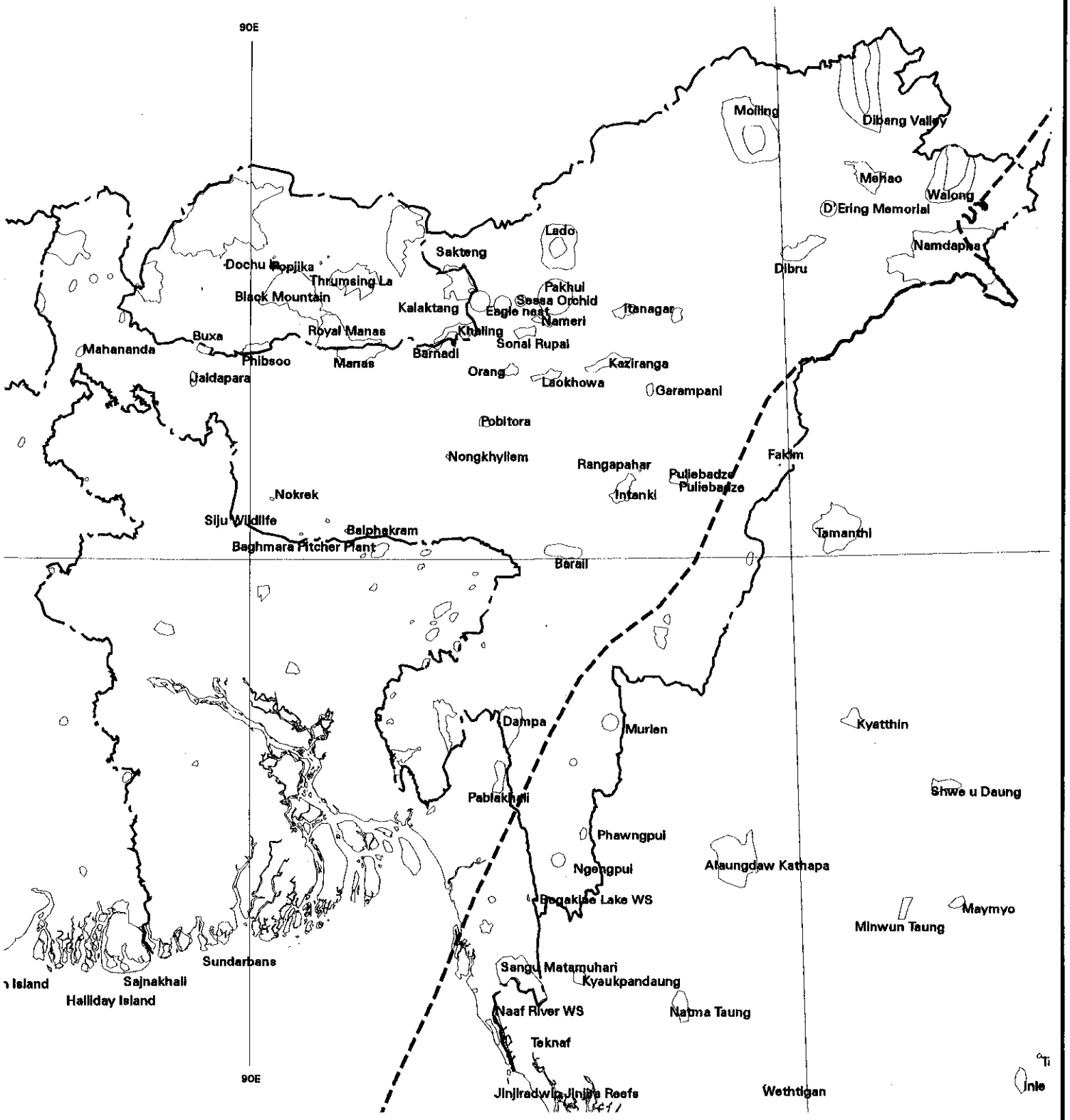


Figure 6b. Protected areas of the Indian Subcontinent Bioregion (southern section).



1:5,000,000

Projection: Lambert Azimuthal
Central Meridian: 90 E
Latitude of Origin: 10 N

Figure 6c. Protected areas of the Indian Subcontinent Bioregion (northeastern section).

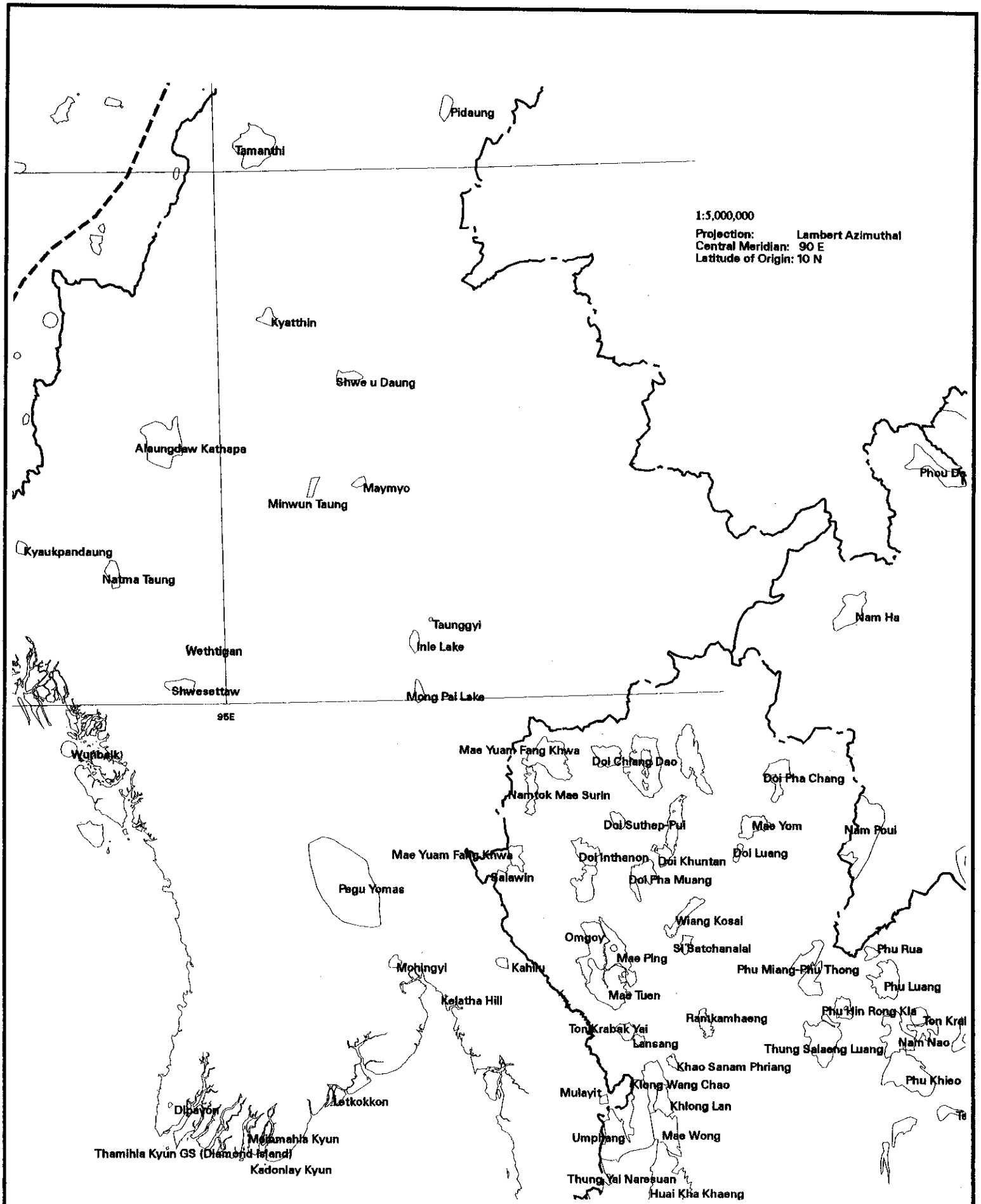


Figure 7a. Protected areas of the Indochina and Southeast Asia Bioregions (northwestern section).

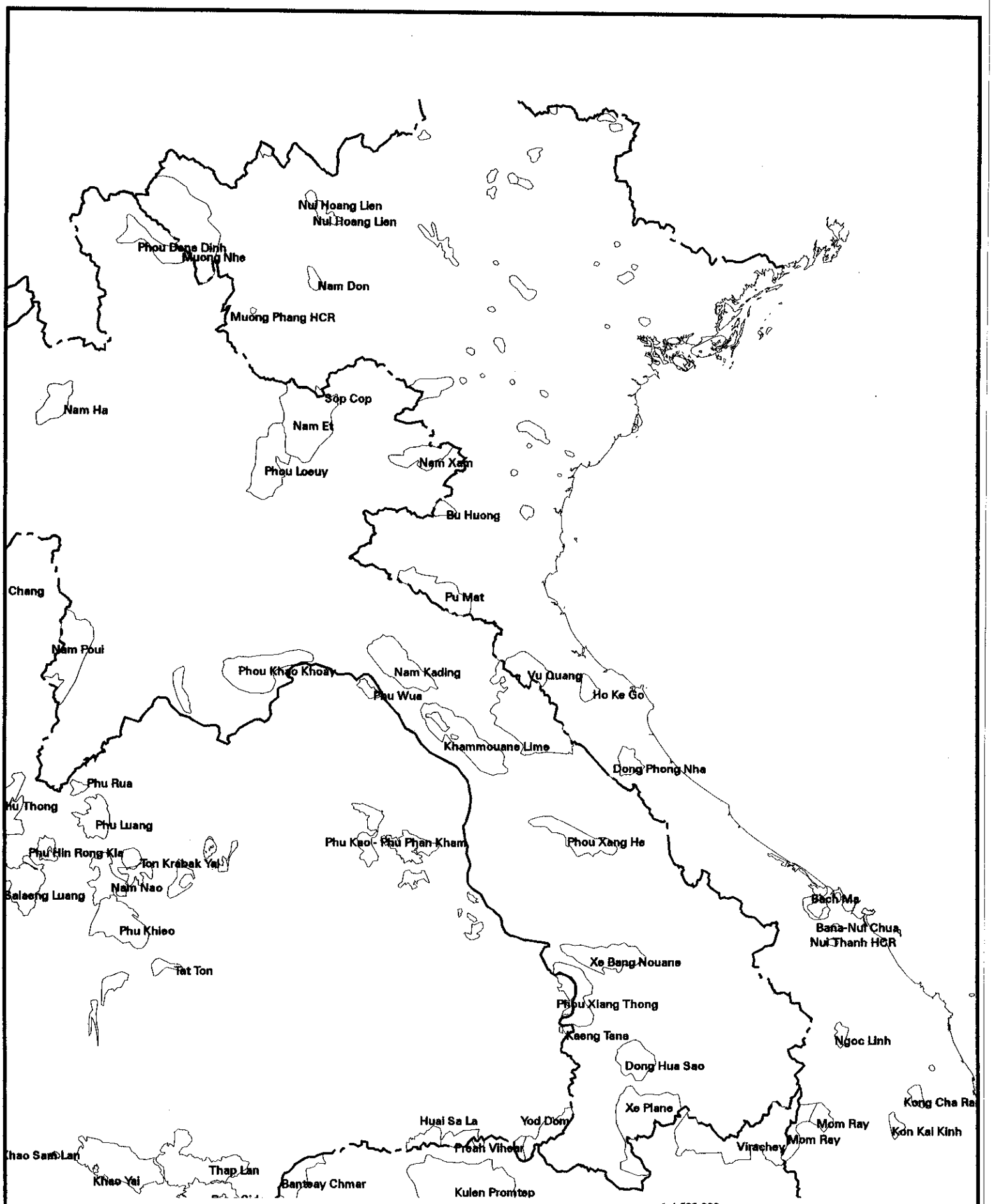


Figure 7b. Protected areas of the Indochina and Southeast Asia Bioregions (northeastern section).

1:4,500,000

Projection: Lambert Azimuthal
Central Meridian: 90 E
Latitude of Origin: 10 N

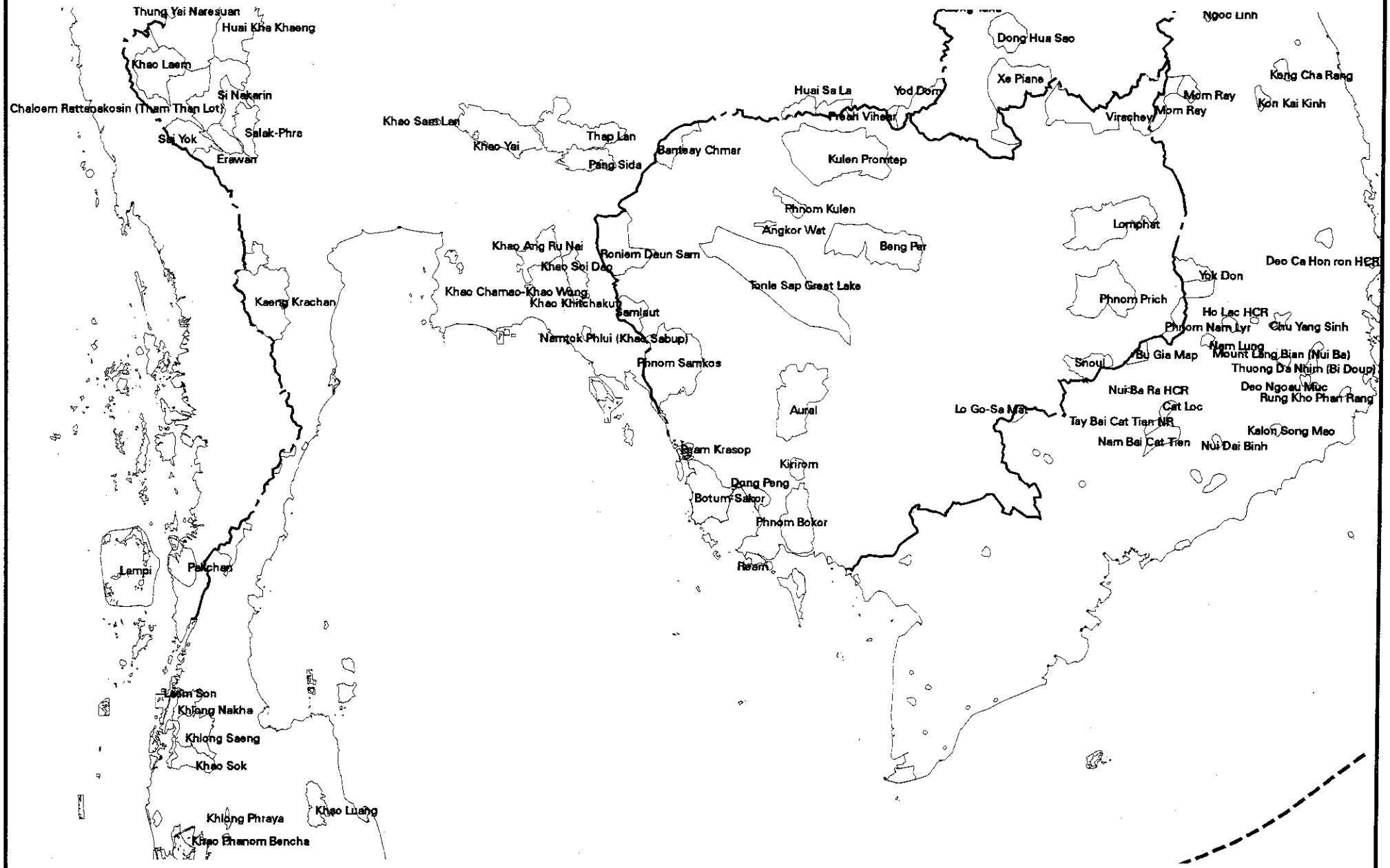


Figure 7c. Protected areas of the Indochina and Southeast Asia Bioregions (central section).

1:5,000,000

Projection: Lambert Azimuthal
Central Meridian: 90 E
Latitude of Origin: 10 N

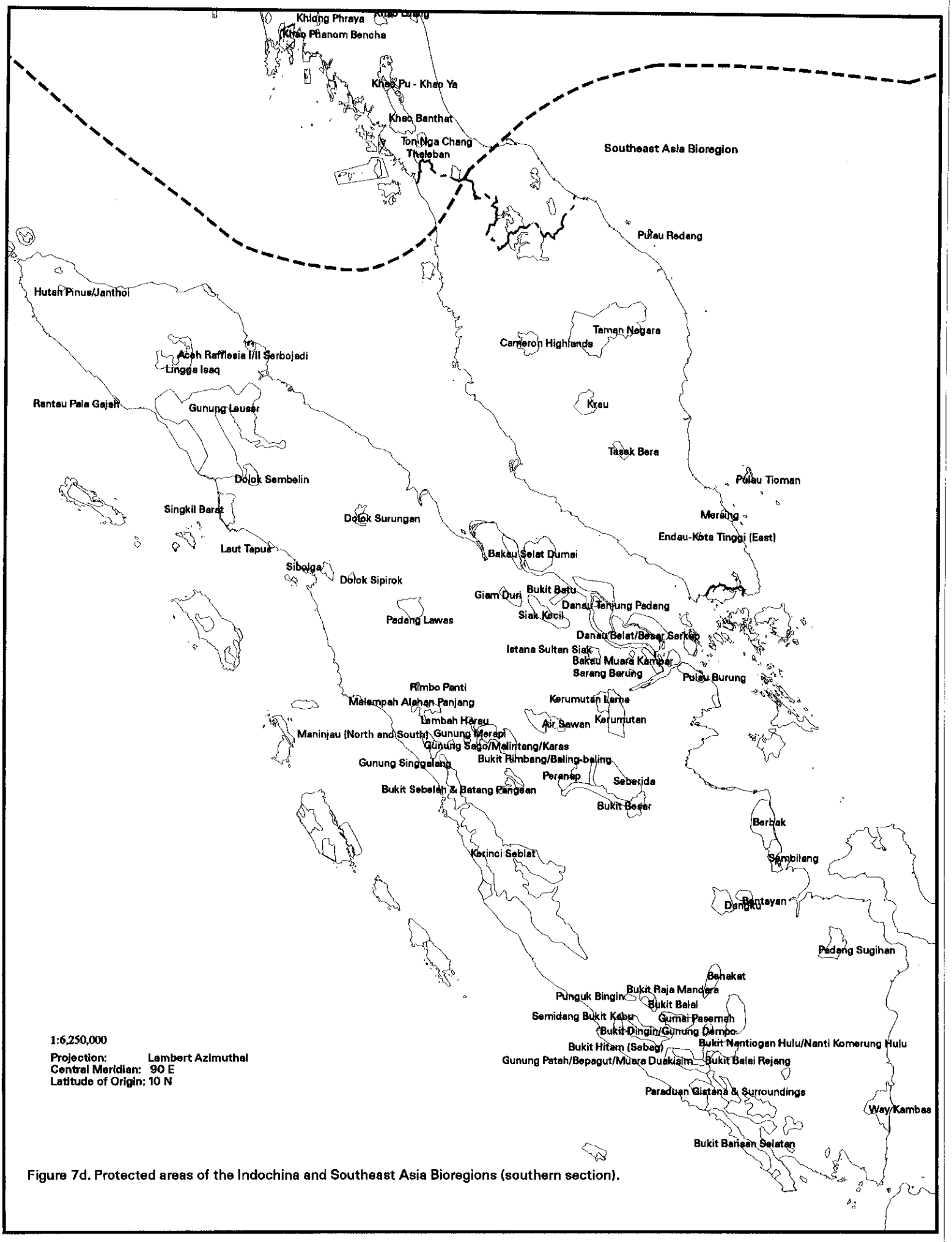


Figure 7d. Protected areas of the Indochina and Southeast Asia Bioregions (southern section).