

## PERSISTENCE OF LARGE MAMMAL FAUNAS AS INDICATORS OF GLOBAL HUMAN IMPACTS

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Large mammals often play critical roles within ecosystems by affecting either prey populations or the structure and species composition of surrounding vegetation. However, large mammals are highly vulnerable to extirpation by humans and consequently, severe contractions of species ranges result in intact large mammal faunas becoming increasingly rare. We compared historical (AD 1500) range maps of large mammals with their current distributions to determine which areas today retain complete assemblages of large mammals. We estimate that less than 21% of the earth's terrestrial surface still contains all of the large (>20 kg) mammals it once held, with the proportion varying between 68% in Australasia to only 1% in Indomalaya. Although the presence of large mammals offers no guarantee of the presence of all smaller animals, their absence represents an ecologically based measurement of human impacts on biodiversity. Given the ecological importance of large mammals and their vulnerability to extinction, better protection and extension of sites containing complete assemblages of large mammals is urgently needed.

Key words: global, historic range, human impact, large mammals, range contraction

Large mammals are fundamental elements in many ecosystems. Large carnivores frequently shape the number, distribution, and behavior of their prey (Berger et al. 2001b; Sinclair et al. 2003; Terborgh 1988; Terborgh et al. 2001). Large herbivores function as ecological engineers by changing the structure and species composition of surrounding vegetation (Dinerstein 2003; Owen-Smith 1988). Furthermore, both sets of mammals profoundly influence the environment beyond direct species interactions, such as through cascading trophic effects (Berger et al. 2001a; Côté et al. 2004; Crooks and Soulé 1999).

Today, the ranges of individual species of large mammals have been reduced greatly because of human activities, primarily through habitat alteration and direct exploitation or persecution (Ceballos and Ehrlich 2002; Sechrest 2003). Large species are particularly prone to local extirpation because they

are differentially hunted for the burgeoning trade in wild meat, controlled as competitors, or otherwise persecuted (Allen et al. 1999; Cardillo et al. 2004; Milner-Gulland et al. 2003; Orians et al. 1997). Large mammals also are sensitive to habitat fragmentation that isolates populations (Woodroffe and Ginsberg 1998). Indeed, a full 39% of these species are considered threatened with extinction compared with 24% for mammals as a whole (the World Conservation Union—IUCN 2005a). Substantial range contractions also have occurred among species whose global conservation status is assessed as Least Concern, such as the wolf (*Canis lupus*—IUCN 2005a). The result is that there are few regions that retain their full complement of native large mammals. Our objectives were to indicate where “historical” human impacts have occurred, and more importantly to show where the remaining intact large mammal assemblages are found, how they are distributed, and their level of protection.

To identify areas still retaining large mammals, we compared current ranges of the largest 263 terrestrial mammal species (body mass >20 kg; Appendix I) with their distributions in AD 1500 (see “Materials and Methods” for an explanation of our rationale behind this body mass threshold and historical baseline).

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## MATERIALS AND METHODS

Mammal taxonomy was based on Wilson and Reeder (1993, 2005), modified in collaboration with IUCN Species Survival Commission (SSC) Specialist Groups. Body size information came from Smith et al. (2003) and Nowak (1999).

A 20-kg body mass was used as the threshold to define a large mammal species because it represents the mass at which carnivores typically switch from invertebrates to larger prey (Carbone et al. 1999). Although other cutoffs have been proposed, and this threshold is perhaps arbitrary with respect to orders of mammals other than Carnivora, this is the sole proposed cutoff based on physiology. We repeated the analyses using a 40-kg threshold, as suggested by Martin and Steadman (1999) and Roberts et al. (2001), and found results to be virtually identical. The lower 20-kg threshold added 70 additional species such as the thylacine (*Thylacinus cynocephalus*) for Australia, although this species occupied only a small portion of the continent circa 1500. At least 35% of the species in our study (using the 20-kg threshold) have experienced serious contractions (>50%) in range (IUCN 2005a; MacPhee and Flemming 1999), and even the species with small range losses typically have experienced localized population extirpations and reduced abundance.

To determine the starting point or baseline for our analysis, we evaluated 4 themes or rationales for selecting a historical cutoff. The spread of anatomically modern humans was a catastrophic event for many prehistoric large mammals, and there is evidence that humans were complicit in the extinction of many species soon after colonization (Martin and Steadman 1999; but see Grayson and Meltzer 2003). Nonetheless, using different historical cutoffs for each continent has 2 major drawbacks. Accurate data on large mammal distributions reaching back 10,000–70,000 years (corresponding to the respective times when modern humans arrived on each continent) for even a large proportion of the 262 large mammals are lacking, and are complicated by natural range shifts due to climate change, competitors, prey, and other factors. In addition, precisely because of the catastrophic nature of the human impacts at these times, many species were pushed to extinction, leaving few options for current conservation and restoration of those species.

Alternatively, we could use the time of the advent of settled agriculture (~10,000 years ago), which began the era of large-scale conversion of natural habitats for human use. Unfortunately, tracking the spread of settled agriculture across the planet continent by continent creates significant complications. For example, the Gangetic plain, home to one of the most extensive intact large mammal assemblages in the Indomalayan realm, was only settled by agriculture in AD 1400, yet a deadly strain of malaria kept much of the Terai zone sparsely settled until the early 1950s when the disease was eradicated (Dinerstein 2003). A similar situation existed for diseases in Africa until relatively recently.

Another possible cutoff is the great increase in absolute human population numbers that occurred after World War II at approximately AD 1950–1960. Although most of this growth

occurred in developing countries, it is certain that human impacts on the planet have increased significantly since this time. Yet our large mammal species maps do not have the temporal resolution that would allow us to analyze the change before and after AD 1950–1960, and one would expect time lags between the human population explosion and large mammal ranges, which would differ significantly by species.

Finally, exploration by Europeans occurred in earnest in the AD 1400s, but colonization began to increase significantly after approximately AD 1500 and the industrial revolution followed approximately 200 years later. The spread of Europeans and the subsequent industrial revolution mark the start of the most profound anthropogenic changes to the planet. As stated above, our objectives were to suggest where “historical” human impacts have occurred, and to show where the remaining intact large mammal assemblages are found. The 1st objective forced us to map accurate historical large mammal range distributions—and this type of information was restricted to the recent historical period. Both the IUCN *Red List* (IUCN 2005a) and the Committee on Recently Extinct Organisms (2007) mammal subgroup also use the year AD 1500 as their cutoff for examining “recent” extinctions. Only 7 large mammals have become extinct since AD 1500, providing opportunities for active conservation of the remaining species.

Historical ranges of individual species were gathered from over 500 published and unpublished sources, including IUCN/SSC *Action Plans* followed by expert consultation. These ranges are the best approximation for the time period and in some cases were reinforced with historical accounts, although in many instances such maps were necessarily reliant on extrapolations based on habitat preferences.

The data on current ranges were gathered as part of the Global Mammal Assessment. The Global Mammal Assessment is in the process of assessing the conservation status of all mammal species. This work is being carried out with extensive collaboration with experts, especially through the existing IUCN/SSC Specialist Groups for mammals. A global land cover classification (Hansen et al. 1998) was digitally applied to all species range maps to remove converted or inappropriate habitat. Individual species maps can be provided (both current and historical) upon request.

The historical range maps and current range maps differ in precision. In our analysis, we were wary of 2 types of errors: species incorrectly identified as present in an intact area in current range maps; and areas that were disqualified from being considered intact because the existing data indicated that 1 or more historically present species was extirpated from the area, but in actuality they were never present there, for instance because of ecological reasons such as inappropriate habitat. The result of such imprecise historical range maps would be to incorrectly disqualify areas from being identified as an intact assemblage. This danger, nonetheless, is reduced for 2 reasons. First, a number of the species that suffered the greatest range contractions are habitat generalists that, in all probability, occupied most of the mapped extent of occurrence; thus, the risk of falsely disqualifying possible assemblages is minimized. Examples include tigers (*Panthera tigris*), elk (*Cervus*

*elaphus*), American bison (*Bison bison*), leopards (*Panthera pardus*), lions (*Panthera leo*), and wolves (*Canis lupus*). Second, we actively sought intact assemblage areas that might have been overlooked because of imprecision in the historical maps, and we consulted extensively with regional experts for evaluation of potential problematic areas.

Range contractions were located and quantified by removing each species' currently known extent of occurrence from its historical range. The areas with intact mammal assemblages were initially mapped as those that were not part of a range contraction for any species. These areas were then subjected to further scrutiny by evaluating the presence of protected areas, proximity to human settlement and agriculture, and – most important – by further consultation with regional experts to ascertain that such intact assemblages were valid.

Despite these efforts there are likely to be errors in the historical maps that affect our estimates of range contraction. Nonetheless, our main emphasis was on locating those areas that still contain a full complement of historic large mammal assemblages, and we are confident that the identified sites are accurate. Thus, the results of our analysis are most robust where they have conservation implications.

Data on level of protection of areas with intact assemblages of large mammals were developed by overlaying the United Nations Environment Programme—World Conservation Monitoring Centre's *World Database on Protected Areas* (UNEP-WCMC 2005) with the intact assemblage polygons. "Poorly protected" was defined as  $\leq 25\%$  coverage by IUCN I–VI protected areas, "partially protected" indicates between 25% and 75% coverage, and "largely protected" indicates  $\geq 75\%$  coverage.

It would be desirable to quantify the percentage loss of large mammals from those areas without intact large mammal assemblages. Nonetheless, at present the quality of the data does not permit comprehensive estimations of all large mammal range losses at fine scales (*sensu* Ceballos and Ehrlich 2002). We hope to pursue the larger goal of quantifying losses comprehensively as information concerning current species ranges improves in the coming years.

With few exceptions, our analysis is restricted to polygons larger than 100 km<sup>2</sup>. A number of intact assemblages are made up of more than 1 polygon (especially in island groups such as Arctic Canada or the Philippines).

All the methods followed the guidelines approved by the American Society of Mammalogists (Gannon et al. 2007).

## RESULTS

Intact large mammal assemblages occur in 108 distinct areas. The smallest intact assemblage identified is 24-km<sup>2</sup> Bawean Island in Indonesia. More than 97% of individual polygons are larger than 100 km<sup>2</sup> and 83% are larger than 500 km<sup>2</sup>. Siberia is the largest area at 6,961,155 km<sup>2</sup>. These areas include 6 extensive wilderness regions (an arctic–northern–eastern Canadian complex, Amazon–Orinoco basins, west-central Africa and the Congo Basin, Siberia, central Australia, and the Himalayas; Fig. 1). Together, the wilderness complexes constitute 82% of the

land area retaining assemblages of large mammals. The large portions of Australia supporting a full assemblage represent a unique case. Three native large kangaroos (*Macropus fuliginosus*, *Macropus giganteus*, and *Macropus rufus*) have expanded their ranges with the spread of the livestock industry, including the clearing of land, extirpation of prehistorically introduced dingoes (*Canis lupus dingo*), and water provision intended for stock (Calaby and Grigg 1989). Because the extinct thylacine (or Tasmanian wolf [*T. cynocephalus*]) had a restricted range on continental Australia in 1500 (approximately the Flinders Range—Paddle 2000), the loss of this large carnivorous mammal did not exclude the majority of the continent. Paradoxically, more mammals have become extinct in Australia in historical times than any other continent despite the continued presence of a few large-bodied species (Cardillo and Bromham 2001; IUCN 2005a). The extirpated mammals were small-bodied, mostly 0.035–5.5 kg in size (Cardillo and Bromham 2001).

The other 99 sites are inhospitable (e.g., Novaya Zemlya), have naturally impoverished large mammal faunas (e.g., Pacific coast of South America), or are under intensive conservation management (e.g., Kruger National Park, South Africa; Yellowstone National Park, United States; Fig. 1). Altogether, the 108 intact large mammal sites represent approximately 21% of the area formerly occupied by large mammals (Table 1). We say "approximately" because of the imprecision of the historic mammal range maps relative to the intact large mammal areas. Among the biogeographic realms, the proportion of land area retaining intact assemblages varies from 68% in Australasia to only 1% in Indomalaya.

Twelve percent of the total area retaining large mammal assemblages are formally protected (IUCN I–VI—UNEP-WCMC 2005). This percentage is equivalent to the global total of 12% (IUCN 2005b). The degree of protection (IUCN I–VI—UNEP-WCMC 2005) varies markedly among sites in different biogeographic realms, from 9% in the Palearctic to 44% in Indomalaya. The overall percentage with full protection for biodiversity (IUCN I–IV—UNEP-WCMC 2005) is only 8%, and ranges from 6% in the Palearctic to 35% in Indomalaya (Table 2). On an individual basis, just 25% of the intact areas are largely covered ( $>75\%$ ) by protected areas of any type (Table 1). Of course, the presence of protected areas does not guarantee actual protection.

Sites vary greatly in the number of large mammal species they support; for example, the highest are at Hwange and Serengeti-Mara sites in Africa (30 species in each), whereas lower numbers are found in northern Eurasia and Siberia (7 species). Five species-richness classes depict the distribution of intact large mammal diversity around the planet (Fig. 1). Overall, 10 sites in sub-Saharan Africa and 1 site in the Palearctic realm each conserve more than 25 species (Fig. 1). Nearly all of the sites with large numbers of species receive some formal protection (Table 1), and the most species-rich sites are generally largely protected. Full species lists for each site are available in Appendix II.

Twenty species with the largest absolute range contractions eliminated large areas of the planet from inclusion as areas with complete mammal faunas (Table 3). Examples include: Amer-

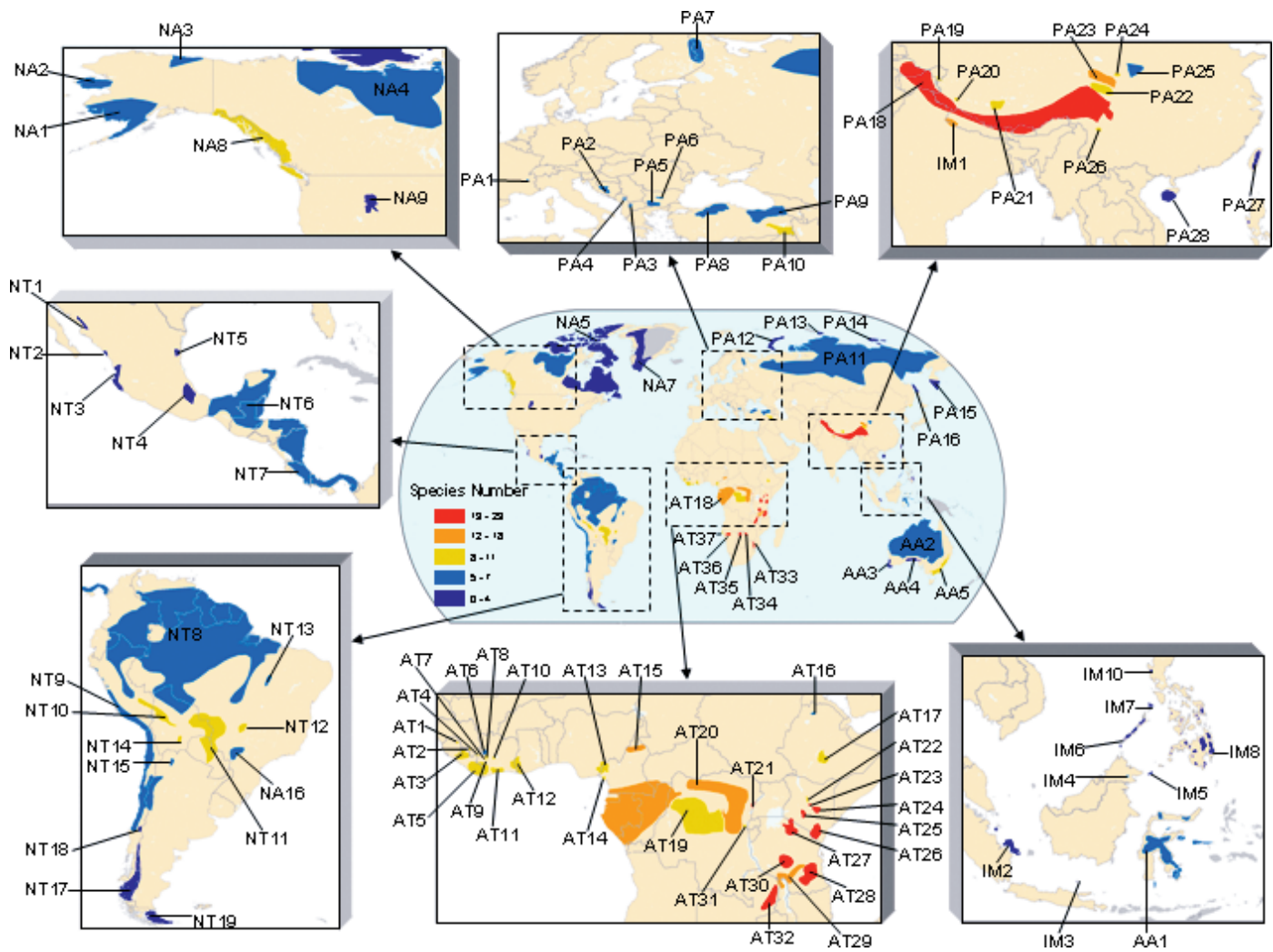


FIG. 1.—Intact large mammal faunas. Colored portions of the map indicate the number of species each intact large mammal area contains. Warm colors denote species-rich sites, whereas cool colors are less rich. The pink areas possessed large mammals in AD 1500 but no longer contained all of their former species. Gray areas did not possess large mammals historically (Antarctica would be gray but is not depicted). Note that the areas with highest mammal richness (East Africa and Indomalaya) have some of the lowest coverage of intact mammal faunas. Map numbers refer to Table 1 (AAxx = Australasia; ATxx = Afrotropics; IMxx = Indomalaya; NAxx = Nearctic; NTxx = Neotropics; PAXx = Palearctic).

ican bison (*B. bison*), wolf (*C. lupus*), and cougar (*Puma concolor*) in North America; jaguar (*Panthera onca*) in South America; lion (*P. leo*) in a broad swath of North Africa and the Near East; African elephant (*Loxodonta africana*), giraffe (*Giraffa camelopardalis*), and African wild dog (*Lycaon pictus*) in Africa; and horses (*Equus caballus*) in Eurasia. Combined range contraction of the 20 formerly widespread species represents 72% of the total range once occupied by large mammals.

Range contraction showed some differences by functional groups. Megaherbivores, defined as plant feeders >1,000 kg in body mass ( $n = 14$ ), which play the most conspicuous role as landscape engineers (Dinerstein 2003; Owen-Smith 1988) have had much greater average range contractions (88% versus 32%; analysis of variance [ANOVA],  $F = 31.94$ ,  $df. = 1, 226$ ,  $P < 0.0001$ ) than smaller herbivores ( $n = 214$ ). The 7 largest obligate carnivores, species that would be expected to exert the

most powerful top-down predator effects on prey, had a slightly but not significantly greater average range contraction than other large Carnivora ( $n = 24$ ; 55% versus 44%; ANOVA,  $F = 0.64$ ,  $df. = 1, 29$ ,  $P = 0.43$ ).

### DISCUSSION

Intact faunas represent another ecologically based measurement of human impact (Imhoff et al. 2004; Sanderson et al. 2002; Vitousek et al. 1997). They overlap portions of the “Wildest 10%” of the terrestrial Earth described in a recent analysis (“Human Footprint”—Sanderson et al. 2002). Yet, even at a coarse scale, there are some notable differences between our analysis and that of Sanderson et al. (2002). The total area of the planet that still retains large mammal assemblages (27 million km<sup>2</sup>) is 1.2 times greater than the total area of the “Wildest 10%,” but overlaps only 48% of the

**TABLE 1.**—Intact large mammal faunas, based on current and historical (circa AD 1500) range maps.

Map no. <sup>a</sup>	Site <sup>b</sup>	Protected <sup>c</sup>	Area (km <sup>2</sup> )	No. species <sup>d</sup>
AA01	Sulawesi	Poorly	76,292	6
AA02	Central Australia	Poorly	—	7
AA03	Southwestern Australia	Poorly	55,311	1
AA04	Southern Australia	Largely	74,834	4
AA05	Southeastern Australia	Partially	223,577	8
AT01	Loma Mts.	Partially	1,028	11
AT02	Massif du Ziamá	Largely	1,216	8
AT03	Gola area	Partially	21,072	10
AT04	Mount Nimba area	Partially	9,665	9
AT05	Sapa-Tai forest area	Partially	52,157	10
AT06	Mont Sangbe NP area	Partially	3,298	7
AT07	Mt. Peko NP	Partially	458	9
AT08	Mt. Tia—Mt. Sassandra	Largely	1,812	9
AT09	Duekoue Classified Forest	Largely	374	10
AT10	Marahoue NP	Largely	1,391	9
AT11	South-central Ivory Coast forests	Partially	13,229	9
AT12	Ghana—Ivory Coast border forests	Partially	28,431	9
AT13	Cross River area	Partially	23,594	10
AT14	Mount Cameroon	Partially	1,912	9
AT15	Bouba Ndjida, Benoue, and Faro NPs	Partially	21,613	18
AT16	Simien Mts.	Partially	1,899	6
AT17	Bale Mts.	Largely	21,205	9
AT18	Western Central Africa forest	Poorly	686,683	13
AT19	Central Congo Basin forests	Poorly	305,395	11
AT20	Northeastern Congo Basin forests	Poorly	293,737	14
AT21	Virunga NP	Largely	2,967	20
AT22	Mathews Range	Largely	2,012	8
AT23	Samburu—Buffalo Springs—Shaba National Reserves	Largely	1,085	25
AT24	Meru NP area	Largely	8,463	25
AT25	Aberdare Mts.	Poorly	6,036	19
AT26	Tsavo NP area	Largely	27,490	24
AT27	Serengeti Plains	Largely	30,030	25
AT28	Selous Game Reserve	Largely	58,099	23
AT29	Southern Tanzania and Malawi Mts.	Poorly	49,456	12
AT30	Ruaha NP area	Largely	32,862	25
AT31	Kahuz-Biegi NP—upland	Partially	1,704	11
AT32	Luangwa NP area	Largely	40,187	27
AT33	Kruger NP area	Largely	26,385	27
AT34	Hwange NP	Largely	18,347	27
AT35	Okavango Delta	Largely	32,291	29
AT36	Etosha NP	Largely	29,971	22
AT37	Skeleton Coast Game Park	Largely	2,461	8
IM01	Western Terai	Partially	12,351	15
IM02	Bangka and Singkep	Poorly	12,722	2
IM03	Bawean	Largely	24	2
IM04	Eastern Sabah	Largely	517	7
IM05	Tawi Tawi	Poorly	633	1
IM06	Palawan	Largely	5,224	1
IM07	Calamians	Poorly	1,528	2
IM08	Mindanao	Partially	17,944	2
IM09	Visayas	Partially	2,509	4
IM10	Zambales Mts.	Poorly	625	2
NA01	Southwestern Alaska	Partially	269,624	6
NA02	Seward Peninsula	Partially	49,501	6
NA03	Northwest Arctic coastal plain	Partially	30,512	7
NA04	North-central Canada	Partially	—	6

**TABLE 1.**—Continued.

Map no. <sup>a</sup>	Site <sup>b</sup>	Protected <sup>c</sup>	Area (km <sup>2</sup> )	No. species <sup>d</sup>
NA05	Arctic Canadian Islands	Poorly	—	3
NA06	Eastern Canada	Partially	—	4
NA07	Western Greenland	Poorly	562,288	2
NA08	Northeastern Pacific rain forest	Partially	223,187	8
NA09	Greater Yellowstone	Largely	50,966	12
NT01	Northern Sierra Madre	Poorly	4,427	3
NT02	Meseta de Cacaxtla	Poorly	1,449	3
NT03	Coastal Jalisco	Poorly	16,401	3
NT04	Sierra Orizaba	Poorly	23,573	3
NT05	Sierra Tamaulipas	Poorly	3,629	3
NT06	Northern Central America	Partially	269,924	6
NT07	Southern Central America	Partially	255,931	5
NT08	Amazon—Orinoco	Partially	—	7
NT09	Sechura and Atacama Desert, Chilean Mataral, Andean	Poorly	436,807	5
NT10	Manu—Madidi—Amboro	Partially	91,632	10
NT11	Chiquitania—Pantanal—Chaco	Partially	369,097	9
NT12	Das Emas	Poorly	22,064	8
NT13	Urucui—Una	Poorly	15,939	7
NT14	Chuquisaca southern Andean Yungas	Poorly	9,463	8
NT15	Calilegua and environs	Poorly	8,118	5
NT16	Ilhas e Varzea do Rio Parana	Poorly	45,249	7
NT17	Southwestern Patagonia	Partially	116,222	2
NT18	Nuble	Partially	4,343	2
NT19	Tierra del Fuego	Poorly	38,264	1
PA01	Hauts de Chartreuse Nature Reserve area	Poorly	596	6
PA02	Montenegro and Albania border mts.	Poorly	8,567	6
PA03	Mavrovo NP area	Poorly	1,824	6
PA04	Bosnia and Herzegovina Mts.	Poorly	2,390	6
PA05	Bulgaria southwestern mts.	Poorly	10,286	6
PA06	Bulgaria central mts.	Poorly	1,768	6
PA07	Finland and Russia border	Partially	33,513	7
PA08	Western Black Sea	Poorly	45,657	5
PA09	Turkish Caucasus	Partially	71,148	7
PA10	Mus—Simak—Van	Partially	33,261	8
PA11	Siberia	Poorly	—	7
PA12	Novaya Zemlya	Poorly	77,055	1
PA13	Ostrov Bol'shevik	Poorly	10,234	1
PA14	Novosibirskiy Ostrova	Largely	35,390	1
PA15	Southern Kamchatka	Partially	120,825	4
PA16	Sakhalin	Poorly	40,623	2
PA17	Russian Maritime	Poorly	8,321	11
PA18	Himalayas	Partially	692,487	23
PA19	Eastern Kashmir	Poorly	3,434	9
PA20	Kangrinboqe Feng	Poorly	2,056	8
PA21	Tibetan Plateau	Poorly	19,465	8
PA22	Bayan Har Shan	Largely	30,488	11
PA23	Anyemaqen Shan	Largely	42,220	14
PA24	Ganligahai-zecha	Partially	2,591	9
PA25	Southern Gansu	Poorly	24,257	7
PA26	Northern Yunnan	Poorly	3,016	9
PA27	Central Taiwan	Partially	10,859	4
PA28	Hainan	Poorly	23,915	3

<sup>a</sup> Map no. refers to numbers on Fig. 1 (AAxx = Australasia; ATxx = Afrotropics; IMxx = Indomalaya; NAXx = Nearctic; NTxx = Neotropics; PAxx = Palearctic).

<sup>b</sup> NP = National Park; Mt. = mountains.

<sup>c</sup> Protection: poorly = ≤25% overlap by IUCN categories I–VI protected areas; partially = 25–75% covered; largely = ≥75% protected.

<sup>d</sup> No. species refers to the number of large mammal species in the referenced site.

TABLE 2.—Areas (km<sup>2</sup>) of historic and present large mammal faunas by biogeographic realm. NA = not applicable.

Realm	Total area	Historic <sup>a</sup>	Current (%) <sup>b</sup>	Protected (%) <sup>c</sup>	Well protected (%) <sup>d</sup>
Afrotropics	21,737,604	21,702,568	1,860,087 (9)	459,092 (25)	354,612 (19)
Antarctica	3,279,055	NA	NA	NA	NA
Australasia	9,247,340	7,874,871	5,362,263 (68)	554,683 (10)	351,034 (7)
Indomalaya	8,523,943	8,426,191	54,077 (1)	23,865 (44)	18,673 (35)
Nearctic	20,424,224	20,077,722	5,192,201 (26)	631,672 (12)	532,572 (10)
Neotropics	19,367,976	19,000,519	6,675,566 (35)	918,686 (14)	528,823 (8)
Oceania	47,030	NA	NA	NA	NA
Palaearctic	52,741,665	52,204,640	8,317,401 (16)	770,403 (9)	494,881 (6)
Total	135,368,837	128,425,982	27,461,595 (21)	2,916,774 (12)	1,964,391 (8)

<sup>a</sup> Area containing large mammal faunas at AD 1500.

<sup>b</sup> Area currently occupied by intact large mammal faunas with the percent of AD 1500 amount in parentheses.

<sup>c</sup> Area (with percent in parentheses) of current large mammal faunas that are within a recognized protected area (IUCN categories I–VI).

<sup>d</sup> Area (with percent in parentheses) of current large mammal faunas that are well protected (i.e., within IUCN categories I–IV).

“Wildest 10%.” Substantial portions of the Nearctic, Neotropical, and Palaearctic regions are sufficiently remote and undisturbed to qualify for inclusion as wilderness, but are missing 1 or more large mammals. Conversely, areas in the Congo Basin, the Amazon Basin, Australia, and portions of Siberia that are not among the “Wildest 10%” still retain their native large mammals despite human activities.

These mismatches are partly explained by historical relationships between humans and large mammals. Although habitat loss is the most important factor in range contractions generally, some species are affected primarily by human persecution. Nonetheless, even large carnivores can persist at relatively high human densities. Linnell et al. (2001) showed that carnivores increased after the introduction of favorable legislation, and that there is no clear relationship between human densities and current carnivore distributions.

The presence of a large mammal species does not imply that population densities today are comparable to what existed in AD 1500 or that the populations are even viable. Furthermore, human-induced mammal extinctions before this time resulted in altered ecosystems throughout the world, particularly in North America, Eurasia (MacPhee and Flemming 1999), and Australia (Cardillo and Bromham 2001; IUCN 2005b), although imprecise knowledge of former species ranges precludes analysis at deeper time periods. Many species no longer play the same ecological roles as before (Soulé et al. 2003), although in some instances extirpation of 1 species may be functionally mitigated by the continued presence of another with a similar niche (Ives and Cardinale 2004).

Areas that contain complete large mammal assemblages merit conservation attention because only 8% of the land area that still retains complete assemblages of large mammals is

TABLE 3.—The 20 species of large mammals with greatest documented area of absolute range contraction since AD 1500.

Scientific name	Common name	Historic <sup>a</sup>	Current <sup>b</sup>	Loss <sup>c</sup>
<i>Cervus elaphus</i>	Elk	$5.20 \times 10^7$	$1.50 \times 10^7$	$3.70 \times 10^7$
<i>Acinonyx jubatus</i>	Cheetah	$3.50 \times 10^7$	$7.27 \times 10^6$	$2.77 \times 10^7$
<i>Panthera leo</i>	Lion	$2.69 \times 10^7$	$3.97 \times 10^6$	$2.29 \times 10^7$
<i>Loxodonta africana</i>	African elephant	$2.52 \times 10^7$	$6.20 \times 10^6$	$1.90 \times 10^7$
<i>Giraffa camelopardalis</i>	Giraffe	$2.10 \times 10^7$	$2.60 \times 10^6$	$1.84 \times 10^7$
<i>Lycan pictus</i>	African wild dog	$1.89 \times 10^7$	$8.87 \times 10^5$	$1.80 \times 10^7$
<i>Panthera pardus</i>	Leopard	$4.18 \times 10^7$	$2.72 \times 10^7$	$1.46 \times 10^7$
<i>Equus caballus</i>	Horse	$1.35 \times 10^7$	$3.07 \times 10^3$	$1.34 \times 10^7$
<i>Equus hemionus</i>	Cougar	$1.35 \times 10^7$	$4.11 \times 10^5$	$1.31 \times 10^7$
<i>Rangifer tarandus</i>	Caribou	$2.93 \times 10^7$	$1.81 \times 10^7$	$1.13 \times 10^7$
<i>Ursus arctos</i>	Brown bear	$3.48 \times 10^7$	$2.37 \times 10^7$	$1.11 \times 10^7$
<i>Diceros bicornis</i>	Black rhinoceros	$1.04 \times 10^7$	$5.84 \times 10^5$	$9.82 \times 10^6$
<i>Elephas maximus</i>	Asiatic elephant	$9.33 \times 10^7$	$6.55 \times 10^5$	$8.68 \times 10^6$
<i>Bison bison</i>	American bison	$8.51 \times 10^7$	$8.57 \times 10^4$	$8.42 \times 10^6$
<i>Oryx dammah</i>	Scimitar-horned oryx	$8.53 \times 10^7$	$2.16 \times 10^5$	$8.31 \times 10^6$
<i>Panthera onca</i>	Jaguar	$1.91 \times 10^7$	$1.09 \times 10^7$	$8.24 \times 10^6$
<i>Puma concolor</i>	Cougar	$3.04 \times 10^7$	$2.23 \times 10^7$	$8.11 \times 10^6$
<i>Panthera tigris</i>	Tiger	$9.68 \times 10^6$	$1.76 \times 10^6$	$7.92 \times 10^6$
<i>Ammotragus lervia</i>	Barbary sheep	$8.67 \times 10^6$	$1.53 \times 10^6$	$7.13 \times 10^6$
<i>Ursus americanus</i>	American black bear	$1.62 \times 10^7$	$9.63 \times 10^6$	$6.54 \times 10^6$
<i>Addax nasomaculatus</i>	Addax	$6.41 \times 10^6$	$5.92 \times 10^5$	$5.82 \times 10^6$

<sup>a</sup> Extent of species range (km<sup>2</sup>) in AD 1500.

<sup>b</sup> Current extent of species range (km<sup>2</sup>).

<sup>c</sup> Species' absolute range loss (km<sup>2</sup>) from AD 1500 to the present.

well protected. Thus, there is a strong need for creation of new reserves in unprotected areas and enhanced efforts to prevent poaching and habitat degradation within current reserves. Further analysis of these areas is required to determine the density of large mammals present and what other, smaller species may be missing. In general, areas retaining a full complement of large mammals are more likely to be ecologically functional than those that are missing 1 or more large mammal species, and the (temporary) loss of other taxa will often matter less to the recovery of an ecological system. Intact large mammal assemblages should be preferentially included in regional conservation portfolios, all else being equal. Modern reserve design methods can incorporate a wide variety of data layers, and we propose that the results of this analysis be another layer to be considered. The weight of these data will depend on the goals of the organizations and agencies involved in the conservation planning. Already, large international conservation organizations have used this layer to prioritize their global actions. Additionally, our analysis reveals that there are 2 general types of intact large mammal assemblages around the world—remote and inhospitable or small and intensively managed—it is critical to make sure that the latter receive adequate support for long-term conservation.

Finally, reintroductions of large mammals to their former range are possible and have been shown to have dramatic positive ecological effects, a prime example being the return of wolves to parts of North America (Ripple and Beschta 2003). To secure and expand areas with a full roster of native megafauna would seem to be at least as important as (and perhaps complementary to) proposed Pleistocene refaunation projects using large mammal surrogates from other continents (Donlan et al. 2005).

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## APPENDIX I

The large mammal species with body mass &gt;20 kg.

Order	Family	Scientific name	Common name
Artiodactyla	Antilocapridae	<i>Antilocapra americana</i>	Pronghorn
Artiodactyla	Bovidae	<i>Addax nasomaculatus</i>	Addax
Artiodactyla	Bovidae	<i>Aepyceros melampus</i>	Impala
Artiodactyla	Bovidae	<i>Alcelaphus buselaphus</i>	Hartebeest
Artiodactyla	Bovidae	<i>Alcelaphus lichtensteinii</i>	Lichtenstein's hartebeest
Artiodactyla	Bovidae	<i>Ammodorcas clarkei</i>	Dibatag
Artiodactyla	Bovidae	<i>Ammotragus lervia</i>	Barbary sheep
Artiodactyla	Bovidae	<i>Antidorcas marsupialis</i>	Springbok
Artiodactyla	Bovidae	<i>Antilope cervicapra</i>	Blackbuck
Artiodactyla	Bovidae	<i>Beatragus hunteri</i>	Hirola
Artiodactyla	Bovidae	<i>Bison bison</i>	American bison
Artiodactyla	Bovidae	<i>Bison bonasus</i>	European bison
Artiodactyla	Bovidae	<i>Bos frontalis</i>	Gaur
Artiodactyla	Bovidae	<i>Bos grunniens</i>	Yak
Artiodactyla	Bovidae	<i>Bos javanicus</i>	Banteng
Artiodactyla	Bovidae	<i>Bos sauveli</i>	Kouprey
Artiodactyla	Bovidae	<i>Bos taurus</i>	Aurochs
Artiodactyla	Bovidae	<i>Boselaphus tragocamelus</i>	Nilgai
Artiodactyla	Bovidae	<i>Bubalus bubalis</i>	Water buffalo
Artiodactyla	Bovidae	<i>Bubalus depressicornis</i>	Anoa
Artiodactyla	Bovidae	<i>Bubalus mindorensis</i>	Tamaraw
Artiodactyla	Bovidae	<i>Bubalus quarlesi</i>	Mountain anoa
Artiodactyla	Bovidae	<i>Budorcas taxicolor</i>	Takin
Artiodactyla	Bovidae	<i>Capra caucasica</i>	West Caucasian tur
Artiodactyla	Bovidae	<i>Capra falconeri</i>	Markhor
Artiodactyla	Bovidae	<i>Capra hircus</i>	Goat
Artiodactyla	Bovidae	<i>Capra ibex</i>	Alpine ibex
Artiodactyla	Bovidae	<i>Capra nubiana</i>	Nubian ibex
Artiodactyla	Bovidae	<i>Capra pyrenaica</i>	Spanish ibex
Artiodactyla	Bovidae	<i>Capra sibirica</i>	Siberian ibex
Artiodactyla	Bovidae	<i>Capra walie</i>	Walia ibex
Artiodactyla	Bovidae	<i>Capricornis crispus</i>	Japanese serow
Artiodactyla	Bovidae	<i>Capricornis milneedwardsii</i>	Chinese serow
Artiodactyla	Bovidae	<i>Capricornis rubidus</i>	Red serow
Artiodactyla	Bovidae	<i>Capricornis sumatraensis</i>	Sumatran serow
Artiodactyla	Bovidae	<i>Capricornis swinhoei</i>	Formosan serow
Artiodactyla	Bovidae	<i>Capricornis thar</i>	Himalayan serow
Artiodactyla	Bovidae	<i>Cephalophus brookei</i>	Brooke's duiker
Artiodactyla	Bovidae	<i>Cephalophus callipygus</i>	Peters' duiker
Artiodactyla	Bovidae	<i>Cephalophus dorsalis</i>	Bay duiker
Artiodactyla	Bovidae	<i>Cephalophus jentinki</i>	Jentink's duiker
Artiodactyla	Bovidae	<i>Cephalophus niger</i>	Black duiker
Artiodactyla	Bovidae	<i>Cephalophus ogilbyi</i>	Ogilby's duiker
Artiodactyla	Bovidae	<i>Cephalophus silvicultor</i>	Yellow-backed duiker
Artiodactyla	Bovidae	<i>Cephalophus spadix</i>	Abbott's duiker
Artiodactyla	Bovidae	<i>Connochaetes gnou</i>	Black wildebeest
Artiodactyla	Bovidae	<i>Connochaetes taurinus</i>	Blue wildebeest
Artiodactyla	Bovidae	<i>Damaliscus lunatus</i>	Common tsessebe
Artiodactyla	Bovidae	<i>Damaliscus pygargus</i>	Bontebok
Artiodactyla	Bovidae	<i>Eudorcas rufifrons</i>	Red-fronted gazelle
Artiodactyla	Bovidae	<i>Eudorcas thomsonii</i>	Thomson's gazelle
Artiodactyla	Bovidae	<i>Gazella arabica</i>	Arabian gazelle
Artiodactyla	Bovidae	<i>Gazella bennettii</i>	Indian gazelle
Artiodactyla	Bovidae	<i>Gazella cuvieri</i>	Cuvier's gazelle
Artiodactyla	Bovidae	<i>Gazella dorcas</i>	Dorcas gazelle
Artiodactyla	Bovidae	<i>Gazella erlangeri</i>	Neumann's gazelle
Artiodactyla	Bovidae	<i>Gazella gazella</i>	Mountain gazelle
Artiodactyla	Bovidae	<i>Gazella spekei</i>	Speke's gazelle
Artiodactyla	Bovidae	<i>Gazella subgutturosa</i>	Goitered gazelle
Artiodactyla	Bovidae	<i>Hemitragus hylocrius</i>	Nilgiri tahr
Artiodactyla	Bovidae	<i>Hemitragus jakhari</i>	Arabian tahr
Artiodactyla	Bovidae	<i>Hemitragus jemlahicus</i>	Himalayan tahr
Artiodactyla	Bovidae	<i>Hippotragus equinus</i>	Roan antelope

## APPENDIX I.—Continued.

Order	Family	Scientific name	Common name
Artiodactyla	Bovidae	<i>Hippotragus leucophaeus</i>	Blaaubok
Artiodactyla	Bovidae	<i>Hippotragus niger</i>	Sable antelope
Artiodactyla	Bovidae	<i>Kobus ellipsiprymnus</i>	Waterbuck
Artiodactyla	Bovidae	<i>Kobus kob</i>	Kob
Artiodactyla	Bovidae	<i>Kobus leche</i>	Lechwe
Artiodactyla	Bovidae	<i>Kobus megaceros</i>	Nile lechwe
Artiodactyla	Bovidae	<i>Kobus vardonii</i>	Puku
Artiodactyla	Bovidae	<i>Litocranius walleri</i>	Gerenuk
Artiodactyla	Bovidae	<i>Naemorhedus baileyi</i>	Red goral
Artiodactyla	Bovidae	<i>Naemorhedus caudatus</i>	Long-tailed goral
Artiodactyla	Bovidae	<i>Naemorhedus goral</i>	Himalayan goral
Artiodactyla	Bovidae	<i>Naemorhedus griseus</i>	Chinese goral
Artiodactyla	Bovidae	<i>Nanger dama</i>	Dama gazelle
Artiodactyla	Bovidae	<i>Nanger granti</i>	Grant's gazelle
Artiodactyla	Bovidae	<i>Nanger soemmerringii</i>	Soemmerring's gazelle
Artiodactyla	Bovidae	<i>Oreamnos americanus</i>	Mountain goat
Artiodactyla	Bovidae	<i>Oryx beisa</i>	Beisa
Artiodactyla	Bovidae	<i>Oryx dammah</i>	Scimitar-horned oryx
Artiodactyla	Bovidae	<i>Oryx gazella</i>	Gemsbok
Artiodactyla	Bovidae	<i>Oryx leucoryx</i>	Arabian oryx
Artiodactyla	Bovidae	<i>Ourebia ourebi</i>	Oribi
Artiodactyla	Bovidae	<i>Ovibos moschatus</i>	Muskox
Artiodactyla	Bovidae	<i>Ovis ammon</i>	Argali
Artiodactyla	Bovidae	<i>Ovis aries</i>	Red sheep
Artiodactyla	Bovidae	<i>Ovis canadensis</i>	Bighorn sheep
Artiodactyla	Bovidae	<i>Ovis dalli</i>	Dall's sheep
Artiodactyla	Bovidae	<i>Ovis nivicola</i>	Snow sheep
Artiodactyla	Bovidae	<i>Pantholops hodgsonii</i>	Chiru
Artiodactyla	Bovidae	<i>Pelea capreolus</i>	Vaal rhebok
Artiodactyla	Bovidae	<i>Procapra gutturosa</i>	Mongolian gazelle
Artiodactyla	Bovidae	<i>Procapra picticaudata</i>	Tibetan gazelle
Artiodactyla	Bovidae	<i>Procapra przewalskii</i>	Przewalski's gazelle
Artiodactyla	Bovidae	<i>Pseudois nayaur</i>	Bharal
Artiodactyla	Bovidae	<i>Pseudois schaeferi</i>	Dwarf bharal
Artiodactyla	Bovidae	<i>Pseudoryx nghetinhensis</i>	Siola
Artiodactyla	Bovidae	<i>Redunca arundinum</i>	Southern reedbuck
Artiodactyla	Bovidae	<i>Redunca fulvorufula</i>	Mountain reedbuck
Artiodactyla	Bovidae	<i>Redunca redunca</i>	Common reedbuck
Artiodactyla	Bovidae	<i>Rupicapra pyrenaica</i>	Pyrenean chamois
Artiodactyla	Bovidae	<i>Rupicapra rupicapra</i>	Alpine chamois
Artiodactyla	Bovidae	<i>Saiga tatarica</i>	Saiga
Artiodactyla	Bovidae	<i>Syncerus caffer</i>	African buffalo
Artiodactyla	Bovidae	<i>Taurotragus derbianus</i>	Giant eland
Artiodactyla	Bovidae	<i>Taurotragus oryx</i>	Eland
Artiodactyla	Bovidae	<i>Tetracerus quadricornis</i>	Four-horned antelope
Artiodactyla	Bovidae	<i>Tragelaphus angasii</i>	Nyala
Artiodactyla	Bovidae	<i>Tragelaphus buxtoni</i>	Mountain nyala
Artiodactyla	Bovidae	<i>Tragelaphus eurycerus</i>	Bongo
Artiodactyla	Bovidae	<i>Tragelaphus imberbis</i>	Lesser kudu
Artiodactyla	Bovidae	<i>Tragelaphus scriptus</i>	Bushbuck
Artiodactyla	Bovidae	<i>Tragelaphus speki</i>	Sitatunga
Artiodactyla	Bovidae	<i>Tragelaphus strepsiceros</i>	Greater kudu
Artiodactyla	Camelidae	<i>Camelus bactrianus</i>	Bactrian camel
Artiodactyla	Camelidae	<i>Lama glama</i>	Guanaco
Artiodactyla	Camelidae	<i>Vicugna vicugna</i>	Vicugna
Artiodactyla	Cervidae	<i>Alces alces</i>	Moose
Artiodactyla	Cervidae	<i>Axis axis</i>	Chital
Artiodactyla	Cervidae	<i>Axis calamianensis</i>	Calamian deer
Artiodactyla	Cervidae	<i>Axis kuhlii</i>	Bawean deer
Artiodactyla	Cervidae	<i>Axis porcinus</i>	Hog deer
Artiodactyla	Cervidae	<i>Blastocerus dichotomus</i>	Marsh deer
Artiodactyla	Cervidae	<i>Capreolus capreolus</i>	European roe
Artiodactyla	Cervidae	<i>Capreolus pygargus</i>	Siberian roe
Artiodactyla	Cervidae	<i>Cervus elaphus</i>	Elk

## APPENDIX I.—Continued.

Order	Family	Scientific name	Common name
Artiodactyla	Cervidae	<i>Cervus nippon</i>	Sika
Artiodactyla	Cervidae	<i>Dama clactoniana</i>	Mesopotamian fallow deer
Artiodactyla	Cervidae	<i>Dama dama</i>	Fallow deer
Artiodactyla	Cervidae	<i>Elaphodus cephalophus</i>	Tufted deer
Artiodactyla	Cervidae	<i>Elaphurus davidianus</i>	Père David's deer
Artiodactyla	Cervidae	<i>Hippocamelus antisensis</i>	Taruca
Artiodactyla	Cervidae	<i>Hippocamelus bisulcus</i>	Guemal
Artiodactyla	Cervidae	<i>Mazama americana</i>	South American red brocket
Artiodactyla	Cervidae	<i>Mazama bororo</i>	São Paulo bororó
Artiodactyla	Cervidae	<i>Mazama bricenii</i>	Mérida brocket
Artiodactyla	Cervidae	<i>Mazama gouazoubira</i>	South American brown brocket
Artiodactyla	Cervidae	<i>Mazama pandora</i>	Yucatan brown brocket
Artiodactyla	Cervidae	<i>Mazama rufina</i>	Ecuador red brocket
Artiodactyla	Cervidae	<i>Mazama temama</i>	Central American red brocket
Artiodactyla	Cervidae	<i>Muntiacus crinifrons</i>	Black muntjac
Artiodactyla	Cervidae	<i>Muntiacus feae</i>	Fea's muntjac
Artiodactyla	Cervidae	<i>Muntiacus gongshanensis</i>	Gongshan muntjac
Artiodactyla	Cervidae	<i>Muntiacus muntjak</i>	Red muntjac
Artiodactyla	Cervidae	<i>Muntiacus vuquangensis</i>	Large-antlered muntjac
Artiodactyla	Cervidae	<i>Odocoileus hemionus</i>	Mule deer
Artiodactyla	Cervidae	<i>Odocoileus virginianus</i>	White-tailed deer
Artiodactyla	Cervidae	<i>Ozotoceros bezoarticus</i>	Pampas deer
Artiodactyla	Cervidae	<i>Przewalskium albirostris</i>	White-lipped deer
Artiodactyla	Cervidae	<i>Rangifer tarandus</i>	Caribou
Artiodactyla	Cervidae	<i>Rucervus duvaucelii</i>	Barasingha
Artiodactyla	Cervidae	<i>Rucervus eldii</i>	Eld's deer
Artiodactyla	Cervidae	<i>Rucervus schomburgki</i>	Schomburgk's deer
Artiodactyla	Cervidae	<i>Rusa alfredi</i>	Visayan spotted deer
Artiodactyla	Cervidae	<i>Rusa marianna</i>	Philippine deer
Artiodactyla	Cervidae	<i>Rusa timorensis</i>	Javan rusa
Artiodactyla	Cervidae	<i>Rusa unicolor</i>	Sambar
Artiodactyla	Giraffidae	<i>Giraffa camelopardalis</i>	Giraffe
Artiodactyla	Giraffidae	<i>Okapia johnstoni</i>	Okapi
Artiodactyla	Suidae	<i>Babyrousa babyrussa</i>	Babirusa
Artiodactyla	Suidae	<i>Hylochoerus meinertzhageni</i>	Giant forest hog
Artiodactyla	Suidae	<i>Phacochoerus aethiopicus</i>	Desert warthog
Artiodactyla	Suidae	<i>Phacochoerus africanus</i>	Common warthog
Artiodactyla	Suidae	<i>Potamochoerus larvatus</i>	Bushpig
Artiodactyla	Suidae	<i>Potamochoerus porcus</i>	Red river hog
Artiodactyla	Suidae	<i>Sus ahoenobarbus</i>	Palawan bearded pig
Artiodactyla	Suidae	<i>Sus barbatus</i>	Bearded pig
Artiodactyla	Suidae	<i>Sus bucculentus</i>	Heude's pig
Artiodactyla	Suidae	<i>Sus cebifrons</i>	Visayan warty pig
Artiodactyla	Suidae	<i>Sus celebensis</i>	Celebes warty pig
Artiodactyla	Suidae	<i>Sus philippensis</i>	Philippine warty pig
Artiodactyla	Suidae	<i>Sus scrofa</i>	Wild boar
Artiodactyla	Suidae	<i>Sus verrucosus</i>	Java warty pig
Artiodactyla	Tayassuidae	<i>Catagonus wagneri</i>	Chacoan peccary
Artiodactyla	Tayassuidae	<i>Pecari tajacu</i>	Collared peccary
Artiodactyla	Tayassuidae	<i>Tayassu pecari</i>	White-lipped peccary
Carnivora	Canidae	<i>Canis latrans</i>	Coyote
Carnivora	Canidae	<i>Canis lupus</i>	Gray wolf
Carnivora	Canidae	<i>Canis rufus</i>	Red wolf
Carnivora	Canidae	<i>Chrysocyon brachyurus</i>	Maned wolf
Carnivora	Canidae	<i>Cuon alpinus</i>	Dhole
Carnivora	Canidae	<i>Dusicyon australis</i>	Falkland Islands wolf
Carnivora	Canidae	<i>Lycan pictus</i>	African wild dog
Carnivora	Felidae	<i>Acinonyx jubatus</i>	Cheetah
Carnivora	Felidae	<i>Lynx lynx</i>	Eurasian lynx
Carnivora	Felidae	<i>Neofelis nebulosa</i>	Clouded leopard
Carnivora	Felidae	<i>Panthera leo</i>	Lion
Carnivora	Felidae	<i>Panthera onca</i>	Jaguar
Carnivora	Felidae	<i>Panthera pardus</i>	Leopard
Carnivora	Felidae	<i>Panthera tigris</i>	Tiger

## APPENDIX I.—Continued.

Order	Family	Scientific name	Common name
Carnivora	Felidae	<i>Puma concolor</i>	Cougar
Carnivora	Felidae	<i>Uncia uncia</i>	Snow leopard
Carnivora	Hyaenidae	<i>Crocuta crocuta</i>	Spotted hyena
Carnivora	Hyaenidae	<i>Hyaena brunnea</i>	Brown hyena
Carnivora	Hyaenidae	<i>Hyaena hyaena</i>	Striped hyena
Carnivora	Ursidae	<i>Ailuropoda melanoleuca</i>	Giant panda
Carnivora	Ursidae	<i>Helarctos malayanus</i>	Sun bear
Carnivora	Ursidae	<i>Melursus ursinus</i>	Sloth bear
Carnivora	Ursidae	<i>Tremarctos ornatus</i>	Spectacled bear
Carnivora	Ursidae	<i>Ursus americanus</i>	American black bear
Carnivora	Ursidae	<i>Ursus arctos</i>	Brown bear
Carnivora	Ursidae	<i>Ursus thibetanus</i>	Asiatic black bear
Cingulata	Dasypodidae	<i>Priodontes maximus</i>	Giant armadillo
Dasyuromorphia	Thylacinidae	<i>Thylacinus cynocephalus</i>	Thylacine
Diprotodontia	Macropodidae	<i>Macropus agilis</i>	Agile wallaby
Diprotodontia	Macropodidae	<i>Macropus antilopinus</i>	Antilopine wallaroo
Diprotodontia	Macropodidae	<i>Macropus bernardus</i>	Woodward's wallaroo
Diprotodontia	Macropodidae	<i>Macropus dorsalis</i>	Black-striped wallaby
Diprotodontia	Macropodidae	<i>Macropus fuliginosus</i>	Western gray kangaroo
Diprotodontia	Macropodidae	<i>Macropus giganteus</i>	Eastern gray kangaroo
Diprotodontia	Macropodidae	<i>Macropus greyi</i>	Toolache wallaby
Diprotodontia	Macropodidae	<i>Macropus parryi</i>	Pretty-faced wallaby
Diprotodontia	Macropodidae	<i>Macropus robustus</i>	Wallaroo
Diprotodontia	Macropodidae	<i>Macropus rufogriseus</i>	Red-necked wallaby
Diprotodontia	Macropodidae	<i>Macropus rufus</i>	Red kangaroo
Diprotodontia	Macropodidae	<i>Wallabia bicolor</i>	Swamp wallaby
Diprotodontia	Vombatidae	<i>Lasiorhinus krefftii</i>	Northern hairy-nosed wombat
Diprotodontia	Vombatidae	<i>Lasiorhinus latifrons</i>	Southern hairy-nosed wombat
Diprotodontia	Vombatidae	<i>Vombatus ursinus</i>	Common wombat
Perissodactyla	Equidae	<i>Equus asinus</i>	Ass
Perissodactyla	Equidae	<i>Equus burchellii</i>	Burchell's zebra
Perissodactyla	Equidae	<i>Equus caballus</i>	Horse
Perissodactyla	Equidae	<i>Equus grevyi</i>	Grévy's zebra
Perissodactyla	Equidae	<i>Equus hemionus</i>	Onager
Perissodactyla	Equidae	<i>Equus kiang</i>	Kiang
Perissodactyla	Equidae	<i>Equus zebra</i>	Mountain zebra
Perissodactyla	Rhinocerotidae	<i>Ceratotherium simum</i>	White rhinoceros
Perissodactyla	Rhinocerotidae	<i>Dicerorhinus sumatrensis</i>	Sumatran rhinoceros
Perissodactyla	Rhinocerotidae	<i>Diceros bicornis</i>	Black rhinoceros
Perissodactyla	Rhinocerotidae	<i>Rhinoceros sondaicus</i>	Javan rhinoceros
Perissodactyla	Rhinocerotidae	<i>Rhinoceros unicornis</i>	Indian rhinoceros
Perissodactyla	Tapiridae	<i>Tapirus bairdii</i>	Baird's tapir
Perissodactyla	Tapiridae	<i>Tapirus indicus</i>	Malayan tapir
Perissodactyla	Tapiridae	<i>Tapirus pinchaque</i>	Mountain tapir
Perissodactyla	Tapiridae	<i>Tapirus terrestris</i>	South American tapir
Pholidota	Manidae	<i>Manis gigantea</i>	Giant pangolin
Pilosa	Myrmecophagidae	<i>Myrmecophaga tridactyla</i>	Giant anteater
Primates	Cercopithecidae	<i>Mandrillus leucophaeus</i>	Drill
Primates	Cercopithecidae	<i>Mandrillus sphinx</i>	Mandrill
Primates	Cercopithecidae	<i>Papio anubis</i>	Olive baboon
Primates	Cercopithecidae	<i>Papio cynocephalus</i>	Yellow baboon
Primates	Cercopithecidae	<i>Papio hamadryas</i>	Hamadryas baboon
Primates	Cercopithecidae	<i>Papio ursinus</i>	Chacma baboon
Primates	Cercopithecidae	<i>Semnopithecus ajax</i>	Kashmir gray langur
Primates	Cercopithecidae	<i>Semnopithecus dussumieri</i>	Southern plains gray langur
Primates	Cercopithecidae	<i>Semnopithecus entellus</i>	Northern plains gray langur
Primates	Cercopithecidae	<i>Semnopithecus hector</i>	Tarai gray langur
Primates	Cercopithecidae	<i>Semnopithecus priam</i>	Tufted gray langur
Primates	Cercopithecidae	<i>Semnopithecus schistaceus</i>	Nepal gray langur
Primates	Cercopithecidae	<i>Theropithecus gelada</i>	Gelada
Primates	Hominidae	<i>Gorilla beringei</i>	Mountain gorilla
Primates	Hominidae	<i>Gorilla gorilla</i>	Western lowland gorilla
Primates	Hominidae	<i>Pan paniscus</i>	Bonobo
Primates	Hominidae	<i>Pan troglodytes</i>	Chimpanzee

## APPENDIX I.—Continued.

Order	Family	Scientific name	Common name
Primates	Pongidae	<i>Pongo abelii</i>	Sumatran orangutan
Primates	Pongidae	<i>Pongo pygmaeus</i>	Bornean orangutan
Proboscidea	Elephantidae	<i>Elephas maximus</i>	Asiatic elephant
Proboscidea	Elephantidae	<i>Loxodonta africana</i>	African elephant
Rodentia	Caviidae	<i>Hydrochoerus hydrochaeris</i>	Capybara
Rodentia	Hystricidae	<i>Hystrix africae australis</i>	Cape porcupine
Rodentia	Hystricidae	<i>Hystrix cristata</i>	Crested porcupine
Tubulidentata	Orycteropodidae	<i>Orycteropus afer</i>	Aardvark

## APPENDIX II

The species present in the intact large mammal assemblages.

Map no.	Site <sup>a</sup>	Species no.	Scientific name
AA1	Sulawesi	6	<i>Sus barbatus</i> , <i>Rusa unicolor</i> , <i>Bubalus quarlesi</i> , <i>Bubalus depressicornis</i> , <i>Sus celebensis</i> , <i>Babyrousa babyrussa</i>
AA2	Central Australia	7	<i>Macropus agilis</i> , <i>Macropus antilopinus</i> , <i>Macropus bernardus</i> , <i>Macropus fuliginosus</i> , <i>Macropus giganteus</i> , <i>Macropus robustus</i> , <i>Macropus rufus</i>
AA3	Southwestern Australia	1	<i>Macropus fuliginosus</i>
AA4	Southern Australia	4	<i>Macropus fuliginosus</i> , <i>Macropus robustus</i> , <i>Macropus rufus</i> , <i>Lasiorhinus latifrons</i>
AA5	Southeastern Australia	8	<i>Macropus dorsalis</i> , <i>Macropus giganteus</i> , <i>Macropus fuliginosus</i> , <i>Macropus parryi</i> , <i>Macropus robustus</i> , <i>Macropus rufogriseus</i> , <i>Wallabia bicolor</i> , <i>Vombatus ursinus</i>
AT01	Loma Mts.	16	<i>Cephalophus jentinki</i> , <i>Cephalophus silvicultor</i> , <i>Syncerus caffer</i> , <i>Tragelaphus eurycerus</i> , <i>Tragelaphus scriptus</i> , <i>Hylochoerus meinertzhageni</i> , <i>Potamochoerus porcus</i> , <i>Panthera pardus</i> , <i>Papio anubis</i> , <i>Pan troglodytes</i> , <i>Loxodonta africana</i> , <i>Cephalophus dorsalis</i> , <i>Cephalophus niger</i> , <i>Manis gigantea</i> , <i>Hystrix cristata</i>
AT02	Massif du Ziama	12	<i>Cephalophus jentinki</i> , <i>Cephalophus silvicultor</i> , <i>Syncerus caffer</i> , <i>Tragelaphus eurycerus</i> , <i>Tragelaphus scriptus</i> , <i>Panthera pardus</i> , <i>Pan troglodytes</i> , <i>Loxodonta africana</i> , <i>Cephalophus dorsalis</i> , <i>Cephalophus niger</i> , <i>Manis gigantea</i> , <i>Hystrix cristata</i>
AT03	Gola area	15	<i>Cephalophus jentinki</i> , <i>Cephalophus silvicultor</i> , <i>Syncerus caffer</i> , <i>Tragelaphus eurycerus</i> , <i>Tragelaphus scriptus</i> , <i>Hylochoerus meinertzhageni</i> , <i>Potamochoerus porcus</i> , <i>Panthera pardus</i> , <i>Pan troglodytes</i> , <i>Loxodonta africana</i> , <i>Cephalophus dorsalis</i> , <i>Cephalophus niger</i> , <i>Cephalophus brookei</i> , <i>Manis gigantea</i> , <i>Hystrix cristata</i>
AT04	Mount Nimba area	13	<i>Cephalophus silvicultor</i> , <i>Syncerus caffer</i> , <i>Tragelaphus eurycerus</i> , <i>Tragelaphus scriptus</i> , <i>Hylochoerus meinertzhageni</i> , <i>Potamochoerus porcus</i> , <i>Panthera pardus</i> , <i>Pan troglodytes</i> , <i>Loxodonta africana</i> , <i>Cephalophus dorsalis</i> , <i>Cephalophus niger</i> , <i>Manis gigantea</i> , <i>Hystrix cristata</i>
AT05	Sapa-Tai forest area	15	<i>Cephalophus jentinki</i> , <i>Cephalophus silvicultor</i> , <i>Syncerus caffer</i> , <i>Tragelaphus eurycerus</i> , <i>Tragelaphus scriptus</i> , <i>Hylochoerus meinertzhageni</i> , <i>Potamochoerus porcus</i> , <i>Panthera pardus</i> , <i>Pan troglodytes</i> , <i>Loxodonta africana</i> , <i>Cephalophus dorsalis</i> , <i>Cephalophus niger</i> , <i>Cephalophus brookei</i> , <i>Manis gigantea</i> , <i>Hystrix cristata</i>
AT06	Mont Sangbe NP area	11	<i>Cephalophus silvicultor</i> , <i>Syncerus caffer</i> , <i>Tragelaphus eurycerus</i> , <i>Tragelaphus scriptus</i> , <i>Panthera pardus</i> , <i>Pan troglodytes</i> , <i>Loxodonta africana</i> , <i>Cephalophus dorsalis</i> , <i>Cephalophus niger</i> , <i>Manis gigantea</i> , <i>Hystrix cristata</i>
AT07	Mt. Peko NP	13	<i>Cephalophus silvicultor</i> , <i>Syncerus caffer</i> , <i>Tragelaphus eurycerus</i> , <i>Tragelaphus scriptus</i> , <i>Hylochoerus meinertzhageni</i> , <i>Potamochoerus porcus</i> , <i>Panthera pardus</i> , <i>Pan troglodytes</i> , <i>Loxodonta africana</i> , <i>Cephalophus dorsalis</i> , <i>Cephalophus niger</i> , <i>Manis gigantea</i> , <i>Hystrix cristata</i>
AT08	Mt. Tia–Mt. Sassandra	13	<i>Cephalophus silvicultor</i> , <i>Syncerus caffer</i> , <i>Tragelaphus eurycerus</i> , <i>Tragelaphus scriptus</i> , <i>Hylochoerus meinertzhageni</i> , <i>Potamochoerus porcus</i> , <i>Panthera pardus</i> , <i>Pan troglodytes</i> , <i>Loxodonta africana</i> , <i>Cephalophus dorsalis</i> , <i>Cephalophus niger</i> , <i>Manis gigantea</i> , <i>Hystrix cristata</i>
AT09	Duekoue Classified Forest	14	<i>Cephalophus jentinki</i> , <i>Cephalophus silvicultor</i> , <i>Syncerus caffer</i> , <i>Tragelaphus eurycerus</i> , <i>Tragelaphus scriptus</i> , <i>Hylochoerus meinertzhageni</i> , <i>Potamochoerus porcus</i> , <i>Panthera pardus</i> , <i>Pan troglodytes</i> , <i>Loxodonta africana</i> , <i>Cephalophus dorsalis</i> , <i>Cephalophus niger</i> , <i>Manis gigantea</i> , <i>Hystrix cristata</i>
AT10	Marahoue NP	13	<i>Cephalophus silvicultor</i> , <i>Syncerus caffer</i> , <i>Tragelaphus eurycerus</i> , <i>Tragelaphus scriptus</i> , <i>Hylochoerus meinertzhageni</i> , <i>Potamochoerus porcus</i> , <i>Panthera pardus</i> , <i>Pan troglodytes</i> , <i>Loxodonta africana</i> , <i>Cephalophus dorsalis</i> , <i>Cephalophus niger</i> , <i>Manis gigantea</i> , <i>Hystrix cristata</i>
AT11	South-central Ivory Coast forests	13	<i>Cephalophus silvicultor</i> , <i>Syncerus caffer</i> , <i>Tragelaphus eurycerus</i> , <i>Tragelaphus scriptus</i> , <i>Hylochoerus meinertzhageni</i> , <i>Potamochoerus porcus</i> , <i>Panthera pardus</i> , <i>Pan troglodytes</i> , <i>Loxodonta africana</i> , <i>Cephalophus dorsalis</i> , <i>Cephalophus niger</i> , <i>Manis gigantea</i> , <i>Hystrix cristata</i>
AT12	Ghana–Ivory Coast border forests	14	<i>Cephalophus silvicultor</i> , <i>Syncerus caffer</i> , <i>Tragelaphus eurycerus</i> , <i>Tragelaphus scriptus</i> , <i>Hylochoerus meinertzhageni</i> , <i>Potamochoerus porcus</i> , <i>Panthera pardus</i> , <i>Pan troglodytes</i> , <i>Loxodonta africana</i> , <i>Cephalophus dorsalis</i> , <i>Cephalophus niger</i> , <i>Cephalophus brookei</i> , <i>Manis gigantea</i> , <i>Hystrix cristata</i>
AT13	Cross River area	13	<i>Cephalophus silvicultor</i> , <i>Syncerus caffer</i> , <i>Tragelaphus speki</i> , <i>Tragelaphus scriptus</i> , <i>Potamochoerus porcus</i> , <i>Panthera pardus</i> , <i>Gorilla gorilla</i> , <i>Pan troglodytes</i> , <i>Loxodonta africana</i> , <i>Cephalophus dorsalis</i> , <i>Cephalophus ogilbyi</i> , <i>Mandrillus leucophaeus</i>
AT14	Mount Cameroon	12	<i>Cephalophus silvicultor</i> , <i>Syncerus caffer</i> , <i>Tragelaphus speki</i> , <i>Tragelaphus scriptus</i> , <i>Potamochoerus porcus</i> , <i>Panthera pardus</i> , <i>Pan troglodytes</i> , <i>Loxodonta africana</i> , <i>Cephalophus dorsalis</i> , <i>Cephalophus ogilbyi</i> , <i>Mandrillus leucophaeus</i>

## APPENDIX II.—Continued.

Map no.	Site <sup>a</sup>	Species no.	Scientific name
AT15	Bouba Ndjida, Benoue, and Faro NPs	22	<i>Damaliscus lunatus</i> , <i>Hippotragus equinus</i> , <i>Kobus ellipsiprymnus</i> , <i>Kobus kob</i> , <i>Redunca redunca</i> , <i>Syncerus caffer</i> , <i>Taurotragus derbianus</i> , <i>Tragelaphus scriptus</i> , <i>Giraffa camelopardalis</i> , <i>Phacochoerus africanus</i> , <i>Acinonyx jubatus</i> , <i>Panthera leo</i> , <i>Panthera pardus</i> , <i>Crocota crocuta</i> , <i>Diceros bicornis</i> , <i>Papio anubis</i> , <i>Loxodonta africana</i> , <i>Orycteropus afer</i> , <i>Ourebia ourebi</i> , <i>Redunca fulvorufula</i> , <i>Hystrix cristata</i> , <i>Lycaon pictus</i>
AT16	Simien Mts.	8	<i>Capra walie</i> , <i>Tragelaphus scriptus</i> , <i>Phacochoerus africanus</i> , <i>Potamochoerus larvatus</i> , <i>Panthera pardus</i> , <i>Crocota crocuta</i> , <i>Hystrix cristata</i> , <i>Theropithecus gelada</i>
AT17	Bale Mts.	11	<i>Redunca redunca</i> , <i>Tragelaphus buxtoni</i> , <i>Tragelaphus scriptus</i> , <i>Phacochoerus africanus</i> , <i>Potamochoerus larvatus</i> , <i>Panthera leo</i> , <i>Panthera pardus</i> , <i>Crocota crocuta</i> , <i>Papio anubis</i> , <i>Hystrix cristata</i> , <i>Lycaon pictus</i>
AT18	Western Central Africa forest	18	<i>Cephalophus silvicultor</i> , <i>Kobus ellipsiprymnus</i> , <i>Syncerus caffer</i> , <i>Tragelaphus eurycerus</i> , <i>Tragelaphus speki</i> , <i>Tragelaphus scriptus</i> , <i>Hylochoerus meinertzhageni</i> , <i>Phacochoerus africanus</i> , <i>Potamochoerus porcus</i> , <i>Panthera pardus</i> , <i>Gorilla gorilla</i> , <i>Pan troglodytes</i> , <i>Loxodonta africana</i> , <i>Cephalophus callipygus</i> , <i>Cephalophus dorsalis</i> , <i>Cephalophus ogilbyi</i> , <i>Manis gigantea</i> , <i>Mandrillus sphinx</i>
AT19	Central Congo Basin forests	13	<i>Cephalophus silvicultor</i> , <i>Syncerus caffer</i> , <i>Tragelaphus eurycerus</i> , <i>Tragelaphus speki</i> , <i>Okapia johnstoni</i> , <i>Potamochoerus larvatus</i> , <i>Potamochoerus porcus</i> , <i>Panthera pardus</i> , <i>Gorilla beringei</i> , <i>Pan paniscus</i> , <i>Loxodonta africana</i> , <i>Cephalophus dorsalis</i> , <i>Manis gigantea</i>
AT20	Northeastern Congo Basin forests	17	<i>Cephalophus silvicultor</i> , <i>Syncerus caffer</i> , <i>Tragelaphus eurycerus</i> , <i>Tragelaphus scriptus</i> , <i>Tragelaphus speki</i> , <i>Okapia johnstoni</i> , <i>Hylochoerus meinertzhageni</i> , <i>Potamochoerus larvatus</i> , <i>Potamochoerus porcus</i> , <i>Panthera pardus</i> , <i>Papio anubis</i> , <i>Gorilla beringei</i> , <i>Pan troglodytes</i> , <i>Loxodonta africana</i> , <i>Cephalophus dorsalis</i> , <i>Manis gigantea</i> , <i>Hystrix cristata</i>
AT21	Virunga NP	22	<i>Cephalophus silvicultor</i> , <i>Damaliscus lunatus</i> , <i>Kobus ellipsiprymnus</i> , <i>Kobus kob</i> , <i>Redunca redunca</i> , <i>Syncerus caffer</i> , <i>Tragelaphus eurycerus</i> , <i>Tragelaphus scriptus</i> , <i>Tragelaphus speki</i> , <i>Okapia johnstoni</i> , <i>Hylochoerus meinertzhageni</i> , <i>Phacochoerus africanus</i> , <i>Potamochoerus larvatus</i> , <i>Potamochoerus porcus</i> , <i>Panthera leo</i> , <i>Panthera pardus</i> , <i>Papio anubis</i> , <i>Gorilla beringei</i> , <i>Pan troglodytes</i> , <i>Loxodonta africana</i> , <i>Cephalophus dorsalis</i> , <i>Hystrix cristata</i>
AT22	Mathews Range	9	<i>Kobus ellipsiprymnus</i> , <i>Syncerus caffer</i> , <i>Tragelaphus scriptus</i> , <i>Hylochoerus meinertzhageni</i> , <i>Potamochoerus larvatus</i> , <i>Panthera pardus</i> , <i>Equus grevyi</i> , <i>Loxodonta africana</i> , <i>Redunca fulvorufula</i>
AT23	Samburu—Buffalo Springs—Shaba National Reserves	26	<i>Aepyceros melampus</i> , <i>Alcelaphus buselaphus</i> , <i>Kobus ellipsiprymnus</i> , <i>Litocranius walleri</i> , <i>Nanger granti</i> , <i>Oryx beisa</i> , <i>Redunca redunca</i> , <i>Syncerus caffer</i> , <i>Taurotragus oryx</i> , <i>Tragelaphus imberbis</i> , <i>Tragelaphus scriptus</i> , <i>Giraffa camelopardalis</i> , <i>Phacochoerus africanus</i> , <i>Potamochoerus larvatus</i> , <i>Acinonyx jubatus</i> , <i>Panthera leo</i> , <i>Panthera pardus</i> , <i>Crocota crocuta</i> , <i>Hyaena hyaena</i> , <i>Equus burchellii</i> , <i>Equus grevyi</i> , <i>Diceros bicornis</i> , <i>Papio anubis</i> , <i>Loxodonta africana</i> , <i>Orycteropus afer</i> , <i>Lycaon pictus</i>
AT24	Meru NP area	27	<i>Aepyceros melampus</i> , <i>Alcelaphus buselaphus</i> , <i>Kobus ellipsiprymnus</i> , <i>Litocranius walleri</i> , <i>Nanger granti</i> , <i>Oryx beisa</i> , <i>Redunca redunca</i> , <i>Syncerus caffer</i> , <i>Taurotragus oryx</i> , <i>Tragelaphus imberbis</i> , <i>Tragelaphus scriptus</i> , <i>Giraffa camelopardalis</i> , <i>Phacochoerus africanus</i> , <i>Potamochoerus larvatus</i> , <i>Acinonyx jubatus</i> , <i>Panthera leo</i> , <i>Panthera pardus</i> , <i>Crocota crocuta</i> , <i>Hyaena hyaena</i> , <i>Equus burchellii</i> , <i>Equus grevyi</i> , <i>Diceros bicornis</i> , <i>Papio anubis</i> , <i>Loxodonta africana</i> , <i>Orycteropus afer</i> , <i>Papio cynocephalus</i> , <i>Lycaon pictus</i>
AT25	Aberdare Mts.	20	<i>Aepyceros melampus</i> , <i>Cephalophus silvicultor</i> , <i>Redunca redunca</i> , <i>Syncerus caffer</i> , <i>Taurotragus oryx</i> , <i>Tragelaphus eurycerus</i> , <i>Tragelaphus scriptus</i> , <i>Giraffa camelopardalis</i> , <i>Hylochoerus meinertzhageni</i> , <i>Phacochoerus africanus</i> , <i>Potamochoerus larvatus</i> , <i>Hylochoerus meinertzhageni</i> , <i>Phacochoerus africanus</i> , <i>Potamochoerus larvatus</i> , <i>Potamochoerus porcus</i> , <i>Panthera leo</i> , <i>Panthera pardus</i> , <i>Crocota crocuta</i> , <i>Diceros bicornis</i> , <i>Papio anubis</i> , <i>Loxodonta africana</i> , <i>Orycteropus afer</i> , <i>Redunca fulvorufula</i>
AT26	Tsavo NP area	28	<i>Aepyceros melampus</i> , <i>Alcelaphus buselaphus</i> , <i>Kobus ellipsiprymnus</i> , <i>Litocranius walleri</i> , <i>Nanger granti</i> , <i>Oryx beisa</i> , <i>Redunca redunca</i> , <i>Syncerus caffer</i> , <i>Taurotragus oryx</i> , <i>Tragelaphus imberbis</i> , <i>Tragelaphus scriptus</i> , <i>Giraffa camelopardalis</i> , <i>Phacochoerus africanus</i> , <i>Potamochoerus larvatus</i> , <i>Acinonyx jubatus</i> , <i>Panthera leo</i> , <i>Panthera pardus</i> , <i>Crocota crocuta</i> , <i>Hyaena hyaena</i> , <i>Equus burchellii</i> , <i>Diceros bicornis</i> , <i>Papio anubis</i> , <i>Loxodonta africana</i> , <i>Orycteropus afer</i> , <i>Eudorcas thomsonii</i> , <i>Redunca fulvorufula</i> , <i>Papio cynocephalus</i> , <i>Lycaon pictus</i>
AT27	Serengeti Plains	32	<i>Aepyceros melampus</i> , <i>Alcelaphus buselaphus</i> , <i>Connochaetes taurinus</i> , <i>Damaliscus lunatus</i> , <i>Hippotragus equinus</i> , <i>Kobus ellipsiprymnus</i> , <i>Nanger granti</i> , <i>Oryx beisa</i> , <i>Redunca redunca</i> , <i>Syncerus caffer</i> , <i>Taurotragus oryx</i> , <i>Tragelaphus scriptus</i> , <i>Giraffa camelopardalis</i> , <i>Phacochoerus africanus</i> , <i>Potamochoerus larvatus</i> , <i>Acinonyx jubatus</i> , <i>Panthera leo</i> , <i>Panthera pardus</i> , <i>Crocota crocuta</i> , <i>Hyaena hyaena</i> , <i>Equus burchellii</i> , <i>Diceros bicornis</i> , <i>Papio anubis</i> , <i>Loxodonta africana</i> , <i>Orycteropus afer</i> , <i>Eudorcas thomsonii</i> , <i>Ourebia ourebi</i> , <i>Redunca fulvorufula</i> , <i>Hystrix africaeaustralis</i> , <i>Hystrix cristata</i> , <i>Papio cynocephalus</i> , <i>Lycaon pictus</i>

## APPENDIX II.—Continued.

Map no.	Site <sup>a</sup>	Species no.	Scientific name
AT28	Selous Game Reserve	28	<i>Aepyceros melampus</i> , <i>Alcelaphus lichtensteinii</i> , <i>Connochaetes taurinus</i> , <i>Hippotragus niger</i> , <i>Kobus ellipsiprymnus</i> , <i>Kobus vardonii</i> , <i>Redunca arundinum</i> , <i>Redunca redunca</i> , <i>Syncerus caffer</i> , <i>Taurotragus oryx</i> , <i>Tragelaphus scriptus</i> , <i>Tragelaphus strepsiceros</i> , <i>Giraffa camelopardalis</i> , <i>Phacochoerus africanus</i> , <i>Potamochoerus larvatus</i> , <i>Acinonyx jubatus</i> , <i>Panthera leo</i> , <i>Panthera pardus</i> , <i>Crocota crocuta</i> , <i>Equus burchellii</i> , <i>Diceros bicornis</i> , <i>Loxodonta africana</i> , <i>Orycteropus afer</i> , <i>Ourebia ourebi</i> , <i>Hystrix africaeaeaustralis</i> , <i>Hystrix cristata</i> , <i>Papio cynocephalus</i> , <i>Lycaon pictus</i>
AT29	Southern Tanzania and Malawi Mts.	13	<i>Cephalophus spadix</i> , <i>Hippotragus niger</i> , <i>Kobus ellipsiprymnus</i> , <i>Syncerus caffer</i> , <i>Taurotragus oryx</i> , <i>Tragelaphus scriptus</i> , <i>Potamochoerus larvatus</i> , <i>Panthera leo</i> , <i>Panthera pardus</i> , <i>Crocota crocuta</i> , <i>Equus burchellii</i> , <i>Loxodonta africana</i> , <i>Lycaon pictus</i>
AT30	Ruaha NP area	30	<i>Aepyceros melampus</i> , <i>Alcelaphus lichtensteinii</i> , <i>Hippotragus equinus</i> , <i>Hippotragus niger</i> , <i>Kobus ellipsiprymnus</i> , <i>Nanger granti</i> , <i>Redunca arundinum</i> , <i>Redunca redunca</i> , <i>Syncerus caffer</i> , <i>Taurotragus oryx</i> , <i>Tragelaphus imberbis</i> , <i>Tragelaphus scriptus</i> , <i>Tragelaphus strepsiceros</i> , <i>Giraffa camelopardalis</i> , <i>Phacochoerus africanus</i> , <i>Potamochoerus larvatus</i> , <i>Acinonyx jubatus</i> , <i>Panthera leo</i> , <i>Panthera pardus</i> , <i>Crocota crocuta</i> , <i>Hyaena hyaena</i> , <i>Equus burchellii</i> , <i>Diceros bicornis</i> , <i>Loxodonta africana</i> , <i>Orycteropus afer</i> , <i>Ourebia ourebi</i> , <i>Hystrix africaeaeaustralis</i> , <i>Hystrix cristata</i> , <i>Papio cynocephalus</i> , <i>Lycaon pictus</i>
AT31	Kahuzi-Biega NP—upland	14	<i>Cephalophus silvicultor</i> , <i>Syncerus caffer</i> , <i>Tragelaphus eurycerus</i> , <i>Tragelaphus scriptus</i> , <i>Tragelaphus speki</i> , <i>Hylochoerus meinertzhageni</i> , <i>Potamochoerus porcus</i> , <i>Panthera pardus</i> , <i>Gorilla beringei</i> , <i>Pan troglodytes</i> , <i>Loxodonta africana</i> , <i>Cephalophus dorsalis</i> , <i>Manis gigantea</i> , <i>Hystrix africaeaeaustralis</i>
AT32	Luangwa NP area	29	<i>Aepyceros melampus</i> , <i>Alcelaphus lichtensteinii</i> , <i>Connochaetes taurinus</i> , <i>Damaliscus lunatus</i> , <i>Hippotragus equinus</i> , <i>Hippotragus niger</i> , <i>Kobus ellipsiprymnus</i> , <i>Kobus leche</i> , <i>Kobus vardonii</i> , <i>Redunca arundinum</i> , <i>Syncerus caffer</i> , <i>Taurotragus oryx</i> , <i>Tragelaphus scriptus</i> , <i>Tragelaphus speki</i> , <i>Tragelaphus strepsiceros</i> , <i>Giraffa camelopardalis</i> , <i>Phacochoerus africanus</i> , <i>Potamochoerus larvatus</i> , <i>Acinonyx jubatus</i> , <i>Panthera leo</i> , <i>Panthera pardus</i> , <i>Crocota crocuta</i> , <i>Equus burchellii</i> , <i>Diceros bicornis</i> , <i>Papio ursinus</i> , <i>Loxodonta africana</i> , <i>Orycteropus afer</i> , <i>Ourebia ourebi</i> , <i>Hystrix africaeaeaustralis</i> , <i>Lycaon pictus</i>
AT33	Kruger NP area	32	<i>Aepyceros melampus</i> , <i>Alcelaphus lichtensteinii</i> , <i>Connochaetes taurinus</i> , <i>Damaliscus lunatus</i> , <i>Hippotragus equinus</i> , <i>Hippotragus niger</i> , <i>Kobus ellipsiprymnus</i> , <i>Redunca arundinum</i> , <i>Syncerus caffer</i> , <i>Taurotragus oryx</i> , <i>Tragelaphus angasii</i> , <i>Tragelaphus scriptus</i> , <i>Tragelaphus strepsiceros</i> , <i>Giraffa camelopardalis</i> , <i>Phacochoerus africanus</i> , <i>Potamochoerus larvatus</i> , <i>Acinonyx jubatus</i> , <i>Panthera leo</i> , <i>Panthera pardus</i> , <i>Crocota crocuta</i> , <i>Hyaena brunnea</i> , <i>Equus burchellii</i> , <i>Ceratotherium simum</i> , <i>Diceros bicornis</i> , <i>Papio ursinus</i> , <i>Loxodonta africana</i> , <i>Orycteropus afer</i> , <i>Pelea capreolus</i> , <i>Ourebia ourebi</i> , <i>Redunca fulvorufula</i> , <i>Hystrix africaeaeaustralis</i> , <i>Lycaon pictus</i>
AT34	Hwange NP	30	<i>Aepyceros melampus</i> , <i>Alcelaphus buselaphus</i> , <i>Connochaetes taurinus</i> , <i>Damaliscus lunatus</i> , <i>Hippotragus equinus</i> , <i>Hippotragus niger</i> , <i>Kobus ellipsiprymnus</i> , <i>Oryx gazella</i> , <i>Redunca arundinum</i> , <i>Syncerus caffer</i> , <i>Taurotragus oryx</i> , <i>Tragelaphus scriptus</i> , <i>Tragelaphus strepsiceros</i> , <i>Giraffa camelopardalis</i> , <i>Phacochoerus africanus</i> , <i>Potamochoerus larvatus</i> , <i>Acinonyx jubatus</i> , <i>Panthera leo</i> , <i>Panthera pardus</i> , <i>Crocota crocuta</i> , <i>Hyaena brunnea</i> , <i>Equus burchellii</i> , <i>Ceratotherium simum</i> , <i>Diceros bicornis</i> , <i>Papio ursinus</i> , <i>Loxodonta africana</i> , <i>Orycteropus afer</i> , <i>Ourebia ourebi</i> , <i>Hystrix africaeaeaustralis</i> , <i>Lycaon pictus</i>
AT35	Okavango Delta	31	<i>Aepyceros melampus</i> , <i>Alcelaphus buselaphus</i> , <i>Connochaetes taurinus</i> , <i>Damaliscus lunatus</i> , <i>Hippotragus equinus</i> , <i>Hippotragus niger</i> , <i>Kobus ellipsiprymnus</i> , <i>Kobus leche</i> , <i>Oryx gazella</i> , <i>Redunca arundinum</i> , <i>Syncerus caffer</i> , <i>Taurotragus oryx</i> , <i>Tragelaphus scriptus</i> , <i>Tragelaphus speki</i> , <i>Tragelaphus strepsiceros</i> , <i>Giraffa camelopardalis</i> , <i>Phacochoerus africanus</i> , <i>Potamochoerus larvatus</i> , <i>Acinonyx jubatus</i> , <i>Panthera leo</i> , <i>Panthera pardus</i> , <i>Crocota crocuta</i> , <i>Hyaena brunnea</i> , <i>Equus burchellii</i> , <i>Ceratotherium simum</i> , <i>Diceros bicornis</i> , <i>Papio ursinus</i> , <i>Loxodonta africana</i> , <i>Orycteropus afer</i> , <i>Hystrix africaeaeaustralis</i> , <i>Lycaon pictus</i>
AT36	Etosha NP	24	<i>Aepyceros melampus</i> , <i>Alcelaphus buselaphus</i> , <i>Antidorcas marsupialis</i> , <i>Connochaetes taurinus</i> , <i>Hippotragus equinus</i> , <i>Oryx gazella</i> , <i>Taurotragus oryx</i> , <i>Tragelaphus strepsiceros</i> , <i>Giraffa camelopardalis</i> , <i>Phacochoerus africanus</i> , <i>Acinonyx jubatus</i> , <i>Panthera leo</i> , <i>Panthera pardus</i> , <i>Crocota crocuta</i> , <i>Hyaena brunnea</i> , <i>Equus burchellii</i> , <i>Equus zebra</i> , <i>Ceratotherium simum</i> , <i>Diceros bicornis</i> , <i>Papio ursinus</i> , <i>Loxodonta africana</i> , <i>Orycteropus afer</i> , <i>Hystrix africaeaeaustralis</i> , <i>Lycaon pictus</i> (reintroduced)
AT37	Skeleton Coast Game Park	9	<i>Antidorcas marsupialis</i> , <i>Oryx gazella</i> , <i>Giraffa camelopardalis</i> , <i>Panthera leo</i> , <i>Crocota crocuta</i> , <i>Hyaena brunnea</i> , <i>Diceros bicornis</i> , <i>Loxodonta africana</i> , <i>Hystrix africaeaeaustralis</i>
IM01	Western Terai	18	<i>Rhinoceros unicornis</i> , <i>Sus scrofa</i> , <i>Hyaena hyaena</i> , <i>Elephas maximus</i> , <i>Axis porcinus</i> , <i>Recervus duvaucelii</i> , <i>Rusa unicolor</i> , <i>Panthera pardus</i> , <i>Panthera tigris</i> , <i>Capricornis thar</i> , <i>Naemohedus goral</i> , <i>Boselaphus tragocamelus</i> , <i>Melursus ursinus</i> , <i>Ursus thibetanus</i> , <i>Antilope cervicapra</i> , <i>Tetracerus quadricornis</i> , <i>Muntiacus muntjak</i> , <i>Cuon alpinus</i>
IM02	Bangka and Singkep	3	<i>Sus barbatus</i> , <i>Rusa unicolor</i> , <i>Muntiacus muntjak</i>
IM03	Bawean	2	<i>Sus verrucosus</i> , <i>Axis kuhlii</i>

## APPENDIX II.—Continued.

Map no.	Site <sup>a</sup>	Species no.	Scientific name
IM04	Eastern Sabah	8	<i>Pongo pygmaeus</i> , <i>Helarctos malayanus</i> , <i>Bos javanicus</i> , <i>Rusa unicornis</i> , <i>Elaphas maximus</i> , <i>Sus barbatus</i> , <i>Dicerorhinus sumatrensis</i> , <i>Neofelis nebulosa</i>
IM05	Tawi Tawi	1	<i>Sus barbatus</i>
IM06	Palawan	1	<i>Sus ahoenobarbus</i>
IM07	Calamians	2	<i>Axis calamianensis</i> , <i>Sus ahoenobarbus</i>
IM08	Mindanao	2	<i>Rusa marianna</i> , <i>Sus philippensis</i>
IM09	Visayas	4	<i>Sus cebifrons</i> , <i>Rusa alfredi</i> , <i>Rusa marianna</i> , <i>Sus philippensis</i>
IM10	Zambales Mts.	2	<i>Rusa marianna</i> , <i>Sus philippensis</i>
NA01	Southwestern Alaska	7	<i>Canis lupus</i> , <i>Alces alces</i> , <i>Rangifer tarandus</i> , <i>Ursus arctos</i> , <i>Ursus americanus</i> , <i>Ovis dalli</i> , <i>Canis latrans</i>
NA02	Seward Peninsula	7	<i>Canis lupus</i> , <i>Alces alces</i> , <i>Rangifer tarandus</i> , <i>Ursus arctos</i> , <i>Ursus americanus</i> , <i>Ovibos moschatus</i> , <i>Canis latrans</i>
NA03	Northwestern Arctic coastal plain	8	<i>Canis lupus</i> , <i>Alces alces</i> , <i>Rangifer tarandus</i> , <i>Ursus arctos</i> , <i>Ursus americanus</i> , <i>Ovibos moschatus</i> , <i>Ovis dalli</i> , <i>Canis latrans</i>
NA04	North-central Canada	7	<i>Canis lupus</i> , <i>Alces alces</i> , <i>Rangifer tarandus</i> , <i>Ursus arctos</i> , <i>Ursus americanus</i> , <i>Ovibos moschatus</i> , <i>Canis latrans</i>
NA05	Arctic Canadian Islands	3	<i>Canis lupus</i> , <i>Ovibos moschatus</i> , <i>Rangifer tarandus</i>
NA06	Eastern Canada	5	<i>Canis lupus</i> , <i>Rangifer tarandus</i> , <i>Ursus americanus</i> , <i>Alces alces</i> , <i>Canis latrans</i>
NA07	Western Greenland	2	<i>Canis lupus</i> , <i>Rangifer tarandus</i>
NA08	Northeastern Pacific rain forest	9	<i>Canis lupus</i> , <i>Alces alces</i> , <i>Odocoileus hemionus</i> , <i>Rangifer tarandus</i> , <i>Ursus arctos</i> , <i>Ursus americanus</i> , <i>Oreamnos americanus</i> , <i>Puma concolor</i> , <i>Canis latrans</i>
NA09	Greater Yellowstone	13	<i>Canis lupus</i> , <i>Alces alces</i> , <i>Odocoileus hemionus</i> , <i>Odocoileus virginianus</i> , <i>Ursus arctos</i> , <i>Ursus americanus</i> , <i>Puma concolor</i> , <i>Cervus elaphus</i> , <i>Bison bison</i> , <i>Oreamnos americanus</i> , <i>Ovis canadensis</i> , <i>Antilocapra americana</i> , <i>Canis latrans</i>
NT01	Northern Sierra Madre	5	<i>Odocoileus virginianus</i> , <i>Puma concolor</i> , <i>Panthera onca</i> , <i>Pecari tajacu</i> , <i>Canis latrans</i>
NT02	Meseta de Cacaxtla	5	<i>Odocoileus virginianus</i> , <i>Puma concolor</i> , <i>Panthera onca</i> , <i>Pecari tajacu</i> , <i>Canis latrans</i>
NT03	Coastal Jalisco	5	<i>Odocoileus virginianus</i> , <i>Puma concolor</i> , <i>Panthera onca</i> , <i>Pecari tajacu</i> , <i>Canis latrans</i>
NT04	Sierra Orizaba	5	<i>Odocoileus virginianus</i> , <i>Puma concolor</i> , <i>Panthera onca</i> , <i>Pecari tajacu</i> , <i>Canis latrans</i>
NT05	Sierra Tamaulipas	5	<i>Odocoileus virginianus</i> , <i>Puma concolor</i> , <i>Panthera onca</i> , <i>Pecari tajacu</i> , <i>Canis latrans</i>
NT06	Northern Central America	8	<i>Odocoileus virginianus</i> , <i>Puma concolor</i> , <i>Panthera onca</i> , <i>Tapirus bairdii</i> , <i>Tayassu pecari</i> , <i>Hydrochoerus hydrochaeris</i> , <i>Mazama pandora</i> , <i>Pecari tajacu</i> , <i>Canis latrans</i>
NT07	Southern Central America	8	<i>Odocoileus virginianus</i> , <i>Puma concolor</i> , <i>Panthera onca</i> , <i>Tapirus bairdii</i> , <i>Tayassu pecari</i> , <i>Mazama temama</i> , <i>Pecari tajacu</i> , <i>Myrmecophaga tridactyla</i> , <i>Canis latrans</i>
NT08	Amazon—Orinoco	10	<i>Odocoileus virginianus</i> , <i>Puma concolor</i> , <i>Panthera onca</i> , <i>Tapirus terrestris</i> , <i>Tayassu pecari</i> , <i>Hydrochoerus hydrochaeris</i> , <i>Priodontes maximus</i> , <i>Mazama gouazoubira</i> , <i>Mazama americana</i> , <i>Pecari tajacu</i>
NT09	Sechura and Atacama Desert, Chilean Mataral, Andean	5	<i>Odocoileus virginianus</i> , <i>Puma concolor</i> , <i>Hippocamelus antisensis</i> , <i>Lama glama</i> , <i>Vicugna vicugna</i>
NT10	Manu—Madidi—Ambo	12	<i>Odocoileus virginianus</i> , <i>Puma concolor</i> , <i>Panthera onca</i> , <i>Tapirus terrestris</i> , <i>Tayassu pecari</i> , <i>Hydrochoerus hydrochaeris</i> , <i>Priodontes maximus</i> , <i>Hippocamelus antisensis</i> , <i>Tremarctos ornatus</i> , <i>Lama glama</i> , <i>Mazama gouazoubira</i> , <i>Myrmecophaga tridactyla</i>
NT11	Chiquitania—Pantanal—Chaco	14	<i>Puma concolor</i> , <i>Panthera onca</i> , <i>Tapirus terrestris</i> , <i>Catagonus wagneri</i> , <i>Tayassu pecari</i> , <i>Hydrochoerus hydrochaeris</i> , <i>Priodontes maximus</i> , <i>Ozotoceros bezoarticus</i> , and <i>Blastocerus dichotomus</i> ; <i>Mazama gouazoubira</i> , <i>Mazama americana</i> , <i>Pecari tajacu</i> , <i>Myrmecophaga tridactyla</i> , <i>Chrysocyon brachyurus</i>
NT12	Das Emas	13	<i>Puma concolor</i> , <i>Panthera onca</i> , <i>Tapirus terrestris</i> , <i>Tayassu pecari</i> , <i>Hydrochoerus hydrochaeris</i> , <i>Priodontes maximus</i> , <i>Ozotoceros bezoarticus</i> , <i>Blastocerus dichotomus</i> , <i>Mazama gouazoubira</i> , <i>Mazama americana</i> , <i>Pecari tajacu</i> , <i>Myrmecophaga tridactyla</i> , <i>Chrysocyon brachyurus</i>
NT13	Urucui—Una	12	<i>Puma concolor</i> , <i>Panthera onca</i> , <i>Tapirus terrestris</i> , <i>Tayassu pecari</i> , <i>Hydrochoerus hydrochaeris</i> , <i>Priodontes maximus</i> , <i>Ozotoceros bezoarticus</i> , <i>Mazama gouazoubira</i> , <i>Mazama americana</i> , <i>Pecari tajacu</i> , <i>Myrmecophaga tridactyla</i> , <i>Chrysocyon brachyurus</i>
NT14	Chuquisaca southern Andean Yungas	11	<i>Puma concolor</i> , <i>Panthera onca</i> , <i>Tapirus terrestris</i> , <i>Tayassu pecari</i> , <i>Priodontes maximus</i> , <i>Hippocamelus antisensis</i> , <i>Tremarctos ornatus</i> , <i>Lama glama</i> , <i>Mazama gouazoubira</i> , <i>Pecari tajacu</i> , <i>Myrmecophaga tridactyla</i>
NT15	Calilegua and environs	8	<i>Lama glama</i> , <i>Puma concolor</i> , <i>Panthera onca</i> , <i>Hippocamelus antisensis</i> , <i>Tapirus terrestris</i> , <i>Mazama gouazoubira</i> , <i>Pecari tajacu</i> , <i>Myrmecophaga tridactyla</i>
NT16	Ilhas e Varzea do Rio Parana	11	<i>Puma concolor</i> , <i>Panthera onca</i> , <i>Tapirus terrestris</i> , <i>Tayassu pecari</i> , <i>Hydrochoerus hydrochaeris</i> , <i>Priodontes maximus</i> , <i>Ozotoceros bezoarticus</i> , <i>Mazama gouazoubira</i> , <i>Mazama americana</i> , <i>Myrmecophaga tridactyla</i> , <i>Chrysocyon brachyurus</i>
NT17	Southwestern Patagonia	2	<i>Puma concolor</i> , <i>Hippocamelus bisulcus</i>
NT18	Nuble	2	<i>Puma concolor</i> , <i>Hippocamelus bisulcus</i>
NT19	Tierra del Fuego	1	<i>Lama glama</i>

## APPENDIX II.—Continued.

Map no.	Site <sup>a</sup>	Species no.	Scientific name
PA01	Hauts de Chartreuse Nature Reserve area	8	<i>Canis lupus</i> , <i>Capreolus pygargus</i> , <i>Cervus elaphus</i> , <i>Rupicapra rupicapra</i> , <i>Sus scrofa</i> , <i>Ursus arctos</i> , <i>Capreolus capreolus</i> , <i>Lynx lynx</i>
PA02	Montenegro and Albania border mts.	8	<i>Canis lupus</i> , <i>Capreolus pygargus</i> , <i>Cervus elaphus</i> , <i>Rupicapra rupicapra</i> , <i>Sus scrofa</i> , <i>Ursus arctos</i> , <i>Capreolus capreolus</i> , <i>Lynx lynx</i>
PA03	Mavrovo NP area	8	<i>Canis lupus</i> , <i>Capreolus pygargus</i> , <i>Cervus elaphus</i> , <i>Rupicapra rupicapra</i> , <i>Sus scrofa</i> , <i>Ursus arctos</i> , <i>Capreolus capreolus</i> , <i>Lynx lynx</i>
PA04	Bosnia and Herzegovina Mts.	8	<i>Canis lupus</i> , <i>Capreolus pygargus</i> , <i>Cervus elaphus</i> , <i>Rupicapra rupicapra</i> , <i>Sus scrofa</i> , <i>Ursus arctos</i> , <i>Capreolus capreolus</i> , <i>Lynx lynx</i>
PA05	Bulgaria southwestern Mts.	8	<i>Canis lupus</i> , <i>Capreolus pygargus</i> , <i>Cervus elaphus</i> , <i>Rupicapra rupicapra</i> , <i>Sus scrofa</i> , <i>Ursus arctos</i> , <i>Capreolus capreolus</i> , <i>Lynx lynx</i>
PA06	Bulgaria central mts.	8	<i>Canis lupus</i> , <i>Capreolus pygargus</i> , <i>Cervus elaphus</i> , <i>Rupicapra rupicapra</i> , <i>Sus scrofa</i> , <i>Ursus arctos</i> , <i>Capreolus capreolus</i> , <i>Lynx lynx</i>
PA07	Finland and Russia border	9	<i>Alces alces</i> , <i>Capreolus pygargus</i> , <i>Cervus elaphus</i> , <i>Rangifer tarandus</i> , <i>Sus scrofa</i> , <i>Canis lupus</i> , <i>Ursus arctos</i> , <i>Capreolus capreolus</i> , <i>Lynx lynx</i>
PA08	Western Black Sea	7	<i>Cervus elaphus</i> , <i>Rupicapra rupicapra</i> , <i>Sus scrofa</i> , <i>Ursus arctos</i> , <i>Canis lupus</i> , <i>Capreolus capreolus</i> , <i>Lynx lynx</i>
PA09	Turkish Caucasus	9	<i>Cervus elaphus</i> , <i>Capra hircus</i> , <i>Rupicapra rupicapra</i> , <i>Sus scrofa</i> , <i>Ursus arctos</i> , <i>Canis lupus</i> , <i>Panthera pardus</i> , <i>Capreolus capreolus</i> , <i>Lynx lynx</i>
PA10	Mus—Simak—Van	11	<i>Capra hircus</i> , <i>Ovis musimom</i> , <i>Sus scrofa</i> , <i>Ursus arctos</i> , <i>Canis lupus</i> , <i>Hyaena brunnea</i> , <i>Panthera pardus</i> , <i>Panthera tigris</i> , <i>Gazella subgutturosa</i> , <i>Ovis aries</i> , <i>Capreolus capreolus</i> , <i>Lynx lynx</i>
PA11	Siberia	7	<i>Ursus arctos</i> , <i>Canis lupus</i> , <i>Rangifer tarandus</i> , <i>Alces alces</i> , <i>Cervus elaphus</i> , <i>Capreolus pygargus</i> , <i>Ovis nivicola</i>
PA12	Novaya Zemlya	1	<i>Rangifer tarandus</i>
PA13	Ostrov Bol'shevik	1	<i>Rangifer tarandus</i>
PA14	Novosibirskiye Ostrova	1	<i>Rangifer tarandus</i>
PA15	Southern Kamchatka	5	<i>Canis lupus</i> , <i>Ursus arctos</i> , <i>Rangifer tarandus</i> , <i>Ovis nivicola</i> , <i>Lynx lynx</i>
PA16	Sakhalin	3	<i>Rangifer tarandus</i> , <i>Canis lupus</i> , <i>Ursus arctos</i>
PA17	Russian Maritime	12	<i>Ursus thibetanus</i> , <i>Ursus arctos</i> , <i>Naemorhedus caudatus</i> , <i>Cervus nippon</i> , <i>Panthera tigris</i> , <i>Alces alces</i> , <i>Cervus elaphus</i> , <i>Capreolus pygargus</i> , <i>Panthera pardus</i> , <i>Canis lupus</i> , <i>Sus Scrofa</i> , <i>Lynx lynx</i>
PA18	Himalayas	34	<i>Equus kiang</i> , <i>Canis lupus</i> , <i>Cervus elaphus</i> , <i>Uncia uncia</i> , <i>Capra sibirica</i> , <i>Ursus thibetanus</i> , <i>Ursus arctos</i> , <i>Pseudois nayaur</i> , <i>Ovis aries</i> , <i>Ovis ammon</i> , <i>Naemorhedus goral</i> , <i>Naemorhedus griseus</i> , <i>Hemitragus jemlahicus</i> , <i>Capricornis thar</i> , <i>Capricornis sumatraensis</i> , <i>Panthera pardus</i> , <i>Hyaena hyaena</i> , <i>Sus scrofa</i> , <i>Rusa unicolor</i> , <i>Elaphodus cephalophus</i> , <i>Ailuropoda melanoleuca</i> , <i>Budorcas taxicolor</i> , <i>Pantholops hodgsonii</i> , <i>Procapra picticaudata</i> , <i>Ovis aries</i> , <i>Muntiacus gongshanensis</i> , <i>Muntiacus muntjak</i> , <i>Semnopithecus schistaceus</i> , <i>Semnopithecus hector</i> , <i>Semnopithecus ajax</i> , <i>Cuon alpinus</i> , <i>Neofelis nebulosa</i> , <i>Lynx lynx</i>
PA19	Eastern Kashmir	12	<i>Equus kiang</i> , <i>Canis lupus</i> , <i>Uncia uncia</i> , <i>Capra sibirica</i> , <i>Ovis ammon</i> , <i>Ovis aries</i> , <i>Pseudois nayaur</i> , <i>Capra falconeri</i> , <i>Bos grunniens</i> , <i>Ursus arctos</i> , <i>Procapra picticaudata</i> , <i>Cuon alpinus</i> , <i>Lynx lynx</i>
PA20	Kangrinboqe Feng	11	<i>Equus kiang</i> , <i>Canis lupus</i> , <i>Cervus elaphus</i> , <i>Uncia uncia</i> , <i>Ovis ammon</i> , <i>Pseudois nayaur</i> , <i>Bos grunniens</i> , <i>Ursus arctos</i> , <i>Pantholops hodgsonii</i> , <i>Procapra picticaudata</i> , <i>Lynx lynx</i>
PA21	Tibetan Plateau	11	<i>Equus kiang</i> , <i>Canis lupus</i> , <i>Cervus elaphus</i> , <i>Uncia uncia</i> , <i>Ursus arctos</i> , <i>Pseudois nayaur</i> , <i>Ovis ammon</i> , <i>Bos grunniens</i> , <i>Pantholops hodgsonii</i> , <i>Procapra picticaudata</i> , <i>Lynx lynx</i>
PA22	Bayan Har Shan	13	<i>Capreolus pygargus</i> , <i>Canis lupus</i> , <i>Cervus elaphus</i> , <i>Przewalskium albirostris</i> , <i>Elaphodus cephalophus</i> , <i>Ursus arctos</i> , <i>Uncia uncia</i> , <i>Capricornis sumatraensis</i> , <i>Naemorhedus griseus</i> , <i>Ovis ammon</i> , <i>Pseudois nayaur</i> , <i>Procapra picticaudata</i> , <i>Lynx lynx</i>
PA23	Anyemaqen Shan	16	<i>Equus kiang</i> , <i>Cervus elaphus</i> , <i>Capreolus pygargus</i> , <i>Canis lupus</i> , <i>Przewalskium albirostris</i> , <i>Ursus arctos</i> , <i>Uncia uncia</i> , <i>Ovis ammon</i> , <i>Pseudois nayaur</i> , <i>Ovis ammon</i> , <i>Capricornis sumatraensis</i> , <i>Naemorhedus griseus</i> , <i>Elaphodus cephalophus</i> , <i>Procapra picticaudata</i> , <i>Lynx lynx</i>
PA24	Ganligahai-zecha	10	<i>Capreolus pygargus</i> , <i>Canis lupus</i> , <i>Cervus elaphus</i> , <i>Przewalskium albirostris</i> , <i>Uncia uncia</i> , <i>Capricornis sumatraensis</i> , <i>Naemorhedus griseus</i> , <i>Ovis ammon</i> , <i>Pseudois nayaur</i> , <i>Lynx lynx</i>
PA25	Southern Gansu	8	<i>Sus scrofa</i> , <i>Capreolus pygargus</i> , <i>Canis lupus</i> , <i>Panthera pardus</i> , <i>Cervus elaphus</i> , <i>Naemorhedus griseus</i> , <i>Pseudois nayaur</i> , <i>Lynx lynx</i>
PA26	Northern Yunnan	11	<i>Canis lupus</i> , <i>Ursus thibetanus</i> , <i>Pseudois nayaur</i> , <i>Naemorhedus griseus</i> , <i>Capricornis sumatraensis</i> , <i>Panthera pardus</i> , <i>Sus scrofa</i> , <i>Rusa unicolor</i> , <i>Elaphodus cephalophus</i> , <i>Muntiacus muntjak</i> , <i>Lynx lynx</i>
PA27	Central Taiwan	5	<i>Capricornis swinhoei</i> , <i>Sus scrofa</i> , <i>Ursus thibetanus</i> , <i>Rusa unicolor</i> , <i>Neofelis nebulosa</i>
PA28	Hainan	4	<i>Sus scrofa</i> , <i>Ursus thibetanus</i> , <i>Rusa unicolor</i> , <i>Muntiacus muntjak</i>

<sup>a</sup> NP = National Park; Mt. = mountain.