Comparison of national wildlife management strategies: What works where, and why?

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Executive Summary

Worldwide, 50% of large mammals are in decline as a result of habitat loss and overexploitation, among other threats. To protect large wildlife, we must identify which management strategies best conserve their populations. Management strategies differ in their regulation of hunting, ownership of wildlife, funding mechanisms, and the biological and socio-political contexts in which they operate. These cross-country differences are so vast that few have undertaken the task of comparing wildlife management strategies on a global scale. This broad comparison speaks to the question of, "What works where, and why?" for wildlife conservation.

To answer this question for policymakers and wildlife managers, we conduct a comparative analysis of three distinct "models" of wildlife management found worldwide: the North American Model, the Southern African Model, and the No-Hunting Model. This report conceptualizes, compares and ranks these models based upon their performance, using measurable indicators and also highlighting differences in context. We considered a model to be successful if it sustains and/or increases wildlife populations, generates high revenues compared to costs, and provides benefits to local people living near conservation areas.

Table 1: Summary of three wildlife management models

	North American	**Southern African**	**No-Hunting (Kenya & India)**
Wildlife ownership	Public	Private	Government
Wildlife conservation funding	1. Sport hunting (US) 2. Public Taxes (Canada)	1. Eco-tourism 2. Sport Hunting	1. Eco-tourism

To understand these models within such a large scope, we conducted an exhaustive literature review, citing over 280 articles of primarily peer-reviewed literature and government reports. Using this research, we compared the models across four categories: wildlife population trends, economics, social support for conservation, and protected area coverage. Next, from each category, we identified measurable indicators of model performance (e.g. for economics: %GDP contribution from wildlife-related tourism). Finally, in order to compare the model performance in a concise and simplified manner, we selected one indicator per category that best exemplified model performance. Our final output is a "Model Performance" table, which shows each country's ranking per the given indicator per a color-coding scheme (green = high, gray = medium, yellow = low).

Fig. 2: **Model Performance:**

Model	Country	Wildlife	Economics	Social benefits	Protected Area Coverage	Sources
North American	United States					Organ et al. 2012
	Canada					
Southern African	South Africa					Reid et al. 2004
	Tanzania					USAID 2012
No-Hunting	Kenya					UNDP 2012
	India					SANEI 2004, Sekhar 2003

The North American Model exhibits generally high performance for ecological, economic, and social goals. Most of the wildlife included in this analysis currently have stable populations. A dedicated federal funding mechanism in the US ensures that a majority of wildlife management costs are covered by excise taxes, paid by hunters and anglers. Furthermore, the public trust doctrine provides all North Americans the opportunity to participate in nature-related activities.

Conditions which enable the North American model to succeed include participation in hunting, public access to wildlife, and enforced hunting regulations. A threat to the model is privatization of wildlife and land, as it runs counter to the principles of the public trust doctrine. In addition, non-consumptive users don't directly pay for conservation the same way that consumptive users do. This may compromise the sustainability of the model's funding source if participation in hunting declines, particularly in the US. To strengthen the North American model, a funding mechanism that targets non-consumptive wildlife users should be established at the federal level.

The Southern African Model has been successful economically and to some extent socially, but many wildlife populations are in decline. Tourism and trophy hunting generate reliable funding sources which are then invested into wildlife conservation efforts. National-level policies empower individuals and local communities with ownership and/or rights over the management of wildlife, enabling them to benefit from the existing opportunities in the tourism industry. The existing markets for wildlife use (e.g. live trade, hunting, tourism) create incentives among private landowners and communities for sustainable management schemes. In many cases, this has encouraged species reintroductions, recovering depleted wildlife populations.

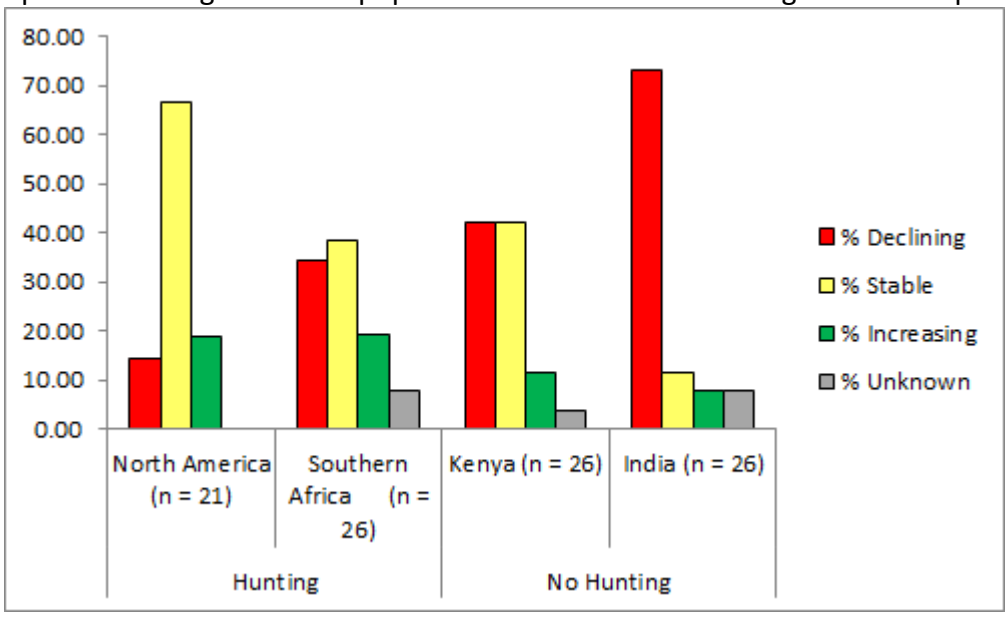
Despite these recoveries, a number of challenges remain. Increases in population density have led to increases in human-wildlife conflict, particularly between pastoralists and carnivores. Heavy poaching has decimated many wildlife populations, and many iconic species are in decline. To strengthen the model and stabilize wildlife populations, Southern African countries must find ways to further incentivize conservation, by establishing and clarifying laws regarding benefit-sharing with local communities, and by making wildlife worth more alive than dead.

The No-Hunting Model, characterized by government ownership of wildlife and its reliance on tourism for external funding, generally exhibits low performance in this assessment. Most of Kenya

and India's large wildlife species are in decline (see Figure 3 for the results of our wildlife analysis). Economically, the No-Hunting model has not proven to be self-sustaining; funding for wildlife conservation depends on fluctuating tourism revenues, which cover only about half of operating costs, on average. Government subsidies must cover the remaining costs. Neither Kenya nor India has national-level policies in place that ensure that wildlife's benefits are shared with local communities; wildlife tourism revenues generally remain in the hands of the government and the tourism operators.

To be successful, this model requires strong institutions that enforce wildlife laws, as there are few positive incentives for individuals to conserve wildlife. To provide a lucrative and sustainable funding source, governments must regulate and develop the tourism industry. Finally, in the face of further human population growth, the model must find ways to ensure benefit sharing with the people who live most closely with wildlife.

Fig. 3: Comparison among models of population trends of selected large mammal species.



'n' represents the number of species included in the analysis. There is no significant difference between the Hunting Models and No-Hunting Model in terms of the percent of large mammal species in decline (paired t-test, p = 0.46, t = 1.3010, df = 1, standard error of difference = 25.550). See Appendix III for full list of species. Source: IUCN 2012.

Conclusion: None of these wildlife management models is perfect, and each country faces a unique set of challenges to conserving its wildlife. Yet, comparing these country's achievements in wildlife management, while acknowledging differences in contexts, offers a valuable lesson in "what works, where, and why" for wildlife management strategies. Future research could build upon this report by examining how successful components of a model could be "scaled up" or transferred to different regions.

The future of wildlife hinges on our ability to conserve populations and habitat while balancing the needs of peoples and economies. We hope that this report offers useful knowledge for policy makers, who will work to address this challenge in policy and practice to ensure sustainable wildlife management.

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List of Tables and Figures

LIST OF ABBREVIATIONS & DEFINITIONS

CAMPFIRE: Communal Area Management Program for Indigenous Resources
CBD: Convention on Biological Diversity
CIA: Central Intelligence Agency
CITES: Convention on the International Trade in Endangered Species
EC: Environment Canada
DEA: Department of Environmental Affairs
ESA: Endangered Species Act
GOI: Government of India
GOK: Government Kenya
IUCN: International Union on the Conservation of Nature
KWS: Kenya Wildlife Services
MNRT: Ministry of Natural Resources and Tourism
MoEF: Ministry of Environment and Forests
SARA: Species at Risk Act
TOPS: Threatened or Protected Species
USA: United States of America
USFWS: United States Fish and Wildlife Service
WDPA: World Database of Protected Areas
WTTC: World Travel and Tourism Council

Consumptive Use of wildlife = Hunting (subsistence and commercial), live or dead sale for meat
Non-consumptive Use of wildlife = Recreation, tourism, wildlife-viewing

Introduction

Worldwide, over 50% of all large mammal species are in decline, and 25% face extinction (Channell and Lomolino 2000, Ceballos et al. 2005). Although threats to wildlife differ by region, habitat loss and overexploitation are the most prominent (Ceballos et al. 2005, Pimm and Raven 2000). Human populations and settlements are expanding, edging out wildlife in the few places they still thrive. Large mammals are particularly threatened due to their need for expansive habitats and abundant food sources (Rondinini et al. 2011). These large, charismatic mammals, however, are often the species that attract the most conservation efforts, media attention (Redford et al. 2011). This begs the question: if we cannot conserve the most beloved species, what can we conserve?

To protect large wildlife, we must identify which management strategies best conserve their populations. Management strategies differ in their regulation of subsistence and commercial hunting, private versus public or government ownership of wildlife, funding mechanisms, and the biological and socio-political contexts in which they operate. These cross-country differences are so vast that few have undertaken the task of comparing wildlife management strategies on a global scale. This type of broad comparison speaks to the question of, "What works where, and why?" regarding wildlife conservation, which allows for the exchange of ideas between countries. Which wildlife management strategies increase wildlife populations, and which generate the most economic returns for their country? What political and economic institutions enable the sustainability of these benefits? With this question in mind, we conducted a comparative analysis of three broad general strategies of wildlife management:

1) **North American** (U.S. and Canada),
   - also used (in part) in Australia and Europe
2) **Southern African** (South Africa, Tanzania)
   - also used in Mozambique, Namibia, Zimbabwe, and Zambia
3) **No-Hunting** (Kenya and India).
   - also used in Botswana, Costa Rica

We considered the three pillars of sustainability to create the framework of this report. A successful model of wildlife management generates positive outcomes for people and wildlife. In other words, we considered a model to be successful if it sustains and/or increases wildlife populations, generates high revenues compared to costs, and provides benefits to local people living near conservation areas. Additionally, we compared conservation policies and protected area coverage among models to provide the context of each model's institutional support of wildlife and habitat conservation. We also examined three case studies of megafauna to

demonstrate how each model contributes to the species' conservation and to the country's economy. We present these models individually and comparatively in this report.

This report offers a novel comparison of national wildlife management strategies on a global scale. With the exception of North American model, these models have not been conceptualized nor compared in the literature until now. Our objective is to increase policymakers' and wildlife managers' awareness of the similarities, differences, and benefits for large wildlife and human communities among the three models.

The Wildlife Management Models

This report focuses on three broad models of wildlife management, each with different strategies for ownership, funding sources, and wildlife utilization laws. Although each model has fundamental contextual differences, we are still able to compare them based on simplified, measurable outcomes, such as wildlife trends and economic revenues. We are also able to describe each model's relative strengths and weaknesses. However, making recommendations regarding the interchangeability of the three models (eg. transferring one particularly successful component from one model to another) is beyond the scope of this report.

In general, Asia's model is characterized by state or governmental ownership, and Africa's by community-ownership of land by large private or corporate holdings (also common in Latin America). In contrast, North American model is characterized by public ownership of wildlife.

Table 1: Summary of three wildlife management models

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***The North American model** of wildlife conservation is characterized by public ownership of wildlife and a **"user pay, user benefit"** system in which hunters and anglers contribute to funding for wildlife conservation. This model is credited with success as it generates millions of dollars each year for conservation and local economies, promotes public interest in wildlife, and promotes stable populations of wildlife (Geist et al. 2001).

***The Southern African model** of wildlife management centers on the **privatization and commercialization** of wildlife resources, with devolution of rights over wildlife to private landowners and local communities. The model finds its success in its ability to simultaneously benefit wildlife populations and local communities, which are able to capitalize on the booming consumptive and non-consumptive tourism industry in Africa.

***The No-Hunting model** is characterized by a **complete ban on commercial hunting** (with minor exceptions for subsistence), and a **reliance on tourism revenues and government subsidies** to cover operating costs for wildlife conservation. The two main arguments made in support of the No-Hunting model state that hunting wildlife 1) harms wildlife populations, and 2) is unethical. Wildlife, both dead and alive, is owned entirely by the state.

Methods

We conducted an extensive review of the literature regarding wildlife management models, contextual difference among models, and outcomes for people and wildlife. We cited over 280 documents and reviewed many more. We relied primarily on government and peer-reviewed literature, but also collected data from white, grey, and popular literature. We present results in this report for each country and model individually.

Within the literature review, we collected data on the historical context and wildlife policies of each model, in order to provide the background and storyline of each model's development. Although we did not utilize this research to compare among models in a quantitative manner, these stories help to explain how and why each model of wildlife management developed, and how it has since evolved. We identified key legislation affecting wildlife conservation in each country, and tied these policies into the history of the model. With few exceptions, all countries mentioned are signatories to several international conservation laws, including the Convention on Biological Diversity (except USA), CITES, Kyoto Protocol (except USA), and the International Whaling Convention, indicating a commitment to international biodiversity conservation.

With this research in hand, we conducted a 'Quadruple Bottom Line Analysis' in which we ranked the performance of each model of wildlife management within four categories: wildlife, economics, social support for conservation, and protected area coverage.

Within these categories, we selected a suite of indicators (over 30 in total) that could be quantified and compared among models. Additionally, we researched the historical and political contexts of each model to provide a background. A brief list of indicators is below. See Appendix I for a complete list of indicators.

- Wildlife:
  1. How is the model affecting large wildlife populations? (See Appendix III and IV for methods)
     - population trends of large mammals
     - % of populations currently declining, stable, and increasing for each country and model, according to IUCN status
- Economics:
  1. Is the model self-sustaining?
     - % of management costs covered by user fees (excise taxes, park fees, etc.)
  2. How does wildlife contribute to GDP and to employment?

    - % GDP from wildlife-related tourism
    - % GDP from trophy hunting/consumptive wildlife use
    - % Population employed by wildlife tourism
    - % Population employed by hunting
- Social:
    1. Does the model encourage social support for conservation?
        - identify any national policies requiring benefit-sharing with local communities
        - identify other possible financial benefits from conservation (eg. employment)
        - identify negative costs associated with wildlife (eg. human-wildlife conflict)
- Protected Area Coverage: (see Appendix II for detailed methods)
    1. Does the model protect habitat for wildlife conservation?
        - % land area with nationally-protected status

Finally, in order to measure performance among the three models and complete a summary table, we selected one indicator per category that best exemplified model performance. We then assigned a three-fold ranking system for it. To set thresholds between each "bin," we utilized metrics from the literature. Table 2 lists selected indicators, ranking values, and assumptions for each category. It should be noted that we compared the three models using simplified metrics. We recognize that a "high performing" model could have been defined differently and would have produced different results.

Table 2. Methods used for the "Model Performance" table

Category	Indicator	Ranking			Assumption
		Green	Gray	Yellow	
Wildlife	% of selected mammal species in decline (n = 21 to 26 per model)	0-33	34-66	67-100	Ranking based upon research that states 'worldwide, 50% of large mammal species are in decline' (Channell & Lomolino 2000, Ceballos et al. 2005, Karanth et al. 2010)
Economics	% of wildlife mgmt. costs covered by user fees	75-100	50-74	0-49	Only considering federal-level funding; current funding may not be adequate
Social	Do local people have the opportunity to benefit financially from conservation?	Yes (>50% do)	Somewhat (25-49% do)	Generally No (0-24% do)	Based on existence of national policy requirements; local people = those living near protected areas; not empirically verified
Protected Area Coverage	How does the country's protected area coverage compare to the global average of 6.6%?	Exceeds (>6.6%)	Nearly equal to (5.6-6.6%)	Less than (<5.5%)	Protected area coverage does not denote effectiveness

Standards and Limitations

This analysis requires comparisons between nations with drastically different economies and populations. To normalize figures and make comparisons, all information is presented in terms

of percent of GDP or percent of total population. Additionally, we converted all figures to US dollars.

Several limitations influence our results. First, we only account for national level policies and revenues, and not state or provincial level; this allows us to compare countries both within and among models. Secondly, we only include nationally-designated protected areas as listed in the World Database of Protected Areas. As we did not include private reserves, our results are conservative estimates of protected area coverage. Finally, we focused exclusively on large (>5kg) terrestrial mammals; this level of focus allows us to capture the most biodiversity in the most efficient manner (i.e. the umbrella species approach). Finally, we accounted only for legal activities, as this constitutes the 'model.' We did not compare poaching or illegal wildlife trade among models, as this was beyond the scope of our report.

Results: Comparisons Among the Models

Using the methods described above, we created a summary table that compares performance among the three models. This summary table allows a simplified overview of the performance of each model and country, within each of the four categories: wildlife, economics, social benefits, and protected area coverage.

Table 3: Model Performance of three wildlife management models

Model	Country	Wildlife	Economics	Social benefits	Protected Area Coverage	Sources
North American	United States					Organ et al. 2012
	Canada					
Southern African	South Africa					Reid et al. 2004
	Tanzania					USAID 2012
No-Hunting	Kenya					UNDP 2012
	India					SANEI 2004, Sekhar 2003

The summary table demonstrates trends, similarities, and differences in outcomes among the countries and the models. Next, we break down this summary table by explaining our results in each of the four categories.

1. Wildlife Trends Synthesis

a. Static Comparison Among Models

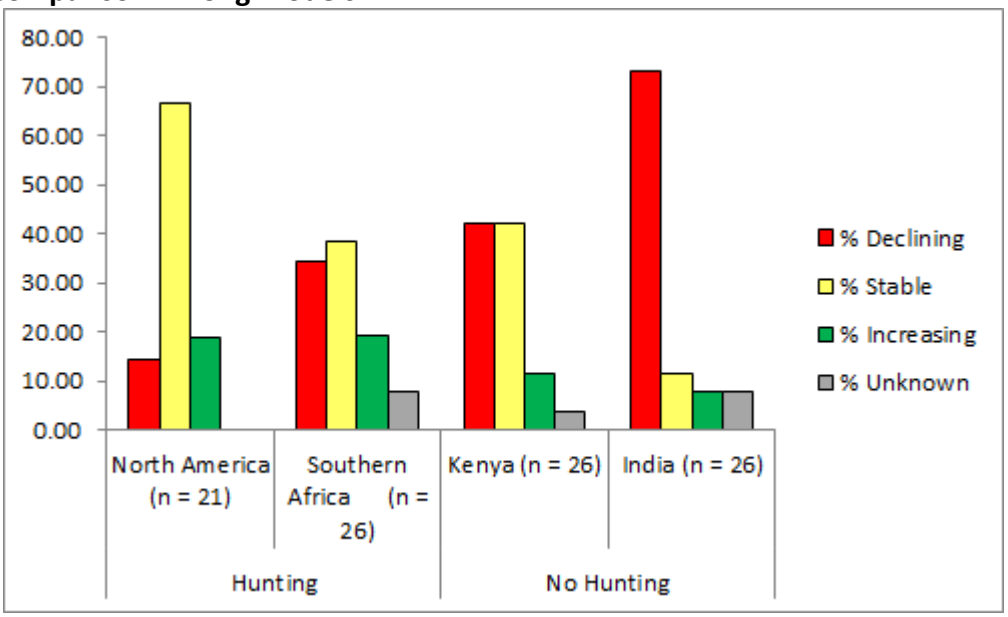


Figure 1: Comparison among models of population trends of selected large mammal species. (n represents the number of species included in the analysis). There is no significant difference between the Hunting Models and No-Hunting Model in terms of the percent of large mammal species in decline (paired t-test, p = 0.46, t = 1.3010, df = 1, standard error of difference = 25.550). See Appendix III for full list of species. Source: IUCN 2012.

Based on our analysis, North America supports the most stable or increasing populations of large mammals, while India has the most declining populations. We used this data to compare the two Hunting Models with the No-Hunting model. Statistically, there is no significant difference between the percent of declining large mammal populations between the No-Hunting Model and the Hunting Models.

The North American model's success in this category may be due to the fact one of its primary goals is to sustain populations of large mammals. **In fact, 90% of the funding generated supports only 10% of the species, which are generally large game species and carnivores** (Mark Humpert, pers. comm.). Wildlife management is generally well funded, hunting is regulated, and hunting enforcement is adequate. Furthermore, reintroduction efforts have successfully prevented the extinction of large mammals such as the gray wolf.

By this analysis, India's large mammals are facing the most severe declines. This is likely due to a multitude of factors including habitat loss, poaching, and human-wildlife conflict with large mammals, which is exacerbated due to India's growing human population. Indeed, India has ten times the population density of Sub-Saharan Africa, with much of this population dependent on forest resources for their livelihoods. India's protected areas are small and fragmented with large human populations living both within and around them, leaving little room for large wildlife.

A comparison of the wildlife population trends in Kenya versus countries in southern Africa may yield a more decisive conclusion on the efficacy of hunting and multiple-use models of wildlife management. In terms of declining large mammal species, however, Kenya and South Africa are very similar: 43% of Kenya's and 38% of South Africa's large mammals are declining. Thus it is not possible to attribute the No-Hunting model's failures solely to the prohibition of hunting. Of the selected species for southern Africa, the majority of those in decline are carnivores. This trend speaks to the ongoing human-carnivore conflict within the region, as well as habitat loss that has come as a result of conversion of land for agriculture (TNRF 2008).

In addition to variations among countries and management models, the status of wildlife may also differ among species. An analysis of wildlife trends by foraging type, rather than region, unveils striking differences in wildlife trends among carnivores, mesocarnivores, and herbivores.

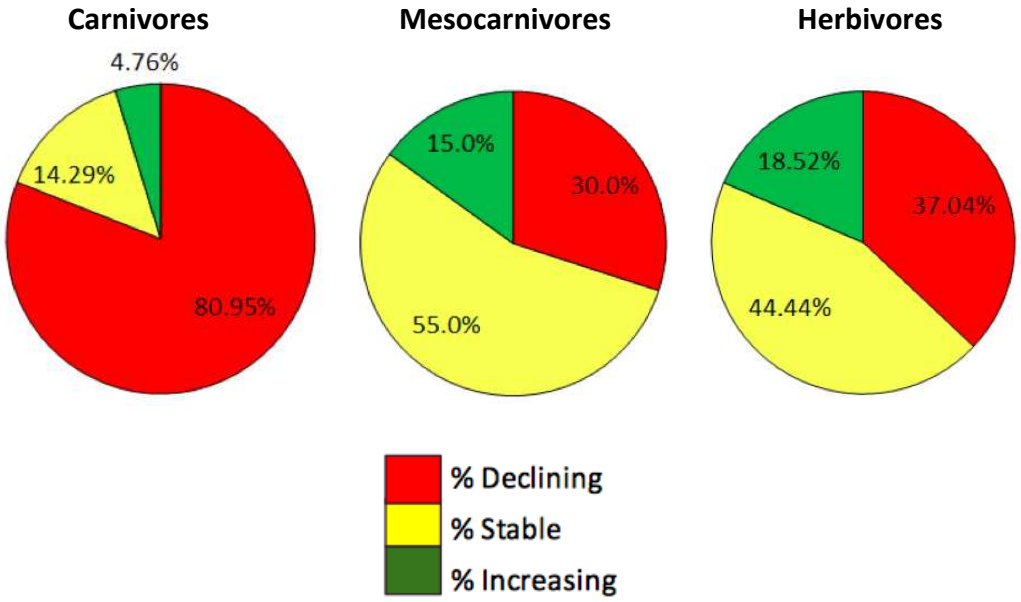


Figure 2: Population trends of select mammal species grouped by functional type).

Carnivore species are exceptionally threatened, with over 81% of species in decline per this analysis. This is likely due to carnivores' higher frequency of human-wildlife conflict, and their more extensive habitat requirements for habitat area and prey abundance.

b. Dynamic Comparisons Among Models

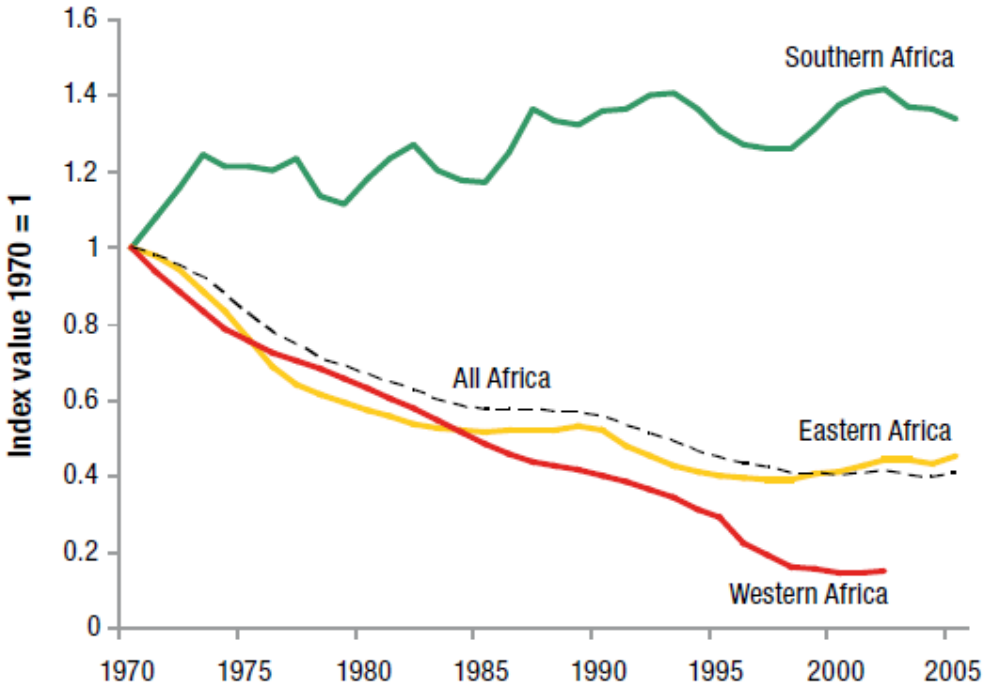


Figure 3: Large mammal population trends in Africa. Species data from protected areas, each species is weighted equally. Source: Craigie et al. 2010.

A study by Craigie et al. supports our findings for large mammals in Africa: they have been in decline since the 1970s, except for in southern Africa. It should be noted, however, that Craigie et al. included mostly large, terrestrial ungulates in this analysis. Thus, our results are not entirely comparable, as we included a balanced proportion of (meso)carnivores and herbivores.

Why have southern Africa's mammals increased, whereas large mammals in the rest of Africa have declined precipitously? James et al. (1999) finds that Southern Africa's parks are relatively well funded compared to those in East and West Africa, which may play a part in protecting its mammal populations. Additionally, South Africa has encouraged private ownership of wildlife, which provides economic incentives for landowners to conserve species on their property.

Although wildlife in eastern Africa has declined by 50% since the 1970s, trends differ among countries (Craigie et al. 2010). Tanzanian parks have more positive trends for wildlife populations than Kenya, which may be due to Tanzania's larger size and greater ecological integrity of parks. Also, Kenya's lack of habitat management, especially rangeland burning, may contribute to their wildlife declines (Western 2009).

In summary, these static and dynamic analyses have illuminated factors that successfully support increasing or stable populations of large mammals. These enabling conditions include **adequate funding for conservation, enforcement of hunting laws, and appropriate habitat and species management.**

2. Protected Areas

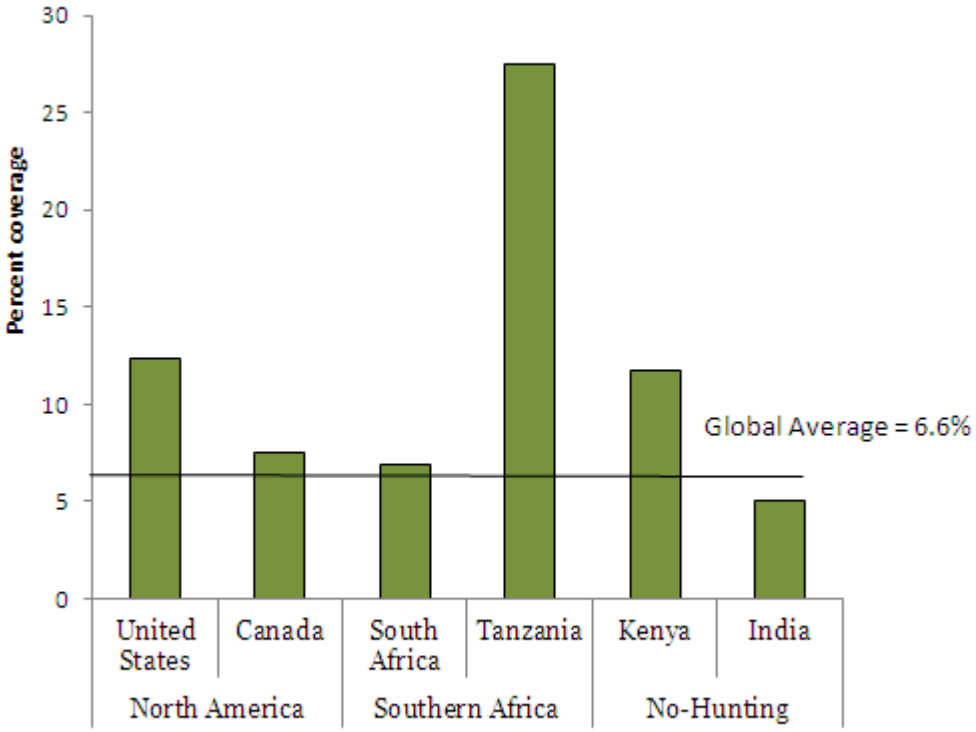


Figure 4: Comparison of protected area coverage among models. There is no significant difference between terrestrial protected area coverage among models (Kruskal-Wallis chi-squared, df = 2, p-value = 0.6514). Source: IUCN and UNEP 2012.

We examined the coverage of protected areas for each country as a way to understand the status of habitat conservation among models. We compared models statistically and found that there is no significant difference among models in terms of terrestrial or marine protected area coverage. However, compared to the other countries, **Tanzania has the highest coverage of terrestrial protected areas** at 28%. This is attributed to, in part, the existence of many protected areas before Tanzania gained independence. Additionally, Tanzania receives significant NGO contributions annually (around US$14 million), which aid in its ability to support protected area management (Brockington et al. 2008).

This analysis is limited in that it does not speak to effectiveness or support of biodiversity, as these factors are not necessarily indicated by protected area coverage. Additionally, results may be an underestimate of actual coverage as they include only nationally designated protected areas, and exclude private reserves.

Our analysis provides a static comparison of protected areas in 2012. In addition, examining regional trends in protected area coverage may further aid in comparing models.

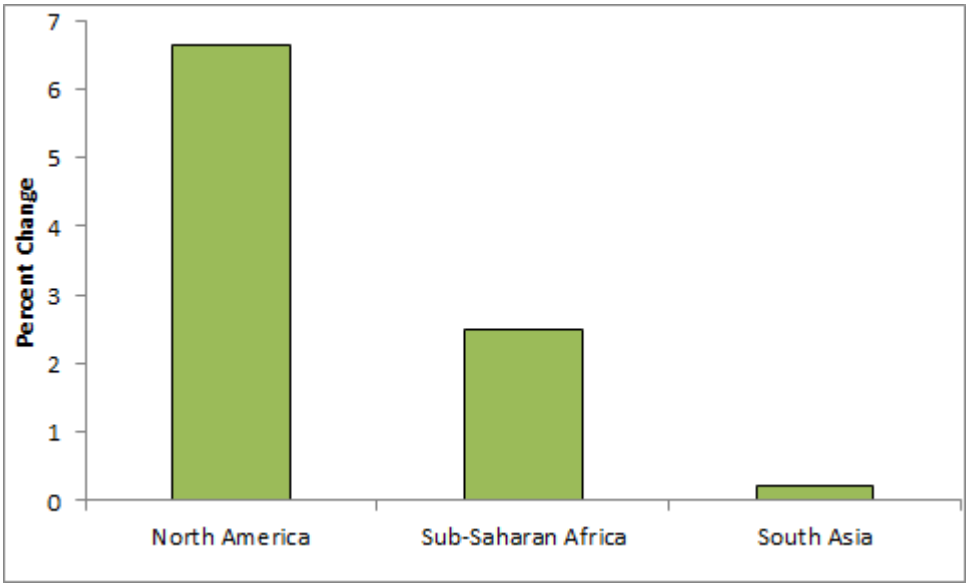


Figure 5: Percent increase in terrestrial protected area coverage by region, 1985-1997. Source: Zimmerer et al. 2004.

Zimmerer et al. found that terrestrial protected area estates have grown at different rates in different regions around the world. Of the regions included, **North America experienced the most growth in its protected area estate between 1985 and 1997**. This may be attributed to the expansion of the protected areas in the United States under the National Wildlife Refuge system, the BLM (e.g. Grand Staircase National Monument) and The Nature Conservancy (Zimmerer et al. 2004). Limited growth of the protected area estate in South Asia could be attributed to its high population density, which has only allowed the creation of small, fragmented reserves.

This figure is limited in time and does not account for more recent protected area growth. **Agreements under the Convention on Biological Diversity** (signed by all countries in this analysis except for the United States) **may promote more rapid protected area growth as nations approach the 2020 target of 17%**.

3. Economics of Wildlife Conservation

Economics is the basis for much of wildlife conservation and can determine each model's success or failure. Where conservation is profitable, it thrives. Although these three models vary widely in nearly every context, we can still make basic economic comparisons to better understand the economic viability of each model.

We measured economic success of each model by comparing revenues to expenditures for wildlife conservation. We based this metric upon the idea that a truly sustainable model would

generate revenues equal to or greater than costs. Revenues can be generated through user fees, such as excise taxes on equipment, hunting licenses, and park entrance fees.

Table 4. Wildlife Conservation Budget Sources of the models

Funding Source	North American	Southern Africa		No-Hunting	
	USA	South Africa	Tanzania	India	Kenya
Percent of Operating Costs covered by Revenue (User fees, tourism)	>75%	85%	100%	50%	45-82%

Sources: USFWS 2013b, Goldstein 2005, IOL 2011, SANEI 2004, UNDP 2012
*Southern Africa: reflects national parks' budget

The Southern African Model generates the highest revenue to cost ratio; revenues cover 93% of costs on average. The North American model's revenues cover about 75% of costs through user fees, and the states must provide the remaining 25% through other funding mechanisms. The No-Hunting model is the least sustainable in this analysis; revenues cover only 57% of operating costs, on average.

The No-Hunting model fails to deliver reliable returns due to its reliance on tourism as the only revenue source. Tourism is inherently a fluctuating industry; it is susceptible to numerous external market forces, including global economic changes, political unrest, and strength if advertising campaigns. With this uncertainty acknowledged, however, tourism can still offer a lucrative and potentially sustainable revenue source for wildlife conservation. Wildlife tourism can bolster local economies, support infrastructure development, and improve social welfare. It incentivizes effective conservation in the places where it matters the most: rural areas surrounding protected areas. When not developed sustainably, however, unregulated tourism can harm wildlife and ecosystems and commodify people and places (Karanth et al. 2012). Governments must create and enforce policies to guide the tourism industry's development.

Wildlife is a strong contributor to national economies. Wildlife is especially economically important to the three African countries in this analysis -- South Africa, Kenya, and Tanzania -- as wildlife tourism contributes 5-11% of their GDPs and employs 5-9% of their populations. As tourism continues to increase, these countries will have increasing economic incentives to support wildlife conservation.

Table 5. Economic Effects of Wildlife Tourism

Economic Indicator	US	Canada	South Africa	Tanzania	Kenya	India
% of Tourism that is Wildlife-based		25	56	>40	77	26.4
% of Population employed by Wildlife Tourism	<10	1.35	5.0	4.6	9.2	2.1
%GDP from Wildlife (non-consumptive use)	<1	1.1	4.8	5.3	10.6	1.7
Expected Annual Growth of Tourism Contributions to GDP (% Increase)	0.8	1.6	4	6	4.3	7.3

Sources: Boora 2005, Booth 2010, Filion et al. 1994, NCAA 2002, SANParks 2012, USFWS 2011, WTTC 2012.

Economic Incentives for Conservation

The table above demonstrates some of the national-level economic incentives to protect wildlife populations. **Economic incentives are also important on the individual-level, as they can play a major factor in deciding whether or not individuals and communities support wildlife conservation efforts.** Giving local communities a share in conservation's direct and indirect financial benefits gives them incentives to ensure effective conservation in the long-term. Wildlife-based benefits can include tourism/hunting revenues, employment, or access to natural resources.

- As the most privatized and commercialized system, the **Southern African model provides the most economic incentives for individuals to conserve wildlife**. In this model, individuals can manage wildlife to sustain their own livelihoods; they directly profit from individual wildlife.

- The **North American model provides indirect benefits for the public good, but fewer direct, individual incentives for conservation**. Although individuals in this model can benefit indirectly from conservation through larger deer populations or healthier ecosystems, for example, they do not directly profit from wildlife as in the Southern African model.

- The **No-Hunting model offers very few indirect, and no direct financial incentives for conservation**. In this top-down, state-owned wildlife management strategy, individuals can only profit indirectly from tourism, and from some ecosystem services provided by protected areas.

According to one study in Kenya, **the equitable distribution of benefits, rather than the quantity, may be the most important factor in generating support for conservation efforts** (Groom and Harris 2008). The study found that local communities receiving financial benefits from conservation were most concerned about fair distribution of benefits to all community members; for example, that they received the same amount as their neighbor, even if this amount is small. They were more likely to support conservation if at least one member in their extended family received some benefit from conservation, even if they did not receive any benefit themselves. This emphasizes the importance of distributing benefits widely and equitably among households.

4. Social Support for Conservation

There is an increasing agreement that successful environmental conservation depends upon the involvement and participation of local communities (Child 2000, Gibson and Marks 1995, Groom and Harris 2008). Human communities living in and around a protected area -- especially those without enforcement or fencing) -- can determine its fate, either by overexploiting its resources or by supporting its boundaries and laws.

National-level policies may be the best way to ensure that conservation's benefits are shared with local people. These policies should clearly define the quantity and the process of benefit sharing. **We ranked each wildlife management model based upon the existence of national-level policies that ensure that successful conservation shares benefits with local communities.**

In the North American model, all citizens can benefit from wildlife, as it is a public trust resource. The Southern African model has several policies that require the equitable distribution of conservation benefits to local communities. Tanzania's Wildlife Management Areas offer up to 65% of revenues to participating communities. In South Africa, the federal government pays communities to lease their lands as national parks. The No-Hunting model, however, has no policy requiring that tourism revenues are shared with local communities, even though many of their protected areas are surrounded by rural, resource-dependent communities for whom wildlife is often a harm rather than a benefit. With human populations only expected to rise in future years, these models of wildlife management must find ways to generate local support for conservation efforts, particularly through benefit-sharing, in order to preserve wildlife for future generations.

Hunting vs. Tourism

The three models differ widely on their policies regarding hunting. The Southern African Model has privatized and commercialized it, the North American Model promotes it as a public right and as a funding source, and the No-Hunting Model bans it as an unethical, damaging practice for wildlife. The arguments on either side of the hunting debate are explained below.

The No-Hunting Argument

Supporters of the hunting ban contend that:

1. **Hunting is unethical**
   - 90% of lions hunted in South Africa are 'canned' (captive-bred animals hunted in small enclosures), although the practice is probably rare/nonexistent elsewhere (Damm 2005)

2. **Hunting harms wildlife populations** (Clifton 2012, Donovan 2013, Lindsey et al. 2006)
   - Many wildlife populations are already declining; hunting will push them over the brink
   - Corruption leads to overharvest even in regions with well-regulated hunting industries (Baldus and Cauldwell 2004)
   - Many quotas are set without reliable biological knowledge of populations

3. **Ecotourism is worth more than hunting, so it is better to protect wildlife for tourism instead of use it for hunting**
   - Nature-based tourism generated almost $3 billion in revenues for South Africa in 2000, as compared to $70 million from hunting tourism in the same year (see Table 6 below)

Table 6. Revenues from Hunting vs. Nature-based Tourism in million USD

Country	Hunting Tourism		Nature-based Tourism (2000-2001)
Botswana	2000 2008	12.6 40	131.3
Mozambique	2008	5	8.4
Namibia	2004	9.6	247.6
South Africa	2003-'04	68.3	2,298.8
Tanzania	2001 2008	39.2 56.3	299.9
Zimbabwe	2000 2007	18.5 15.8	143.5

Source: Booth 2010

Most No-Hunting countries -- including Kenya and India described here -- have banned hunting in response to alarming declines in wildlife populations. Botswana and Zambia recently

followed suit. Botswana banned all hunting starting in 2014, soon after they discovered that many wildlife species, especially ostrich and wildebeest, had declined over 60% since 1996 (Donovan 2013). As ecotourism brings in 11% of Botswana's GDP, as compared to 1% from hunting, the government declared that hunting was no longer compatible with Botswana's goals to preserve wildlife (Donovan 2013, Lindsey et al. 2007). Only one month later in January 2013, Zambia banned the hunting of leopards and lions, declaring that if Zambia lost these carnivores, they would lose their entire tourism industry (Donovan 2013).

Although these actions are taken with the goal of stopping the wildlife decline, a hunting ban often does not address the root causes of the decline: habitat loss due to human expansion, human-wildlife conflict, and illegal poaching. For this reason, the hunting bans in India and Kenya have failed to stabilize wildlife populations.

The Pro-Hunting and Multiple-Use Argument

Supporters of hunting argue that a well-regulated hunting industry:

1. **Involves low harvest and is sustainable** (Bond et al. 2004)
2. **Creates financial incentives for wildlife conservation** (Leader-Williams et al. 2005)
3. **Generates higher fees per client than ecotourism**, and thus the industry has lower environmental impacts than tourism (Baker 1997; Lewis and Alpert 1997)
4. **Generates revenues in areas unsuitable for tourism** (Gössling 2000; Lindsey et al. 2006)
5. **Is more resilient than tourism to outside market forces such as political instability** (Leader-Williams and Hutton 2005; Lindsey et al. 2006)

Supporters argue that where wildlife pays, it stays (Lindsey et al. 2007). The ban on hunting gives wildlife little or no economic value to much of the population, causing local people to view wildlife as a liability rather than an asset to be protected. As a result, landowners invest in agriculture which decreases wildlife habitat and increases the potential for human-wildlife conflicts (Lindsey et al. 2006, Norton-Griffiths 2007). Hunting, on the other hand, has spurred private sector investment in wildlife conservation and provides economic incentives for conservation over vast regions of southern Africa and Tanzania (Lindsey et al 2006). Well monitored trophy hunting is inherently self-regulating and self-protecting, because modest harvest is required to ensure high trophy quality and thus marketability of the area in future seasons (Lindsey et al 2006). It can operate in areas with low populations and diversity of wildlife, because hunters focus on individual trophies, whereas photographic tourists desire wildlife abundance and diversity (Booth 2010).

Supporters of the multiple-use approach argue that hunting and tourism are compatible. When used in tandem, the two methods can provide the broadest range of benefits to the largest number of people and wildlife species. Trophy hunting of a few older males can generate funds to conserve the entire population. Tourism can utilize the most accessible parts of a reserve,

while hunting can bring a small number of high-paying clients to remote areas. Together, the two approaches can protect a larger amount of habitat for wildlife, as seen in table 7 below.

Table 7. Percent of total land area utilized for Sport Hunting vs. Protected Areas

	South Africa	Tanzania	USA
Sport Hunting	26.4	13	60
Protected Area	6.9	28	12.4

Sources: IUCN and UNEP 2012, Lindsey et al. 2006, McCarthy n.d. (USA)

Recommendations:

There is a lack of consensus concerning the acceptability and effectiveness of sport hunting as a conservation tool, which is partly due to a lack of reliable information on the economic and ecological impacts of the industry (Lindsey et al. 2006). It seems clear, however, that hunting bans do not fully address the causes of wildlife decline, nor do they appear to stabilize wildlife populations. Yet hunting is no silver bullet: a successful and sustainable industry is contingent upon strong enforcement and regulation. Many countries are unable to enforce current wildlife laws, let alone manage to ensure the sustainable harvest of a multitude of species. Without strong enforcement, opening a legal market for species such as elephants and rhinos can create parallel illegal markets that use forgeries to sell their product as 'legal' wildlife goods. **Before a country includes hunting in its wildlife management strategy, it must ensure that it can provide the proper legal, economic, and enforcement framework for a sustainable and profitable hunting industry**.

Model Conclusions

Any discussion comparing these models must first address the vast differences in context, as described below in Table 8. Our comparisons include both developed and developing nations. The developing nations described here have much higher population growth, rates of poverty, and percentages of rural populations, all of which strongly influence their strategies and capabilities to implement wildlife management strategies.

Table 8. Economic and Demographic Comparisons

Indicator	US	Canada	South Africa	Tanzania	Kenya	India
Population Density (pop/km^2)	34.3	3.77	40.9	49.2	75.6	405
Population Growth Rate (%)	0.9	0.78	-0.41	2.85	2.44	1.31
Population living under $1.25/day (%)	N/A	N/A	13.8	67.9	43.4	32.7
Urban Population (%)	82	81	62	26	22	30
GDP Per capita ($USD)	$49,800	$41,500	$11,300	$1,700	$1,800	$3,900

Source: CIA World Factbook 2012, World Bank 2011.

With these contextual differences in mind, we can still compare measurable outcomes among the models to rank performance, and highlight strategies that are creating positive outcomes for people and wildlife.

North American Model

Overall, the North American model of wildlife conservation has demonstrated high performance for ecological, economic, and social goals (with the exception of Canada's economic goal). 70% of the selected large mammal species in this analysis currently have stable populations. In addition, in the US, a dedicated federal funding mechanism ensures that a majority (over 75%) of wildlife management costs are covered by excise taxes on hunters and anglers (USFWS 2013b.). There is no equivalent federal funding mechanism in Canada, although provincial level funding mechanisms exist (Organ et al. 2012). Furthermore, the public trust doctrine provides all North Americans the opportunity to participate in hunting, fishing, and wildlife viewing (Organ and Mahoney 2004). Participation in hunting is crucial to the success of the model, particularly in the US, as hunters contribute funds directly to wildlife management. Additional conditions that enable the North American model to succeed include public access to wildlife, adequate hunting regulations, and quota setting based on accurate population estimates to ensure sustainable harvests (Geist 2006). A notable threat to the model is

privatization of wildlife and hunting land, as it runs counter to the principles of the public trust doctrine (Gary Kania, personal communication). In addition, non-consumptive users don't directly pay for conservation the same way that consumptive users do. This may compromise the sustainability of the model's funding source if participation in hunting declines, particularly in the US. To strengthen the North American model, a funding mechanism that targets non-consumptive wildlife users should be established at the federal level. In addition, public access to nature-related activities such as hunting and wildlife viewing should be ensured in order to uphold the public trust doctrine.

In comparison to the Southern African model, the North American model provides fewer direct incentives for wildlife conservation. Despite the opportunity to participate in nature-related activities, the average person does not receive direct financial or intangible benefits from wildlife. Fewer than 5% of the population hunted in the United States in 2011; a higher percent (23%) participated in wildlife viewing, but these non-consumptive users do not provide funding for wildlife management in the same way that consumptive users do (USFWS 2011).

Southern African Model

The Southern African model has been successful economically and, to some extent, socially, but some wildlife populations are in decline. Tourism generates a reliable source of funding which can then be invested back into wildlife conservation efforts. National-level policies empower individuals and local communities with ownership and/or rights over the management of wildlife. This has enabled them to benefit from the existing opportunities in the tourism industry. The existing markets for wildlife use (e.g. live trade, hunting, tourism) create incentives among private landowners and communities for sustainable management schemes. In many cases, this has resulted in recoveries of a number of depleted wildlife populations by encouraging species reintroductions. Despite these recoveries, a number of challenges remain and some demographic constraints directly impact wildlife conservation. The African continent is an area of rapidly increasing population density. These increases in population density, coupled with the extensive use of fencing by private landowners establishing ownership over wildlife, have led to habitat fragmentation and increased human-wildlife conflict. Conflicts between pastoralists and carnivores, in particular, has resulted in population declines of the very species for which Africa is famous.

This model requires abundant wildlife populations in order to maintain economic viability through tourism and hunting. Habitat fragmentation can be alleviated by creating incentives for the creation of more conservancies, which are consolidations of private reserves. Additionally, for the model to improve, it is imperative that government officials ensure maximum clarity and transparency regarding benefit sharing to local communities utilizing wildlife on their land. When local people see that wildlife tourism is an economically viable use of their land, they may choose to conserve habitat rather than convert it for agriculture.

No-Hunting Model

By this analysis, the No-Hunting Model has generally low performance in wildlife management. Kenya and India's large wildlife species are in decline: Kenya has lost 70% of its wildlife since the

1970s, and most of India's large mammals persist in only 10% of their former range (Karanth et al. 2008, Norton-Griffiths 2007, Western et al. 2009).

Economically, the No-Hunting model has not proved to be self-sustaining; funding for wildlife conservation depends on variable tourism revenues, which cover only 45-80% of operating costs (UNDP 2012, SANEI 2004). Thus the model relies on government subsidies -- which may vary depending on the political environment -- to cover the remaining costs. Furthermore, funding is not widespread among wildlife species: India spends 50% of its conservation budget on tigers alone, and in Kenya, anti-poaching efforts consume 80% the budget (KWS 2008).

Neither country has national-level policies in place that ensure that wildlife's benefits are shared with local communities; wildlife tourism revenues generally remain in the hands of the government and the tourism operators (Sekhar 2003).

The model's poor performance, however, cannot be easily attributed to the lack of hunting. There are several other factors at play, including high population densities in India, poverty, and land use change. Economic incentives also play a major role in conserving wildlife. In this model, wildlife only has economic value when tourists pay to see it. When local communities do not receive a share of tourism's benefits, they lose all economic incentive to conserve wildlife. In the face of further human population growth, the model must find ways to ensure benefit-sharing with the people who live most closely with wildlife.

In order to succeed, this model requires strong institutions that can and will enforce the hunting ban, even in remote areas. It must regulate and develop the tourism industry, so that it is lucrative and sustainable. With tourism only expected to rise, both Kenya and India could find ways to better harness the tourism market to raise funds and capacity for conservation. These funds could be used to protect vital remaining wildlife habitats, enforce anti-poaching laws, and promote species recovery.

Conclusions and Recommendations for Future Research

No wildlife management model is perfect, as there will always be trade-offs between economic, ecological, and social goals. Ideally, an effective model would provide high quality habitat, generate adequate funding, and offer incentives for local people to conserve wildlife.

Our research begs the question,

If we can't conserve and manage large charismatic species, what can we do?

The future of conservation hinges on our ability to sustain wildlife populations while balancing the needs of peoples and economies. National and international policy makers must incorporate these demands in policy and practice in order to ensure sustainable wildlife management.

Our literature review and comparative analysis allows us to make broad comparisons while illuminating the complexity of each wildlife management model. Since our scope is so vast, we cannot identify the "winning" model, but we do highlight general trends in wildlife populations, funding for wildlife management, protected area coverage, and social support for conservation. We envision that this review and analysis will inform a broader dialogue within the wildlife conservation community regarding the sustainability of wildlife management models.

Future research should aim to develop a richer assessment of the models to comprehensively assess their sustainability as well as suggest components of each model which can be scaled up and/or transferred to other regions of the world. We offer the following recommendations:

Overall:

- Broaden scope to include other countries within the Southern African and No-Hunting models

Economics:

- Quantify funding generated at the state/provincial level for US and Canada
- Canada: If and when a new survey from the Canadian Wildlife Service becomes available, future analyses should compare trends in participation in nature-related activities between the US and Canada
- Explore the question: Is current funding adequate to support the goals of wildlife managers? If not, how much more is needed?

Wildlife:

- Consider historical wildlife population levels as baselines for analysis
- Instead of broad IUCN trends, use *abundance* data for wildlife and replicate Craigie et al. 2010's study to derive indexed trends for wildlife over time for each region
- Expand the analysis to include other taxa for which data is available (small mammals, amphibians, reptiles, etc) in order to capture a broader suite of biodiversity

Protected Areas and Habitat:

- Include private protected areas within our analysis
- Distinguish between protected areas that permit hunting and those that do not

Policy

- Explore the political feasibility of re-establishing hunting in Kenya
- Explore the political feasibility of establishing an excise tax on non-consumptive wildlife users in the United States and Canada
- Assess the enforcement of existing policies (ex. ToPS in S. Africa, the hunting ban in Kenya/India)
- Explicitly explore "hybrid models" and explore the impact on wildlife of an Endangered Species Act or similar act regulating hunting of certain species
- Explore the role of international treaties (such as the Migratory Bird Treaty Act and the Convention on Biological Diversity) in their contribution to sustaining wildlife

Social:

- Survey local people living near protected areas to explore the questions of: 1) which model provides direct incentives for wildlife conservation, and 2) if national-level policies for benefit-sharing are effective

The Wildlife Management Models: stories from around the globe

North American (US & Canada)

Southern African (South Africa & Tanzania)

No-Hunting (Kenya & India)

The North American Model

The North American Model of wildlife conservation evolved as a reaction to the decimation of wildlife by early colonists (Batcheller et al. 2010, Bechtel 2012). Until the turn of the 20th century, sustainability of wildlife populations was not considered in policy or practice; unregulated wildlife markets provided incentives to hunt and sell dead wildlife. In response to declining populations and hence fewer opportunities to hunt big game, policy makers, land managers, and hunters began to consider the sustainability of wildlife populations. Governments eliminated markets for wildlife, established funding mechanisms for wildlife conservation, and created hunting regulations such as quotas and permits.

The North American model of wildlife conservation is characterized by seven fundamental pillars:

1. Wildlife as a public trust resource
2. Markets for wildlife are eliminated
3. Democratic allocation of wildlife by law
4. Wildlife can only be killed for a legitimate purpose
5. Wildlife is considered an international resource
6. Science is the proper tool for the discharge of wildlife policy
7. Democracy of hunting

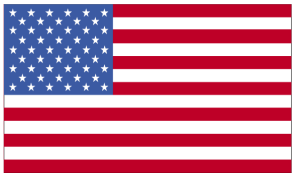
Source: Geist et al. 2001, Geist 2006, Organ and Mahoney

The core of the North American model is the Public Trust Doctrine - wildlife is held in public trust by the government for the benefit of the public, who own the wildlife (Organ and Mahoney 2004, Batcheller et al. 2010). Both the public and wildlife benefit from public ownership. Because the public owns the resource, they receive tangible benefits of the existence of wildlife (the opportunity to hunt and view it) and have a stake in its conservation. The public has the ability to hold the government accountable to its responsibility through litigations. Also, because the state assumes responsibility for wildlife, state fish and wildlife agencies employ wildlife professionals (public servants) to conduct scientific wildlife management (Geist et al. 2001, Geist and Organ 2004).

Certain conditions are required to ensure success of the model, including adequate funding for wildlife conservation, democratic rule of law, and the availability of wildlife populations and suitable habitat (Geist 2006). The model is credited with many successes including the recovery

of certain species (buffalo, white-tailed deer, migratory birds) as well as public involvement with wildlife and the establishment of International treaties including the Migratory Bird Treaty Act 1918 (Geist et al. 2001).

Threats to the North American model include privatization of wildlife and reduced access to wildlife via high hunting permit prices and gateway properties adjacent to public land. Privatization is in direct conflict with the public trust doctrine. Also, few North Americans are aware of the tenets of the model, especially public ownership and rights to wildlife. Other threats include the existence of wildlife markets, poaching, and game ranching. Additionally, increasing urbanization may be disconnecting the general public from nature and hunting. This calls into question the sustainability of the model itself, as hunters and anglers provide most of the conservation funding (Geist and Organ 2004). It has been suggested that non-consumptive users of wildlife (eg wildlife watchers) should contribute to funding conservation efforts and secure sustainability of the model (Organ et al. 2012).



UNITED STATES OF AMERICA

"The nation behaves well if it treats the natural resources as assets which it must turn over to the next generation increased, and not impaired, in value."
-Theodore Roosevelt, 1910

Policy and History of Wildlife Conservation

The United States of America is a constitutional republic of fifty states, a capital, and several territories. Terrestrial wildlife management is under the jurisdiction of the Department of the Interior (US Fish and Wildlife Service, National Park Service, Bureau of Land Management, Bureau of Reclamation, Bureau of Indian Affairs, USGS) and the Department of Agriculture (Forest Service, Natural Resource Conservation Service). Other stakeholders in wildlife conservation include non-governmental organizations including Trout Unlimited, Ducks Unlimited, Boone & Crockett Club, and many others.

Early natural resource management in the US was characterized by exploitation; colonists over-hunted wildlife and contributed to population declines of grizzly bears, cougars, and wolves. In response to the extinction of the once-abundant passenger pigeon in the 1860s, conservation organizations formed and advocated for hunting quotas to ensure sustainable wildlife populations (Geist et al. 2001).

Several key laws are relevant to wildlife management in the United States. The Lacey Act of 1900 prohibits trade in wildlife, fish, and plants that have been illegally taken, transported or sold. The Wilderness Act of 1964 protected 9.1 million acres of federal public land, which serves as critical wildlife habitat. The Endangered Species Act of 1973 is designed to prevent extinction of imperiled species. Listed species cannot be harvested or harmed ("taken"); violators are subject to federal fines and imprisonment. Several other laws apply to specific taxa, including the Migratory Bird Conservation Act of 1929, the Marine Mammal Protection Act of 1972, and the Bald Eagle Protection Act of 1940.

The Public Trust Doctrine was explicitly established in 1842 by the US Supreme Court case Martin vs. Waddell, which set precedent for **public ownership of resources including wildlife**. Hunting is permitted and regulated at the state level. Any individual may hunt for sport or subsistence, provided s/he holds the proper license. State governments regulate hunting seasons and off-take quotas for game species. Game ranching is permitted as well; private citizens raise game species such as elk, wild boar, and deer and charge trophy hunters to hunt on their property. Legal markets for wildlife generally do not exist, but there are exceptions for fish, amphibians and reptiles (Nanjappa and Conrad 2011, Organ and McDonald 2013).

Funding Policy for Wildlife Conservation

Two laws in the United States establish dedicated federal funding mechanisms for wildlife conservation: the Federal Aid in Wildlife Restoration of 1937 (known as the Pittman-Robertson Act) and The Federal Aid in Sport Fish Restoration Act (known as the Dingell-Johnson Act). For the **Pittman-Robertson Act, an excise tax on equipment and ammunition goes directly to the federal government; funding is deposited into the Wildlife Restoration Account and allocated to state fish and wildlife agencies**. Currently, the excise tax is set at 10% on pistols, handguns, and revolvers, 11% on firearms and ammunition and 11% on bows, quivers, broadheads, and points (USFWS 2013b.). In addition to the tax, hunters must also purchase licenses, tags, and stamps to hunt specific species (USFWS 2007).

Funding generated from these taxes is deposited into the federal Wildlife Restoration Account and allocated by the US Fish and Wildlife service to state fish and wildlife agencies, including territories (USFWS 2013c.). **75% of wildlife management costs are covered by this fund; states must raise 25% of the costs with their own funding mechanisms** which may include license and permit fees; motor boat fuels taxes; excise taxes on hunting, shooting sports, and angling products (USFWS 2013b.). States use these funds to manage wildlife and ensure viable populations of both game and non-game species. The funding mechanism is commonly referred to as a "**user-pay, user-benefit**" system, as consumptive users (hunters) both pay and benefit. However, wildlife watchers (non-consumptive users) also benefit from the presence of wildlife in North America, yet do not pay into the system through federal excise taxes.

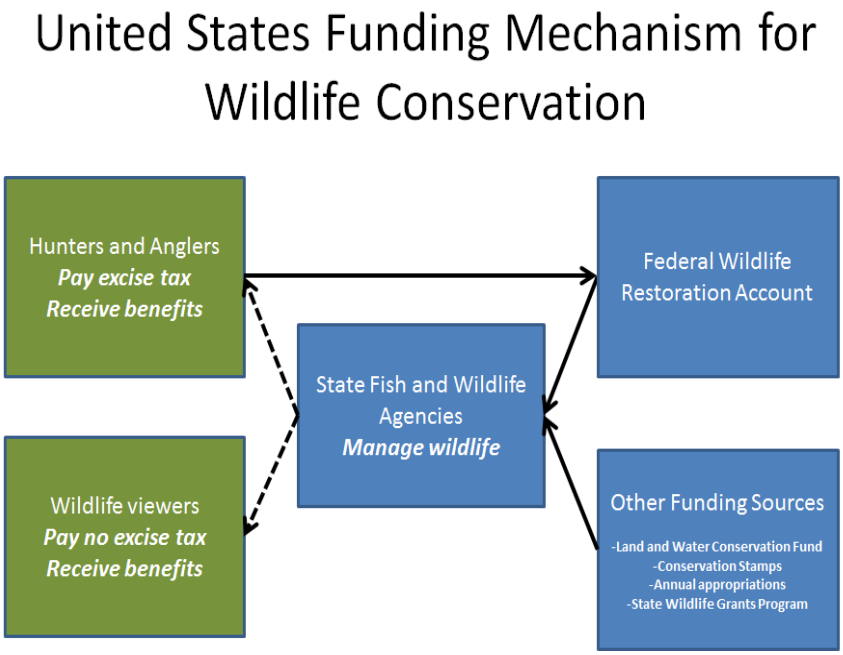


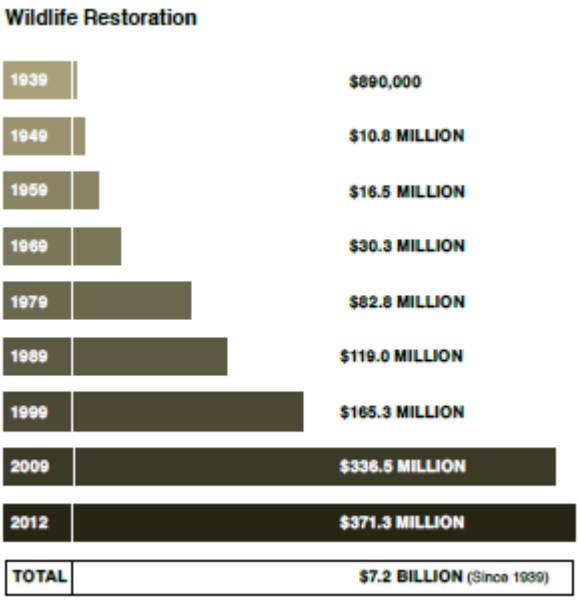
Figure 6: Conceptual diagram of the United States Funding Mechanism which supports wildlife conservation. Solid arrows represent the flow of funds; dotted arrows represent tangible and intangible benefits of wildlife management including the ability to hunt, view, and enjoy wildlife.

Other funding sources contribute to the work of state fish and wildlife agencies. For example, the State and Tribal Wildlife Grants (SWG) Program was created in 2000 to prevent endangered

species listings for at-risk species (AFWA 2011). Unlike wildlife conservation in many other countries, states play a significant role in wildlife management. **States are primarily responsible for the management of all species, unless the species is listed on the federal Endangered Species Act** at which point primary jurisdiction is conferred to the federal government. The United States not only lists and protects domestic species, but also lists foreign species such as the African wild ass, cheetah, and chimpanzee on the ESA. This listing process implements CITES and regulates the import of these species. Not all foreign species that are listed under the ESA are also in CITES (USFWS 2013a.).

Economics of Wildlife Conservation

Since the Pittman-Robertson Wildlife Restoration program began, the program has collected more than $7.15 billion in manufacturers' excise taxes to distribute to state fish and wildlife agencies; states have matched the required amount of over $1.78 billion (USFWS 2013b). It is estimated that **sportsmen contribute $3.5 million each day to wildlife conservation through excise taxes and license fees (**National Shooting Sports Foundation n.d.).



Anglers also contribute to wildlife conservation. The Federal Aid in Sport Fish Restoration Act of 1950 (commonly known as the Dingell-Johnson Fishery Restoration Act) established an excise tax on angling equipment and serves as a funding source for state fishery management.

Figure 7: Funding from excise taxes on hunters directed into the Wildlife Restoration account. Source: Southwick Associates 2012; Congressional Sportsmen's Foundation 2012.

All funding generated from Pittman-Robertson is allocated toward wildlife conservation activities including habitat preservation, harvest management, hunter safety education, research, restoration, and monitoring. It is estimated that **90% of the funding manages 10% of the species,** especially carnivores (wolves, mountain lions) and large game species (white-tailed deer, pronghorn antelope) (Mark Humpert, personal communication, March 8, 2013). Funding for species that are not hunted or fished, especially those at risk of listing on the Endangered Species Act, is supplemented by the State and Tribal Wildlife Grants Program (AFWA 2011).

Funds are allocated to wildlife research, surveys, and species and habitat management and must be detailed in a state's Wildlife Conservation Plan. Since 2000, this program has provided over $600 million to state fish and wildlife agencies for at risk species (USFWS 2013b.).

In April 2013, North Dakota auctioned a bighorn sheep hunting license for a record $75,000. Even so, this is a small sum compared to the $273,000 spent for the same purpose in Canada (Geist 2006). Over $1 million has been raised since 1986 through bighorn sheep licenses; all funds are used directly for bighorn sheep management in North Dakota. This is one example of a state's efforts to raise money to match federal Pittman-Robertson funds.
Source: North Dakota Fish and Game Dept. 2013)

In addition to contributing directly to the federal Wildlife Restoration Account, hunters also contribute to GDP through the purchase of hunting equipment, trip-related expenses, and other spending. In 2011, hunters spent $33.7 billion on all hunting-related gear and secondary expenses; this amounts to 0.22% of GDP. Of this, $14 billion was spent on equipment, $10.4 billion was spent on trip-related expenses, and $9.3 billion was spent on other expenses (USFWS 2011). **Hunting supported approximately 575,000 jobs in the United States in 2001 which amounts to 0.20% of the population** (IAFWA 2002).

Gray wolves contribute to local economies around Yellowstone National Park. **"Wolf ecotourism" is estimated to generate $70 million per year solely because of the public's interest in viewing wolves**. Between 1995 and 2002, it is estimated that 14,285 additional visitors per year visited Yellowstone to view wolves. Source: Duffield 2006

Non-consumptive users of wildlife, including bird watchers and wildlife tourists, also contribute to GDP. I**n 2011 alone, "wildlife watching" generated $54.9 billion for the US economy, which amounts to about 0.36% of GDP** (USFWS 2011). Of this, $27.2 billion was spent on equipment, $17.3 billion was spent on trip-related expenses, and other $10.5 billion was spent on other expenses (USFWS 2011). **Non-consumptive users do not contribute directly to a federal fund dedicated to wildlife conservation**. A tax on outdoor recreation equipment has been suggested which would contribute to wildlife conservation above and beyond the existing excise taxes (Regan 2010). This way, non-consumptive users might directly fund conservation efforts. However, such legislation has not been enacted. Although wildlife watchers do not pay an excise tax, their spending on equipment and travel costs contributes to local economies. **Recreation and nature tourism associated with public lands supported approximately 671,000 jobs in 2010 in the United States, which amounts to 0.21% of the population**.

Although estimates of wildlife benefits are significant, studies have suggested that the costs of wildlife conservation are often overlooked. These costs include human illnesses and fatalities from wildlife-related diseases, animal-vehicle collisions, and damages to agriculture and households. One study suggests that wildlife related damages total $3 billion annually in the US (Conover et al. 1995).

Markets for wildlife

In general, markets for live or dead wildlife are prohibited. However, exceptions exist which are regulated at a state level. Most states allow the sale of lawfully taken fur-bearing animals (badgers, beavers, fox, mink, muskrat, nutria and raccoon) and their parts to licensed fur dealers (Todd and Boggess 1987, Organ et al. 2001).

Protected Areas: United States

The United States protected area system is considered the oldest in the world. The establishment of Yellowstone National Park in 1872 paved the way for hundreds of protected area designations in the US and around the world. Currently, 12.38% of the terrestrial area and 28.6% of the coastal and marine area is designated as nationally protected (IUCN and UNEP 2012). Four agencies manage federal public lands (Forest Service, Bureau of Land Management, Fish and Wildlife Service, and the National Park Service) and all operate under different mandates. State, local, and privately protected areas also contribute to the national network. There are many different protected area designations in the United States; currently, the most common designation is a State Wildlife Management Area (IUCN and UNEP 2012). The protected area system in the United States is characterized by scientific management and designates a wide range of uses (from pure preservation in Wilderness and Roadless Areas to conservation and multiple-use in some BLM and Forest Service lands). Hunting is permitted on 60% of U.S. public lands, which amounts to 17% of the land area (McCarthy n.d.)

CANADA

Policy and History of Wildlife Conservation

Canada's government is a democratic constitutional monarchy, formerly "Her Majesty's Government." Terrestrial wildlife management is under the jurisdiction of Environment Canada (which runs the Canadian Wildlife Service) and Parks Canada. Other stakeholders involved in wildlife conservation in Canada include the Canadian Wildlife Federation, Nature Canada, Ducks Unlimited (Canada), WWF Canada, TNC Canada, WCS Canada, and the Canadian Nature Federation. The early history of natural resource management in Canada was characterized by exploitation of fish and wildlife. Early settlers believed natural resources to be unlimited, and contributed to the extirpation of Wapiti (American elk), the Great Auk, and the Wild turkey in Canada (Kerr 2012). The rapid decline and extinction of the once-abundant passenger pigeon in the 1860s brought public attention to the issue, and the government passed the Constitution Act of 1867 (Kerr 2012, AAAS 2011). Although this Act did not explicitly mention wildlife, the Act was interpreted to mean that wildlife is considered a part of the land and falls with legislative authority under "property." Therefore, the Constitution grants the provinces the right to manage wildlife on provincial land while the right to manage federal lands, including interjurisdictional wildlife, is under federal jurisdiction (Kerr 2012).

There is no explicit precedent in Canada for the Public Trust Doctrine on a federal level, but the PTD has been incorporated into some provincial level doctrines (Henquiet and Dobson 2006) Although the Public Trust Doctrine is not explicitly stated in these doctrines, wildlife is owned by all people and "vested in his/her Majesty in the right of the Province" (Hogg 1977). This implies that wildlife is held in trust for the benefit of the people (Kerr 2012).

Several additional laws govern the management of Canadian wildlife. The Constitution Act of 1982 recognizes and affirms existing Aboriginal and treaty rights in Canada, which may concern the right to hunt or otherwise use wildlife resources. Canada Wildlife Act 1985 created the National Wildlife Area system under the Canadian Wildlife Service to preserve critical habitat for migratory birds and other at-risk species (Environment Canada 2012a). The federal Species at Risk Act of 2002 mirrors the US Endangered Species Act and applies to listed species under federal jurisdiction and may be extended to those under provincial jurisdiction (S.C. 2002). Hunting in Canada is regulated in a similar way as in the US; sport and subsistence hunting are permitted with a license and Outdoor Identification Card or proof of completing a hunter education course. Hunting seasons are regulated according to the target species and restrictions exist for certain firearms and non-Canadian guns. Game ranching and game farming (the raising of animals for viewing or live sale) are permitted. Currently, the Canadian government is considering the development of a comprehensive National Conservation Plan which focuses on stakeholder engagement, habitat conservation, and stewardship of natural areas. It will include a large-scale survey to gauge public participation in nature activities (House of Commons 2012).

Economics of Wildlife Conservation

Canada lacks federal funding mechanism dedicated to wildlife conservation. Funding for conservation is generated from the general revenue system; taxes such as hunting license fees are pooled annually and appropriated according to national priorities. Wildlife must "compete" with other national level priorities; hence, wildlife conservation is not adequately funded. On a provincial level, however, dedicated funding from license sales and lotteries contribute to wildlife conservation. For example, Ontario's Federation of Anglers and hunters holds an annual "Lottery for Conservation" to raise money for wildlife management in Ontario. Additional funding for conservation is generated from wildlife tourism, NGOs, and federal, provincial, and territorial cost-share agreements. Funding for wildlife conservation is allocated to research, protection of habitat, wildlife management activities and operations.

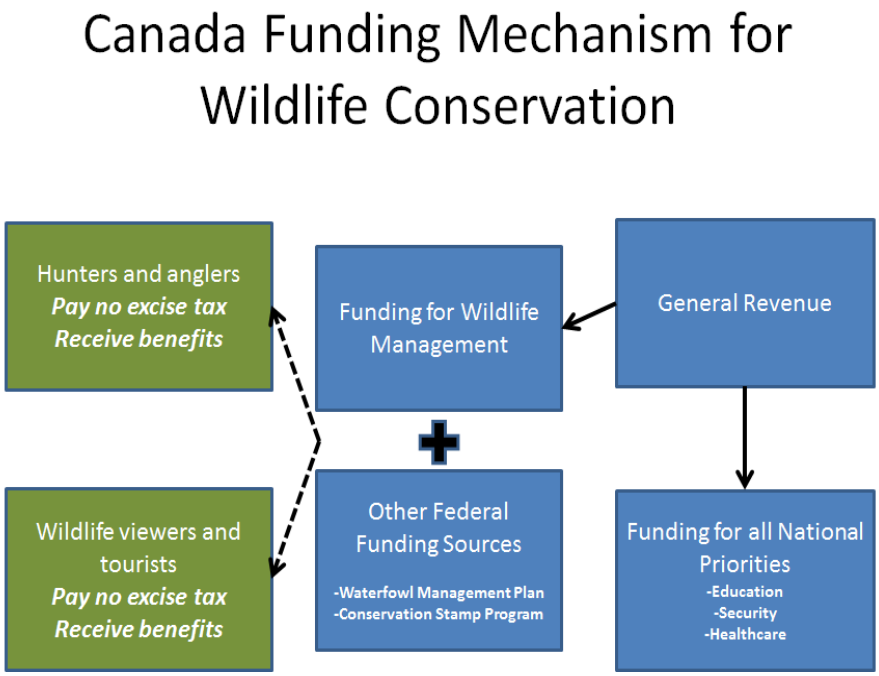


Figure 8. Canada's funding mechanism for wildlife conservation. There are no dedicated federal excise taxes for wildlife management; provincial agencies must rely on allocations from the general revenue and other sources. Solid arrows represent the flow of funds; dotted arrows represent tangible and intangible benefits of wildlife management including the ability to hunt, view, and enjoy wildlife.

Hunting expenditures contribute millions of dollars to Canada's GDP each year. Spending on hunting equipment accounted for 46%, transportation accounted for 20%, food was 12%, accommodation was 4%, and spending on other items such as license fees and ammunition was 17% (DuWors et al. 1999). This contribution to GDP can be further broken down: $493 million was spent for hunting as the main activity, whereas hunting as a secondary activity was estimated to involve expenditures of $116 million (DuWors et al. 1999).

Wildlife-viewing and related activities contributed even more to Canada's GDP. Wildlife-viewing expenditures totaled to $962 million in 1996, which supported approximately 22,300 jobs (approximately 0.08% of the population). This amount can be broken down by type of activity: equipment 54.4%, transportation 12%, food 7.7%, accommodation 5%, and other items 20.9%. $361.2 million was spent on wildlife viewing as the main activity; $602.14 million was spent on secondary activities. **The government received over $447.7 million in tax revenues from wildlife viewing activities.**

Many tourists visit National and Provincial parks and participate in hunting and wildlife viewing activities. Nature tourists in 1996 from the US to Canada contributed over $521 million to the Canadian economy. It is estimated that **up to 25% of Canada's tourism industry is wildlife-related** (Filion et al. 1994). This amounts to 1.1% of total GDP.

Beneficiaries of wildlife conservation include government agencies that manage wildlife (Parks Canada and Environment Canada), wildlife tourism operators, equipment merchants, and local economies which receive spillover benefits from hunting and wildlife viewing activities. Some Canadians also rely on the fur industry for a source of supplementary income; Canadian trappers and fur farm owners earn over $120million annually in pelt sales (Statistics Canada 2006). Furthermore, government wildlife habitat conservation programs receive $672,000 annually from license revenues paid by fur trappers (Fur Institute of Canada 2008).

Protected Areas

Protected areas in Canada are defined as "lands and waters where development and use is restricted by legal or other means for the conservation of nature" (Environment Canada 2012b). **Currently, 7.51% of the terrestrial area and 1.25% of the coastal and marine area is designated as nationally protected** (IUCN and UNEP 2012). Parks Canada manages federal public lands and classifies them according to their management objectives. Other levels of management include provincial agencies, private individuals and companies, and First Nations communities. As of 2011, 94% of protected lands in Canada were in "strictly protected" categories, IUCN I - IV, although multiple use protected areas exist as well (Environment Canada 2012). In addition, Canada's terrestrial protected area estate doubled between the years of 1990 and 2011 (Environment Canada 2012b).

North American Wildlife (United States & Canada)

In this analysis, North American wildlife trends and information will be presented at a regional (instead of country-level) scale. This is justified as both the US and Canada harbor similar species of large mammals, similar threats to biodiversity, and nearly identical strategies to support mammals (e.g. reintroduction and wildlife crossing structures).

Many populations of large mammals are currently stable in North America (see figure 1, IUCN 2012). Exceptions include the puma and polar bear (declining populations) as well as the American black bear, coyote, and moose (increasing populations) (IUCN 2012). Overall, the status of large mammals in North America can be characterized as having an **under abundance of predators and an overabundance of certain ungulates** (especially white-tailed deer).

Management of both game species and carnivores within the same model poses a challenge; these functional types require extremely different habitats in terms of size and quality (Peek 2010). While deer survive in fragmented patches and browse on "edge" vegetation alongside roads, wolves and pumas require large swaths of land and adequate prey. Carnivores are also perceived as a threat to rural livelihoods as they may prey on livestock and game species (Niemeyer 2007). As more infrastructure is built in North America, carnivores lose habitat while deer gain "edge" habitat. Game species such as deer are rigorously managed; state fish and wildlife agencies monitor that license requirements are met and set annual quotas based on scientific population estimates. Carnivores, especially pumas, are rare and elusive and therefore much more difficult to track and count. Methods such as camera traps and radio tags aid in the count, but these methods require intensive monitoring and evaluation (Balme et al. 2009). In addition, large carnivores and bears often require connectivity between adjacent habitat patches (metapopulations) to support genetic diversity and exchange of alleles (Beier and Noss 1998).

Governments have enacted reintroduction efforts for top predators such as the red and gray wolf to supplement declining carnivore populations. These efforts supplement critically small wild populations with captive bred individuals and promote a high level of genetic diversity (Vonholdt et al. 2008). Reintroduction of large predators in particular has spillover benefits to the ecosystem; predators control populations of herbivores such as elk and deer. This reduces overgrazing and improves overall integrity of the ecosystem (Ripple and Beschta 2003). The Northern Rocky Mountain and Western Great Lakes populations of the gray wolf, once listed on the Endangered Species Act, were de-listed (via a rider on an appropriations bill) due to a population increase and stabilization. This policy decision is still extremely controversial; proponents of de-listing and wolf hunting fear conflicts between wolves and wildlife while critics argue that management plans and off-take quotas are not adequate to ensure the sustainability of the wolf population.

An additional strategy employed in North America (especially in Canada) to aid wildlife populations is the installation of wildlife crossing structures such as overpasses and underpasses. These structures serve as habitat corridors between small patches and also

promote metapopulation connectivity for bears and other large mammals to use (Clevenger 2005, Hanski 1999).

Threats to Wildlife

In general, legal hunting is not a threat to wildlife populations in North America; hunting is rigorously regulated and monitored by state fish and wildlife agencies to ensure sustainable populations. Hunters in the United States and Canada legally harvest over 100 million animals each year (Delaware Action for Animals 2011). This figure does not speak to the sustainability of the harvests; sustainability must be assessed for each species on a regional basis.

Threats to wildlife in North America differ by region, but cumulative threats include climate change (which may contribute to range shifts), habitat fragmentation and loss, invasive species, and human-wildlife conflict, particularly wildlife-vehicle collisions and perceived risk of livestock predation (Imre and Derbowka 2011, Collins and Kays 2011). Given the trends in global biodiversity loss, it is likely that more species will be listed on the US Endangered Species Act and the Canadian Species at Risk Act in the future.

Social Support for Conservation: North America

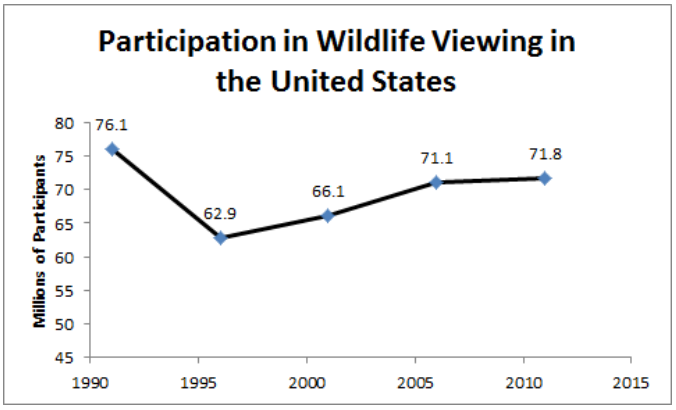


Figure 9: Participation in Wildlife Viewing in the United States.
Sources: USFWS 1991, 1996, 2001, 2006, 2011.

North Americans generally support wildlife conservation; millions of Americans and Canadians participate in consumptive and non-consumptive activities including hunting, bird watching, and visiting national parks and other natural areas. 71.8 million Americans (23% of the population) participated in wildlife watching in 2011; 68.6 million of these were around the home, while 22.5 million of these were away from home (USFWS 2011). In addition, nearly one in five Canadians (18.6 percent of the population) participated in wildlife viewing in Canada in 1996 (DuWors et al. 1999). Furthermore, membership in non-governmental environmental organizations in both the US and Canada is in the millions and increasing which indicates growing support for environmental conservation (Rands et al. 2010, Dunlap and Mertig 1992). In general, Americans and Canadians agree with wildlife and hunting policies, although exceptions exist, including animal welfare groups, which generally advocate for a complete ban

on hunting. Furthermore, certain carnivores including wolves and coyotes are perceived as a threat to livestock and may be targeted as "problem animals."

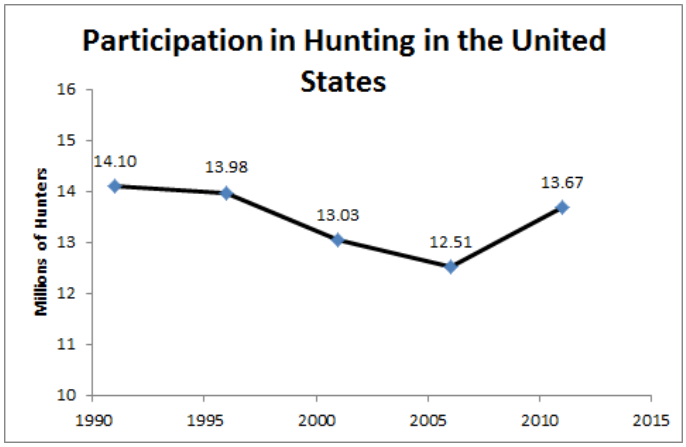


Figure 10: Participation in Hunting in the United States.
Sources: USFWS 1991, 1996, 2001, 2006, 2011.

During the years 1991 - 2006, participation in hunting in the US declined by 12% (USFWS 1991, USFWS 2006). This trend may be attributed to increasing urbanization, reliance on technology for entertainment, and an overall disconnect of youth from nature. However, **participation in hunting in the US increased by 9% from 2006 to 2011,** with a total of 13.7 million Americans participating in 2011 (UWFWS 2011). This amounts to about 4.4% of the population. This upward trend may be attributed to high unemployment and availability of leisure time or perhaps by a movement to get "back to nature," as advocated by Richard Louv. The US population is growing by 0.9% each year and becoming more diverse as immigration increases (CIA 2012). It remains to be seen how these demographic shifts will affect participation in hunting in the future.

The most recent survey in Canada indicates that 20 million people, or 71.4% of the population, participated in hunting and wildlife viewing in 1996 (DuWors 1999). In addition, d**uring the years 1981-1991, participation in hunting in Canada declined by 12% while participation in non-consumptive activities grew by 8%** (Gray et al. 1993). This trend is similar to that in the US for hunting and may also be attributed to urbanization and/or lack of recruitment of young hunters. The increase in participation in non-consumptive activities was proportional to population growth. Unfortunately, more recent comprehensive surveys for Canada's participation in nature-related activities do not exist. If and when such a survey becomes available, future analyses should compare trends in participation between the US and Canada.

In general, North Americans relationship to nature differs from that of developing countries included in this analysis. North Americans do not rely on wildlife or other natural resources for their primary source of income. There is some reliance on furbearers such as beavers for supplementary sources of income. In addition, indigenous populations, especially those in Canada, rely on large mammals for traditional cultural purposes.

The Southern African Model

The Southern African model of wildlife management centers on the privatization and commercialization of wildlife resources. In recent decades, the governments of South Africa, Zimbabwe, and Namibia have made key changes to their colonial legal regimes, giving full control over the utilization of wildlife to the owners of private land on which the wildlife are located. With complete control over use of their wildlife, landowners are able to capitalize on the many economic opportunities available within the tourism and wildlife trade industries, among others. This incentive is the driving force behind the region's model for wildlife management. The economic gains realized by private landowners provide the justification for this form of land use, as opposed to livestock ranching which typically generates significantly less revenue, while producing more negative environmental impacts. A side effect of this form of management is the diligent maintenance of natural and semi-natural habitat for wildlife, which has led to overall recoveries of some of southern Africa's wildlife populations (Muir-Leresche and Nelson 2000).

Also critical to the success of the model is the devolution of wildlife management rights to local communities by spreading out the authority over wildlife from the central government to people at the local level. Some African countries, such as Tanzania, have attempted to implement legal changes that would give local villages rights over the use of wildlife on their land. Implementation of these changes, while somewhat sluggish, has recently begun to make headway. Tanzania's failure to rapidly decentralize the authority over land, wildlife, and the access to the benefits from them has made it difficult for local communities to see the incentives behind conserving wildlife, particularly those outside of protected areas (Nelson 2006). Another major challenge faced by all areas of southern Africa is ensuring proper monitoring of wildlife populations so that consumptive uses of wildlife are sustainable (Wilfred 2010).

"Hunting has been the single biggest factor in the success of conservation in South Africa; when game gained a commercial value, it became protected" (WC 2012).

SOUTH AFRICA

Policy and History of Wildlife Conservation

Conservation of South Africa's natural resources dates back many centuries, before the arrival of European settlers. For some of the earliest inhabitants of southern Africa, such as the indigenous Sanqua people, a symbiotic relationship formed between people and environment, and a 'wise use' ethic was employed regarding the utilization of natural resources (DEA 2009). In the 19th century, however, careless hunting practices by colonists from Europe resulted in rapid decline of wildlife (DEA 2009). Growing concern over decreasing wildlife numbers led to the formation of the first National Parks, such as Kruger and Kalahari Gemsbok. The primary function of these parks was to preserve those animals viewed as valuable (mostly antelope for hunting purposes). By contrast, predatory species were viewed as vermin and shot on sight. The effects of these ecologically destructive practices were further exacerbated by the country's race-based social structure, commonly known as apartheid.

Policies enacted during the time of apartheid proved particularly costly to the communities, biodiversity, and ecosystems of South Africa, resulting in widespread poverty, social dislocation, and damage to the environment. Conservation policies typically reflected the sentiment of apartheid, restricting certain groups of individuals from access to protected areas. These policies, coupled with the forcible removal of indigenous communities from their homelands led to the belief that conservation was elitist and of no benefit to ordinary people. South Africa's transition away from apartheid came after a push for democracy in which marginalized citizens were granted rights and access to resources previously denied them. With its newly amended Constitution in 1996, the country developed a legal framework aimed at securing sustainability and equitable access to resources for all people (DEA 2009). The Department of Environmental Affairs, established in the 1990s, became South Africa's main environmental governing body, tasked with implementing policies to reflect the country's new outlook on the management of its natural resources. Within this department, the Biodiversity and Conservation branch promotes the conservation and sustainable use of natural resources to help grow the economy and contribute to poverty alleviation (DEA 2012).

Several key pieces of legislation helped to transition South Africa's approach to wildlife management from preservation and exclusivity to sustainable use and public participation with sharing of benefits. The National Environmental Management Act (NEMA) (1998) established that the environment is held in public trust for the people, and that the beneficial use of environmental resources must serve the public interest. A few years later, both the NEM: Biodiversity Act (NEMBA) (2004) and the NEM: Protected Areas Act (NEMPA) (2004) were passed, providing regulatory framework for the protection of South Africa's valuable species and the areas in which they live (DEA 2009). The NEM: Biodiversity Act also provided for the listing of species as threatened or protected, with certain "restricted" activities requiring special regulation (e.g. hunting). Additionally, under NEMBA, the South African National Biodiversity

Institute (SANBI) was established, which monitors the conservation status of all listed threatened or protected species and ecosystems (DEA 2012).

Under South African law, wildlife is considered *res nullius*, meaning that it is owned by no one. Wild animals can become owned, however, if a landowner takes control of them with intent to become the owner. Since the 1960s, when wildlife became associated with monetary value (i.e. people began paying to hunt wild animals), the commercial use of wildlife increased significantly. The concern amongst landowners was the lack of legal compensation in the event of loss of wildlife from poaching or escaped animals. To combat this issue, the Game Theft Act of 1991 provided that owners of commercially used wildlife on "sufficiently enclosed" (i.e. adequately fenced) land would not lose ownership of their animals if they escape. This law provided landowners with a feeling of security in making investments in wildlife, and further supported the growth of the wildlife enterprise industry (Higginbottom and King 2006).

Economics of Wildlife Conservation

South Africa is an upper-middle income country with the largest economy in Africa (CIA 2012). It has a thriving tourism industry, which generated nearly $2.3 billion from 2000-2001, and accounted for **8.6% of the total GDP in 2011** (Booth 2010, WTTC 2011). Wildlife tourism, in particular, contributes a significant amount of annual revenue to the national economy. From 2011-2012, SANParks generated more than US$100 million in tourism revenue (SANParks 2012). **Just 15% of SANParks funding comes from the government; the remaining 85% is generated through tourism** (IOL 2011). This heavy reliance on tourism revenue applies a great deal of financial pressure to national parks, which must cover their operational costs, compensate over 6000 employees, maintain infrastructure, and support their conservation initiatives (SANParks 2008*a*, Castley et al. 2009).

In 2012, a buffalo cow with the largest horns in South Africa, and her calf sold for $2.5 million (USD). A sable antelope bull sold for over $326,000. In 2010, the annual value of game sold at auctions was over $210 million (WC 2012).

National parks typically engage in auctioning of wildlife (e.g. rhino) to private reserves to generate income for park development and conservation projects. **SANParks reported that the total income generated from wildlife sales during 2011-2012 was over US$4.8 million** (SANParks 2012). Red hartebeest, black wildebeest, and eland are common species of game found at auctions. Private buyers pay top dollar for high-value species like buffalo and white rhino. In 2008, during South Africa's annual Absa Kirkwood Wildlife Festival, **a single white rhino from Kruger National Park generated almost US$72,000** (SANParks 2008*b*). Owners of private reserves, who are granted ownership rights over wildlife fenced in on their property, typically manage their animals for the purposes of meat and trophy hunting, live game sales, or tourism (Bothma 2002).

The growth in international wildlife tourism has acted as a catalyst in the development of sustainable wildlife enterprises in the private sector (Cousins et al. 2010). **South Africa has the largest hunting industry in Africa,** serving over 8500 clients per year and generating revenues

of US$100 million per year (Lindsey et al. 2007, PHASA 2006). Although hunting supports relatively low volumes of tourists, it generates high revenues and creates 5000-6000 jobs (Lindsey et al. 2007).

Conservation and Local Communities

Many South Africans express a **generally positive attitude toward wildlife conservation**, due to the economic opportunities that arise as a result (i.e. employment); however, they realize that the need for jobs often greatly exceeds the availability of jobs (Strickland-Munro et al. 2010). Members of local communities, particularly those situated adjacent to national parks, often have a sense of pride in living near an internationally recognized icon, which often fosters an attitude of ecosystem stewardship. However, the racially dichotomous nature of South African tourism contributes to a feeling of separation and alienation experienced by some members of local communities who are of the opinion that national parks exist for the benefit of tourists (Strickland-Munro et al. 2010).

In areas outside of National Parks, however, community-owned land can be added to the national protected area estate in the form of contractual parks (Reid et al. 2004). Under such agreements, **SANParks contributes an annual lease fee to a local community in exchange for use of their land for conservation activities**. These contractual parks have contributed to increased protective coverage of South Africa's land surface area, as conservation within national parks is insufficient. While local communities participate in these contractual park agreements, these arrangements are not exclusive to local people. Private landowners often enter into similar agreements with SANParks, and there is sometimes unequal treatment of private and communal landowners in their contracts with the state. This prevents communities from reaching the full potential of natural resource utilization on their land (Reid et al. 2004).

Protected Areas

South Africa has protected 6.9% of its land area, and 6.5% of its marine territory (CIA 2013). The protected areas of South Africa include South African National Parks (SANParks) and marine protected areas managed by the national government, and public nature reserves managed by provincial and local governments (DEA 2004). Some "special nature reserves" are highly protected areas, which restrict human activity to conservation and scientific research only (Paterson 2009). Protected areas serve many purposes including wildlife conservation, public education, and for many South Africans, economic development.

Much of South Africa's terrestrial flora and fauna is protected in designated state and public protected areas, but the private sector also plays a critical role in the management and conservation of wildlife (Child 2009). **An estimated 13% of South Africa's land is under some type of private conservation management**, in the form of private game reserves, conservancies, and mixed game/livestock farms, compared to the 6.9% represented by designated protected areas (Cousins et al. 2010). The potential for huge economic gains in wildlife utilization enterprises creates an incentive for private landowners to maintain 'natural' or semi-natural

habitat and resources for species, and in many cases this can achieve both economic and conservation goals.

Wildlife

South Africa has incredibly rich biodiversity, home to 7.5% of the world's plants, 8% of its birds, 5.8% of its mammals, 4.6% of its reptiles, and 5.5% of its insects, despite representing only 2% of the planet's land surface (DEA 2009). According to a study by Craigie et al. (2010), **large mammal populations within 35 of southern Africa's protected areas have increased by 25% between 1970 and 2005, unlike eastern and western Africa, whose large mammal populations in protected areas have steadily decreased** within the same time frame. Craigie et al. at least partially attribute the regional differences in population trends to the relatively well-funded status of protected areas in southern Africa, driven by tourism revenue, and the fact that these protected areas are often managed specifically for their large mammals.

It is suggested that trophy hunting has played a significant role in many of southern Africa's thriving wildlife populations (Lindsey et al. 2007). On private land in South Africa, trophy hunting facilitated the recovery of bontebok (*Damaliscus dorcas*), black wildebeest (*Connochaetes gnu*), and cape mountain zebra (*Equus zebra*) by providing the financial incentives for reintroduction (Lindsey et al. 2007). **South Africa houses 93% of the global population of southern white rhinoceros**, another species that has recovered, at least in part, by the incentives from trophy hunting encouraging its reintroduction on to game ranches (Lindsey et al. 2007).

Major threats to South Africa's wildlife include human population expansion, habitat fragmentation, and climate change. Increasing human population densities apply pressure to wildlife, as closer proximity to humans increases the rate of human-wildlife conflict. **However, this issue is less severe in southern Africa, as compared to eastern and western Africa** (Craigie et al. 2010). **Extensive usage of fencing as a method of delineating ownership of wildlife has led to habitat fragmentation on private and communal land.**

TANZANIA

Policy and History of Wildlife Conservation

The history of wildlife conservation in the United Republic of Tanzania dates back to 1891 when the use and management of wildlife was controlled by German colonial laws. The first Game Reserves were established as hunting areas, and while local communities were able to continue living on the land, they were not able to use the wildlife (Nelson et al. 2007). During this time, all governance of the wildlife sector was directly controlled by the state, and local communities were legally barred from the use of wildlife resources and the economic benefits associated with them. As a result, there was little incentive at the local level for the conservation of wildlife (Nelson 2009). Tanzania's government began to move towards stricter protections of wildlife and increased limitations on their use by humans. The National Parks Ordinance of 1959 empowered the President to designate an area as a National Park, and it established the Tanzania National Parks Authority (TANAPA). Under the Ordinance, any rights previously held by local communities to the use of land in these areas were effectively extinguished (Nelson et al. 2007). The Wildlife Conservation Act (1974), provided for the protection and sustainable utilization of wildlife and wildlife products. The statute was generally exclusive of local communities regarding defining a role for them in the conservation and management of wildlife. However, the Act also established the Tanzania Wildlife Protection Fund (TWPF), which facilitates and supports wildlife conservation inside and outside of protected areas, with particular attention to anti-poaching operations and development of rural communities near protected areas.

This centralization of wildlife governance, and the consequent lack of incentives for conservation among local communities led to declines of Tanzania's wildlife populations by the 1980s. About half of the country's elephant population had been poached, and nearly all of its rhinos had been hunted for bushmeat (Nelson 2009). In response, the government developed a new policy for wildlife, which aimed to increase local participation in wildlife conservation. The Wildlife Policy of Tanzania, issued in 1998, established the country's vision of decentralization of wildlife management and devolution of rights over the use of wildlife to local communities. About half of the tourist hunting concessions are on Game Reserves where human settlement is prohibited, and the other half are on community lands. As such, giving local communities the opportunity to benefit economically from the hunting concessions on their land was central to this policy reform (Goldstein 2005). Other goals included ensuring that conservation is profitable enough to compete with alternate land uses such as agriculture.

The creation of village-based Wildlife Management Areas (WMAs) in the 1990s reflected the aims of The Wildlife Policy. WMAs are community-owned and managed conservation areas in which several villages come together and give up land for conservation (Benjaminsen et al. n.d.). In exchange, the communities receive a proportion of the revenue generated on the land from

wildlife-related tourism. In some cases, WMAs form partnerships with private enterprises who supply hospitality and other tourism services (Goldstein 2005). Villages seeking to form WMAs often encounter a number of challenges, including issues with the complexity of the establishment process, and a lack of clarity regarding the proportion of revenue from WMAs retained at the local level. Critics of the Wildlife Policy point to its failure to provide local communities with greater rights over the use of wildlife. The control over WMAs remains largely with the central government, despite proclaimed efforts to the contrary (Nelson 2009).

Tanzania's present-day management of wildlife falls under the governance of the Ministry of Natural Resources and Tourism (MNRT), which manages the country's use of natural and cultural resources, and oversees the development of the tourism industry. Within the MNRT, the Wildlife Division manages wildlife conservation in all parts of Tanzania, excluding its National Parks and the Ngorongoro Conservation Authority area; these are managed by TANAPA and the Ngorongoro Conservation Area Authority (NCAA), respectively (MNRT 2007, Goldstein 2005).

Economics of Wildlife Conservation

Tanzania is characterized as a low income economy, with a large traditional rural sector and a small modern urban sector (Kweka et al. 2003). The country's GDP (PPP) was estimated to be $73.5 billion in 2012 (CIA 2012). Its economy is largely based in services and agriculture, which account for about 48% and 27% of its GDP, respectively (CIA 2013). Agriculture provides 85% of its exports and employs 80% of the work force (CIA 2013). **Tanzania's wealth of natural resources attracts steady streams of tourists annually, which represented 13.2% of the total GDP in 2012** (WTTC 2012). The main tourist attractions in Tanzania are the wildlife safaris. From 2000-2001, nature tourism generated nearly US$300 million (Booth 2010). TANAPA receives about $US11 million from photographic tourism in the Serengeti National Park and Ngorongoro Conservation Area, alone.

Although it is conducted on a smaller scale than photographic tourism, hunting tourism represents a significant contribution to the economy and supports over 4300 jobs in Tanzania (Lindsey et al. 2007). Tanzania's Wildlife Division handles all management and administration of hunting, and it receives funds from a variety of sources: the overwhelming majority (99%) comes from hunting licenses and hunting block fees, with the remaining 1% of revenue from capture permits, game license fees, certificates of ownership, trophy export certificates, trophy dealer licenses, compounding fees, miscellaneous receipts, and CITES fees (Booth 2010). In 2008, hunting tourism generated US$56.3 million in gross income, 22% of which accrued to the Wildlife Division (Booth 2010). Between 2008-2011, trophy hunting contributed US$75 million to Tanzania's economy (Songorwa 2013).

Conservation and Local Communities

Although Tanzania's centralized system of wildlife management has been successful in terms of its establishment of a large network of protected area and providing legal protection for certain species, there have been a number of flaws. **With uniform state ownership of the land and its resources, local people have little incentive to value wildlife** and concern themselves with its conservation. Rather, they remain burdened with the costs of living with wildlife, while the benefits produced by the resource flow primarily back to the government (Nelson 2006).

Current Wildlife Management Area (WMA) regulations allocate 35% of revenues generated on village lands to the Wildlife Division, and the remaining 65% is retained within the local community (WRI 2010). WMAs have the potential to be a successful method of community engagement in wildlife management and conservation, but their establishment continues to be a very complex, time-consuming process. Local communities seeking to establish WMAs often face challenges navigating these highly bureaucratic processes. The regulations require communities to satisfy a vast array of prerequisites, such as formulating a WMA general management plan and Environmental Impact Assessments. The local community often interprets these complexities as intentional regulatory hindrances from the government, with the intent to limit the devolution of management rights to the local level (Nelson et al. 2007).

1994 Director of Wildlife M.A. Ndolanga:
"Ownership of wildlife is another major issue that must change to encourage community-based conservation. At present the state owns all wildlife and villagers in community-based conservation project areas are issued with a quota by the Department to give them the opportunity to hunt legally. Although this is a considerable step forward, the villagers do not own the wildlife and until they do, they will not feel responsible for it." (Ndolanga 1996)

Protected Areas

All land in Tanzania is owned by the government, which includes its network of protected areas comprising about 28% of the country's total land surface area (WDPA 2012). The land is comprised of 17 National Parks, 28 Game Reserves, 5 Game Controlled Areas (GCAs), and the Ngorongoro Conservation Area (NCA). In National Parks and Game Reserves, human settlement is prohibited, and within the NCA and in GCAs, humans and wildlife co-exist. A total of 570 Forest Reserves cover about 15% of Tanzania's land surface area, some of which overlaps with protected areas committed to wildlife conservation. Wetlands comprise about 10% of the country's land area (MNRT 2007).

Tanzania's protected areas and wetlands are vitally important for wildlife and wetland resource uses, including game viewing, trophy and resident hunting, game farming, and ecotourism. Ngorongoro and National Parks in northern Tanzania are the main tourist destinations for game viewing, an activity which is growing in popularity in the southern National Parks and Game

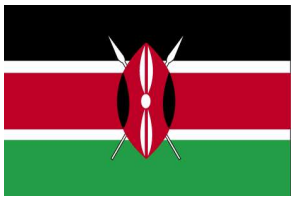
Reserves. Trophy hunting in Tanzania is consistent with the policy of high quality, low density tourism, and it is practiced in Game Reserves, GCAs, Forest Reserves, wetlands, and areas outside of these protected areas. Indigenous Tanzanians have the right to hunt wildlife with licenses issued for use in GCAs and in areas outside of protected areas that are not set aside for trophy hunting by tourists.

Wildlife

Tanzania has one of the highest levels of biodiversity and wildlife richness in sub-Saharan Africa (Nelson, et. al 2007). It has the greatest number of large mammal populations in the world, and the second largest population of elephants after Botswana (TNRF 2008). The country's wildlife populations are widespread, occurring both inside protected areas, as well as outside of protected areas where they co-exist with local communities on private and communal lands.

Although the country has invested considerably in wildlife conservation and management, the best available scientific data -- from the Tanzania Wildlife Research Institute -- suggests that wildlife is declining in all of Tanzania's main wildlife areas, including national parks and game reserves. Studies show that **most wildlife species in Tanzania have undergone population declines since the 1980s** (TNRF 2008).

Major threats to wildlife include over-exploitation, especially for bushmeat, and habitat loss stemming from rangeland conversion to cultivation or human settlement. Bushmeat poaching, though illegal, is widespread throughout northern Tanzania, representing one of the main forms of wildlife use within the region (Rodgers et al. 2003). Resident hunting also represents and substantial proportion of unsustainable wildlife exploitation. There is difficulty in ensuring that the number of animals being harvested is in compliance with the license issued. Additionally, added pressure from poaching makes determining the sustainability of current quotas difficult. **The sale of meat from a buffalo can fetch about 100 times the amount of money spent on the license to hunt that animal**, which often encourages citizens to exceed quotas (Rodgers et al. 2003). Finally, land conversion adds an additional level of pressure to wildlife populations by removing and fragmenting habitat. As the human population increases and continues to encroach upon wildlife habitat, human-wildlife conflict also increases. In defense of their livelihoods and personal safety, communities with crops and livestock are prepared to lethally remove species of wildlife that they perceive to be a threat, namely carnivores (Rodgers et al. 2003). In order for wildlife conservation to be effective, wildlife need to be responsibly managed both inside and outside of protected areas, which Tanzania has been struggling to achieve thus far.

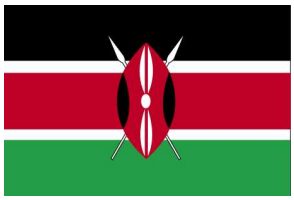


The No-Hunting Model
Kenya & India

The 'No-Hunting' model of wildlife conservation is represented in this report by the countries of Kenya and India. These countries banned all consumptive use of wildlife in the 1970s, in response to alarming wildlife declines. The two main arguments made in support of the ban are that hunting wildlife 1) harms their populations, and 2) is unethical. Wildlife, either dead or alive, is owned entirely by the state. Wildlife conservation is a top-down endeavor, with the government responsible for species conservation, enforcement of wildlife laws, habitat protection, and management of protected areas. As there is no legal consumptive use of wildlife, funding from the No-Hunting model depends on tourism revenues and government support. Tourism does not fully offset the operating costs for the model.

Wildlife populations of large mammals the No-Hunting model are generally declining, although there are many factors other than hunting which could influence this trend. The primary threats to wildlife populations in the No-Hunting model are population growth, habitat loss, and poaching. Human populations living around and within protected areas exert increasing pressure for land and natural resources in wildlife habitats. Opponents to the model argue that a multiple-use approach that involves hunting and commercial markets for wildlife offers a broader array of financial incentives for conservation, and provides benefits for more of the human population.

To be successful, the No-Hunting model requires strong institutions and enforcement capabilities, and a lucrative and well-regulated tourism industry. Without these enabling conditions, the model fails to be self-sustaining.



KENYA

Policy and History of Wildlife Conservation

Kenya has the largest economy in east and central Africa, yet is a developing country with over 43% of its population living on less than $1.25 per day (UNDP 2013). The majority of Kenya's 43 million inhabitants live in rural areas, with agriculture employing 75% of the workforce (CIA 2012, MoENR 2000). **Over 80% of the population either directly or indirectly relies on biodiversity for their survival.** Rapid population growth (2.4% per year) combined with a reliance on natural resources has put enormous pressures on Kenya's wildlife (CIA 2012).

The Kenya Wildlife Service (KWS), founded in 1989, is responsible for protecting Kenya's biodiversity and protected areas. ***All* of Kenya's wildlife is the property of KWS**. KWS manages most of Kenya's national parks and reserves, with one notable exception being the Maasai Mara National Reserve, which is managed by local authorities. KWS manages specific conservation projects for imperiled species and habitats, including elephants, rhinos, forests and wetlands. Additionally, KWS operates the Community Wildlife Service, the Security Service, and the Veterinary Service. These programs work to improve wildlife corridors and reduce human-wildlife conflict, fight poaching in protected areas, and secure breeding populations of threatened species, respectively.

Soon after Kenya gained its independence in 1963, the government crafted wildlife policy focused on habitat preservation and expanded the national park system. Yet despite the additional habitat protection, Kenya lost much of its wildlife in the following decades. Poaching, political disturbance, corruption, habitat destruction, and drought all played a large part in Kenya's wildlife decline (Herne 1999). The legal hunting market, on the other hand, contributed to only a fraction of the rhino and elephant taken in East Africa. In 1972, for example, hunters in Kenya used only 19 of 34 permits issued for rhinos. In the same year, Hong Kong alone imported over 1000 rhino horns from Kenya (Herne 1999).

In just 2 years (1974-1976), elephant populations had crashed by 45%, falling from 35,900 to 22,000 individuals. Much of this decline occurred in Tsavo National Park, a region where no legal hunting of any kind had ever been allowed (Coogan 2012). In response to heavy international pressure to stop the wildlife decline, the Kenyan government banned elephant hunting in 1973. The ban however failed to address the root cause of the decline -- *illegal* hunting -- and poaching continued to decimate elephant populations. In fact, elephant poaching may have increased due to the lack of hunters, whom had previously protected their hunting grounds from poachers (Herne 1999). During this time, Kenya was under significant pressure from several international donor and animal welfare organizations to halt the decline through a ban on legal hunting (Coogan 2012, Herne 1999). In 1977, Kenya agreed, and signed into law the **Wildlife (Conservation and Management) Act**, effectively ending all legal hunting

in Kenya (GOK 1989). The hunting ban has since been upheld in subsequent amendments to the act, most recently in 2011. Hunting of gamebird species, however, was reinstated in 1984, and continues to be a profitable tourism activity on many private conservancies in Kenya (Simiyu 2000).

The new Wildlife Bill of 2011 addresses several pressing issues in wildlife compensation, including **compensation, problem animals, and poaching fines**. It provides the first clear mechanism for compensation to individuals who have suffered losses to crops, livestock, or human life due to wildlife damage. The Government recently issued their first compensation payments totaling $220,000 for 230 cases of death or injury, most related to snake bites (Whittle 2013). The Bill breaks from previous policy by permitting individuals to kill problem animals. as long as they report the kill within seven days. Many conservationists fear that this clause will lead to widespread wildlife decline, as individuals can now kill animals they deem to be an inconvenience. Importantly, the Bill increases the fines for illegal sport hunting to a minimum of $23,500 or seven years imprisonment, and for lesser poaching infractions to $5800 (Gov. of Kenya 2011). This much-needed adjustment better reflects the black market value of hunted species, as compared to the previous fines of $200.

Kenya is a vocal participant in international conservation efforts, especially regarding the ivory trade. After the Convention on International Trade in Endangered Species (CITES) banned the commercial ivory trade in 1989, Kenya set a famous precedent by burning its ivory stockpile as a symbol of its determination to fight the illegal trade. Kenya repeated the act again in 2011, burning 5 tons of ivory worth over $16 million (BBC 2011). Kenya opposes the legal sale of any ivory, arguing that it drives further illegal poaching.

Despite these conservation efforts and hunting ban, however, Kenya **has lost 45-70% of its wildlife since 1977** (Coogan 2012, Norton-Griffiths 2000, 2007; Western et al. 2009). In light of the continuing declines, many are advocating for alternative methods of wildlife management. The Kenya Wildlife Service has recently demonstrated its willingness to reconsider the hunting ban. In 2006 a ‘think tank’ comprised of members of KWS, a conservation organization, and private landowners concluded “sustainable, science-guided consumptive utilization [licensed hunting] was the way to establish a monetary value for wildlife among local peoples and thereby guarantee its future in Kenya” (Coogan 2012).

Zimbabwe's CAMPFIRE Program

In contrast to Kenya, consider what has happened in Zimbabwe. In 1989, conservation organizations helped the government implement a program known as the Communal Areas Management Programme for Indigenous Resources or CAMPFIRE. This approach devolves the rights to benefit from, dispose of, and manage natural resources to the local level, including the right to allow trophy hunting. Community leaders with local knowledge about wildlife help establish sustainable hunting quotas. Hunting then provides jobs for community members, compensation for crop and property damage, revenue to build schools, clinics, and water wells, and meat for villagers.

By granting local people control over wildlife resources, their incentive to protect it has strengthened. As a result, poaching has been contained and human-wildlife conflicts have been reduced. While challenges remain, especially from the current political climate in Zimbabwe, CAMPFIRE has proved successful in raising funds for conservation and local people.

Ten years after the program began, wildlife populations had increased by 50%. By 2003, elephant numbers had doubled both inside and outside of CAMPFIRE areas, with half living outside national parks. Between 1989 and 2001, CAMPFIRE generated more than $20 million in direct income, the vast majority of which came from hunting. During that period, the program benefited an estimated 90,000 households and had a total economic impact of $100 million. These benefits occurred during a time of economic collapse, regime uncertainty, and socio-political challenges in Zimbabwe.

Through its multiple-use approach, Zimbabwe's wildlife contributes over US$ 250 million annually to its economy (one-quarter of the total contribution made by agriculture) through safari hunting, game cropping, tourism and live animal sales. Hunting accrues 12% of this total, or $30 million.

Source: Anderson 2011, Booth 2010, Murindagomo 1990

Economics of Wildlife Conservation

Kenya's economy relies heavily on wildlife tourism, which contributes over 10.5% of Kenya's GDP and employs almost 10% of its population (Booth 2010, CIA 2012). Over **77% of visitors come to Kenya for wildlife tourism**.

As consumptive use of wildlife is banned, tourism and donations are the only revenue sources for Kenya's wildlife management. Indeed, some studies estimate that Kenya's hunting ban costs the state $20-40 million per year in lost revenues (Elliott and Mwangi 1998; Hurt and Ravn 2000). **Entrance fees, however, offset most of KWS' operating costs.** In 2007 and 2011, entrance fee revenues offset 68% and 82% of operating expenses, respectively (UNDP 2012). Even in 2008 when tourist visits fell dramatically due to political instability, entrance fees still covered 45% of operating costs (UNDP 2012). KWS' covers the remaining costs through the

KWS Endowment Fund, and also from outside development partners, which contribute 5-10% of KWS' budget (KWS 2008).

KWS spends over 80% of its budget on infrastructure, equipment, and human capital, such as vehicle and fence maintenance, communication systems, and staff training. The remaining 20% is used to 'enhance wildlife conservation.' **KWS spends the majority of this budget (73%) on law enforcement and anti-poaching activities** (KWS 2008, Sabahi 2013).

The government accrues 95-100% of all tourism revenues, primarily as park entrance fees. There is no regulation requiring that tourism revenues are shared with local communities, nor is there a requirement that tourism revenues be used on conservation efforts. Instead, revenues enter Kenya's general fund (Gov. of Kenya 2010, Norton-Griffiths 2007, Sindinga 1995).

Economic Value of Wildlife

Poaching is driven by the market value of wildlife, which has skyrocketed in recent years for many African species. Black market prices for elephant tusk and rhino horn can reach $3000 and $65,000 per kilogram, respectively (Langfitt 2012, Parker 1982, Stoddard 2012). This translates to an average price of $19,000 for one elephant tusk, and over $160,000 for one rhino horn, although the poacher receives just a fraction of this.

Even so, a live elephant is worth even more over its lifetime than a dead one. It is estimated that an elephant in Kenya generates over $14,000 in income from tourists every year, yielding a potential lifetime value of $900,000 (Lenfant 1995). Elephant-related tourism brings about $200 million each year to Kenya (Lenfant 1995). Yet, poaching continues because the short-term, individual gains from poaching are greater than from tourism (Sindinga 1995, Norton-Griffiths 2008).

As consumptive wildlife use is banned in Kenya, wildlife is only worth what a tourist will pay to see it. Yet the majority of Kenya is not currently suitable for tourism: **70% of Kenya's land area is rangeland, and of this only 5% is developed for tourism** (Norton-Griffiths 2007). Safari tourism requires infrastructure, accessibility, and a trained industry to be successful in the long-term, which is lacking in most of Kenya (Norton-Griffiths 2007, Lindsey 2006).

Rather than a financial benefit, the presence of wildlife is often a financial drain on rural people. A study of a ranch in southern Kenya found that the presence of wildlife cost 48% of the ranch's annual net returns, through wildlife protection costs, disease, predation, infrastructure damages, and compliance costs with KWS (Norton-Griffiths 2007). Thus **the ranch would experience 52% higher profits if wildlife were eliminated**. Unless this ranch can profit from tourism, there is no financial incentive for it to conserve its wildlife. Without tourism, wildlife cannot compete economically with livestock or agriculture. Many pastoral landowners are choosing to disinvest in their wildlife (Norton-Griffiths 2007).

Conservation and Local Communities

Many Kenyan protected areas are surrounded by human communities, who incur costs from wildlife through the loss of agricultural land, livestock, human injury and mortality (Sindinga 1995). These communities need a positive incentive to preserve wildlife on their land to offset these negative costs.

Yet even if a Kenyan ranch or community successfully brings in tourism revenues, there is no mechanism or policy that requires that these benefits are distributed equitably. Although KWS encourages revenue sharing with local communities, it does not specify quantity nor process (Sindinga 1995, Norton-Griffiths 2008). **The vast majority of revenues still go to operators and owners of the safari industry, rather than the communities that surround these tourist destinations** (Groom and Harris 2008, Norton-Griffiths et al. 2008).

Communities desire equitable benefit sharing that compensates themselves or a family member for the losses they incur due to wildlife. A study of several Maasai ranches in Kenya demonstrated that availability and equitable distribution of financial benefits was more important than the amount of money provided in shaping attitudes toward conservation (Groom and Harris 2008). To increase local support for conservation in Kenya, **KWS and private landowners should focus on increasing the spread rather than the quantity of wildlife benefits**, perhaps to the extent of ensuring that at least one member of every extended family receives some benefit from wildlife (Groom and Harris 2008).

Protected Areas

The Kenyan landscape is a mosaic of grasslands, semi-arid scrublands, forests, inland lakes and wetlands, coastal and marine ecosystems. Approximately 70% of the land area is mostly rangeland -- intermixed grasslands and woodlands -- which supports much of the country's wildlife population (CBD 2012). 20% of the land area is under agriculture and also simultaneously supports most of the human population. Forests provide ecosystem services especially important to Kenya's economy, including food, medicine, fuelwood, water catchment areas. Kenya's indigenous forests, however, are in decline due to overexploitation and human encroachment, threatening much of Kenya's population (CBD 2012).

Kenya has protected 10% of its land area, with KWS or Kenya Forest Service managing 8% of this area as National Parks, National Reserves, Sanctuaries, and Forest Reserves. Many private wildlife conservancies and ranches exist, especially in Northern Kenya in Samburu and Laikipia counties. Kenya's protected areas are threatened by human encroachment and subsequent overgrazing from livestock.

Wildlife

Wildlife in Africa has been in steep decline since the 1970s, primarily due to habitat destruction due to human population expansion.

A study by Craigie et al. (2010) found that African national parks have lost 59% of their large mammals since 1970. As this study excludes elephant and rhino -- which are primarily threatened by poaching -- it demonstrates that factors other than overhunting led to this decline in protected areas. Habitat loss due to human and agricultural expansion are believed to be the primary drivers of this decline (Western et al. 2009). Ensuing habitat fragmentation has degraded migratory corridors for wildlife, inhibiting large mammals such as wildebeest and zebra from moving safely between their wet and dry season ranges (Western 2009). **Wildlife outside of protected areas -- which includes 70% of Kenya's wildlife, and 80% of its elephants -- has likely fared even worse (**Economist 2010, KWS 2013, Norton-Griffiths 2007).

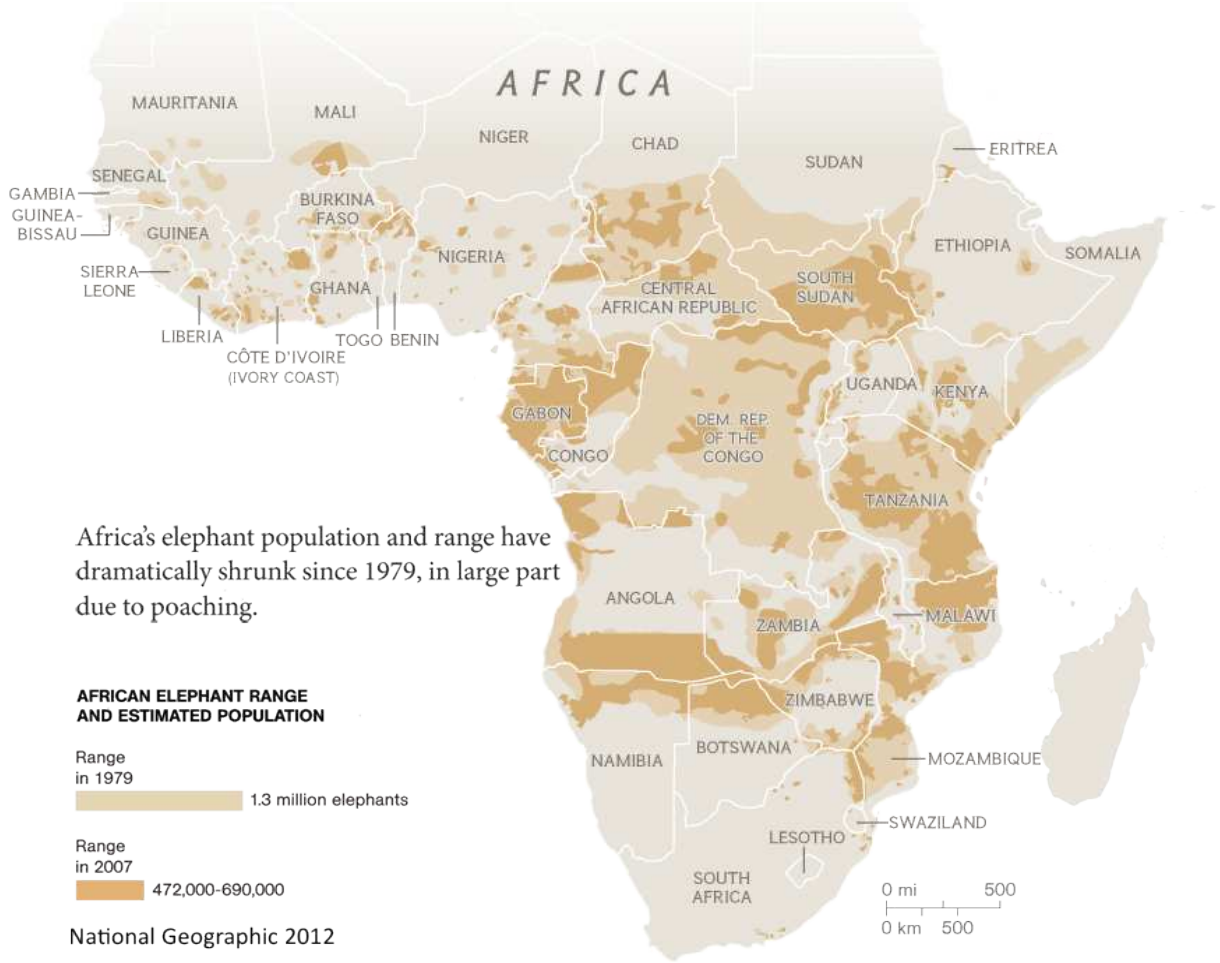


Figure 11. Range map of African elephant (1979 and 2009).
Source: National Geographic 2012.

Since 1977, **Kenya has lost 45-70% of all its large wildlife** (LeeuwJan de et al. 1998, Norton-Griffiths 2000, 2007, Western et al. 2009). Many of these species are listed as endangered in Kenya, including the elephant, lion, wild dog, cheetah, leopard, hyena, and several ungulates. Kenya lost 98% of its black rhino population from 1970 to 1991, primarily due to illegal hunting. KWS' rhino program has succeeded in nearly doubling the population to 623 individuals as of 2012 (KWS 2013).

In the 1980-1990s, elephant populations fell by over 87% (Coogan 2012). Today, Kenya elephant population has doubled to 32,000, but this figure is still a fraction of the estimated 150,000 elephants that lived in Kenya in 1972 (Coogan 2012). Elephants have fared better in neighboring Tanzania, which banned hunting in 1973 but reopened it 5 years later. Tanzanian elephant opulations nearly tripled during 1990-2006 and are currently estimated at 110,000 - 140,000 individuals, although their numbers are declining rapidly due to ivory poaching (Douglas-Hamilton and Poole).

Even the internationally renowned Maasai Mara ecosystem -- the focal site for Kenya's safari tourism -- has lost over two-thirds of its wildlife since 1989. **95% of giraffe, 80% of warthogs, 76% of hartebeest, and 67% of impala disappeared from the Mara** (Ogutu et al. 2010). Increased human settlement in and around the reserve is the primary driver of these declines; **the amount of cattle illegally grazing within the reserve has increased by a 1100% since 1977** (Ogutu et al. 2010, 2011). The Mara is jointly-managed by two local councils and is subdivided into thousands of smaller land holdings, which presents a challenge for ecosystem-wide conservation (Kalan 2011, Norton-Griffiths 2007). **For its wildlife to rebound, the Mara needs a reduction in poaching and livestock grazing, regulated human settlement expansion and fences** (Ogutu et al. 2011).

Poaching

Poaching in Kenya has skyrocketed since 2007, killing 400 elephants in 2012 , as compared to 50 in 2007 (Safina 2013). **Continent-wide, poachers killed 17,000 elephants in 2011 alone** (McGrath 2013). Most of this poaching occurs in Kenya, Tanzania, and Uganda, is transported through Malaysia, Vietnam, and the Philippines, and is sold in China and Thailand (McGrath 2013). Many believe that the recent increase is due to the 2008 CITES decision to permit a one-time sale of stockpiled ivory to China, which jumpstarted the industry and Asian demand for ivory (Safina 2013). The existence of legal tusks has created a parallel black market industry, which can fake permits to sell its tusks under the guise of legality (Safina 2013). Although KWS has ramped up its anti-poaching efforts to combat the trade, **80% of poaching occurs outside of protected areas** (KWS 2013). **To protect the majority of Kenya's wildlife, KWS must increase its capacity to enforce wildlife conservation outside of the park system.**

Conclusion

The three primary threats to Kenya's wildlife are habitat loss due to human expansion, lack of protection outside of protected area boundaries, and poaching (Lamprey and Reid 2004, Norton-Griffiths et al. 2009, Serneels et al. 2001). To secure the future of its wildlife, Kenya must face these threats head on, and soon. **Kenya's large wildlife simply cannot survive another 20-30 years under the present conditions, which have decimated wildlife in just three decades**. Although KWS has been successful in reducing poaching in protected areas, it has struggled to prevent human encroachment into wildlife habitats, to provide safe corridors for wildlife, and to enforce wildlife laws outside of protected areas.

Economically, Kenya's strategy of wildlife conservation is fairly successful. The tourism industry sustains most (45-80%) of KWS' budget through park entrance fees, with the remaining operating costs covered by an endowment fund and international donor (UNDP 2012). Tourism income, however, is highly variable and depends on external market factors that Kenya cannot predict nor prevent. Many argue that a multiple-use approach that includes some consumptive wildlife use, such as hunting or game ranching, would strengthen KWS' resiliency and long-term financial sustainability (Norton-Griffiths 2012, Boora 2005, Lindsey 2007).

Kenya's model of wildlife conservation has failed to ensure that its financial benefits are distributed equitably to local communities living near protected areas. Especially in human-dense regions such as Kenya, local support and buy-in is necessary to insure the long-term viability of conservation projects. Financial incentives are often successful in securing this support. Kenya's policy must require benefit sharing with local communities, not just encourage it. The spread and equity of benefit sharing, rather than the amount shared, may be more important to securing social support for conservation in Kenya (Groom and Harris 2008).

INDIA

Comparing India and Africa

The context of India's wildlife conservation is dramatically different than that of Africa. **In general, India has smaller protected areas, higher population pressures, and the dilemma of large human populations living within protected areas** (Rodgers et al. 2003). India faces more extreme pressures for land, with a population density more than ten times greater than that of sub-Saharan Africa's (World Bank 2011). India receives fewer direct financial benefits from conservation than many African countries, which have larger tourism industries and can also benefit from consumptive use of wildlife such as trophy hunting and game ranching (Lindsey et al. 2007, Rodgers et al. 2003). In regards to benefit-sharing in conservation, Indian communities generally desire sharing of natural resources (fuelwood, grazing, and land), while African communities desire financial benefits through tourism and hunting (Rodgers et al. 2003). **Some speculate that India's current situation could represent the future of Africa, after several more decades of increasing populations in rural areas, and the lack of an industrial base**.

Table 9. Comparisons between India and Kenya

Demographic Indicator	Kenya	India
Population Density (people/mi^2)	190	1070
Avg. size of Protected Areas	>770 mi^2 (Tanzania) max.= 80,000 mi^2	<115 mi^2 max.= 3200 mi^2
No. of Protected Areas	348	664

Source: ENVIS 2012, Rodgers et al. 2003, IUCN and UNEP 2012

Policy and History of Wildlife Conservation

India is the world's second most populous country, home to over 17% of the global population (CIA 2012). Despite its rapid economic growth, widespread poverty persists: a third of the population lives on less than $1.25 per day (UNDP 2013). India's population is largely rural and dependent on agriculture, and nearly half of the total land area is cultivated (Karanth et al. 2008, UN 2006). **High population growth coupled with rapid economic expansion exerts enormous pressure on India's natural resources**. A substantial portion of India's population -- 250 million people -- relies upon natural forests for part of their subsistence or cash livelihoods.

The Indian constitution states “it shall be the duty of every citizen of India to protect and improve the natural environment including forests, lakes, rivers, and wildlife and to have compassion for living creatures.”

India is the largest constitutional democracy in the world. The Government of India, seated in the capital of New Delhi, operates in a parliamentary style with the Prime Minister as the head of government, while the President holds a more ceremonial position with fewer executive powers. Governmental powers are split between the the Central Government, which determines policy and supplies most funding, and the 28 State Governments, which are responsible for management, implementation, and providing partial funding.

Within the Central Government, the India Board for Wildlife is the highest advisory body in the country for wildlife conservation, and is responsible for drafting policy and directives to manage protected areas. The Ministry of Environment and Forests (MoEF) is the agency responsible for conservation of wildlife and plant species. The MoEF is divided into a Forest and Wildlife Wing, which operates the India Forest Service, and the Wildlife Wing, which has four divisions: Project Tiger, Project Elephant, Project Snow Leopard, and the Wildlife Conservation Division, which operates the Central Zoo Authority and the Wildlife Institute of India. The State Governments are responsible for the remainder of conservation activities, including the operation of national parks through the Forest Department.

India has a mixed conservation history, with recent efforts contrasting the extensive natural resource exploitation of the colonial period. During this time, **British authorities offered bounties for ‘vermin’, killing over 80,000 tigers, 1.5 million leopards and 2 million wolves in the 50-year period of 1875-1925** (Rangarajan 2005). The ensuing population declines alarmed the public and changed public perception; wildlife began to be valued as a game resource rather than as a pest. From 1860 to the 1930s, the Government of India offered legal protections for elephants, created the India Forest Department, and established the National Park system. Despite these protections, overhunting continued to contribute to wildlife declines.

In the 1960s India began to implement a preservationist view of conservation (Madhusudan and Karanth 2002). In 1963 the Government of India listed the tiger (*Panthera tigris tigris*) as an endangered species and prohibited its hunting or sale. In 1973, the Government established Project Tiger -- the largest wildlife conservation project in the world at the time -- to safeguard tiger habitats and increase populations (Rangarajan 2005).

The Government expanded its preservationist conservation strategy upon enacting the Wild Life Protection Act of 1972. **The Act banned the hunting of all wildlife, as well as the commercial exploitation of timber and forest products from nature reserves. Only crows, bats, mice and rats could now be legally hunted** (Gov. of India 1972). The Act established further protected areas in the form of sanctuaries and National Parks, and protected specified wildlife and plant species under an endangered species list (Gov. of India 1972). It also defined all wildlife, dead or alive, as the property of the Central Government.

In the following decades, the government implemented new conservation projects across the country, including the preservation of the last remaining population of the Asiatic lion (1965), reintroductions of rhinos in northern India (1984), and the creation of Project Elephant (1992). The Indian government established new protected areas, increasing their extent from <1% to 5% of total land area (Karanth et al. 2008). The became active in international conservation efforts, and passed legislation including the Forest Conservation Act (1980), the Environment Protection Act (1986), and the Biological Diversity Act (2002). India serves as the current President of the Convention of the Parties for CITES, and is a signatory of the Ramsar Convention, the Convention on Migratory Species, and the International Whaling Commission (UNDP 2012).

Many conservation gains, however, were offset by heavy poaching and a growing concern for the welfare of local human communities, whom were frequently displaced by the establishment of protected areas (Rangarajan 2005). The Government responded to these concerns in 2006, with the passage of the controversial 'Recognition of Forest Rights Act,' which provides land deeds to tribal or traditional communities who have inhabited (legally or not) a forest area for three generations or more (Gov. of India 2006). Opponents of the Act claim that it will result in significant loss of forest cover, while supporters argue that it will provide secure land tenure and livelihood security to marginalized forest dwelling communities, which constitute 8% of India's population (Jayakrishnan 2005, Ramnath 2008, Rangarajan 2005, Sekhsaria 2007).

While wildlife conservation has traditionally been implemented through a "species- and protected area-centered" approach, rising population and land pressures are forcing governments and conservationists to seek alternative approaches, namely: 1) a preservationist model, which excludes people from protected areas (Karanth, K.U. 1998, Madhusudan and Karanth 2000), and 2) a multiple-use model, based on "sustainable resource use by local people" (Gadgil and Guha 1992, Kothari et al. 1996). Conservationists are divided over the efficacy and equity of these two contrasting models, and it is yet to be seen which will prevail.

The Hunting Ban

Although hunting is banned, it continues as a widespread practice in India, especially in the northeast. People hunt for cultural reasons, for non-essential and 'luxury' food supplements, and for illegal export (Aiyadurai et al. 2010, Velho et al. 2012). Especially in impoverished regions in the country, hunting wildlife for the black market offers a lucrative livelihood.

Many conservationists support the hunting ban, claiming that sustainable-use of wildlife resources is unattainable given the declining wildlife populations, expanding human pressure, and rising prices for wildlife goods (Madhusudan and Karanth 2002). They argue that hunting is an unnecessary and biologically damaging practice in India, a country in which hunters do not rely on large wildlife for protein, and whose size makes enforcement of hunting regulations impossible (Madhusudan and Karanth 2002). Hunting has already decimated many species of Indian wildlife, and continuing protection is required for their survival (Karanth et al. 2010)

Yet others argue that Indian wildlife suffers primarily because there are few financial incentives for wildlife conservation, as local people cannot profit from consumptive use of wildlife, nor do they profit significantly from ecotourism (Karanth and DeFries 2011, Sekhar 2003). Some seek a solution in the legalization of regulated hunting, and point to the success of multiple-use countries such as South Africa and Tanzania. Others argue that a government ban cannot effectively change behavior, and that more bottom-up approaches that provide alternative livelihoods are required (Lenin 2011).

Economics of Wildlife Conservation

Tourism is the primary funding mechanism for wildlife conservation in India. Over 26% of foreign visitors come to India for wildlife, adventure, and beach tourism (Boora 2005). Wildlife tourism contributes an estimated 1.7% of India's GDP, and employs 2% of the population (Boora 2005, CIA 2012). **Tourist visitation to India's protected areas is increasing by 15% a year** (Karanth and DeFries 2011). Although over **80% are domestic tourists** from India's rising middle class, international tourists contribute 50% of tourism revenues (Curtin 2011, Karanth and DeFries 2011).

India's wildlife tourism industry is largely controlled by private and state agencies, and has developed slowly and inconsistently relative to other ecotourism destinations (Sekhar 2003). **The tourism industry self-regulates: there are few government guidelines for tourism development, and each protected area operates differently** (Sekhar 2003). Private tourism operators claim that they contribute to conservation by preventing poaching and enforcing wildlife conservation laws, as their livelihoods are tied to effective conservation (Matthews 2008). There is an urgent need, however, to establish and enforce regulations to manage tourism development, resource-use and land-use change around protected areas (Karanth and DeFries 2012).

Funding Sources

The Central Government is the primary funding source for wildlife conservation. India's 2012-2013 national budget included **$63 million for wildlife conservation, of which 50% went to Project Tiger, 6% to Project Elephant, 1.5% to combat the illegal wildlife trade, and the remainder to support national parks and reserves** (Banerjee 2012). Most species, especially those that live outside of tiger reserves, do not receive funding. Private organizations play a key role in filling this deficit by providing small grants for conservation and research on these species (Banerjee 2012).

The Central Government funds national parks and reserves for 100% of non-recurring works, and 50% of all other activities. The State Government, through its agency the Forest Department, is responsible for the remainder of funding and operations for protected areas within its territory. Tourism generates much of this funding.

Tourism revenue only covers 50% of the total costs of managing and protecting the reserve, making the Forest Department dependent on the Central Government for the remaining funds

(SANEI 2004). **Entrance fees for India's National Parks average $4 for foreigners and 30 cents for Indian citizens, exceedingly low when compared to Kenya's $80 entrance fees** (ITOPC 2012, KWS 2013). Yearly tourism revenues range from $6800 in Bhadra Tiger Reserve to over $3 million in Ranthambore National Park (Karanth and DeFries 2011).

Even though tourism revenues help sustain protected areas, they may not contribute greatly to further conservation efforts; **tourism revenues are directed back to the general state fund and can be used for other government projects** (Ahsan 2009, Sekhar 2003). Nor do tourism revenues necessarily aid communities living near protected areas, as there is no policy mandating that a portion of tourism revenues be directed to local communities (Gubbi 2008, Gossling 2002).

Economic Value of Wildlife

Given that many Indians do not benefit financially from protected areas, some seek alternative uses of wildlife: poaching for the black market. **The body parts from a single tiger can fetch up to $50,000 on the black market**, with pelts selling for $20,000 and a single paw worth as much as $1000 (WWF 2011). The fine for poaching a tiger of just $450 or two years imprisonment offers little disincentive for poachers (WSPI 2012).

Tourism can make a live tiger worth more than a dead one. Tigers are the cornerstone of India's ecotourism industry: one study demonstrated that only 34% of tourists would return to a National Park if tigers were absent (Karanth and DeFries 2012). Travel Operators for Tigers estimated that **one tigress in Ranthambore National Park generated over $130 million in direct tourism revenue in the 10 years of her adult life** (Matthews 2008). As tourism revenues remain in the hands of a few, however, would-be-poachers still have high incentive to poach rather than protect tigers.

Conservation and Local Communities

Communities near protected areas receive few direct financial benefits from conservation (Karanth and DeFries 2011, Sekhar 2003). Although the Indian National Wildlife Action Plan states that ecotourism benefits must be shared with local communities, this rarely occurs (DOTS 2005, Karanth and DeFries 2011). **Tourism employs less than 0.001% of the population living near India's protected areas** (those within a 6 mile radius), and generally employs locals only in the lowest-paid positions (Karanth and DeFries 2011). A 2003 survey found that among the communities surrounding Sariska Tiger Reserve, **76% of individuals received no direct or indirect benefits from tourism** (Sekhar 2003). Yet, nearly 70% supported conservation and protected areas, and are aware that effective conservation would attract more tourism (Sekhar 2003). They also value the improved access to fuelwood and forest resources that protected areas provide (Karanth and Nepal 2012, Sekhar 2003).

India has a cultural affinity for conservation, and an exceptional tolerance for coexisting with predators that can contribute to conservation goals in the region (Karanth and Nepal 2012). Even though hundreds of people each year are killed in human-wildlife conflicts, primarily

involving tigers and elephants, rural communities continue to live near protected areas and maintain a general respect for wildlife's right to exist (Karanth and Nepal 2012). For example, in Bhadra Tiger reserve, 90% of households lose 14 to 30% of their annual income due to crop or livestock damage by wild animals, yet nearly all report that they do *not* kill problem animals (Karanth and Nepal 2012). Although there is a compensation program in place in Bhadra, over the vast majority (90%) of these households do not receive government compensation for these losses (Madhusudan 2003). Despite the lack of financial incentives, the majority of Indians living near protected areas in India hold positive views towards conservation and protected areas (Karanth and Nepal 2012, Sekhar 1998, 2003).

Protected Areas

India is an incredibly diverse landscape of mountains, steppes, grasslands, deserts, forests, shrublands, wetlands, and mangroves. Although previously a completely forested country, today **23% of India's total land area is covered by forest** (ENVIS 2012, Laurance 2007). India's forests have declined at 1.5%-2.7% annually over the past decade, and are threatened by further thinning, degradation and overharvesting of fuelwood (Davidar et al. 2010, Puyravaud 2010, Sinha and Bawa 2001).

India has designated 5% of its land area and 1.7% of its marine territory as a protected area (IUCN and UNEP 2010). The most common protected area designation is a Sanctuary, which unlike a National Park, offers a varying degree of rights to people who live within the protected area. These rights could include the right to grazing, fuel wood collection, or agriculture within the Park. Additionally, India preserves 42 Tiger Reserves, which restrict or prohibit human encroachments and development, especially in the core area (as opposed to the buffer area) (Madhusudan and Karanth 2000). There is legal and theoretical contention, however, over the amount of human activities such as tourism permitted in tiger reserves (Pidd 2012).

India's protected areas contain most of the country's remaining biodiversity, and are under enormous pressure from human development. **India's protected areas have human communities residing both inside and surrounding them whom rely on these reserves for subsistence** (Forest Survey of India 2000, Karanth et al. 2008, Rodgers et al. 2003). **They are small and fragmented, with an average size of 115 square miles, yet they can support a diverse array of large mammals when managed effectively** (Karanth et al. 2004). Improving protection, monitoring populations, and expanding and connecting India's nature reserves should be conservation policy priorities (Karanth et al. 2010).

Wildlife

India is one of the 12 mega-diverse countries in the world. Although it covers just 2.4% of the world's area, India contains 7.6% of all mammalian species, 12.6% of birds, 6.2% of reptiles, and 6% of flowering plant species on the planet (UNEP et al. 2001). India serves as the last stronghold for many South Asian mammals, despite having one of the highest human population densities in the world (Schipper et al. 2008)**. India is home to 70% of the world's tigers, half of the world's Asian elephants, 70% of Indian Rhinos, all Asiatic lions, many large ungulates including wild buffalo, deer and antelope, and other predators such as the Indian Leopard and Indian Wolf** (UNEP et al. 2001). India's strong legal and constitutional framework for wildlife protection, as well as its cultural and religious tolerance for wildlife, has likely contributed to sustaining these populations (Karanth and DeFries 2012, Sekhar 2003).

Tigers

India's heritage is interwoven with its national animal, the tiger. The tiger (*Panthera tigris*) has been used as an umbrella species to preserve a wide range of biodiversity in India through the establishment of tiger reserves. The **conservation of just one tiger protects over 25,000 acres of forest** (WWF 2013a). India's Project Tiger receives over 50% of all funding for wildlife conservation in India (Banerjee 2013). Some conservationists debate the effectiveness of spending half of all funding for wildlife conservation on just one species, and question if single-species conservation is robust enough to ensure conservation in a mega-diverse country such as India (Banerjee 2013, Karanth et al. 2008).

Tiger populations are believed to have reached 100,000 individuals in the early 1900s (WWF 2010). **Overhunting drove three subspecies -- Bali, Javan and Caspian tigers -- extinct by the 1980s.** Tiger populations in India are believed to have increased 20% since 2006 to their current population of 1706 individuals, although their occupancy in connecting habitats has contracted by 12.6% (Chundawat et al. 2011, Jhala et al. 2011). This demonstrates that **although Project Tiger has been effective in increasing populations, it has failed to create effective corridors for tigers to move across the landscape**, which help prevent local extinction due to poaching. Currently, only a few populations have the required population size for long term survival without immigration (Jhala et al. 2011).

Despite a short-term increase in numbers, tiger populations and their ranges have been in decline for the past 20-30 years (Chundawat et al. 2011). Tigers in northern India have the highest probability of extinction within the next 50-100 years (Karanth et al. 2010) **Tigers are primarily threatened by habitat loss, and now, poaching for their body parts**. Having lost their own tiger populations, Far Eastern traditional medicine manufacturers have been targeting India for their supply of tiger bones since the 1980s (WSPI 2012).

Elephants

India is home to the half of the world's population of Indian elephant (*Elephas maximus indicus)* (Choudhury 2012). **Once widespread in India, their populations have declined at least 50% in the past 60-75 years**, although one population in southern India appears to be increasing in

recent years due to conservation efforts (Choudhury 2012). Indian elephants are threatened by habitat loss, degradation and fragmentation due to expanding human populations; **around 20% of the world's human population lives in or near the present range of the Asian elephant** (WWF n.d.) India's Project Elephant attempts to increase populations and minimize human-elephant conflict, to secure the long-term future for elephants outside of protected areas (Choudhury 2012).

What is the future for India's Wildlife?

Although India has succeeded in saving many South Asian wildlife species from extinction, the future is uncertain. **Expanding human populations, widespread poverty, and unsustainable human development are forcing many wildlife species to the brink of extinction.** Overall, conservative estimates suggest that **20% of Indian mammals face imminent extinction, and many have disappeared from over 90% of their historic range** (Madhusudan and Mishra 2003).

A recent study by Karanth et al. (2010) demonstrates that all of the 25 mammal species examined face a significant probability of local extinction in the next 50 to 100 years. Lower probabilities of extinction are associated with the high protected area coverage and forest cover, high elevations (due to limited accessibility and agricultural use), and low human population densities. **Protected areas were found to be essential in conserving large carnivores, forest-dwelling mammals, and species that occupy a small remnant of their former range, such as tiger, wild buffalo, wolf, rhino, sloth bear, and elephant.** In order to conserve its remaining large mammal species, India must improve, expand, and connect its protected areas. In the face of continuing human expansion and resource demands, conservation planning be integrated into all land use decisions and development (Karanth et al. 2010).

Conclusion

From a survey of over 150 Indian conservationists, Karanth et al. (2008) determines the prevailing opinions on the present state and future of India's wildlife and protected areas. Indian conservationists are divided over many conservation issues involving ethics, science, and management (Saberwal and Rangarajan 2003). What are the rights of people living in protected areas? Is single-species conservation truly effective for the ecosystem (ie. does tiger conservation protect the entire forest)? Should the state control reserves, or should management be devolved to the local level?

They are in agreement, however, that protected areas are effective at conserving biodiversity, and should be expanded to about 15% of land area. **Many (61%) believe that the situation of people living inside reserves is unsustainable, and most (76%) felt that it is acceptable to use force to prevent illegal human activities within reserves**. Most (82%) believed that participatory approaches to conservation, which involve local communities in decision-making, can be effective under certain conditions. This is a hopeful answer to **India's biggest conservation challenge: finding solutions that balance wildlife conservation with the needs of a rising population**.

Wildlife Case Studies:

Polar Bear:
Climate change and the sustainability
of trophy hunting

African Lion:
Conflict, trade, and the Endangered Species Act

Rhinoceros:
The Survivors

Polar Bear (*Ursus maritimus*): Climate change and the sustainability of trophy hunting

Introduction

We conducted a case study on the polar bear to determine the extent to which the North American model of management has contributed to polar bear conservation. We found that polar bear management differs from the model in that the sale and exportation of polar bear trophies is legalized, largely for the sake of indigenous rights for traditional uses of wildlife. Additionally, we found that the current and future impacts of climate change are severe enough that they impose serious limitations on the North American model's ability to effectively protect the polar bear.

Range/Habitat

Polar bears (*Ursus maritimus*) live throughout the ice-covered waters of the Arctic Circle, ranging as far south as the sea ice extends. They are found in Canada, Greenland, Norway, Russia, and the United States. Some populations of polar bears have year long access to sea ice enabling them to hunt; others with annual summer ice melt must retreat to land and survive off of fat stores until the ice returns (IUCN 2013).

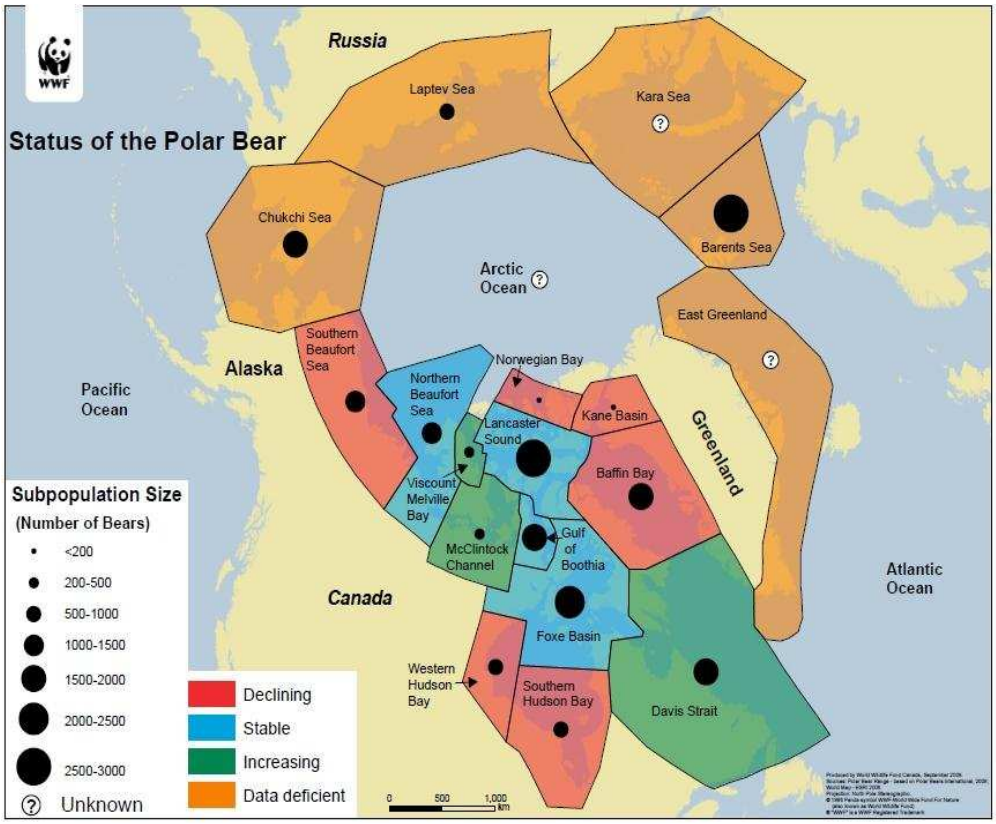


Figure 12. Population sizes and trends of the Polar Bear. Source: WWF 2011

Legal Framework

There are a number of national and international laws in place that protect the polar bear and its habitat. In the United States, protective statutes include the Marine Mammal Protection Act (1972) and the Endangered Species Act (1973). In Canada, the polar bear is listed as a species of special concern under the Species At Risk Act (PBI 2011). All five countries with polar bear populations are signatories to the International Agreement on the Conservation of Polar Bears (1973). This treaty establishes the groundwork for polar bear harvest regulation and calls for continued cooperative research between signatories. Canada and the United States entered into a bilateral agreement in 2000, which prohibits the taking of any member of a polar bear family group and establishes clearly defined hunting seasons, among other protections (PBSG 2012).

Despite a number of international agreements establishing common legal framework, harvest regulation specific to individual countries varies to a great degree:

United States:
- The Marine Mammal Protection Act prohibits hunting except by coastal AK natives for subsistence and handicraft

Canada:
- Manitoba prohibits hunting; Ontario, Quebec – only natives may hunt; no enforced quotas
- Canada is the only country that allows polar bear trophy hunting and the international commercial sale of hides of polar bears killed by indigenous hunters (HSI and IFAW 2009)

Norway:
- Total protection in 1973; can only be killed in self-defense or for scientific research

Russia:
- Total protection in 1957; bilateral agreement with US (2000) allowed limited subsistence hunting by Chukotka

Greenland:
- Harvest allowed without quotas until 2006; National regulations fixed by law (exec. order: On the Protection and Hunting of Polar Bears) License system, annual catch report

Conservation Status

As of 2009, the IUCN Species Survival Commission Polar Bear Specialist Group (PBSG) estimated the total number to be **between 20,000 – 25,000 individuals**. The polar bear is on the IUCN Red List and is classified as a vulnerable species. There has been a 16% increase in the number of declining subpopulations since 2005; currently, eight of the total nineteen subpopulations show negative trends (IUCN, 2008; PBSG, 2009).

In May 2008, the polar bear was listed as a threatened species under the Endangered Species Act, which recognizes that the species is at risk of becoming “endangered,” or in danger of extinction. The listing allows for continued subsistence hunting among Alaskan natives, and the recent (2013) rejection of the proposed ban on international trade of polar bear parts at the last CITES meeting will allow the continued importation and exportation of polar bear trophies between nations.

The 16th Convention of the Parties of CITES

On March 3rd, 2013 several key issues were discussed amongst the Parties to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). One issue that received considerable public attention was the proposed international ban on polar bear trade, which would make it illegal to sell skin, bones, claws, teeth, and other bear parts. The proposal was ultimately rejected on March 7th, with 42 votes against, 46 abstentions, and just 38 voting in favor. The United States and Russia strongly supported the ban, however Canada stood out as the most vocal nation in opposition (Connor 2013).

Dan Ashe, head of the U.S. delegation to CITES, explained that, based on the best scientific evidence, two-thirds of the polar bear population will be gone by 2050; if this is the case, he does not see how a commercial trade could be sustainable (Carrington 2013). Canadian delegates argue, however, that there is "insufficient scientific evidence" that polar bear populations will decline by more than half in the next several decades and insist that trade is "not detrimental to the species." In addition, Canada stresses the point that hunting and trading of polar bears and polar bear trophies is "integrally linked" with Inuit culture (Carrington 2013). A member of the Russian delegation and a leading expert on polar bears rejects Canada's arguments saying that with the survival pressure polar bears already face from climate change, hunting will lead to extinction. Canada maintains, however, that the impact of shrinking ice on polar bears is "uncertain" (Carrington 2013).

Cultural and economic significance of trophy hunting in Canada

Relative to other countries with polar bear populations, Canada has a large Inuit population that relies on polar bears for food, clothing, and as a source of income. As the only country allowing trophy hunting of polar bears, Canada monopolizes the industry, bringing in roughly US$40 million per year as of 2012 (GON 2012). **A hunt for a single polar bear costs between $40,000 to $45,000.**

In Nunavut, the Canadian territory in which many of the trophy hunts take place, an estimated 14,000 tourists visit every year. The Inuit community utilizes harvested animals' meat for food, their fur and skin for clothing, and their bones for tools and art sold to visiting tourists. (GON 2012). Polar bears represent a big part of the Inuit community's livelihood, yet many question the sustainability of trophy hunting in polar bear management.

Is trophy hunting sustainable in Canada?

In the past, polar bears in some areas were severely over-harvested by trophy hunters who employed aircraft and large motorized vessels to capture bears in large numbers. In addition, the use of snowmobiles and high-powered rifles made it easier for natives to successfully hunt polar bears. The International Agreement on the Conservation of Polar Bears placed a ban on trophy hunting from ships and aircraft in the 1970s, ending the dwindling of polar bear numbers (PBI n.d.).

Over the majority of polar bears' range, hunting is regulated by a quota system designed to keep the kills within a sustainable limit. Each village is assigned a number of tags allowing

resident hunters to take a designated number of polar bears. In Canada, natives may sell these tags (as well as their guidance and expertise) to sport hunters, who then hunt in place of the natives. These sport hunts typically result in fewer polar bear kills, as foreigners are often not as successful as the local hunters.

When polar bear habitats were stable, a sustainable harvest limit could be calculated and hunter tags distributed accordingly. However, Arctic ice habitat is no longer stable, and shrinking sea ice means less hunting area for polar bears, which threatens their survival. Unless humans reduce greenhouse gas emissions, hunting bears will only accelerate their population declines (PBI n.d.).

Currently, global warming is affecting some, not all, polar bear populations. Within populations that have not yet felt the negative impacts of climate change, limited harvests can be sustained (PBI n.d.). In the long term, maintaining sustainable harvests will depend on the reduction of greenhouse gas emissions. Without a significant emissions reduction, there will eventually be no polar bears, and thus, no hunting quotas to manage, at all.

African Lion (*Panthera leo leo*): Conflict, trade, and the Endangered Species Act

Introduction

We conducted a case study of the African lion in order to compare the No-Hunting and Southern African models of wildlife conservation in terms of their ability to support lion populations. We also discuss pros and cons of the proposed listing of the lion on the US Endangered Species Act. Social, economic, and ecological considerations are incorporated in this case study.

Background

The African lion (*Panthera leo leo*)is an iconic predator whose populations have been declining for the past 50 years due to habitat loss and human-wildlife conflict. Lions depend on large swaths of habitat and prey including zebras, wildebeest, and springbok. They live in prides of four to six members, which consist of related females and their cubs as well as a dominant male. Females hunt and raise young communally. Typically, lions live in open woodlands or scrub and grass complexes where sufficient cover is provided for hunting and denning. They are found in most countries in eastern and southern Africa, yet they survive in only 22% of their historical range (IUCN 2006a,b; Bauer 2008).

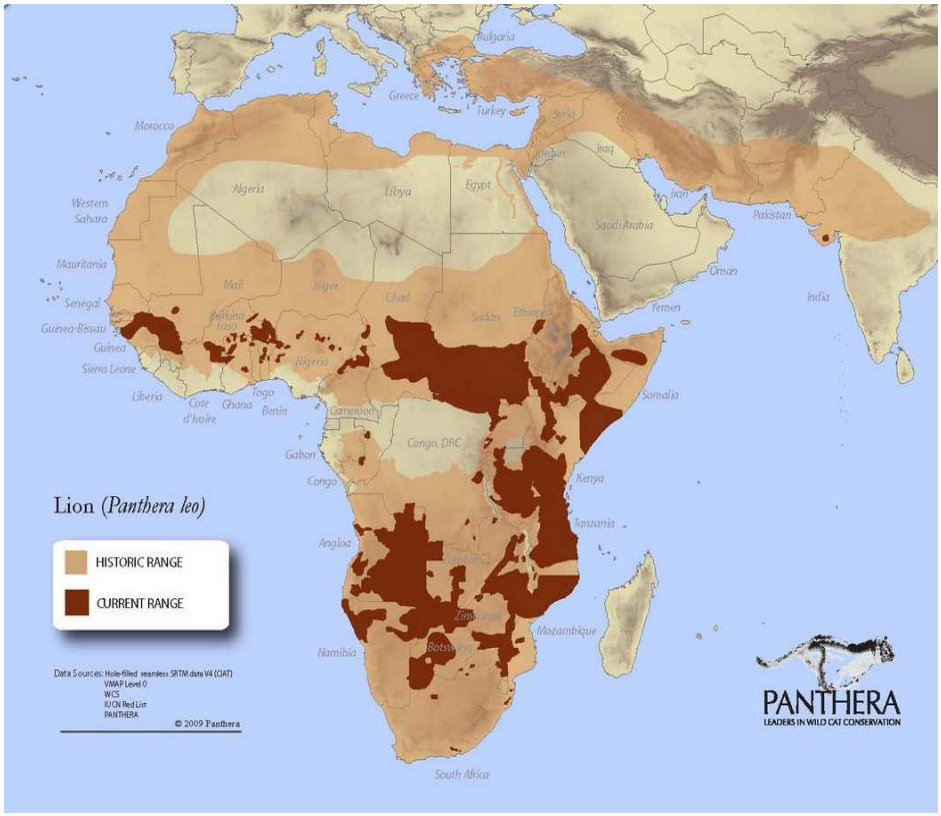


Figure 13: Current and historic range map of the African lion. Source: Panthera 2009.

Population Status

African lions live on both protected and private lands, although there are fewer lions outside protected areas than in the past. In 1990, 75% of African lions lived outside protected areas, while in 2002, 50% did (Ferreras and Cousins 1996, Chardonnet 2002). This decline may be attributed to high levels of human-wildlife conflict on unprotected lands.

African lions have been listed on the IUCN Red list as Vulnerable since 1996. Recent estimates suggest that the **lion population has undergone a 30% to 50% reduction over the past two decades** with current estimates ranging from 23,000 to 39,000 (IUCN 2012)

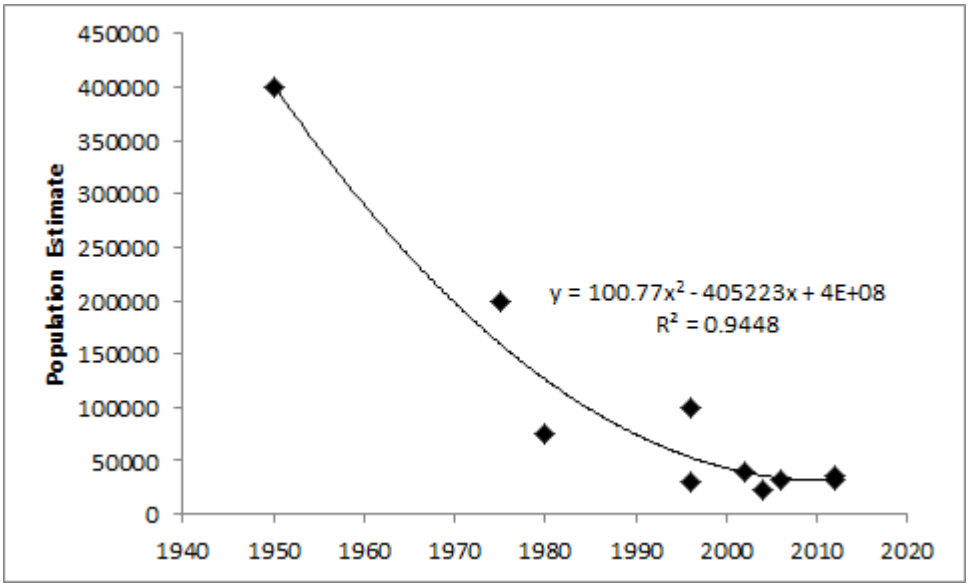


Figure 14: Population trend of the African lion. Sources (in chronological order): Myers 1975 (1950 and 1975); Ferreras and Cousins 1996; Nowell and Jackson; Chardonnet 2002; Bauer and VanderMerwe 2004; IUCN 2012; Riggio et al. 2012.

The African lion is listed on CITES II, which allows international trade with an export permit. In 2004, a proposal to transfer the lion from CITES II to CITES I (and restrict all international trade) was denied. This meeting drew national attention to the lion population decline and prompted IUCN to organize regional workshops in Africa to assess the status of lion conservation.

Trophy hunting:

Trophy hunting is permitted in South Africa and Tanzania, but not in Kenya. Hunting quotas are established by wildlife departments, typically based on rough population estimates (Baker 1997). Trophy hunting of lions generates significant income for local communities, which is attributed to its high market value. **Lions attract the highest prices of all trophy species, on average $24,000 - $71,000** (Lindsey et al. 2012). Lions contribute 5-17% to trophy hunting incomes in each country. Trophy hunting tourists contribute additional revenue including fees to hunt other animals, lodging, and transportation.

Lion trophy hunting was recently banned in Botswana; studies have shown that this ban cost the trophy hunting industry 10% of total revenues (US$1.26 million) and has adversely affected community conservation efforts (Lindsey Roulet 2006, Peake 2004b). A ban on trophy hunting may confer additional costs or losses of revenue to other tourism providers, such as the hotel and wildlife watching industries.

However, **trophy hunting may impact population dynamics of lions**. Loveridge et al. found that trophy hunters typically target males and therefore skew sex ratios in favor of adult females. As males are removed from the population, males from outside the pride replace them and may commit infanticide (2007). Interestingly, in certain countries such as South Africa, up to 90% of lions hunted for sport are captive bred (Damm 2005). Lindsey et al. also suggest that the

captive-bred hunting industry in South Africa has grown while the number of wild lions hunted has declined (2012).

Local Perceptions and Threats

In general, **local people perceive lions as a threat to their livelihoods and income-generating opportunities**. Lions may prey on livestock, attack people, or otherwise reduce available land for human settlement (Abe et al. 2003). Lion conservation efforts have not historically involved local communities until recently. A 2006 IUCN workshop found that local communities support lion conservation actions given that they are given a stake in management.

Threats to lions include poisoning, trapping, and shooters by farmers and herders, habitat loss and fragmentation, scarcity of wild prey, and inbreeding/small populations, improperly managed trophy hunting (Bauer 2008, Trinkel et al 2010). Although habitat fragmentation is listed as a threat, a recent study suggests that lions residing within fenced reserves maintain populations closer to carrying capacity and require $500/Km^2 annually for management, while lions in unfenced reserves maintain much lower densities and over $2000/km^2 for management (Packer et al. 2013). **This suggests that physical separation of lions from human settlements via fences mitigates conflict, reduces management costs and may prevent further declines.**

Root causes of these threats include human population growth, expanding settlement, poverty, and armed conflict, which limit tourism and enable wildlife poaching and illegal trade. **Illegal hunting and trade** persist due to ineffective law enforcement and lack of motivation (IUCN 2006). Although comprehensive data sets do not exist, illegal trade in cubs, skins, and body parts is common; wares are often exported to Asian markets to be sold as traditional medicine.

Proposed Listing of the Lion on the ESA

In 2011, a group of conservation organizations (IFAW, the Humane Society of the United States, Humane Society International, Born Free and Defenders of Wildlife) submitted a proposal to list the African lion on the Endangered Species Act. If passed, import of trophy lions into the US would be banned (except for imports that enhance the species' propagation or scientific purposes). The proposal claims that trophy hunting is unsustainable and contributing to severe declines of the lion populations (Place et al. 2011). The proposal also states that existing regulatory mechanisms such as CITES are inadequate to conserve the species, and that a US listing would attract international attention for the species. Lindsey et al. 2012 suggest that the reduction of hunting by American tourists would be detrimental to communities that rely on trophy hunting funds to control lion populations and combat poaching. Additional studies have offered alternative actions which may make trophy hunting more sustainable including reducing quotas, improving oversight to prevent illegal activities and setting restrictions to allow for shooting of only the oldest male lions (Loveridge and Macdonald 2002, Packer et al. 2011, Whitman et al. 2004). As of April 2013, this proposed listing has undergone a public comment period and is under a 12 month review by the USFWS.

African lion conservation: A comparison between models

This case study can be used to compare the effectiveness of the South African (for Tanzania) and No-Hunting (for Kenya) models in terms of their ability to support populations of African lions that generate revenues for local communities. The lion range in Tanzania covers 92% of the country, 45% of which is located inside protected areas (Mesochina et al. 2010). Tanzania has the largest lion population in Africa (estimated at 16,800 individuals) and is first in terms of lion trophy hunting; about 200 lions are legally harvested each year. This figure does not include illegal harvests (Mesochina et al 2010). Due to the lack of robust data, it is unknown whether lion populations in Tanzania are declining, stable, or increasing.

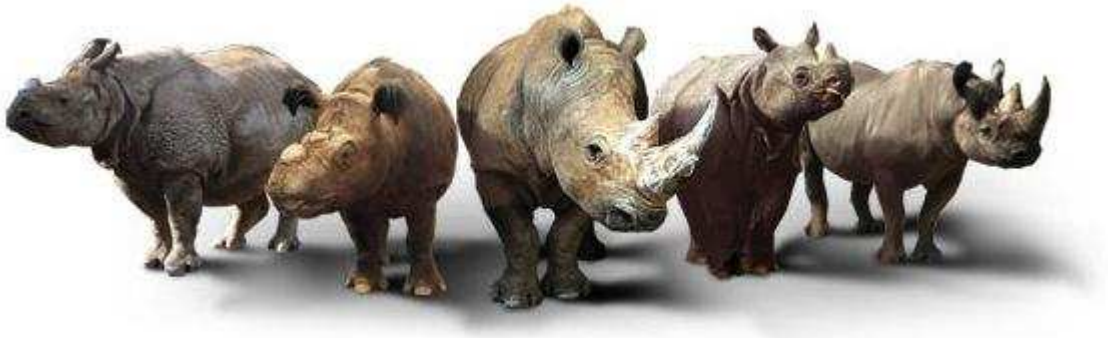
The director of wildlife for the Tanzanian Ministry of Natural Resources and Tourism recently spoke out against the proposed ESA listing (Songorwa 2013). Songorwa wrote that lion hunters **pay $9,800 to hunt lions; an average of $1,960,000 (60% of the trophy hunting market) is generated each year** (Songorwa 2013). Listing the species on the ESA and concurrent loss of this revenue would be detrimental to conservation efforts and game reserves in Tanzania.

In contrast, Kenya earns revenues from lions only through tourism. **Kenya's 2000 remaining lions could be worth $17,000 each, or $34 million total**, in annual ecotourism revenues (Barley 2009). The beneficiaries of lion tourism include the government and private tourism operators; however, these stakeholders are not living alongside lions everyday. Landowners who live near lions are more in control of their populations, but do not receive financial benefits and hence do not have the incentive to conserve them (Nelson 2012). Some rural Kenyan communities are eliminating lions by poisoning animal carcasses with a pesticide, Carbofuran, which can be purchased over the counter (Mynott 2008).

Kenya has been losing 100 lions per year for the past seven years, leaving the country with just 2000 individuals (Barley 2009). At this rate, lions will go extinct in Kenya within 20 years. Lion populations are crashing due to human-lion conflict and habitat destruction (KWS 2008).

It is difficult to conclude which model (the Southern African or the No-Hunting) is working better for lions based simply on the model itself, but based on lion population abundance and trends, funds generated, and social support, lions are faring better in Tanzania than they are in Kenya. Tanzania has a larger population of lions, is experiencing less steep declines, and generates revenues from both trophy hunting and ecotourism. Tanzania also has more protected areas which means that there is less direct contact between people and lions. However, threats to the lion persist despite the model. An inclusion of additional countries within the Southern African model could allow for more robust comparisons.

Rhinoceros: The Survivors



From left: Indian, Sumatran, White, Javan, and Black Rhino
Photo: Rhino Resource Center 2013.

The rhinoceros serves as a potent example of how different models of wildlife management can lead to a species' decline or recovery. The model that provides ample habitat and enforcement can support thriving rhino populations. The models differ in their ability to support these requirements, and also in the incentives they offer to encourage rhino conservation.

There are five species of rhinoceros (rhino) alive in the wild today: two in Africa-- the White Rhino (*Ceratotherium simum*) and the Black Rhino (*Diceros bicornis*) -- and three in Asia -- the Indian Rhino (*Rhinoceros unicornis*; also known as the Greater One-horned Rhino), the Javan Rhino (*Rhinoceros sondaicus*), and the Sumatran Rhino (*Dicerorhinus sumatrensis*). These species persist in a wide variety of habitats, ranging from open grasslands of Africa and India to the dense montane forests of Indonesia. Rhinos are true landscape engineers: their grazing, browsing, seed dispersal, and defecation into latrines alters the habitat dramatically (Wilson and Mittermeir 2011). Thus, their conservation -- or extinction -- greatly affects the entire ecosystem. All rhino species are in danger of extinction. According to the IUCN, the Sumatran, Java, and Black Rhino are critically endangered, the Indian Rhino is endangered, and the White Rhino is near threatened.

Over the past century, rhino populations have been decimated by overhunting for sport and for its prized horn, as well as by habitat destruction. **In just 35 years, poachers cut black rhino populations by 98%, leaving just 2500 individuals alive in 1995** (Emslie et al. 2012). The Southern White Rhino, hunted down to a meager 100 individuals in 1900, has since recovered to over 20,000 individuals in 2012 -- a true conservation success story. Although less is known about historical numbers of Asian rhinos, they likely existed in large populations across South Asia (Wilson and Mittermeir 2011).

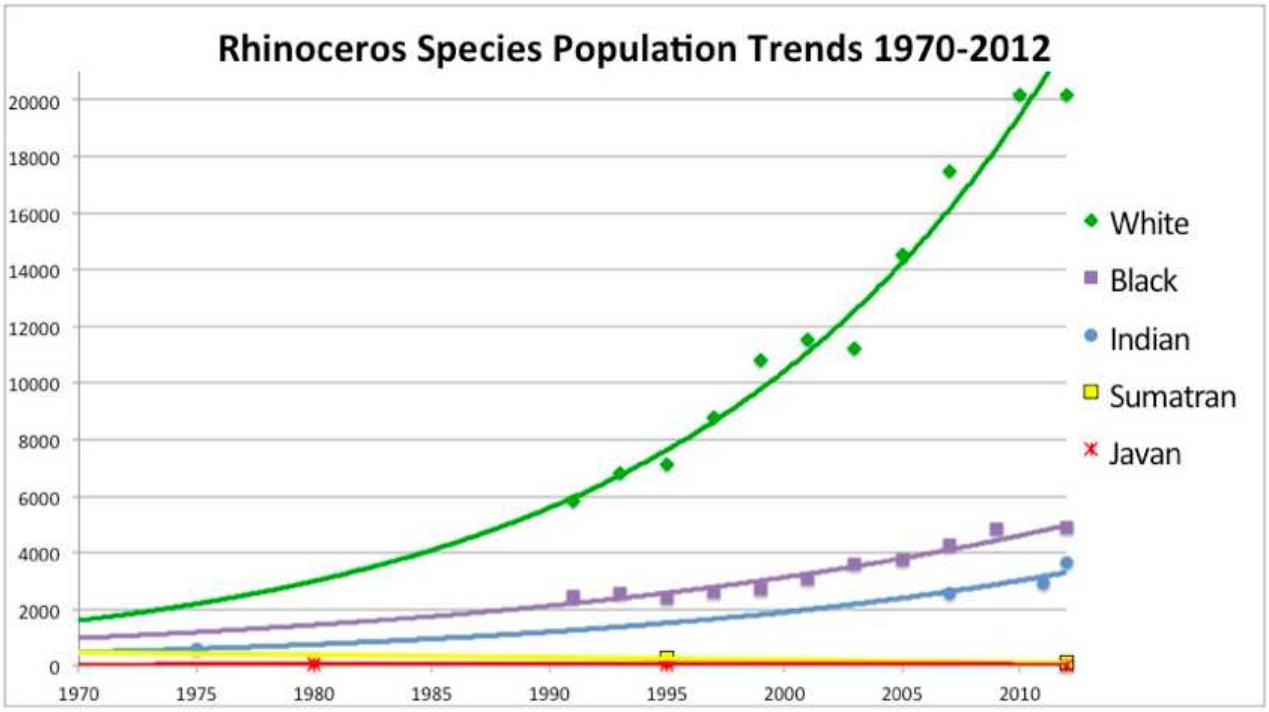


Figure 15. Rhinoceros population trends by species. Trend line equations: White (0.00e 0.06x; $R^2 = 0.98$), Black ($0.00e^{0.04x}$; $R^2 = 0.93$), Indian ($0.00e^{0.05x}$; $R^2 = 0.99$), Sumatran (-8.8235x + 17853; $R^2 = 1.00$), Javan ($y = -0.04x^2 + 153.22x - 152{,}508.76$, $R^2 = 0.86$). Source: IUCN Red List 2012, Save the Rhino 2012, WWF n.d.b

Today, **African rhinos comprise 90% of the global population**, and survive primarily on privately-owned land holdings (Welz 2012). Although some range states (India, Kenya, Namibia, Nepal and South Africa) have increased the area of available rhino habitat in both State-run and privately managed conservation areas, habitat destruction is still a significant threat, especially for the Asian species (Mainka 1997, Save the Rhino 2012b).

The Poaching Threat

The primary threat to all species of rhino today remains poaching for its horn (Emslie et al. 2012, Emslie et al. 2007). Despite a 1977 international ban on the trade in rhino parts, **the global rhino population has plummeted by more than 90% in the past 50 years** (Gettleman 2012). Highly-organized, international gangs supply the trade, trafficking poached horns from Africa to markets in Southeast Asia. The wildlife trade is the world's second largest illegal trade, second only to drugs, and is estimated to be worth $10-20 billion annually (Hormats 2012, TRAFFIC 2008). Prices for rhino horn are surging: **Asian buyers, many in China and Vietnam, now pay upwards of $23,000 per pound for rhino horn (**Welz 2012). Although scientific studies have never shown a medical basis for rhino horn use, it is advertised in Vietnam as both a cancer and hangover cure, and in Traditional Chinese Medicine as a method to reduce fever and inflammation (Larson 2010, Paul 1991, Welz 2012).

Rhino poaching escalated dramatically in 2007, likely due to increasing wealth in Southeast Asia. South Africa, home to 75% of the world's rhino population, lost over 630 rhinos to poaching in

2012, as compared to only 13 in 2007 (Emslie et al. 2012, Welz 2012). This represents a **4800% increase in poaching losses in just 5 years**. Although populations of Indian Rhinos are increasing in India, which holds 70% of the world's population of the species, increased poaching threatens to undercut this progress (Cota-Larson 2013). Since 2010, poaching has driven two rhino subspecies into extinction, the western subspecies of black rhino and the Vietnamese subspecies of Javan rhino, which was once the most widespread of all Asian rhinoceros (Wilson and Mittermeir 2011). The northern white rhino, with only 7 individuals remaining in captivity, may be the next to disappear (Welz 2012).

Current Status

Despite the poachers' onslaught, most African rhino populations are still increasing, at least for the time being (Emslie et al. 2007). In Kenya, poaching intensity peaked during 2001–2003 but has actually fallen in recent years. Rhino populations in Zimbabwe and DRC have experienced the greatest impact from poaching, and have lost 12% and 59% of their rhino populations, respectively. These losses may be partially attributed to a lack of socio-economic stability and governance, which are key enabling factors for anti-poaching enforcement (Emslie et al. 2007). Although South Africa's rhinos are currently increasing in number, there is still reason for concern: if current poaching rates are maintained, South Africa's rhino population will begin to decline in 2016 (Welz 2012). Asian rhinos are at even greater risk of extinction from poaching, due to their small populations and sparse available habitat.

What steps can governments and NGOs take to protect the world's remaining rhinos?

Rhino translocation (relocation) has been a crucial conservation tool in increasing rhino populations and expanding their range across the landscape, especially for the White and the Indian Rhino. Much **rhino translocation now occurs via helicopter**: rhinos are tranquilized, suspended by the ankles, and flown to their new home. It may appear ungainly, but it's one of the safest and least stressful ways to relocate rhinos (WWF n.d.d).

Sheltering rhinos from sophisticated poaching gangs, who operate over thousands of square miles of land, is expensive. Government spending on rhino protection has not been quantified, but it possibly runs to tens of millions of dollars per country (Welz 2012). In South Africa, maintaining a basic, armed, full-time private security team costs over $11,000 per month (Welz 2012). These **increased security costs and risks are causing some private rhino owners to disinvest in rhinos**. This is a serious concern, given that private rhino owners in South Africa conserve more rhinos than exist in the rest of Africa (Welz 2012).

These escalating security costs have driven some private rhino owners to search for alternative methods of protecting their rhino populations, such as **dehorning**. In the current trade, a rhino without a horn is not worth the poaching effort. The dehorning process, however, has proved to be expensive ($600 to $1000 per rhino, per 1-2 years)**,** potentially harmful to the rhino, and

ineffective at stemming poaching, as many poachers consider even a few centimeters of horn valuable (Save the Rhino 2012a, Wilson and Mittermeir 2011, Welz 2012).

To provide financial incentives for rhino conservation, some wildlife managers are advocating for the legalization of the horn trade, and the utilization of game ranching to provide a sustainable supply of rhino horn (Welz 2012). The idea is that by increasing supply, the cost and thus the incentives to poach will drop. Many conservationists, however, oppose game ranching of threatened species. They argue that the **existence of a legal trade in farmed wildlife creates a higher-priced parallel market for the more 'authentic' wild-caught individuals** (Foley 2011, Yee 2013). This has certainly proved true for crocodiles in Thailand, and for Asiatic black bears in China, both of which have declining wild populations despite the legalization of farming. Furthermore, given the pervasiveness of corruption and the current inability to prevent illegal trade, it's unlikely that a formal market could be effectively controlled (Damania and Bulte 2001).

What does the future hold for rhinos?

When given protection and adequate habitat, rhinos thrive. If poaching ceased in Africa, rhino populations would increase rapidly because extensive habitat still remains. Asian rhino populations, however, are severely limited by their landscape (Wilson and Mittermeir 2011). **In Asia, remaining rhino habitat is threatened by rapid deforestation, oil palm and paper plantations, and human population growth near protected areas** (Wilson and Mittermeir 2011).

Yet with determined conservation planning, dedicated habitat protection and restoration, and increased enforcement including heavy fines and jail time for poaching, all remaining rhino species could have a chance at survival. The Southern African model has been especially effective in increasing rhino populations, largely through funded through privately-owned game ranches. The No-Hunting model, which has relied on funds from the government outside organizations, has also been successful. As Mavuso Msimang, a former Chief of South African Parks, says, "We have a historical and international obligation to save [the rhino]. It would be a dereliction of our duty as a nation to allow this wonderful animal to disappear. History and humankind requires us to protect it" (Marshall 2012).

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APPENDIX I: Complete list of indicators used in analysis

Policy Indicators

1. Primary wildlife-relevant legislation
2. Primary agency responsible for wildlife
3. Wildlife owned by government?
4. Wildlife owned by public?
5. Wildlife owned by private?
6. Is there a legal private market for wildlife?
7. Is there an Endangered Species Law?
8. Sport hunting allowed?
9. Subsistence hunting allowed?
10. Game ranching allowed?

Economic Indicators

1. GDP
2. %GDP from tourism
3. % of tourism that is wildlife-related
4. %GDP from wildlife-related tourism ('%GDP tourism' X % of tourism that is wildlife-related')
5. % Population employed by tourism
6. % Population employed by wildlife tourism ('%employed by tourism' * '%tourism that is wildlife-related')
7. %GDP of revenues generated by consumptive use of wildlife
8. %GDP of revenues generated by non-consumptive use of wildlife
9. % of wildlife revenues accrued by the Government
10. % of wildlife revenues that accrues back to conservation efforts
11. % GDP generated from legal consumptive wildlife use ($revenues/GDP)
12. % of hunting revenues accrued by the government
13. % of hunting revenues accrued by local people living near conservation areas
14. % of population employed by hunting
15. % population employed by wildlife tourism/non-consumptive wildlife use

Social and Demographic Indicators

1. Population Growth Rate
2. GDP Per capita $USD
3. %Population living under $1.25/day
4. Urban Population (as % of total population)
5. Qualitative information about attitudes toward wildlife management

Protected Area Indicators

1. % of land area protected
2. % marine area protected

3 % of total area protected
4 % land area utilized for sport hunting

Appendix II: Detailed methods for protected area analysis

To analyze this data and compare among models, we used a non-parametric Kruskall-Wallis chi squared test to compare % land area and % marine area protected among the models. A p-value lower than 0.05 would be considered significant. We addressed the following questions:

Does the percent of land protected differ significantly among models?
Does the percent of marine area protected differ significantly among models?

Appendix III: Detailed methods for wildlife analysis

To quantify and compare trends in large mammal populations, we selected approximately 25 species for each model. We selected unique suites of species for India and Kenya due to differences in geography and biodiversity. We selected India's species based upon Karanth et al. 2010, which identified the extinction probabilities of 25 large mammals in India. To select species, we used several criteria:

1. Only large terrestrial mammals (>5kg) were considered
2. Approximately equal numbers (5 each) of carnivores, mesocarnivores/omnivores, browsers, grazers, browser/grazers were chosen to represent a wide variety of foraging types
3. As a whole, the suite of species was verified as geographically representative of the model in terms of physical coverage and habitat types represented

After we identified species, we assessed them using regional-level data from IUCN. We recorded information on population trends (increasing, stable, decreasing) for each species and verified this using other sources (FWS and NatureServe for North America, and Karanth et al 2010 for No Hunting). We also recorded IUCN global status and national protection status for both countries within each model. We then calculated summary statistics for each model:

% of selected mammals with declining populations
% of selected mammals with stable populations
% of selected mammals with increasing populations

To statistically analyze this data, we compared the no-hunting (India and Kenya) and hunting (North American and Southern African) data using paired t-tests. We weighted all species equally. We addressed the following questions:

- Is the number of declining species significantly different from the no hunting model as compared to the hunting models?
- Is the number of stable species significantly different from the no hunting model as compared to the hunting models?
- Is the number of increasing species significantly different from the no hunting model as compared to the hunting models?