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Geographic and taxonomic biases in conservation research efforts in Nepal

Ranjit Pandey[1,*], Kapil K Khadka[2], and Monica Papes[1]

[1]*Oklahoma State University, Department of Integrative Biology, 501 LSW, Stillwater, OK 74078, USA*
[2]*University of Arkansas, Department of Biological Sciences, Fayetteville, AR 72701, USA*

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ABSTRACT

The concerns over the current deterioration of biodiversity call for immediate actions to restore and maintain the biotic diversity. Development of robust conservation actions, however, requires broad taxonomic and geographic research efforts. Thus, identification of gaps in conservation research potentially aids to broaden the scope for effective biodiversity conservation. To identify research foci and gaps in the knowledge of conservation issues in Nepal, a biodiversity rich country, we reviewed studies indexed in ISI Web of Science database. We found a vast disparity in research efforts allocated to species and protected areas, with the least studies published on amphibians, fishes, and reptiles, and no representation of 46% of the country's protected areas. Widening the research scope is necessary to reduce the current taxonomic and geographic research biases. Also, indicator species of climate change like butterflies are little studied, thus the scientific community lacks the baseline information needed to investigate possible effects of global warming.

Key words: biodiversity conservation, Nepal, protected area, research-bias, fauna

Escalating human population growth and associated habitat loss and habitat degradation, as well as introduction of exotic species and new pathogens, have negative effects on the biodiversity, posing serious threats of extinction to many species (Millennium Ecosystem Assessment, 2005). These threats have stimulated the growth of a large community of conservation scientists, practitioners, and stakeholders, expressing concerns and promoting actions to maintain the integrity of ecosystems and ensure effective biodiversity conservation through various principles, approaches, and tools (Simberloff, 1998; Lindenmayer *et al*., 2002).

However, often the synthetic views on conservation problems are derived from research programs of individual scientists and groups that may not comprise broad taxonomic and geographic lines of investigations, which can result in a disproportionate representation of certain taxa and ecosystems in conservation research, while other ecologically important species and areas are overlooked (Wilson *et al*., 2007). It appears that our conservation science knowledge is taxa and region biased (Clark and May, 2002; Fazey *et al*., 2005; Seddon *et al*., 2005) and influenced by research priorities, funding, and logistics (Wilson *et al*., 2007). Thus, identification of taxonomic and geographic gaps in biodiversity research may aid in shifting research foci and expanding biodiversity conservation investigations.

Broadly, in developing countries, selection of taxa and regions for conservation biology studies is influenced by the interest of donor agencies (Prins and Wind, 1993). In Nepal, a developing country with a system of protected areas that omits many of the species-rich regions (Hunter and Yonzon, 1993), such research biases have direct effects on biodiversity conservation efforts. The concept of nature conservation is relatively new in Nepal and the current network of 32 protected areas, covering 23.2% of the country's total area, is comprised of 10 national parks, 3 wildlife reserves, 6 conservation areas, 1 hunting reserve, and 12 buffer zones (DNPWC, 2013). To identify possible geographic and taxonomic biases in conservation research in Nepal, we reviewed studies published in ISI indexed journals, under the assumption that rigorous investigations, with expert involvement, would be published in such journals. Our considering only primary literature may produce an incomplete depiction of research trends in the protected areas of Nepal, however grey literature is largely inaccessible and would generally be overlooked when drawing broad conclusions and conservation directions.

We searched for peer-reviewed publications in ISI Web of Science database using combinations of keywords: "conservation Nepal", "protected area Nepal", "national park Nepal", and specific names of protected areas. We filtered the resulting collection of papers by area and animal taxa studied, thus we concentrated our analysis on studies that investigated animal species within the network of protected areas in Nepal. Our initial database contained 2,887 papers, however the majority were not directly related with our objectives: only 326 studies were carried out in protected areas of Nepal and only 149 specifically addressed conservation of plants and

*Corresponding Author's E-mail: ranjit.pandey@okstate.edu

animal taxa, the rest focusing mostly geology and altitudinal physiology. Further, more than half of this subset of 149 papers (Appendix 1) focused on park-people conflicts, ecotourism, and management of protected areas, thus we did not include them in our analysis. Consequently, we reviewed 70 papers directly related to conservation and management of animal species (Appendix 1). We found that Chitwan national park was the most studied protected area of Nepal, followed by Bardiya national park. More than 62% of the published studies were conducted within these two protected areas (Table 1). Animal species studies were conducted only in 10 out of 20 existing protected areas, of which three (Banke national park, Gaurishankar conservation area, and Api Nampa conservation area), are newly established. The most studied species were tiger (*Panthera tigris* Linnaeus, 1758), greater one-horned rhino (*Rhinoceros unicornis* Linnaeus, 1758), and snow leopard (*Uncia uncia* Schreber, 1775), and more than 85% of the studies were conducted on mammals (Figure 1). We found only one study published on fishes, two on reptiles, and none on amphibians. Financial support information was included in the acknowledgements section of 57 of the 70 papers analyzed, and surprisingly, all these studies were on large charismatic mammals (tiger, greater one-horned rhino, and elephant).

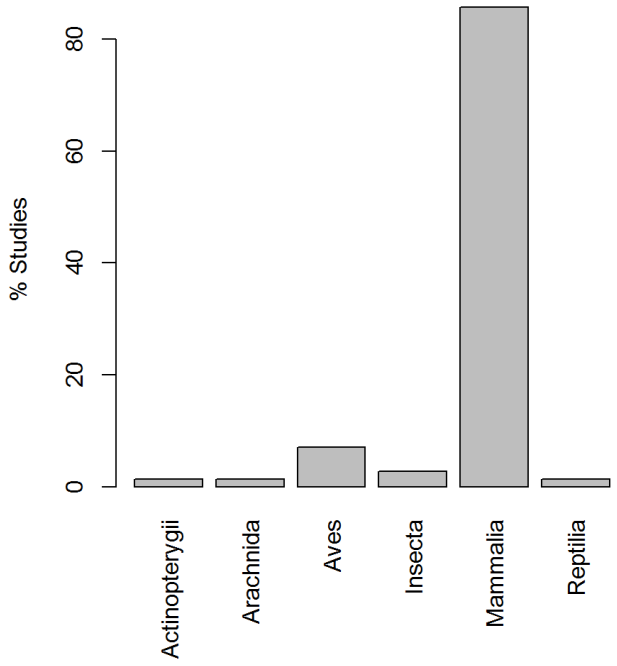

Figure 1. The percentage of studies by taxonomic groups (class) published in ISI indexed journals.

Our review of the ISI-indexed papers revealed a strong bias in conservation research efforts, with a few geographic locations and taxonomic groups more frequently studied than others. Despite the recommendation of conservation biologists for prioritization of all endangered and keystone species (Paine, 1995), research in Nepal appears to be focused on a few taxa and regions. This discrepancy indicates that many protected areas and species of conservation interest are neglected from a rigorous research perspective, creating a gap in our understanding of biodiversity status in this country. Of importance is the lack of animal research in 46% (approximately 16,000 km^2) of the total area protected by the national network of reserves. The bias in research focus in Nepal has been pointed out two decades ago by Heinen and Yonzon (1994) and unfortunately the trend has persisted since. More generally, the knowledge of basic natural history of many Nepalese endemic species is inadequate for effective conservation planning.

Table 1. List of protected areas in Nepal with studies published in ISI indexed journals. Two studies carried out in multiple parks are not included in this list.

Protected area	Number of studies	Percentage
Annapurna Conservation Area	6	8.5
Bardiya National Park	18	25.7
Chitwan National Park	26	37
Dhorpatan Hunting Reserve	1	1.5
Kanchenjunga Conservation Area	1	1.5
Koshi Tappu Wildlife Reserve	2	3
Langtang National Park	5	7
Sagarmatha National Park	8	11.5
Rara National Park	1	1.5

The majority of studies reviewed focused on tropical regions in Nepal, although higher elevation regions tend to have more endemic species due to topographic isolation (Körner, 2004). In addition, tundra and alpine endemics should receive increased interest from the scientific community since they are threatened by climate change (Xu *et al*., 2009). Baseline knowledge of fauna from these regions is crucial because it will provide means of comparing species' future distributional patterns with current ones, enabling more robust estimations of climate change effects on biodiversity in the coming decades. Thus, current and future research efforts need to consider the representation of a wider array of geographic regions and altitudinal gradients.

The taxonomic bias we identified here is especially troubling since taxonomic groups like amphibians are declining sharply and are considered more threatened worldwide than others (Caldwell *et al*., 1991; Houlahan *et al*., 2000; Stuart *et al*., 2004; Wilcove and Master, 2005; Whiles *et al*., 2006). The publications we reviewed concentrated only on a few megafauna species such as tiger (*Panthera tigris* Linnaeus, 1758*)*, greater one-horned rhino (*Rhinoceros unicornis* Linnaeus, 1758*)*, and Asian elephant (*Elephas maximus* Linnaeus, 1758*)* in the lowlands of Nepal. This is presumably a result of the conservation focus towards charismatic, flagship species (Myers *et al*., 2000; Isaac *et al*., 2007). However, we argue that exclusion from conservation research efforts of other threatened species and species of low conservation concern, and subsequent lack of understanding of their status, may be unreasonable and detrimental to broad and long-term conservation initiatives. Furthermore, the lack

of research efforts towards other flagship species like pygmy hog (*Porcula salvania* Hodgson, 1847), wolf (*Canis lupus* Linnaeus, 1758), and Tibetan antelope (*Pantholops hodgsoni* Hodgson, 1834) is inexplicable. For example, the entire population of the Tibetan antelope in the country is estimated to be as low as 30-50 individuals, or perhaps even extinct (Jnawali *et al*., 2011).

Here we highlight the biases in animal diversity research in Nepal, reflected in the peer-reviewed literature, toward a small subset of vertebrate groups and a few species in particular, in a country that harbors a high diversity of species. We do not assert that the conservation research in Nepal is going in the wrong direction, rather that it needs to be broadened. We emphasize the need to increase the number and taxonomic diversity of investigations, a change that we think would be proactive in nature by providing highly valuable information for conservation initiatives in the near future.

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