

Short Communication

Conservation of the orange-bellied Himalayan squirrel *Dremomys lokriah* using a traditional knowledge system: a case study from Arunachal Pradesh, India

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Abstract The orange-bellied Himalayan squirrel *Dremomys lokriah* is used for medicinal purposes by the Apatani community in north-east India. The monetary value of the species has increased 40-fold since 1986. Hunting is perceived to be the primary cause of the decline of *D. lokriah* but this is now being curtailed through a unique social restriction system (*Dapo*) under the administration of the traditional village council (*Builyang*). Here we report on the socio-ecological values of *D. lokriah* and the traditional hunting system, and conservation initiatives implemented by the Apatani community to conserve the species. This initiative is an opportunity for government agencies and conservationists to merge a traditional knowledge system with modern conservation methods and strengthen participatory conservation management.

Keywords Apatani, disease treatment, *Dremomys lokriah*, governmental agencies, hunting, traditional medicine

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The orange-bellied Himalayan squirrel *Dremomys lokriah* is a medium-sized forest squirrel (Prater, 1971; Menon, 2003) occurring from central Nepal to the Salween river in China, and in north Burma, north-east India and Bhutan (Prater, 1971; Corbet & Hill, 1992; Hoffmann et al., 1993). In India the species occurs at altitudes of 1,500–2,700 m (Menon, 2003). Although the species is categorized as Least Concern on the IUCN Red List (IUCN, 2009), the population on the Apatani plateau in the north-eastern state of Arunachal Pradesh has gradually declined because of hunting and habitat loss. Information from older members of the Apatani tribe suggests that, besides occurring in native forest, the species was previously common close to

human settlements, particularly in managed bamboo gardens (pers. comms to authors).

This case study of the conservation of *D. lokriah* was conducted on the Apatani plateau in Lower Subansiri district in central western Arunachal Pradesh, India (Fig. 1). The plateau lies between the Panior and Kamla rivers at altitudes of 1,524–2,738 m. The Apatani tribe migrated to their present location from the Talle valley in south-east Arunachal Pradesh (Haimendorf, 1962) and are of Tibeto-Mongoloid stock. They are settled in 35 villages, with a population of c. 24,650 and a density of 23 people km⁻² (Census of India, 2001).

During 2005–2008 we used semi-structured questionnaires (Appendix) and informal interviews with villagers, village hunters and traditional experts from 15 randomly selected villages to examine the role of a traditional knowledge system in conservation. With the assistance of local experts we conducted interviews with 154 hunters, of a total of 180 identified, who were prepared to disclose information. We also interviewed 50 traditional healers, recording the number of people they treated and treatment outcomes, and 30 traditional council members. During these various interviews we gathered information on the traditional values and uses for the squirrel, hunting methods, the species' current status, and conservation initiatives carried out by the Apatani. In extensive discussions we explored people's perceptions of biodiversity and conservation management, and historical and cultural matters regarding the Apatani tribe and their use of the squirrel. We visited local markets to obtain further information on hunting and wildlife trade, and squirrel specimens were collected from villagers for verification and identification (Prater, 1971; Menon, 2003).

D. lokriah is used by Apatanis for a variety of purposes, from disease treatment to social ceremonies (*Myoko*, *Murung* and *Yayu* rituals). Traditional medico-ritual disease healers, known as *Nyibu*, use squirrels preserved in bacon and ginger. It was reported that > 92.7% of patients were cured of various complaints following such medico-ritual treatment. The highest number of patients was recorded in Hong village (45) followed by Hija (31) and Reru (27), and the lowest in Bare (two). Although such use of the squirrel appears to be

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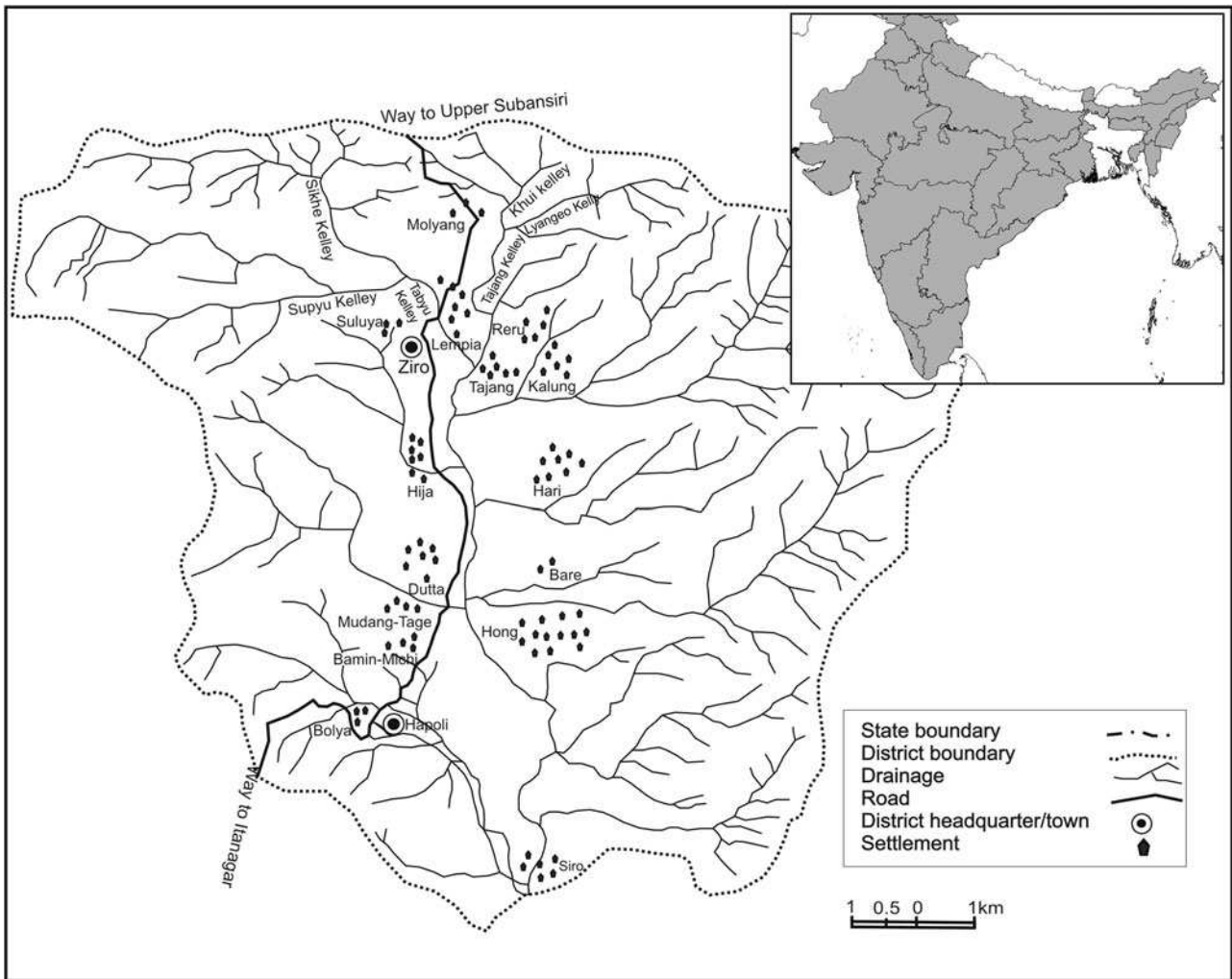


FIG. 1 Location of the 15 villages on the Apatani plateau where informal interviews (Appendix) were carried out. The black square on the inset indicates the location of the main figure in Arunachal Pradesh, north-eastern India.

declining, perhaps because of the availability of modern healthcare facilities, there is still considerable demand for the squirrel for medico-ritual practices. We estimate that this has led to a 40-fold increase in the species' monetary value from 1986 to 2008 and a specimen is now priced at c. INR 250 (c. USD 5.4), indicating the importance of *D. lokriah* to the Apatani community.

Our discussions revealed that 35% of respondents were aware of the Wildlife Protection Act 1972 (Anon, 2003), which prohibits killing of wildlife, and the penalties for violation of the Act. It is therefore likely that some of our respondents may have underreported the numbers of squirrels hunted. The method of hunting the squirrel for medico-ritual purposes is different from that used when hunting the species for other purposes. When hunting squirrels for medicinal uses the hunter has to ensure that the skin and skeleton are not damaged as it is believed that this reduces the effectiveness of any treatment. The hunters therefore usually catch the species using a bamboo and cane

trap during October–December, coincident with the fruiting of *Quercus* spp., the fruits of which are used for trapping the squirrel. We recorded the highest number of hunters in Hong village (36) followed by Hari (13), and the lowest in Molyang and Bare (three each). The percentage of the village population that are hunters was highest in Bolya village (19.4%) followed by Bare (13.0%) and Molyang (2.3%), and lowest in Suluya (0.7%). In 2005, 2006 and 2007 a total of 141, 97 and 76 squirrels were reported to have been trapped, respectively, in the 15 villages surveyed. The perception of the villagers is that *D. lokriah* is declining: 19% of respondents believed the squirrel population is declining severely, 37% that it is declining moderately and 40% that it is declining slightly.

As in other tribal communities, Apatanis have diverse mechanisms to protect and conserve the biological resources available to them (Sundriyal & Dollo, 2004), and these mechanisms are viewed as an efficient way of managing these resources (Dollo, 2008). Apatanis believe that their

survival depends on the maintenance of good relations with divine forces that protect various species of flora and fauna and natural resources such as water. To this end Apatanis perform a range of rites, rituals, ceremonies and festivals to maintain these relations. However, the cultural heritage of the Apatani is increasingly under threat from modernization and development, and we found that the younger generation now place limited value on their traditional culture and are influenced by alien cultural practices that have limited conservation value.

D. lokriah is one of the species that is conserved by Apatanis through traditional village institutions under the traditional council (*Builyang*). The squirrel and other flora and fauna with socio-cultural and ritualistic values are protected by a mechanism called *Dapo* (Plate 1). Under the *Dapo* system illegal hunting of wild animals, including the squirrel, hunting out of season and over-extraction of forest resources are subject to penalties, which can range from a chicken to a mithun *Bos frontalis*, depending on the gravity of the case. Since 1995, penalties have also taken the form of fines (INR 1,000-15,000, i.e. USD 22-323).

Of the 154 hunters interviewed 148 believed the squirrel population has declined since 1998. In response to this perceived decline the community initiated conservation of the species in 2004 by restricting hunting for decorative purposes and meat. One hundred and eighteen hunters reported that the community's conservation initiatives are helping to maintain the population but 27 of the hunters felt that more extensive action is required and that this conservation scheme for the squirrel should be extended to the neighbouring Nyishis tribe (nine hunters did not express their views on the conservation initiative).

It is of value to protect traditional knowledge of environmental resources, especially in the context of globalization and the increased demand for such resources (Gadgil, 1993; Laird, 1999). Traditional knowledge can also be of value for modern medicine (Mahawar & Jaroli, 2007) and for the sustainable management of non-timber forest products. Although indigenous knowledge, traditional institutions and customary practices are generally disappearing (Berkes, 2004), traditional conservation practices are still largely intact amongst the Apatani. Nevertheless, these practices need to be documented and revitalized, and acknowledged by their integration with modern conservation practices and by the inclusion of relevant information into the Wildlife Protection Act.

The observation of the decline of the orange-bellied Himalayan squirrel by the Apatani and the subsequent conservation initiatives instigated by the community is an opportunity for government agencies and other groups concerned with biodiversity conservation. We observed that creating awareness of the squirrel's decline is not necessary; rather, the opportunity provided by the community's own concerns could be used to promote conser-



PLATE 1 A traditional *Dapo* symbol for biodiversity conservation is put at the entrance of a forest foot path, indicating that the forest is protected by customary law.

vation of biodiversity, including conservation of the orange-bellied Himalayan squirrel and other threatened species.

On 28 July 2009, 15 Village Biodiversity Conservation Councils were set up across the villages of the Apatani plateau by the G.B. Pant Institute of Himalayan Environment and Development, Itanagar, and Nature Care and Disaster Management Society, Ziro. The objective of this programme, funded by the Government of India and UNDP, is to conserve biodiversity through community participation. One of the principal focuses of the Councils is the conservation of *D. lokriah*, and a possibility being considered is ex situ breeding of the squirrel to fulfil local need for the species for rituals and customs.

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Appendix

The appendix for this article is available online at <http://journals.cambridge.org>

Biographical sketches

MIHIN DOLLO is involved in biodiversity conservation through community participation. He belongs to the Apatani tribe, and his research interests include ethnobiology, traditional ecological knowledge and conservation of bioresources. G.V. GOPI'S main research interests are the ecology and conservation of threatened species, colonial waterbird ecology, and human–wildlife interactions in the coastal and eastern Himalayan landscapes. KARTHIK TEEGALAPALLI is involved in a project monitoring the recovery of fauna and vegetation following shifting cultivation in Arunachal Pradesh. His earlier work was on forest recovery in abandoned cultivation in Bhadra forest. KRIPALJYOTI MAZUMDAR works in the proposed Tsangyang Gyatso Biosphere Reserve, Arunachal Pradesh. His areas of interest include human–wildlife conflict and management, primatology, avifaunal and mammalian diversity and community conservation.