

Towards Integrated Ecosystem Management in the Koshi Tappu Wildlife Reserve, Nepal

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The Koshi Tappu Wildlife Reserve (KTWR), located in eastern Nepal, is a protected area that represents a typical Terai ecosystem. Established in 1976 to serve as a haven for the last of the Asiatic water buffalo (*Bubalus bubalis*), the Reserve covers 175 km² and is one of the most important protected areas in Nepal. The KTWR sprawls across Sunsari, Udayapur, and Saptari districts in Nepal forming a mosaic of diverse ecosystems: agricultural land, forests, grasslands, swamps and marshes, rivers and lakes, and riverine areas. Located in the floodplains of the Sapta Koshi, KTWR has strong upstream and downstream linkages.

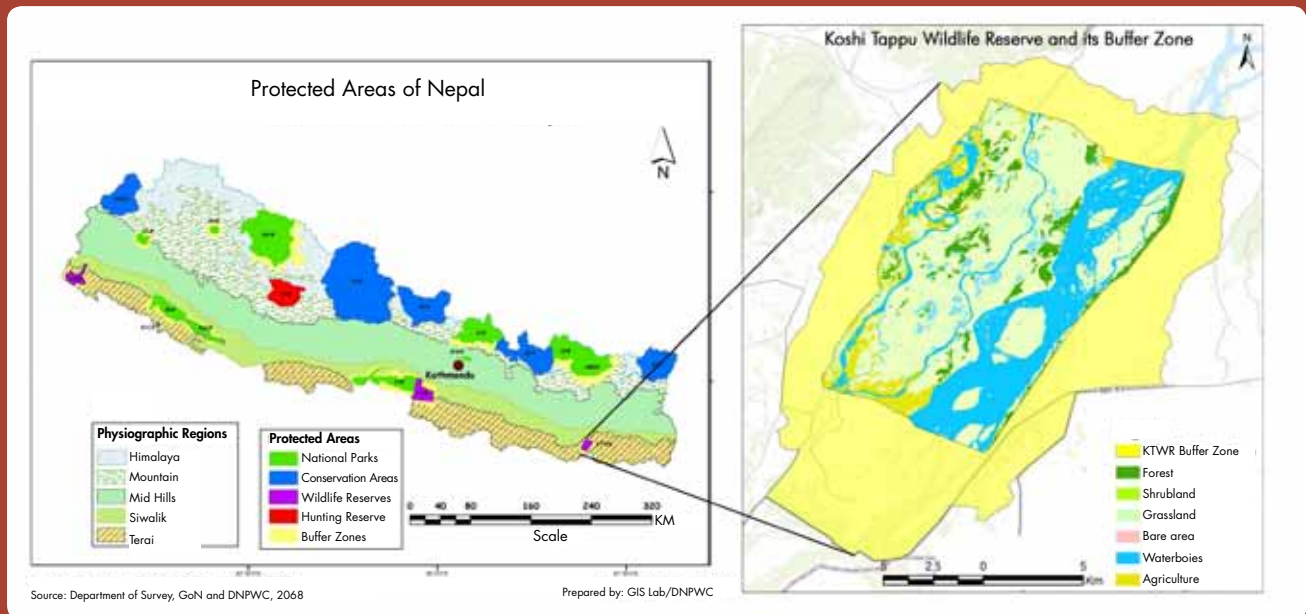
In December 1987, KTWR was designated as a Ramsar site for its special pool of genetic and ecological diversity. Its ecosystems are a wealth of natural biodiversity with 670 species of vascular plants, 21 species of mammals, 45 species of herpetofauna, 77 species of butterflies, and 494 species of birds. The Reserve is also home to a large number of endangered species like the Ganges river dolphin, gharial, smooth-coated otter, swamp francolin, and Bengal florican. In 2005, the Reserve was identified as one of 27 important bird areas in Nepal.

Threats and challenges

KTWR is under threat from different drivers of change, both human-induced and natural. Changes, including land use and land cover change and climate change, have led to the alteration of the critical habitat of many threatened species. The Reserve's capacity to provide goods and services is also being challenged, more so in the face of a growing population that is extremely dependent and creating additional pressure on these valuable resources. More importantly, changes in the course of the Koshi River have brought significant changes in land cover and land use patterns in the Reserve.

In 2004, an area of 173.5 km² adjacent to the KTWR, encompassing 16 Village Development Committees with a population of 93,000 from 16,280 households, was established as a buffer zone to reduce conflicts between the Reserve and local people. About 87% of local families depend on agriculture for their livelihood; only 20% of households are food secure. Livestock density stands at 1.5 cattle per household.

Koshi Tappu Wildlife Reserve and its Buffer Zone



Local people have a high level of dependence on ecosystem goods and services from the KTWR, primarily forest and wetland products. The increasing population is adding new pressure on the Reserve leading to the overextraction of resources. This has resulted in significant changes in land cover and key ecosystems.

As elsewhere, KTWR is not free from the challenges of global warming. Projected scenarios using data from 1985 to 2003 show that by 2080 the average maximum annual temperatures could increase by 0.48 °C to 1.11 °C, and minimum average annual temperatures could increase by 0.62 °C to 1.46 °C. Annual precipitation is projected to increase by up to 7%. Understanding the implications of these changes will require predictive models that build future scenarios based on both climate and biophysical factors.

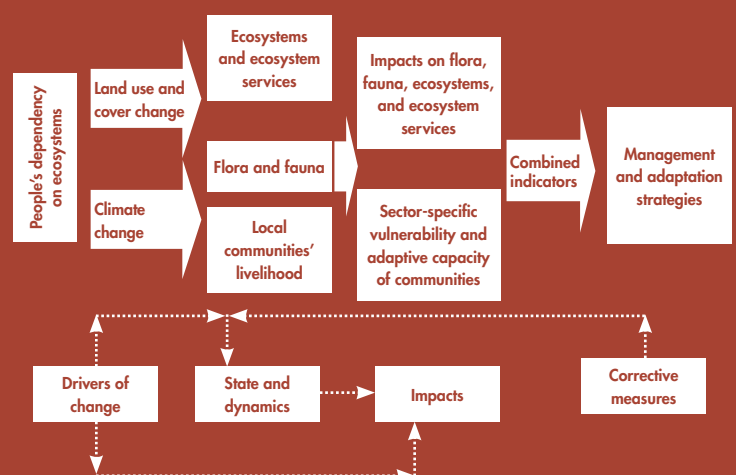
Significant changes in land cover and ecosystem types have been observed in KTWR over the last 34 years. While the area of forests has been reduced by 94%, grasslands

have increased by 79%. Although rivers and streams cover just 10% of the KTWR and swamps account for only 5% of the total area, these key ecosystems are the source of a large number of services that people depend on. Similarly, forests, with just 1% coverage, also provide important goods and services compared to other ecosystems. The portion of total land cover represented by forests, rivers and streams, and swamps and marshes has decreased by 16%, 14%, and 3% respectively. Protecting these important ecosystems and working to ensure the continued provision of valuable ecosystem goods and services will require an integrated approach to ecosystem management.

Economic benefits of select ecosystem services of the Koshi Tappu Wildlife Reserve are estimated at around USD 16 million each year

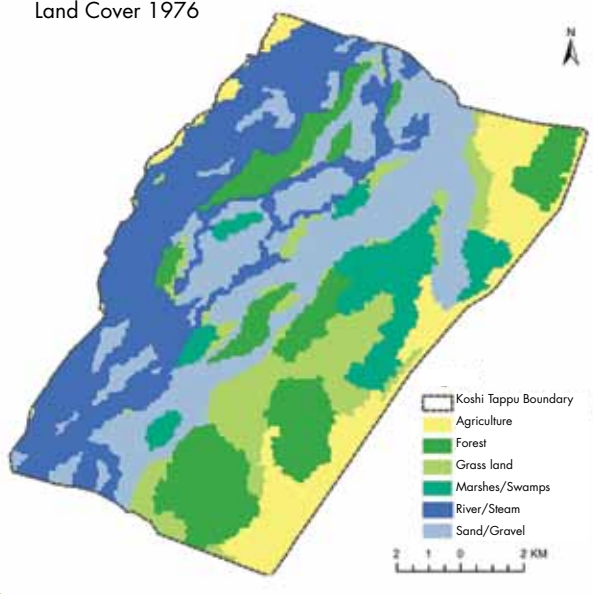


Conceptual research framework

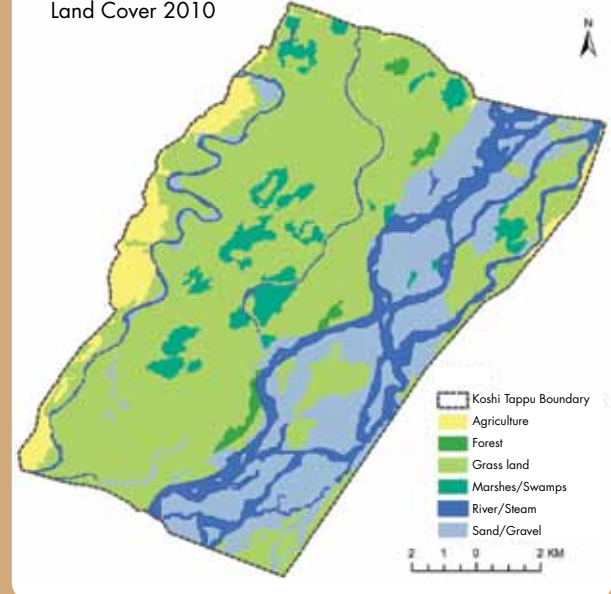


Land use and land cover changes in the Koshi Tappu Wildlife Reserve from 1976 to 2010

Land Cover 1976



Land Cover 2010



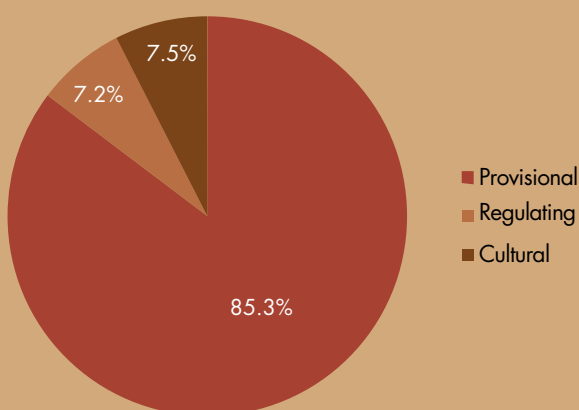
Impact assessment

- **Faunal diversity:** Significant changes in land cover and ecosystems are affecting important habitats. Impacts of these changes are particularly felt by species with specific habitat requirements and narrow habitat ranges. The concern, however, is more serious for species whose primary habitat is wetlands or forests, which are important habitats for many globally significant species.
- **Ecosystem services:** The Reserve is the provider of a large number of ecosystem goods and services. These services are not only the source of subsistence livelihoods, they also contribute to the local economy. However, as the result of changes in the areal coverage of important ecosystems, the functioning and sustainability of ecosystem services in KTWR are being affected. This could also affect the equitable sharing of benefits arising from these valuable resources.

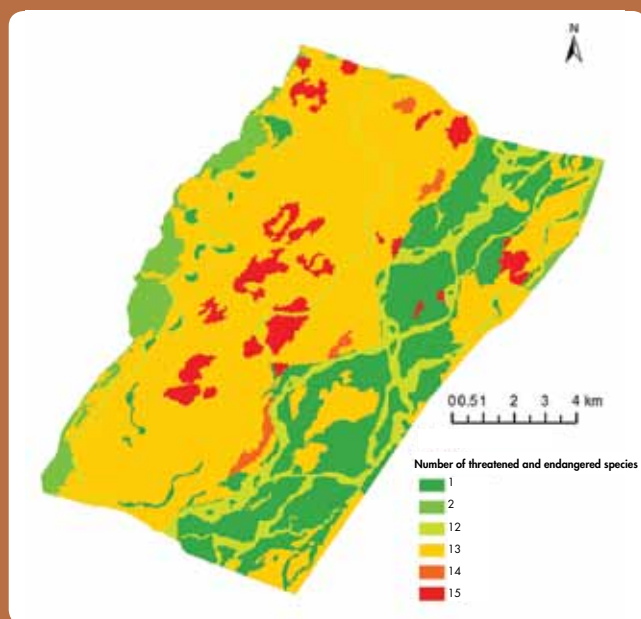
More than 70,000 people are directly or indirectly dependent on resources from the Koshi Tappu Wildlife Reserve

- **Community vulnerability:** Both ecosystems and local communities in KTWR are vulnerable. Population increase and other changes have put additional stress on important ecosystems. This has led to a loss in productivity of the ecosystem goods and services local people depend on. Although there are diverse opportunities for communities to adapt to changes in KTWR, this adaptation must be a part of a broader conservation and development strategy. An integrated and participatory management approach is needed to increase the resilience of local communities while ensuring the sustainable use of resources from the KTWR.

Contribution of major types of ecosystem services to the total estimated economic value of the Koshi Tappu Wildlife Reserve from 1976 to 2010



Distribution and habitat use patterns of threatened species in KTWR



The Koshi Tappu Wildlife Reserve is the source of 18 provisioning services, eight regulating services, four cultural services, and two supporting services

Recommendations

There are ample opportunities for conservation and development in the KTWR. A holistic and integrated approach should be applied. To increase both ecological and socioeconomic resilience, the following responsive strategies are recommended:

- Adopt a river basin or landscape-level management approach that considers upstream-downstream linkages and creates connectivity corridors for wildlife
- Consider climate uncertainty while planning conservation and development interventions

- Identify the change-drivers and monitor changes continuously
- Address the vulnerabilities of people
- Strengthen and involve local institutions and services
- Diversify livelihood options
- Move from coping to adaptive strategies
- Ensure the maintenance of natural ecosystems for sustained ecosystem goods and services
- Raise awareness on the value and importance of ecosystem services

Many globally significant species seek refuge in the ecosystems of the Koshi Tappu Wildlife Reserve, including 15 in swamps and marshes, 14 in forests, 14 in rivers and lakes, and 12 in grasslands

Note: Information presented here is based on the findings of collaborative research on KTWR undertaken in 2010 and 2011 by the International Centre for Integrated Mountain Development (ICIMOD); the Ministry of Forests and Soil Conservation, Government of Nepal; Tribhuvan University; Koshi Victim Society; and Bird Conservation Nepal.



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