

# An Integrated Assessment of the Effects of Natural and Human Disturbances on a Wetland Ecosystem

## A Retrospective from the Phobjikha Valley, Bhutan



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Himalayan wetlands are important as water reservoirs and carbon sinks and as habitats for several endangered species of flora and fauna (including migratory birds). They are also important to the livelihoods of poor and marginalized communities. But mountain wetlands are very susceptible to environmental and non-environmental stressors, and because they are poorly studied, especially in developing countries, they are difficult to manage.

In this regard, the International Centre for Integrated Mountain Development (ICIMOD) and the Royal Society for Protection of Nature (RSPN) under the Kangchenjunga Landscape Conservation and Development Initiative (KLCDI) jointly developed a multidisciplinary research framework under the auspices of a MacArthur Foundation-funded project on ecosystem services, biodiversity, and climate change adaptation in the eastern Himalayas.

A study was carried out in the Phobjikha Valley, Bhutan, to see how locals depend on ecosystems for various ecosystem services and how changes in land cover affect the flow of ecosystem services and their dependency. The study's findings can help plan an integrated and holistic approach to conservation and the sustainable development of the newly-notified Gangtey-Phobji Ramsar site.



### Methodology

#### Study site

- The study was carried out in the main watershed considering the habitat of the black-necked crane (*Grus nigricollis*) in the Phobjikha valley, an area of 162 km<sup>2</sup> located at 3,500 metres above sea level.
- The valley has one of the largest high-altitude wetlands in Bhutan and contains 254 species of flora from 43 families; 90 species of birds, including the endangered black-necked crane and threatened white-bellied heron (*Ardea insignis*); and 20 mammalian species, including the globally-threatened red panda (*Ailurus fulgens*).
- The local community depends on agriculture and animal husbandry for their livelihoods.

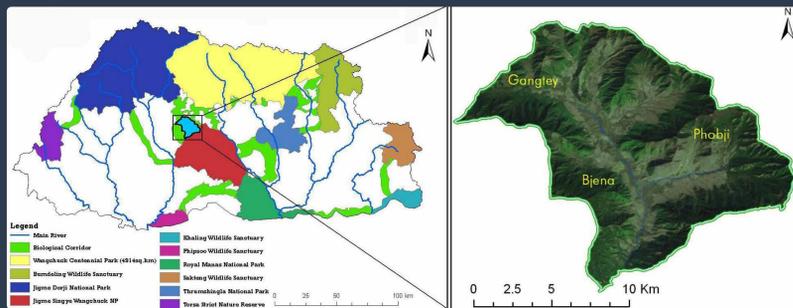


Figure 1: Location of PCA and protected areas of Bhutan

#### Methods

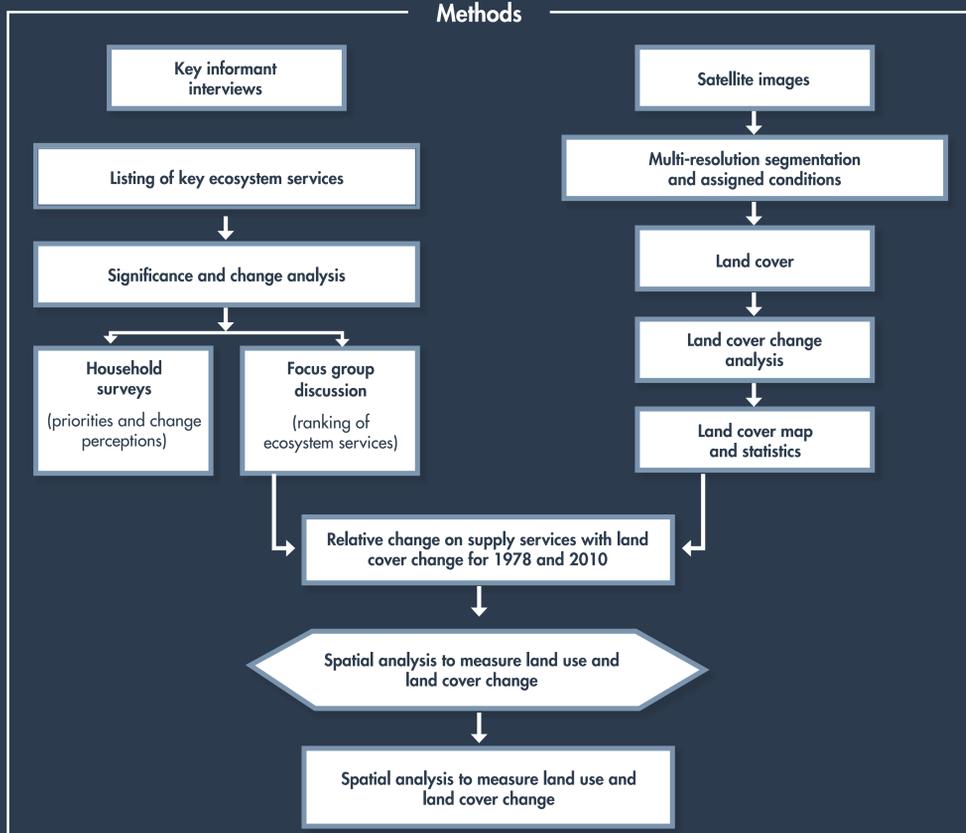


Figure 2: The methodological framework. (Source: Chaudhary et al., 2017)

### Key findings

- Twenty-four key ecosystem services were identified through key informant interviews and household surveys (14 provisioning, four regulating, two supporting, and four cultural).
- Provisioning services were perceived as the most important, followed by cultural, regulating, and supporting services.
- Forest was the most important land cover type for services, followed by marsh, scrub, water bodies, and agriculture.
- Over a 32-year period, the forest area declined by 2% and the marsh by 7%, suggesting a potential decrease in ecosystem services that was corroborated by the local community.

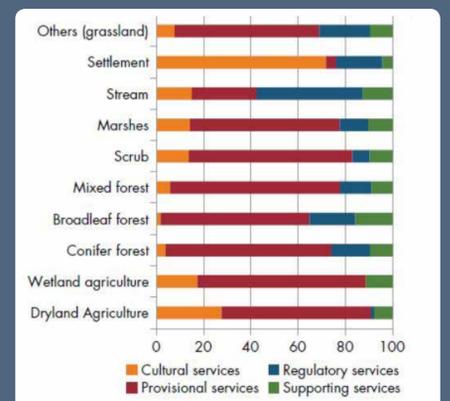


Figure 3: How people perceive the relative importance of their ecosystem services

#### Land cover change

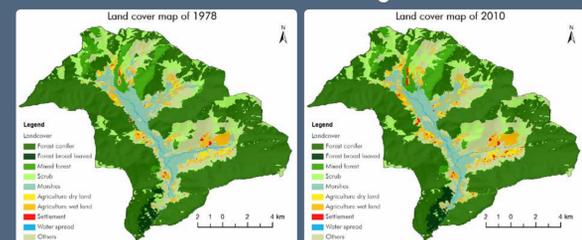


Figure 4: Land cover map of the study area in (a) 1978 and (b) 2010

#### Impact of land cover change on ecosystem services

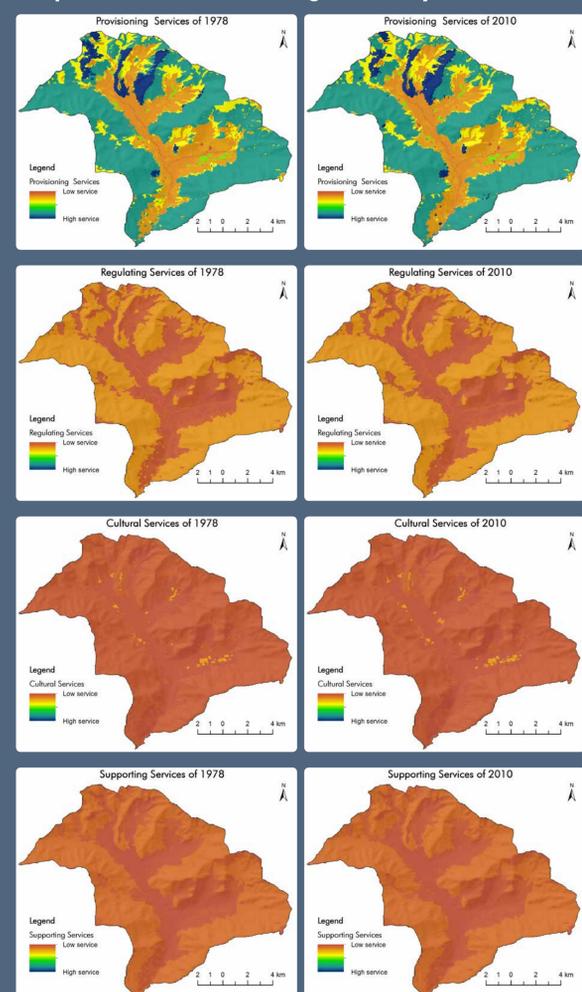


Figure 5: State of four major ecosystem services in 1978 and 2010

