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# Valuing forest ecosystem services: Case study of a forest reserve in Japan

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## ARTICLE INFO

## Article history:

Received 9 August 2012

Received in revised form

30 January 2013

Accepted 22 February 2013

Available online 28 March 2013

## Keywords:

Economic valuation

Forest ecosystem services

Oku Aizu forest reserve

Japan

## ABSTRACT

Forests ecosystems provide several intangible benefits which policy makers ignore since these values do not register in conventional markets or are difficult to measure. Drawing on results of a case study of a forest reserve in Japan, this paper suggests that the annual value of the ecosystem services provided by forests is not only worth millions of dollars, but also in per hectare terms much more than hitherto known. This value for the Oku Aizu forest reserve ranged US\$ 1.427–1.482 billion or about US\$ 17,016–17,671 per ha. If these are accounted for, then governments and societies faced with the development versus conservation dilemma can make more informed decisions and policies that will help conserve forests and the ecosystem services they provide, and thereby promote human well-being and sustainable development.

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## 1. Introduction

Forests provide several intangible benefits such as regulating local and global climate, protecting watersheds, arresting soil erosion, nutrient cycling, etc. which policy makers ignore since these values do not register in conventional markets or are difficult to measure. While in the past the use, non-use and intrinsic values were cited to justify conservation of biodiversity and ecosystems, the MEA (Millennium Ecosystem Assessment) 2005 added another dimension—viz., its role in providing ecosystem services which impact on human well-being and sustainable development (MEA (Millennium Ecosystem Assessment) 2005; Ninan, 2007, 2011). In a seminal article, Costanza et al. (1997) estimated the total annual value of the world's ecosystem services at an average of US\$ 33 trillion, and of global forests at US\$ 969 per ha. Despite Japan having the largest proportion of land area under forests among high income countries in the world (about 69% as per the Global Forest Resources Assessment Report for 2010), surprisingly there are very few studies which have assessed the economic value of the ecosystem services of Japan's forests, and these too being in Japanese are not easily accessible to the international scientific community. One such study cited recently estimated the total economic value of the ecosystem services of Japan's forests at about US\$ 620 billion (2001 US\$) per annum (MRC (Mitsubishi Research Centre) 2001; White et al., 2011).

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This paper, therefore, makes a case study to assess the economic value of the ecosystem services of forests in Japan. In attempting this we are aware of the limitations and criticisms leveled against economic valuation and conventional cost-benefit analysis, and the need for relying on plural approaches to justify conservation of biodiversity and ecosystem services (Norgaard, 2010). Economic valuation, however, does not imply that other perspectives for better management of the environment have to be neglected. All that it seeks to convey is that if proper values are assigned to environmental goods and services it would lead to better conservation outcomes. However, market values tend to be precise monetary values, but are highly inaccurate as measures of social costs and benefits. Estimated monetary values of ecosystem services are imprecise, but improve accuracy by making the combined market + non-market values better reflect actual costs and benefits. Moreover, the estimated values of ecosystem services will change with changes in quantity, incomes, prices and methods used to value these services. These points may be borne in mind while evaluating the estimated values of forest ecosystem services for Japan.

## 2. Study area

Oku Aizu forest ecosystem reserve located in the south-west region of Fukushima prefecture in Japan i.e. about 150 km north of Tokyo has been selected for an in-depth study (see Fig. 1). This is one of 29 and largest among forest ecosystem reserves in Japan (Yoshida, 2010). The reserve covers 83,890 ha of which the core

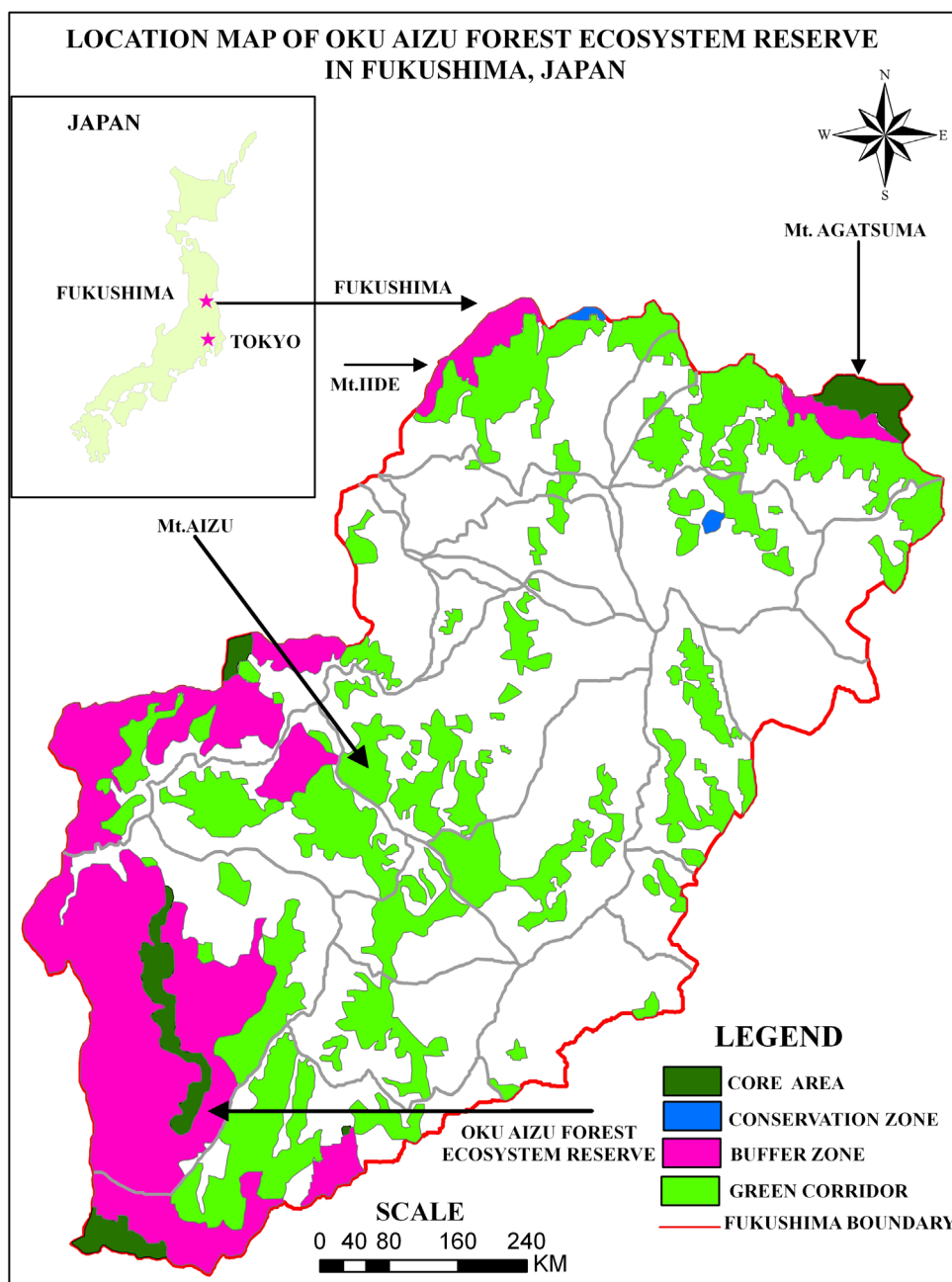


Fig. 1. Location map of Oku Aizu forest ecosystem reserve in Fukushima, Japan.

zone constitutes about 9.2% and the buffer zone 90.8% (MAFF, undated). Besides there is also a green corridor of forests adjoining the forest reserve. While entry to the core zone is prohibited except for authorized academic purpose, in the buffer zone some activities are permitted such as allowing local communities to harvest small quantities of some non timber forest products such as wild mushrooms and edible plants for self consumption, forest recreation, etc. (Yoshida, 2010). Over 75.3% of the forest reserve is under forests of various types, and the remaining over 24.6% is non-forest area. Broadleaved forests constitute the major share (84.7%) of the forest area (63,204.82 ha) in the reserve, while needleleaved and other unidentified forests constitute the remaining 15.3% (Kanto RFM Office). The reserve is home to several endangered and rare flora and fauna such as the golden eagle (*Aquila Chrysaetos*), northern goshawk (*Accipiter gentilis*), Japanese serow (*Capricornis Crispus*), etc.

### 3. Materials and methods

Information and data have been collected from the Kanto Regional Forest Management (RFM) office of the Ministry of Agriculture, Forests and Fisheries (MAFF), publications and reports of the Government of Japan, research agencies, and journal articles (MAFF, undated); MAFF (Ministry of Agriculture, Forestry and Fisheries) 2010); MIAC (Ministry of Internal Affairs and Communication) 2012). These are indicated in relevant places in the text or references.

Seven ecosystem services are evaluated. Other benefits such as biodiversity and cultural values, flood protection, pollination and NTFP benefits, etc. are not considered in our analysis due to lack of data or information. To that extent our estimates understate the total value of the ecosystem services provided by the Oku Aizu forest reserve. Although, as stated earlier, local communities

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