Culterra 56

Forest quality in the southwest of Mexico City. Assessment towards ecological restoration of ecosystem services

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Abstract

Most forests have already been modified by people. Complete ecological integrity is a historical concept in most parts of the world. The distinction between 'natural' and 'disturbed' forests is less important than the *degree* and *type* of disturbance.

Numerous attempts have been made to define criteria and indicators (C&I) for the assessment of sustainable forest management (SFM) at various levels (e.g., global, regional, national, forest management unit). In 1998, the WWF and the IUCN developed the forest quality C&I initiative to assess SFM at the landscape level. The initiative relies on the forest quality principle and encompasses criteria from three categories: (1) forest authenticity, (2) environmental benefits and (3) other social and economic benefits. Forest conditions are measured at the landscape level, allowing more room to consider the way in which the people and forests of a region interact.

This project presents an evaluation of the forests in the southwest of Mexico City, one of the world's biggest and most populated metropolises, adhering to the concept of forest quality. The forests studied are located in the upper Magdalena watershed, in the southern-central part of the country.The study area covers a surface area of ca. 6,400 ha and is host to the main temperate forest types of Mexico: pine (*Pinus hartwegii*), fir (*Abies religiosa*), mixed (*Pinus*, *Abies*, *Quercus* and *Alnus*), montane cloud, and oak forests (*Quercus rugosa* and *Q. laurina*). The forests were given protection status primarily because they are a major source of drinking water, but also because of their crucial role in the maintenance of the sizable biodiversity of the area, their ability to sequester carbon, and the provision of recreational opportunities for the inhabitants of Mexico City. The urban sprawl of the city poses a continuous threat to this area, but its protected status together with its complex topography, its high elevation, and the communal system of land tenure have succeeded in checking further encroachment by this enormous urban system.

Data relating to the criteria, indicators and verifiers of forest quality were collected from 116 sample plots. Interviews (n=57) were held with representatives of the main stakeholder groups (landowners, visitors, academics, officials, etc.), in order to determine their perceptions of the relative importance of the ecosystem services provided by the area and the environmental issues. To assess forest quality, field and laboratory verifiers of forest composition, pattern, function, process, tree health, area and fragmentation, and

management, as well as ecosystem services indicators were integrated and weighted by a group of experts through a pairwise multi-criteria analysis.

The stakeholders recognised the existence of ecosystem goods and services provided by the forests of the area and deemed those related to soil erosion control, the provision of clean water and habitats for plants to be the most important. The area is an important biodiversity refuge and is host to 1,175 species (including plants, mammals, birds, amphibians, reptiles, fungi, algae and butterflies), 209 of which are considered useful (e.g., medicinal, edible, used for construction, etc.) and 39 are listed as being at risk. The forests of the area store an average of 101 tC/ha. The *Quercus* and mixed forests have the highest carbon content values, followed by the *A. religiosa* forest. The soil type and the forest stands promote the infiltration of rainwater, recharging the aquifer of the basin of Mexico City (from which ca. 70 % of the city's water comes). The River Magdalena supplies 500 l/s of water directly to neighbourhoods in the urban zone. Recreation is another of the most important ecosystem services. Mexico City's inhabitants visit the area, mainly on the weekends, to fulfil their need for less crowded and green spaces, where they can engage in activities such as hiking, football, cycling, etc. The recreational activities mainly occur near the access roads. An understanding of the values and benefits provided by the forests should be of fundamental importance to their management. The information presented here will allow for the implementation of a more precise and better adapted ecosystem services payment programme, as an economic instrument for the conservation and ecological restoration of the forests in the area.

The experts agreed that forest composition and process verifiers are the most important indicators for the assessment of forest quality. Fir (*Abies religiosa*) forest has the highest values for the forest quality indicators, whereas the *Pinus hartwegii* forest, typical of very high elevations, had lower values in general. A forest quality map was produced by means of spatial interpolation and by integrating information for all of the indicators. This tool is expected to provide a solid yet flexible framework for decision making and for the monitoring of sustainable forest management in the area.

The stakeholders identified irregular human settlements as being one of the most important environmental disturbance factors in the area, followed by the interest groups amongst the landowners, littering and land tenure problems. Factors such as visitors, lumberjacks, tree disease, authorities, air pollution and livestock management were deemed to have a moderate impact. People in general are aware of the importance of the forests in the area, but there is a lack of environmental education and information, and the responsibilities for management and conservation are not clear.

General guidelines for a more sound management geared towards the ecological restoration and conservation of the main ecosystem services are presented, together with a proposal for an environmental education programme, and a zoning of the area.