

People, Pixels and Parks: Forest Conservation in the Tropics

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Abstract: While protected areas have become a cornerstone of conservation efforts, there is significant debate about whether parks have been effective in enabling conservation. A meta-analysis of information on rates of land cover clearing in protected areas finds that government protected areas are significantly likely to lower rates of habitat clearing over time. At the same time, it is essential to ask whether government protection is the only successful approach to conservation. A focused set of studies in Nepal and India indicates that it is not the official designation of a forest as government or community that impacts forest conservation as much as the actual degree of monitoring that takes place on the ground. Communities can be effective forces for conservation, if properly involved. By locating individual protected areas within the context of the biophysical, social and institutional landscape in which they are embedded, we will be able to better devise more effective approaches to conservation.

Protected areas have become a cornerstone of conservation efforts across the globe. By 2003, over 100,000 parks and other protected areas were in existence on paper, covering an area of over 18,000,000 km² across the world (UNEP 2004). In response to increasing awareness of the impact of these exclusionary strategies of conservation on local communities, park managers have attempted to establish more inclusive management strategies that involve local communities in conservation, especially in countries where the lives of indigenous communities are closely intertwined with forest habitats. Yet, there is significant debate about the impact of these participatory approaches on conservation, with arguments that habitat fragmentation and species loss have increased in areas where local communities coexist with protected areas (Brandon et al. 1998, Terborgh 1999).

Given the centrality of this debate in the international conservation community - and when viewing the vast effort expended in setting up and managing parks - it is surprising to note that there have been very few comparative studies that evaluate park effectiveness across multiple sites, and simultaneously examine community and government conservation. The few multi-site assessments

of park effectiveness have been based largely on interviews with park managers (e.g. Bruner 2001, Hockings 2003). Although these are experienced individuals with a great deal of information on their specific areas, there is also the danger of introducing biases in the analysis, since these same individuals are in charge of monitoring, and could have a vested interest in declaring the parks as successfully managed (Vanclay 2001).

Part of the difficulty has been in developing quantitative surveys by monitoring ecological change in a manner that enables comparison across multiple sites located across the globe. Yet, this remains a crucial task, if we are to be able to critically evaluate the effectiveness of parks as a policy strategy for conservation. A major challenge has been to identify a set of criteria applicable to protected areas embedded in different ecological habitats across the world, which can be used to evaluate their functioning in a commonly applicable, acceptable manner. Satellite remote sensing, possibly the most frequently used technique for the mapping of changes in forest cover, provides a particularly effective tool for such an analysis (Nagendra et al. 2004a, 2006). A meta-analysis of quantitative data on land cover change in 37 parks from 20

countries was conducted by this author, based on published literature on rates of land cover change in officially designated protected areas.

How effective have parks been in limiting land clearing? This can be assessed in two ways. In the first approach, rates of clearing within the park were compared to the surrounding landscape, which receives less protection. The rate of habitat clearing within the parks were significantly lower compared to its surroundings ($p < 0.01$), indicating that these areas have been successful in limiting habitat destruction. The second approach tested whether parks were successful in limiting land cover clearing over time, by comparing rates of land cover change in the area before and after establishment of the park. Although there was limited data on this aspect, the numbers indicate that the majority of parks were successful in maintaining or lowering rates of land cover change following their establishment ($p < 0.10$) – an impressive record when one considers how rates of land cover clearing have been steadily increasing over time, across the world.

There was no significant variation in rates of habitat clearing parks belonging to different regions – Africa, Asia, Latin America and North America-Europe. Rates of land cover clearing also did not differ significantly between low, medium and high income countries. Indeed, some protected areas in low income countries are performing very well, with positive rates of habitat regrowth – such as the Royal Chitwan National Park Buffer Zone in Nepal (Nagendra et al. 2005). Finally, there were no significant differences in rates of land cover change between parks managed in higher IUCN categories indicating stricter protection, and parks which are subject to a greater degree of human intervention for management or sustainable use. This is a particularly interesting finding in light of the intense debate in the conservation community about whether participatory management has negatively impacted park effectiveness. Clearly, the variation in park effectiveness can not be accounted for by simple, broad-brush arguments that apply consistently across sites.

Drivers and agents of land cover change did however appear to differ across regions. In North America and Europe, timber logging was frequently mentioned as a major cause for land cover clearing. Park managers appeared to play a more significant role in determining the location and extent of forest clearing, and these parks appeared to be managed predominantly for recreational purposes and forestry. Thus, the need is for these landscapes to satisfy the requirements of forest dependent communities is less pressing, which can make it easier for official management plans to translate into practice. In Africa, Asia and Latin America the actors were predominantly local communities, indicating the pressing need to involve communities with park management in these parts of the world. Managers in these countries presumably have to deal with a doubly difficult situation – working with lower levels of investment into park management and protection, as well as managing local communities living in conditions of poverty and forest dependence. Yet, these do not appear to be worse off when compared to protected areas in higher income countries.

This analysis finds that officially designated, government protected areas are likely to lower rates of habitat clearing. It does not however answer the question of whether government protected areas are the only successful approach to conservation (Dietz et al. 2003). Hayes (2004) and Hayes and Ostrom (2005) examined this question in greater detail, conducting detailed evaluations of whether formal government ownership was related to forest protection. Drawing on a dataset of 163 forests across multiple locations in different countries, their analysis did not find any statistically significant difference between forest density in officially designated protected areas, as compared to other public, private and communally owned forests. Thus, while some government protected areas may be effective at forest protection, other protection mechanisms appear to be equally effective. Banana and Gombya-Ssembajjwe (2000) found that the monitoring activities of local communities have been remarkably successful in conserving a government forest in Uganda. Batistella, et al. (2003) similarly found that rubber tappers have proved to be very active and effective (even

though unofficial) forest monitors in 16 forest reserves in Brazil. These studies indicate that local forest dwellers can be active and motivated monitors under appropriate conditions.

Similar findings emanate from our research in South Asia. Based on a rigorous set of methods developed over the past decade at the Center for the Study of Institutions, Population, and Environmental Change (CIPEC, www.cipec.org), we have studied forests managed under a variety of tenure arrangements across the world. Our findings indicate that multiple factors impact the effectiveness of forest conservation. Formal ownership – whether private, community or government – is less important than the actual rules and mechanisms used to manage these forests on the ground.

Our studies in South Asia are particularly illustrative. Forests in this biodiversity-rich region are a priority for conservation, yet subject to some of the highest population pressures, with forest-dependent communities, emerging markets and substantial conflicts over forest resources. A variety of forest institutions co-exist, ranging from traditional systems to fenced government parks and recent co-management initiatives - providing an environment that facilitates careful comparative study of which policies, rule systems and institutions appear to assist effective forest conservation.

Through a focused set of studies in Nepal and India, where some of the most thickly populated settlements coexist with dense tropical forest cover, we have attempted to address these questions in multiple landscapes (Nagendra et al. 2004 b, 2005, 2006). Time series analyses of remotely sensed images enable us to identify the trajectories of land cover change in different parts of the landscape. By overlaying management boundaries on these images, we are able to interpret the impact of different government, community or co-managed systems on forest conservation. Through in-depth interviews conducted with local inhabitants, we can hope to understand the major factors associated with successful conservation in these forested landscapes.

The multi-temporal remote sensing studies in India cover landscapes within which government protected national parks and reserve forests. The

Mahananda Wildlife Sanctuary in northern India and the Tadoba Andhari Tiger Reserve (TATR) in central India contain relatively stable forests, while the less protected government protected reserve forests nearby have witnessed some degradation and thinning over time. Yet, small patches of clearing are also visible within the parks, where the density of surrounding habitation is high, and there is sustained pressure for grazing, and extraction of firewood and timber (Ghate 2003, Nagendra et al. 2006). Increased conflicts between park guards and local people have amplified the difficulties involved with monitoring. Despite the strongly and often expressed opinion that the communities within the park are responsible for most of the negative impacts on the forests, our findings indicate that local communities, if appropriately involved, can act as a powerful force for conservation. The primarily subsistence villages located within the TATR do not have a significant negative impact on forest clearing or fragmentation. Instead, it is the villages located outside the park, well connected to urban markets for timber and forest products, that appear responsible for most of the forest degradation, which is primarily taking place at the outer boundary (Nagendra et al. 2006).

In contrast to the government protected areas we study in India, we examine a range of community protected areas in Nepal. Amongst developing nations, Nepal has proved to be a forerunner in implementing innovative and effective programs of decentralized forest management. The Nepal analyses demonstrate the potential of community protected and co-managed areas to provide effective forest conservation. We find significant regrowth in community managed buffer zone forests adjoining the Royal Chitwan National Park. While these areas experienced increased clearing between the first two dates, this trend was reversed with forest regrowth following establishment of protection. Some areas belonging to the buffer zone program have been able to completely halt all deforestation activities within their boundary. These buffer zone forests are located near the park main gate, earn substantial incomes from tourist visits, and have a much greater financial incentive for conservation (Nagendra et al. 2004 b, 2005). All these forests have substantial monitoring by the communi-

ties, or by forest guards hired and supervised by the community. Encouragingly, recent field visits in May 2005 indicate that these communities have been able to protect their forests even in the face of some very difficult and insecure situations following the intense conflicts within the country, indicating the resilience of these efforts.

These in-depth case studies indicate that it is not the official designation of a forest as government, community or co-managed that impacts forest conservation as much as the actual degree of monitoring that takes place on the ground. Whether community forests in Nepal, or government protected reserve forests in India, if these forests are not adequately monitored for violations by official guards or by the users themselves, they are not substantially protected. If substantial monitoring is present, whether through government or community inputs or a combination of both, as in the case of the Nepal community forests and Indian national forests, they are able to maintain forest cover and encourage regeneration, even in a landscape that is otherwise surrounded by degrading forests.

The meta-analysis of land cover clearing found that a large proportion of parks in developing countries, where human demands for scarce forest resources are particularly acute, are placed in IUCN categories that indicate they are being managed through strict protection - yet, this analysis has demonstrated that these parks appear no likely to provide more protection compared to parks that employ more participatory approaches. Our case studies in South Asia indicate that both community and government protected areas can be successful in halting and reversing habitat clearing, if properly monitored. Given the context of forest protection in many low income regions of the world, limited by manpower and by resources, these studies indicate that it is critical to effectively involve local communities in the management of these parks, and provide them with economic incentives for conservation. This will prevent the burden of protection from falling solely on often ill-equipped national Governments and can help bring ill-equipped, understaffed and underfunded parks on an even footing with others working in easier conditions - as is being increasingly demonstrated in countries such as Mexico and Nepal (Bray et al.

2003, Nagendra et al. 2005). It is only by moving away from universalized, global "blueprint" management approaches, and locating individual protected areas within the context of the biophysical, social and institutional landscape in which they are embedded, that we will be able to better devise more effective and inclusive approaches to conservation (Dietz et al. 2003).

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