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What drives the success of reforestation projects in tropical developing countries? The case of the Philippines

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ABSTRACT

In response to substantial deforestation over many decades, large scale reforestation programs are being implemented across many tropical developing countries. Examples include the United Nations Billion Trees Campaign, the National Greening Program in the Philippines, and the 5 million ha reforestation program in Vietnam. However, while substantial investments are being made in reforestation, little information exists on the drivers influencing reforestation success and how these interact to determine environmental and socio-economic outcomes. In this study we surveyed 43 reforestation projects on Leyte Island, The Philippines to identify the drivers that most influence reforestation success as measured by key indicators drawn from the literature, including interactions between drivers and between drivers and indicators. We investigated 98 potential success drivers, including technical and biophysical factors; socio-economic factors; institutional, policy and management factors; and reforestation project characteristics. We also measured 12 success indicators, including forest establishment, forest growth, environmental and socio-economic success indicators. Stepwise multiple regressions were used to identify significant relationships among drivers and indicators and this analysis was used to develop a system of driver and indicator relationships. Based on this we found that revegetation method, funding source, education and awareness campaigns, the dependence of local people on forests, reforestation incentives, project objectives, forest protection mechanisms and the condition of road infrastructure were highly connected drivers that influenced multiple success indicators either directly or indirectly. We conclude that policies targeting revegetation methods, socioeconomic incentives, forest protection mechanisms, sustainable livelihoods, diversification of funding and partnerships, technical support, and infrastructure development are likely to have a broad systemic and beneficial effect on the success of reforestation programs in tropical developing countries.

1. Introduction

While tropical deforestation continues at alarmingly high rates, the net loss of forest area globally has slowed from 8.3 million ha per year between 1990 and 2000 to 5.2 million ha per year between 2000 and 2010 (FAO, 2010). This reduction in net loss is mainly due to an increase in afforestation, reforestation, and natural forest regrowth. It appears that a number of tropical countries have recently been through a forest transition, whereby there has been a shift from deforestation to net reforestation (Meyfroidt and Lambin, 2011).

Reforestation through planting trees on cleared land is an important mechanism that leads to tree cover establishment as reported in the forest transition literature, however reforestation is not a straightforward process that leads invariably to tree cover increase (de Jong, 2010). Rather, the outcome of forest rehabilitation itself is influenced by many factors (Chokkalingam et al., 2005; Le et al., 2012). If forest rehabilitation outcomes can be appropriately assessed, and these outcomes linked to forest cover increases, the study of forest rehabilitation could shed light on some of the many complex processes that ultimately result in forest transition (de Jong, 2010).

Little information exists to indicate the success of reforestation projects in achieving ecological or socio-economic benefits. Unfortunately, many existing reforestation projects have partially or completely failed, often because the trees that were planted have not survived or have been rapidly destroyed by the same pressures that caused forest loss in the first place. Even when planted trees have survived to maturity, they have not necessarily

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been welcomed by local communities. Dudley et al. (2005:6) observed that, 'too many restoration projects do not bother to find out what local people really want'. This is a particular problem in the rural areas of developing countries because if reforestation projects do not meet community livelihood needs, then the planted trees will not be respected and will most likely be removed and replaced with agricultural land uses.

A number of problems with past reforestation projects can be identified. Reforestation projects have often sought to encourage and sometimes impose tree planting without understanding why the trees disappeared in the first place and without attempting to address the immediate or underlying causes of forest loss (Eckholm, 1979). There has also often been a mismatch between social and ecological goals of reforestation; either reforestation has aimed to fulfil social or economic needs without reference to ecological goals, or it has had a narrow conservation aim without taking into account the social and economic needs of people. For foresters, reforestation traditionally meant establishing trees for a number of functions (wood or pulp production, soil protection). For many conservationists, reforestation is either about restoring original forest cover on degraded areas or about planting corridors of forest to link protected areas. For many interested in social development, the emphasis of reforestation is on establishing trees that are useful for fuel-wood, fruit, or as windbreaks and livestock enclosures.

Until now, most reforestation practitioners and ecologists have tended to see their jobs as strictly technical. In reality, however, reforestation is as much a cultural activity as any other human endeavour. As Higgs (1997) has compellingly argued, good reforestation requires a view expanded beyond the technical to include historical, social, cultural, political, aesthetic and moral aspects. Otherwise conflicts may arise when reforestation programs are introduced (Light and Higgs, 1996; Swart et al., 2001).

Based on a variety of case studies, the most important socio-economic requirements for reforestation success appear to be a stable land-use pattern, equitable land-tenure systems, homogeneous human populations (with respect to ethnicity, economics, and so forth), local public involvement, and strong local leadership and participation by government institutions (Karki, 1991; Lamb, 1988). However, the success or failure of reforestation projects cannot be explained by either a single technical or a socio-economic factor (Aronson et al., 1993; Le et al., 2012; Sayer et al., 2004). Little quantitative research has been conducted on reforestation success drivers and their interactions.

Through a comprehensive review of the literature we have identified a list of potential success drivers and grouped these into technical/biophysical drivers; socio-economic drivers; institutional, policy and management drivers; and reforestation project characteristics (Le et al., 2012). In that study, we also identified a large set of indicators that have been used to measure the success of reforestation projects (Fig. 1). A critical shortcoming in our current understanding concerns the relationships between the drivers of reforestation success and the indicators. In some cases these links are relatively clear, for example weed control and grazing management are logical drivers that would affect seedling survival rate (a key indicator of reforestation success). However in many other cases, the links are not clear and there may be many drivers that affect the outcomes of reforestation in unknown or unexpected ways. We also do not know the relative importance of the many potential drivers, nor their impact on one or more indicators of success. In addition, we do not know what the interactions are between drivers and/or indicators. The aim of this paper is to gain a deeper understanding of these relationships by investigating the drivers that have determined reforestation success in the Philippines. We do this by surveying 43 reforestation projects on Leyte Island, covering 98 potential drivers and 12 success indicators.

2. Methods

2.1. Study region and reforestation programs

The Philippines is one of world's seventeen mega-diverse countries (Mittermeier et al., 1997) and is one of the world's most threatened biodiversity hotspots. Like many other Asian countries, the Philippines lost its forest cover rapidly through heavy logging, upland migration and agricultural expansion over the last century. Up to 59% (9.3 million ha) of the country's official forest lands are not forested at present and are either grass or shrub land, or under cultivation (Chokkalingam et al., 2006). There is approximately 1 million ha of primary forest remaining, which represents less than 3% of the original primary forest cover (Agoncillo et al., 2011).

Reforestation efforts in the Philippines started almost a century ago and were meant to restore forest cover, provide environmental services, supply timber, and more recently contribute to local livelihoods. The common perception is that the efforts were largely a failure, with little to show on the ground and logging and livelihood pressures continuing to degrade remaining forests (Chokkalingam et al., 2006). Although the reforestation effort in the Philippines planted approximately 1.7 million ha of forest between 1960 and 2002, only 50% was estimated to have survived (FMB, 2002).

Given the current state of the Philippines' forest lands and the demands placed on them, reforestation still continues to remain high on the national environmental policy agenda (Lasco, 2008). Reforestation was one of the major programmes in the 'General Program of Actions for the Forestry Sector from 2005–2010' (Chokkalingam et al., 2006). In 2011, President Benigno S. Aquino III issued Executive Order No. 26, ordering the implementation of a National Greening Program as a government priority (NGP, 2011). The programme aims to plant some 1.5 billion trees covering 1.5 million ha over a period of six years from 2011 to 2016. Understanding reforestation success drivers will be central to the success of the programme and others like it around the world.

Our study was conducted on Leyte Island (Fig. 2), which is the eighth largest island in the Philippines (Wernstedt and Spencer, 1967), with a total land area of 750,000 ha (Groetschel, 2001). Leyte is located in the Eastern Visayas region (Region 8), at about 9°55′N–11°48′N latitude and 124°17′–125°18′E longitude, with an extension of 214 km from north to south (Langenberger et al., 2006), and about 65 km at its widest point. The island is divided into two provinces: Leyte and Southern Leyte. Based on the Corona system of classifying climatic conditions, the island has two climate types (Coronas, 1920). The eastern part of the island has a Type II climate characterised by a pronounced rainfall from November to January, while the western part has a Type IV climate with a rainfall more or less uniformly distributed throughout the year. This climatic difference is due to a mountain range that bisects the island (Emtage, 2004; Groetschel, 2001). The average annual precipitation is relatively high, at about 2900 mm (Kucharski, 2010).

Leyte province is home to 1,724,240 people of which 390,847 live in Southern Leyte province (NSO, 2008). The island has relatively flat lands around the coastline and mountainous terrain towards the centre, rising up to 1,150 m above sea level at the top of Mt. Pangasugan (Vilei, 2010). The average annual family income of the Eastern Visayas Region was approximately 3606 USD as in 2011 (NSCB, 2011). Fifty-five per cent of the households on Leyte depend on agriculture and fishing for their living (Vilei, 2010).

As in most parts of the Philippines, forests were the major natural resource on Leyte in the early 1900s. Large-scale logging