Restoration Cases Flagship Collection

Case #1:

Community-led watershed restoration in Intag Valley, Ecuador

RESTOR

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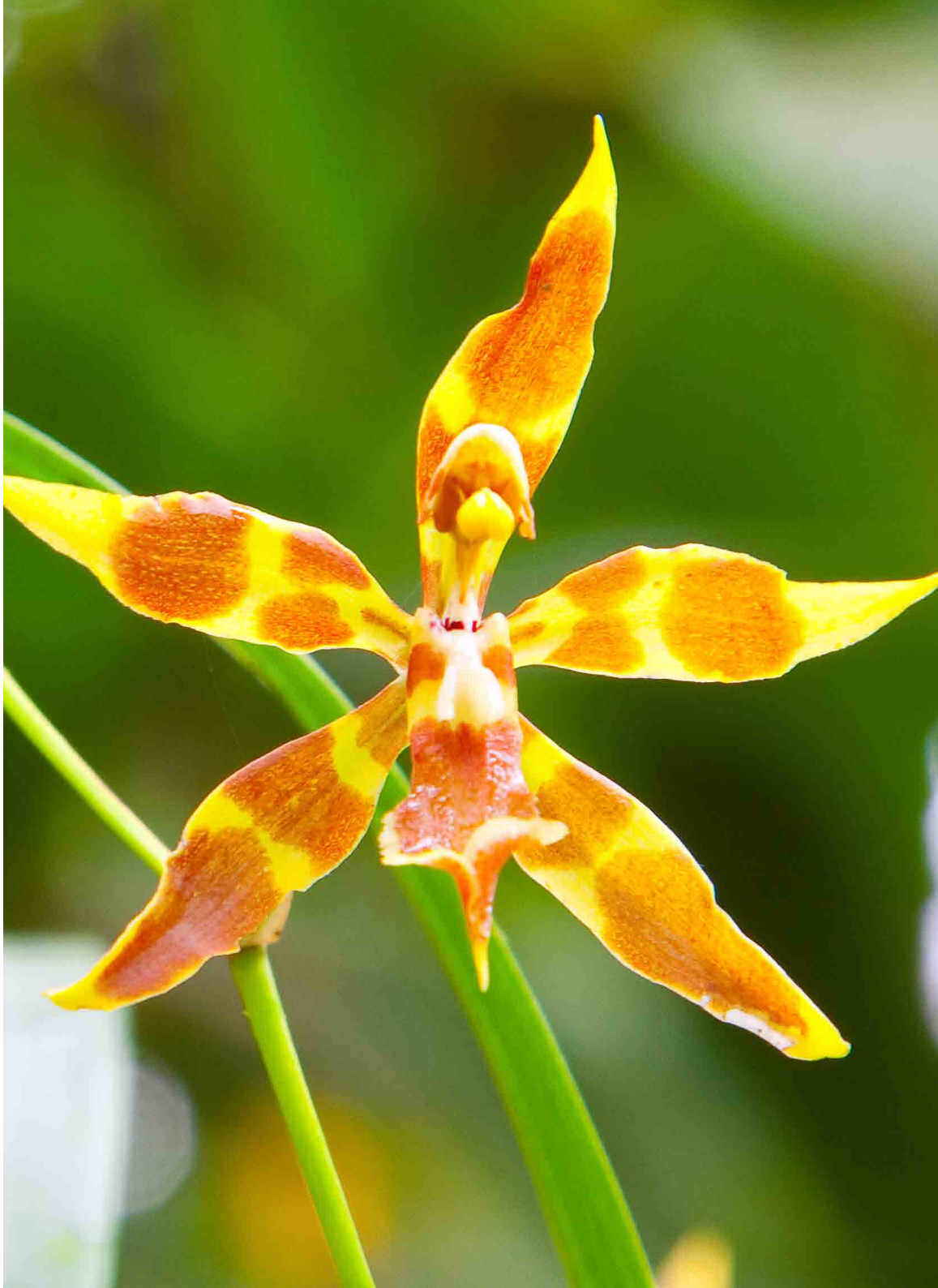
FORESTORATION INTERNATIONAL

Contents



In brief

Overview

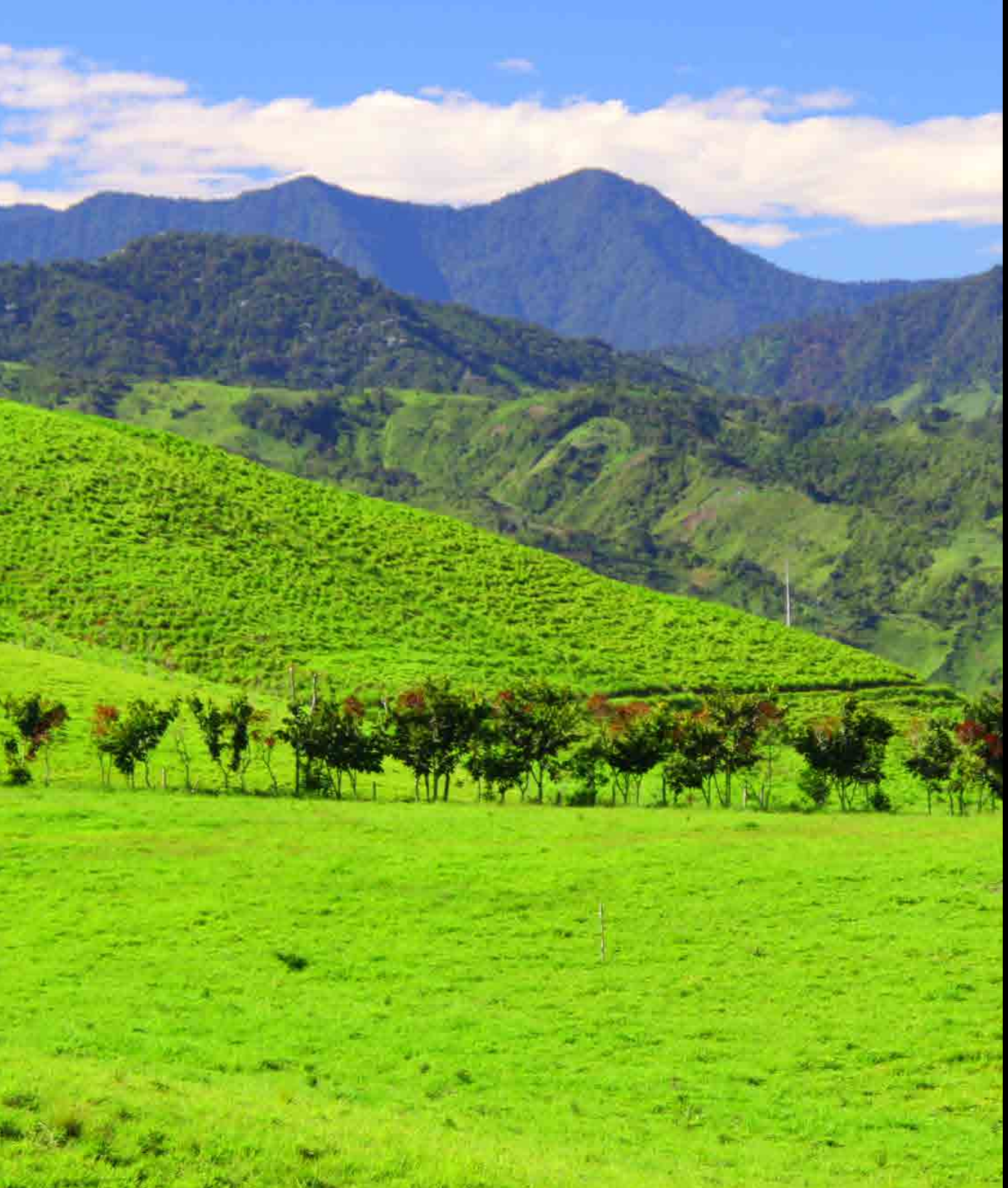
In one decade, farmers in the Intag Valley in Ecuador went from clearing to conserving and restoring forests. Intag's dense cloud forests were cleared rapidly in the 1970s and '80s for agriculture and ranching. Soon after, landholders experienced severe declines in water quality, seasonal droughts, and declining soil fertility. The future of farming was uncertain, and communities faced an environmental crisis. A local NGO, Defensa y Conservación Ecológica de Intag (DECOIN), helped people make the critical connection between healthy forests and clean, abundant water. Funded through international donations and partnerships with international NGOs, DECOIN sought to improve water resources and conserve forest biodiversity. They helped 38 communities establish small-scale watershed reserves, introducing communal land arrangements and the practice of forest restoration using native species. DECOIN's tree planting projects ignited a restoration movement. Most people participated in communal planting, and after seeing the benefits firsthand, even more began planting trees on private lands. Planting trees accelerated forest succession and increased biodiversity in degraded pasture. Linking trees with water and establishing communal land for reforestation gave farmers the technical and cultural conditions to switch from degrading to restoring forests.

Exemplary practices

DECOIN created communal lands, signing the reserve land title over to communities for conservation and restoration with use restrictions (e.g., no burning, cattle, mining, or harvesting for sale). DECOIN held high-impact local environmental awareness campaigns, including working with schools. They experimented with a variety of native trees and then trained local community members to collect, cultivate, and plant them. They also engaged trusted local leaders to implement projects, worked with communities most in need, and provided flexibility to accommodate community needs and preferences.

Key lessons learned

- *Environmental crises can motivate people to restore.*
- *Reframing restoration as solution to tangible environmental problems can make projects relevant to local communities*
- *Work with communities and people who stand to benefit most from restoration.*
- *Restoring communal lands can encourage more inclusive participation and facilitate knowledge sharing.*
- *Communal restoration on shared land can inspire and facilitate planting on private land.*
- *Restoration on communal land can achieve goals that may be out of reach to individuals but possible when people work collectively.*
- *Restoring forests can encourage people to conserve them.*



Restoraton narrative

Local farmer clearing grass around planted trees.
Photo credit: Jake Brennan

Visit restor.eco

Intag Valley, Ecuador

DECOIN's watershed restoration

Visit and learn more about the project's ecological analytics *here*

RESTOR

Background and context

The Intag Valley (Imbabura, Ecuador) is a farming region in the Andes (Figure 1). Mountainous, steep, and remote, it spans 650–4900 masl and receives up to 5,000 mm of precipitation per year (average 2,500 mm). Intag is in the center of the Tropical Andes biodiversity hotspot, and its cloud forests (premontane to upper montane) are exceptionally diverse, home to the endangered Spectacled bear, hundreds of endemic orchid species and other plants, and housing >120 tree species in 0.1 ha (Gentry, 1992; Kocian et al., 2011; Wilson and Rhemtulla, 2018). Cloud forests also play a key role in the hydrological cycle, capturing moisture from passing clouds which sometimes contributes half of total precipitation reaching the ground (Bruijnzeel and Proctor, 1995; Bruijnzeel, 2004). Deforestation patterns here are typical of many places in the Andes. Intag was once densely forested, but as people settled under the Ecuadorian land reform laws in the 1960s and 1970s, deforestation rates increased and remained high through the 1990s. A typical land-use sequence was to clear and burn forest (sometimes extracting timber first), plant crops for 2–4 years (rotating corn and beans), and then allow land to fallow or, more commonly, convert land to pasture (Wilson, 2015). Today, cloud forests in this valley have been extensively cleared (upwards of 60%), mainly for cattle ranching and small-scale farming (Mulligan, 2010; Wilson et al., 2019).

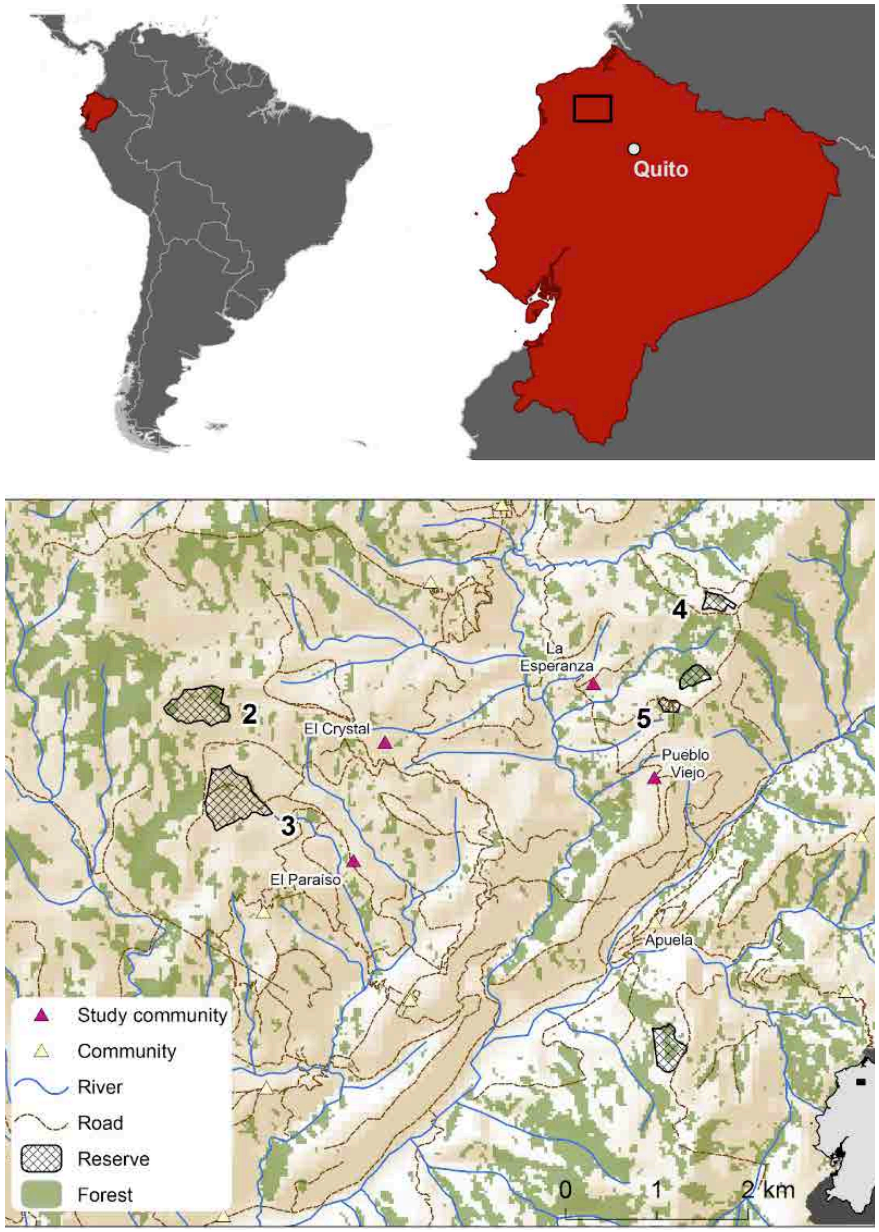


Figure 1: Map of the Intag valley watershed reserves with restoration projects. Source: Wilson and Coomes, 2019

Intag's population (1600 people across 70+ communities) is primarily rural. Most families are mestizo with minority populations of Otavaleños (indigenous people from the Central Valley) and Afro-Ecuadorians. Most of Intag's residents farm using hand tools, often on 10–35° slopes (Wilson et al., 2019), and about 90% own land (Kocian et al., 2011). Communities grow a large range of crops for both sale and subsistence, from bananas, coffee, and cocoa to staple crops beans, potatoes, and corn. Many households also raise chickens and pigs for consumption and cattle for beef or milk (Wilson and Coomes, 2019; Figure 2).

Figure 2. Intag farmhouse. Photo credit: Jake Brennan

This case is based on work with residents in four small communities in northeast Intag (23–45 households, average farm size 8 ha) that participated in forest restoration projects supported by the local NGO Defensa y Conservación Ecológica de Intag (DECOIN) starting in 2003 (Wilson and Coomes, 2019) (Figure 1). Restoration efforts were focused on elevations from 1700 to 2300 masl (Figure 1). Households in these communities tended to have diverse livelihood strategies but with an emphasis on one or two main activities: subsistence farming, market-oriented farming, cattle ranching, off-farm skilled work, or day labor. Most people worked primarily as farmers, producing subsistence and some cash crops, and nearly half also raised cattle for beef production. Over a third earned income through wage labor or skilled, off-farm work (Wilson and Coomes, 2019). Many people moved to the region from the lowlands in the past 30 years, and most did not have a culture of forest use except for some timber extraction. During restoration, both men and women tended and planted trees, but mostly male household heads participated (Wilson, 2015).

The turning point

Immediately prior to engaging with DECOIN to conserve and restore forests, communities faced declining environmental conditions. Cloud forests are essential for regulating stream flow and water supply. After they were cleared from watersheds, communities in Intag reported increasing droughts and erratic water supply during the dry season in the late 1990s and early 2000s (Wilson, 2015). One resident recalled that in his youth 40 years ago: *"Antes en el monte, cuando se pasaba por las quebradillas había bastante agua, en cambio ahora … las quebradillas que había dentro del monte se secan en los veranos* (In the past, in the [cloud] forest we would encounter streams with plenty of water. … now the streams that used to run through the forest dry out in the summer)." Summer drought conditions were so severe that people wondered if they would be able to continue farming. These conditions were compounded by declining soil fertility and the underperformance of 'green revolution' farming technologies like chemical fertilizers, which tended to run off steep slopes and contributed to declining water quality. Without a reliable water source, communities in this region faced an environmental crisis (Wilson and Coomes, 2019).

DECOIN responded directly to these needs by making the link between forests and water. They helped 38 communities establish small-scale, community-based reserves to conserve forests and biodiversity by linking forest conservation to essential services in communities. Goals were to improve the quality and reliability of water resources in communities and restore and conserve forest biodiversity. They also served to provide local sovereignty over land development in strategic locations as part of an attempt to stop illegal gold mining and resource exploitation. Using funds from international donors aimed at conserving the region's biodiversity, DECOIN purchased land in watersheds from local farmers and signed the title over to communities for conservation and restoration with use restrictions (no burning, managing cattle, cultivating crops, or harvesting for sale). Where forests were still present, DECOIN emphasized forest conservation as the primary way to achieve their goals—it is much more effective to conserve cloud forest than to restore it for both biodiversity and water outcomes. Thirty-six reserves relied only on conserving forests and allowing forests to regenerate naturally. In six communities where forests had been extensively cleared and conditions were not amenable to natural regeneration because of invasive pasture grass, DECOIN also engaged local communities to plant native trees.

Restoration baseline conditions

No ecological or socioeconomic baseline studies were conducted prior to restoration. But several other methods were used to understand and document the social and ecological restoration outcomes.

1. Landsat imagery from 1991–2001 and 2001–2010 was used to examine forest clearing rates. In the decade prior to restoration, forest clearing rates were high, especially in and around remnant primary forests (Wilson et al., 2019).

2. Household surveys and oral histories were used to understand changes in forest use, tree planting, and land use generally (Wilson and Coomes, 2019; Wilson et al., 2019). Prior to DECOIN's intervention, many households cleared land for agriculture, and almost no households planted trees (Wilson and Coomes, 2019). Forests were generally not considered important for agriculture.

3. Reference sites and naturally regenerating control sites were compared to areas planted with native trees to understand the impacts of restoration using planted native trees on forest recovery. Control treatments were in areas with similar conditions to restored areas and under protection for the same period (Wilson and Rhemtulla, 2016).

Actors and arrangements

Restoration work in community reserves was implemented by DECOIN with support from international private donors (United States) and Rainforest Concern, Ecuador (International NGO with national chapter). Whereas existing farmers organizations focused interventions on private farms, DECOIN focused exclusively on creating and managing communal reserves. After planting native trees in communal reserves, many landholders adopted tree planting on private land, installing agroforestry systems, planting trees around fields, streams and roads, and allowing forests to regenerate naturally (Wilson, 2016). Support for on-farm tree planting came from a local coffee cooperative (AACRI) and the local agrarian association. Landholders also often planted trees without external assistance, sometimes with support from others in the community (e.g., seed and sapling sharing, knowledge exchange).

In Intag "communities" are self-defined administrative units, with a leader/mayor nominated by its residents. Land in the reserves was signed over to these administrative units to manage collectively, including enforcing use rules (Wilson, 2016). However, the groups managing and performing restoration work in reserves were defined to best suit the dynamics and structure of each community, rather than having a standard user group configuration. Sometimes community presidents led the restoration work. In other cases, individual households were engaged to lead the work. Restoration work was done by households that used water from the restoration catchments. In the initial communities, people were not paid for their work and participation was considered a communal duty. In subsequent communities, people were paid a daily wage. Interestingly, participation rates were higher in unpaid communities than in paid ones, indicating that where the motivation to restore is strong, limited funds might be better spent on materials and non-wage benefits (Wilson, 2016; Wilson and Coomes, 2019).

Several other local organizations formed to provide livelihood alternatives to mining and to help communities self-organize and mobilize (Bebbington et al., 2008; Kocian et al., 2011). In 1998 DECOIN initiated a shade-grown sustainable coffee co-op which now operates independently, the Association of Intag River Small Coffee Growers (AACRI). AACRI provided farmers a market for high-quality coffee produced in agroforestry systems and required that landholders use native trees and also maintain home gardens for subsistence. AACRI now exports high quality coffee as far as North America and Europe, benefitting over 100 families. DECOIN also developed a women's handicraft production group and assisted with marketing and sales (UNDP, 2019). Other organizations include a farmers' association which supports agroforests and green fertilizers on farms, a shade grown coffee coop, and an ecotourism group.

Planning and engagement

DECOIN's approach to engaging residents relied on helping people understand the connection between healthy forests and clean water and working with people who were trusted and known in communities. DECOIN used several strategies to achieve this. Initially, DECOIN worked through local schools to increase environmental awareness about the value of forests and promote forest stewardship. Some schools were given native trees to plant, and one housed a small nursery. Students learned about trees and the environment in their lessons which sometimes included reading and discussing "The Lorax."

Throughout the Intag Valley, DECOIN worked to raise awareness about why and how to conserve Intag's forests and biodiversity. For several years running they held an annual Water and Biodiversity Assembly where hundreds of people attended and which included talks and workshops by experts on various themes (Figure 3). Activities included writing and painting contests in local elementary schools; workshops; and creating and distributing posters, videos, brochures, and books on topics including: bird conservation, forest fire prevention, correct land use, Intag's forests and wildlife, watershed, biodiversity conservation, river conservation and restoration, and the impacts of mining (Figure 3) (UNDP, 2019). Materials also highlighted problems with some environmental practices including burning and clearing forests, and alternative practices.

DECOIN worked with local farmers who were well respected in each community. The general manager for restoration was also a local farmer who was widely known and respected. DECOIN worked with communities in a range of locations in Intag, but projects with a restoration focus were undertaken in areas with a longer history of forest clearing and land degradation and also with communities experiencing more acute water shortages. In other areas, DECOIN focused on creating conservation areas for existing forests—a much more effective strategy for water and biodiversity conservation (Wilson and Rhemtulla, 2016). When it comes to cloud forests, as Carlos Zorilla of DECOIN put it, "an ounce of conservation is worth a pound of restoration."

The first step in the planning process was to present the project to the selected community, and work to bring residents on board. Communities generally responded with an enthusiastic “yes.” DECOIN then identified and purchased land from landholders in watershed regions and engaged communities to help plan tree planting efforts. Local people were involved in selecting and cultivating tree species in the communal reserves. DECOIN encouraged the use of native species, but as no information was available on many of the native species, DECOIN’s founder and director Carlos Zorrilla collected seeds and experimented with growing them, planting them, and learning where they grew best for restoration. He then wrote a manual for information on each of the 37 species used in reforestation. Some communities had a preference for fast-growing exotic species (especially *Alnus nepalensis*, an exotic, fast-growing alder). DECOIN allowed a certain percentage of exotic trees, but they required that people cultivate and plant a large proportion of native species. As people learned more about native species this preference changed. Prior to restoration researchers or outside specialists were not directly consulted.

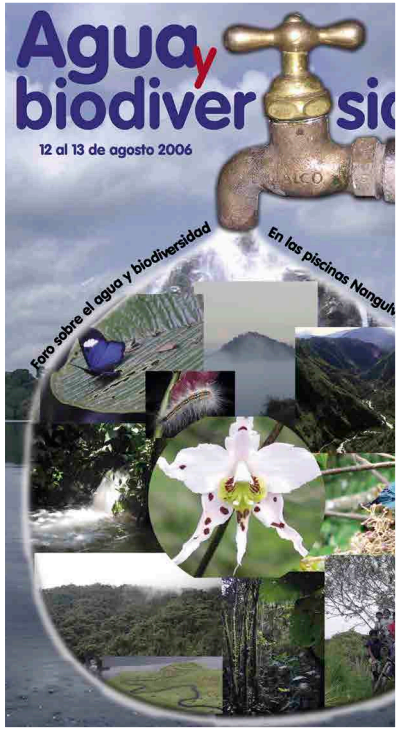


Figure 3 . A poster for the Forum on Water and Biodiversity (right). The Forum being held in Pucará (top left) and Apuele (middle left). An information poster on the Intag Hydrological Reserves (bottom left); it reads “healthy forests, pure water. This is how the water is protected in Intag.”

Box 1: Timeline of events and activities

1995 DECOIN formed

1998 AACRI formed and DECOIN's engagement with communities through schools

1999 Land purchased for restoration

2000 Municipal Ecological Ordinance, an initiative originally led by DECOIN, takes effect in Cotacachi, making it the first Ecological County in Latin America

2002 Lodge for community ecological tourism site in Intag is finished

2003 Planting in communal reserves

2004 *La Case de Intag* (formerly the Toisan Solidarity Store) opens as a place for groups to sell sustainable products

2008 DECOIN helps local residents present a lawsuit against Copper Mesa Mining Corporation and the Toronto Stock Exchange

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2016 DECOIN funds investigation in a mining concession that rediscovers the Longnose harlequin frog, assumed to be extinct. Three years later another thought-to-be extinct frog, the Confusing Rocket Frog is also rediscovered in the same general area

2018 The Municipality approves the Conservation and Sustainable Land Use ordinance, which applies to all of Intag and states that forests should be managed sustainably or are for strict conservation purposes. The community reserves made it easier for this to be approved, given that there was already a strong conservation awareness

2019 DECOIN works with lawyers to present legal actions based on the violation of the Constitutional Rights of Nature, based on the threat of extinction of the two endemic frogs due to mining activities. In September of 2020, they win at the lower court. The appeal is pending (May 2, 2021)

2020 DECOIN proposes declaring the whole Intag area a Life Sanctuary, in an effort to draw attention to the area's unique biodiversity, rich water resources, and the threats these face. The Municipality of Cotacachi is currently working to create a local ordinance to make the declaration official. If approved, it will be the first in the nation

2021 The Municipality of Cotacachi seeks to expand the Unesco Andean Choco Biosphere Reserve to include all of the Intag area

Funds were not available for systematic monitoring and data collection, but some funds were available for maintenance, which included replacing and planting additional trees. DECOIN developed participatory management plans with communities. Monitoring to determine maintenance needs was performed through regular site visits by local implementers. Funds for maintenance were extremely limited and difficult to obtain—donors tended to fund tree planting, but not tree care. However, independent researchers and volunteers provided *ad hoc* monitoring at different times (including extensive research on social and ecological outcomes for a PhD thesis).

As part of their environmental education program with schools, DECOIN developed participatory monitoring of water and biological diversity with water testing equipment distributed to participating communities. They also provided training to collect, analyze, and interpret water samples.

Costs, funding and other support

Direct restoration costs included land purchase, fencing, paid labor in two communities, nursery materials, and staff time for DECOIN's employees. Restoration work was financed mainly through individual donations from the United States and elsewhere. As of writing, DECOIN receives requests for additional restoration that they cannot fill due to limited funds.

Implementation

Starting in 1998, DECOIN helped 38 communities and local governments throughout the Intag Valley create small watershed reserves (many 7–150 ha each, with some now over 4,000 ha such as the Cuellaje watershed and forest reserve) (Figure 4). DECOIN helped six of these communities plant trees in watershed reserves (7–42 ha) between 2001 and 2007 (Box 1). The first and often most challenging step was purchasing land in the watersheds from landholders, which sometimes involved five or more separate negotiations for each reserve. Although DECOIN paid a fair market price for land, peer pressure and the sense that this was "good for the community as a whole" were important components of securing land sales. Commercial and agricultural land uses were prohibited on communal land, but DECOIN encouraged people to harvest wood, plants or fruit from the reserve for personal use, and to use the reserves for ecotourism. This tenure arrangement in which titles were held by the community was new to the region and an important component of the success of the restoration. However, it did not require policy change as it was classified as a type of private land held by multiple households.

In each community, DECOIN provided materials and technical expertise to build tree nurseries (Box 2). They also helped them apply to the municipal government for other supplies, including fencing. Each community had a locally designated coordinator/leader who was respected in the community. In some cases, individuals or groups were contracted to grow and plant a specified number of trees, and in others the whole community was expected to participate. Most work was completed in 'mingas' (communal work days).

Planting involved using commercial seed for a quick growing, nitrogen-fixing exotic (*Alnus nepalensis*) which local people favored, and training residents to collect and propagate seeds from native trees in nearby forests. Seedlings were planted 2.5 m apart, and people planted a total of 50 species with between 12–26 species in each reserve. After planting, community members cleared pasture grass using machetes around seedlings by hand every 3–4 months, with additional plantings to replace dead trees as needed (Figure 5).

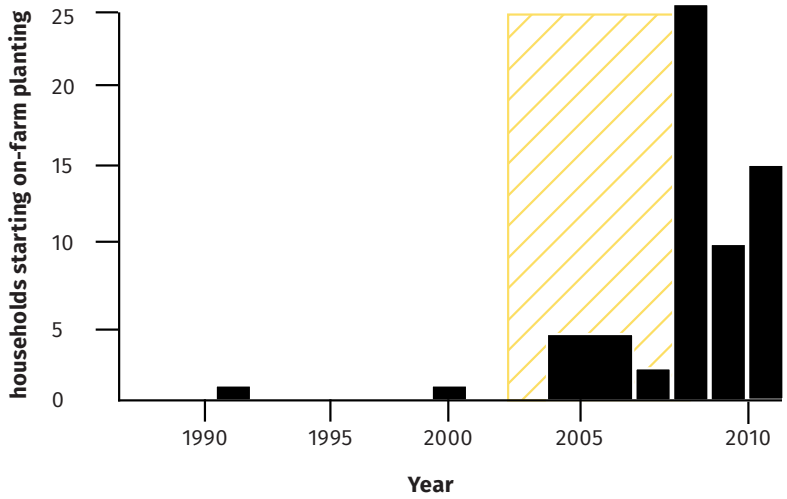

Figure 4. The number of households starting on-farm planting from 1990-2010. Trees were planted in 5 community reserves. The blue box shows the period during which restoration via tree planting in communal reserves was implemented. The grey bars show the number of households who started planting trees on their land during the same time (Wilson and Coomes, 2019).

Photo credit: Jake Brennan

DECOIN is still present in the region but developed a solid 'exit strategy' by turning control of the communal land over to communities; building community capacity to grow, plant, and maintain trees; and providing a solid motivation to restore and conserve forests. These key components helped develop the autonomy of communities and create a sense of responsibility for maintaining and conserving the restored areas.

Box 2 - Key elements of DECOIN's implementation strategy (adapted from ITTO, 2020):

- Worked at the communal level to purchase land and create community watershed reserves
- Sought international funds for projects (for biodiversity conservation)
- Worked through elementary schools to provide environmental education
- Provided regional outreach/education on unsustainable land use practices (i.e., burning, cattle on marginal lands, etc.)
- Trained local people to collect seeds and seedlings from native forests, grow them, and plant and maintain them
- Engaged trusted local leaders/managers in each community
- Ensured that resources for maintenance were in place 3-4 years after planting

Field level practices included:

- Provided training and materials for establishing tree nurseries (Figure 6)
- Creating restoration associations/cooperatives within communities
- Provided training for collecting and propagating native species, training to plant trees and maintain restored areas

Outcomes & Impacts

The restoration projects in Intag led to an overall increase in forest cover in the region (Wilson et al., 2019). Remote sensing analysis of LANDSAT imagery (from 1991, 2001, and 2010), household surveys, and oral histories showed that before people started planting trees in watersheds, deforestation rates were high (> 3%/year) (Wilson et al., 2019). But during the period of tree planting, from 2001 to 2010, deforestation slowed, and forest recovery increased. The result was a net increase (+3%) in forest cover—a transition from forest decline to recovery (Box 3).

Prior to restoration, forests were cleared in more populated areas and regenerated far from towns. But from 2001 to 2010, forests recovered in communal reserves and also on peoples' private farms especially near streams, farms and roadways. Deforestation rates in existing forests also dropped precipitously. Returning forests included naturally regenerating areas, agroforestry, and silvopastoral systems (Wilson and Coomes, 2019). This change in clearing rates and spatial redistribution of forest cover reflects people's reasons for planting trees—to restore water and other key

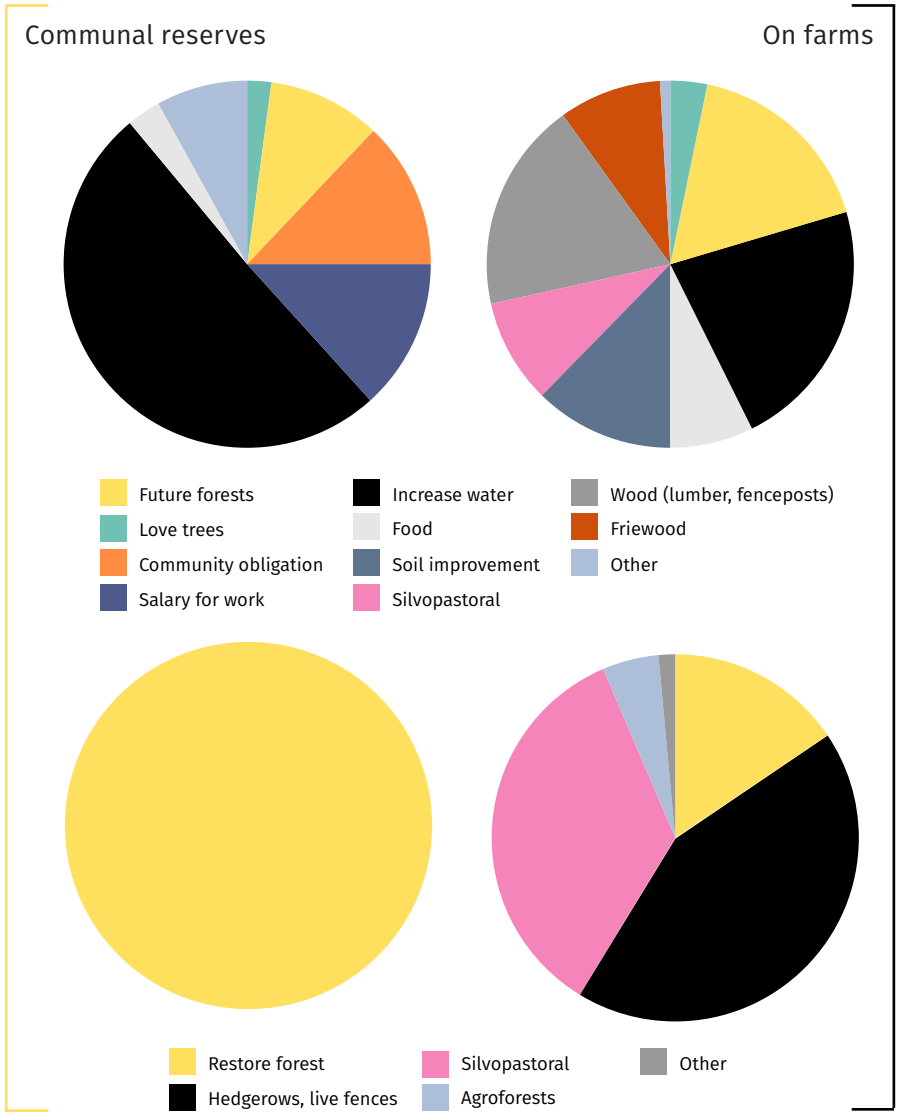

Figure 7. Tree planting goals and practices on communal and private land. a) Household reasons and production goals for planting trees in communal watershed reserves and on farms, and b) the percentage of trees planted in different systems in communal watershed reserves and on farms (Wilson and Coomes, 2019).

ecosystem services perceived to be “scarce.”

Returning forests reflect a change in the way trees are used by farmers. Before, people had relied on either traditional slash and burn or chemical inputs. But while restoring forests in reserves, people began to turn to trees and forests to deliver many of these services (Wilson and Coomes, 2019). Knowledge about and support for agroforestry and forests was adopted by many farmers over a period of 3–5 years, who learned about it through local agricultural associations and word of mouth. Restoration also promoted conservation by showing people the value of forests—people learned how challenging it is to regrow a forest and talked about discovering the value of native and old forests through working to restore new ones (Wilson, 2015).

The ‘ecosystem service scarcity’ path to reforestation was driven by local demand for forest ecosystem services. This transition occurred at a time when the region as a whole was still losing forest cover (Wilson et al., 2019). In communal reserves, people planted mainly to restore water; whereas on farms, people planted for a range of services including soils, water, direct livelihood benefits, and for the good of the community (Figure 6). Today, restoration projects are widely accepted by community members, and DECOIN now receives more requests from

Figure 6. Seedlings prepped for planting.
Photo credit: Sarah Wilson

additional communities wishing to establish watershed reserves than they can fill. Pastures planted with native tree species had higher tree diversity than naturally regenerating pastures, although both were less diverse than primary forests (Wilson and Rhemtulla, 2016). The combinations of trees in each were notably different, with planted forests sharing more species with primary forests than unplanted forests. Planted forests also contained more animal-dispersed species than unplanted forests, and the highest proportion of species with use value for local people. Planting trees in degraded pasture thus increased biodiversity and accelerated forest recovery, but in the short term represent novel ecosystems that are distinct from the region's previous ecosystems. The diversity of agroforestry systems and natural regeneration along streams has not been studied, but both contributed significantly to increasing forest cover.

Baseline data was not taken on water quality prior to reforestation. However, many community members talked about a decrease in gastrointestinal disease (especially in children) following reforestation. Implementer Carlos Zorrilla also notes that: "Most populated centers (including Apuela, where I lived, García Moreno, and Peñaerrera especially) used to get their water from farmland and cattle pastures; it is logical that reforestation would improve water. The same for many communities since the sources of water were privately owned and farmed, some using toxic agrochemicals, or letting cattle run around ..." The project also had the collateral effect of making it much cheaper for the municipality to install water systems to deliver safe water for communities since they didn't have to invest so much in water purification equipment and chemicals. In addition, the municipality required legal deeds proving communities owned the land before they would invest in water tanks, purifying equipment, and other infrastructure.

Interviews with households, oral histories, and focus groups showed that people who earn a living from the land—ranchers and farmers—were most likely to plant trees, regardless of their income or how big their farm was. After learning about the benefits of tree planting from working in communal reserves, farmers planted more trees, more kinds of trees,

"Porque plantamos árboles? Por que nos dan AGUA!"

"Why do we plant trees? Because they give us WATER!"

- Local Intag farmer speaking passionately about his community

and more native trees than households that earned a living from wages or salaries. The communal watershed reserves also provided a low-risk space for learning about both the benefits of and skills required to grow trees and forests (see innovations section below). After planting on communal land, many households applied what they had learned on their own farms. People planted on farms to increase or diversify production, whereas on reserves, planting was intended to restore diverse cloud forest and hydrological services. But both were practiced to restore ecosystem services essential to farming.

Driven by local ecosystem service scarcity, 'crisis restoration' was an integral part of a local movement to renew and sustain farming culture—people switched from clearing forests for agriculture to planting trees to sustain it (Wilson and Coomes, 2019). People commonly stated, "Somos unidos (We are united)" in their commitment to remain on the land. People stated that in the past they did not know trees were important for water but now plant trees to prevent soil erosion, increase rainfall, and retain soil moisture. One farmer described her experience 30 years ago: "*Todo el mundo fue trabajando en los montes. Cada propietario trabajó. Botaron los montes al suelo. Eso es lo que pasó*. (Everyone cleared [cloud] forests. Every landholder

worked. They cut forests clear to the ground. That's what happened)." A productive, well maintained farm was one cleared of forests and trees. But today many tree-planting residents self-define as "ecologistas"—stewards of the land (Buchanan, 2013).

Restoration was seen as a path to continue to earn a living from the land in the face of environmental degradation and outside environmental pressures (mining). The shade-grown coffee cooperative (ACCRI) provided both an incentive to reforest and a small supplemental source of income to some farmers. The cooperative also required that its coffee farmers produce food for subsistence on their farms, which helped farmers re-establish traditional 'huertos' or home gardens, which also contributed to many household's livelihood strategies. However, these changes generally supplemented rather than replaced the livelihood strategies of the residents of Intag, who still relied on income from either farming or wages outside the community for the majority of their livelihood needs (Wilson and Coomes, 2019).

Introducing communal land represented a new tenure system in Intag. Compared to private lands, restoring on land owned and governed by the community was a relatively low risk investment. Smallholders could restore forests without giving up farmland, making the opportunity costs of restoring on communal land lower than on private land, where restoration may compete with agricultural production. Restoring forests to watershed areas may not have been possible (or attractive) if the burden had been placed on the few households who owned land in watersheds (2–6 in each community) but were both attractive and accessible when the resources of the community (labor, knowledge, motivation) were pooled. This allowed a broader range of community members, from the land rich to the land poor or landless, to participate and benefit from restoration. Ultimately, community members were responsible for the upkeep and conservation of the communal lands. This likely relies on a shared sense of purpose (a commitment to community and the land) and the belief that forests support that goal. Seven years after the projects were initiated this commitment remained strong.

Restoration also established local expertise in reforestation, and in some cases, restoration leaders also acquired expertise in green fertilizers and agroforestry systems. Having local 'champions' for restoration was important for the success of these projects, and in turn, local leaders who had and developed this expertise often saw their

leadership reinforced. Restoring forests on communal land produced a number of social and environmental benefits and was widely considered a success, according to interviews with both landholders and local NGOs.
In 2000, DECOIN was directly responsible for, and led the formulation of, the Ecological Ordinance that made the municipal government of Cotacachi the first Ecological County in Latin America. The Municipal Ecological Ordinance, which was published in the Official Registry in 2000 and affects all 1,800 square kilometers of Cotacachi County, was aimed at reorienting development in the county by backing truly sustainable activities (organic farming; clean industries; ecological, rural, and community tourism; etc.) that benefit communities and the environment.

The Ordinance makes the conservation of native forests a priority and prohibits destructive activities, such as mining and industrial logging, while imposing strict environmental controls on the flower industry and the use of watersheds. It encourages a change in attitude towards the environment through social and economic incentives, and institutionalized recycling, among many other measures. One of the main objectives of the Ordinance is the creation of a sustainable development model for Latin America (UNDP, 2019, p. 11).

Photo credit: Jake Brennan

Major outcomes	Detailed description
High Participation	In total, ~ 60% of households (69 people) restored over 70 hectares of land in four micro-watersheds, planting over 75,000 trees. Most people reported planting trees to restore water resources, and four to seven years after the inception of the projects, more than half reported an increase in water quality, quantity, or both.
Landscape-level impacts	Strikingly, after inception even more households began planting on private land – an activity that was not directly supported by DECOIN but tended to arise organically when people saw the benefits of planting trees. They also started to allow natural regeneration around waterways, fences and roadways.
Jump-starting succession	Areas were restored with 'useful' species with which people were familiar. Although different in composition from primary forests in the region, these sites were recruiting native species at much faster rates (both in terms of species richness and numbers) than unrestored, abandoned pastures nearby.
Communal governance around shared benefits	Compared to private lands, restoring on land owned and governed by the community was a relatively low risk investment. Smallholders could restore forests without giving up farmland, making the opportunity costs of restoring on communal land lower than on private land, where restoration may compete with agricultural production. Restoring forests to watershed areas may not have been possible (or attractive) if the burden had been placed on the few households who owned land in watersheds (2–6 in each community) but were both attractive and accessible when the resources of the community (labor, knowledge, motivation) were pooled. This allowed a broader range of community members, from the land rich to the land poor or landless, to participate and benefit from restoration.

Table 1: Summary of major outcomes (adapted from ITTO, 2020)

Key challenges

DECOIN faced a number of challenges during planning and implementation; however, they were able to overcome them and ultimately achieve their stated project goals. Working with communities who believed in the restoration and wanted it was critical to overcoming these challenges. The strategy of first working with small communities facing the most severe water shortages was an important component of project success.

In some cases, land holders who were unwilling to sell or who were holding out for a higher price delayed implementation and presented a major challenge to the communal reforestation model. Ultimately, this challenge was reduced where: 1) landholders were sympathetic/ believed in/ stood to benefit from the restoration; 2) there were fewer landholders to purchase land from (each involved a significant transaction cost) and 3) community cohesion was such that other landholders could apply pressure to encourage the landholder to sell. Thus, working with communities who were very enthusiastic and serious about the restoration was critical. The impacts on the livelihoods of those who sold land was minimal, as many were absentee landholders, and those that were not were able to purchase land elsewhere. Land purchase elsewhere generally did not lead to deforestation on that land (Wilson, 2015).

Tree planting is generally easier to find funding for than maintenance and monitoring, aspects that are not as exciting or as high impact for donors. As a result, many of the planted trees in one reserve died in the first year and had to be replanted. In these environments, clearing exotic pasture grass is essential for tree survival in the first few years. In some instances, communities allowed some activities—such as allowing animals in reserves—especially if the families breaking the rules were either very poor or in a position of authority. However, because most of the community was on board with the restoration, these infractions tended to be minor, and the overall impact of reforestation was positive. In general, communal land rules were enforced by peer pressure from others in the community, and for the most part, this was effective.

A continual challenge in this region is the encroachment of mining interests that threaten to cause widespread deforestation around communities. DECOIN is continuously involved in the effort to prevent illegal mining exploration and to keep companies from exploiting the area. Promoting forest conservation and restoration and providing attractive and sustainable livelihood alternatives are important elements of their strategy, along with advocacy, legal action, and working with governments nationally and abroad.

Enabling factors and innovations

People chose to restore forests in Intag because they faced a dire situation: their future as farmers was uncertain in the face of environmental change. By framing forest restoration as a way to alleviate urgent environmental problems, the NGO DECOIN initiated restoration projects with exceptionally high participation rates. Households planted trees in communal reserves and on farms to obtain different ecosystem services, but the ultimate goal was the same—to restore and provide products and services to maintain and sustain farming, which was threatened by a perceived decline in environmental conditions. After clearing forests for decades, trees and forests were re-envisioned as a means to help farming. This model of restoration holds considerable potential to benefit rural farmers and restore biodiversity across the many heavily deforested regions of the Andes.

The success of Intag's restoration actions depended on a number of specific enabling conditions. First, the projects were implemented by a well-respected local NGO with in-depth knowledge of the communities. Second, communities were experiencing the effects of forest degradation—especially water shortages—and needed an answer to environmental problems. The NGO helped them make the link between a resource that they needed and forest restoration. This campaign was so successful that after the first few reserves were established and word got out, communities would often contact DECOIN to replicate the initiative in their communities. This desire of the communities made it much easier for the organization to implement the conservation measures.

Third, Intag has a strong farming, land-based culture. People identified as farmers, and many expressed a commitment to farming and to remain on the land. Planting trees became symbolic of this commitment, as well as a pragmatic solution to environmental problems.

Fourth, the community had a history of community cohesion and working together. Many residents had previously worked together to prevent illegal mining exploration in the years preceding the creation of the communal reserves. This history reinforced a shared sense of purpose and provided a foundation for communities to continue to work together.

Several innovative components contributed to success. Introducing communal land into an area where private land was the norm created a new, safe space for people to become familiar with, experiment with, and participate firsthand in restoration. These activities provided a creative way to engage many stakeholders at the local level—even those who did not have land. It also allowed landholders to collectively achieve benefits that would have been challenging for individual farmers restoring large tracts in strategic watershed regions.

Flexibility to local preferences by allowing local people to plant the species they wanted but within a given framework (i.e., allowing some exotics and a choice of natives) helped make the project locally relevant and accepted. Linking reforestation to local needs was also key, although providing environmental education on the importance of trees for water and farming was essential for bringing communities on board and encouraging a way of thinking as environmental stewards.

Having a long-term presence in the community was important for establishing trust and understanding both local needs and solutions. DECOIN's continued presence after implementation also allowed for troubleshooting and institutional learning. Hiring local leaders as implementers was key for engaging communities in a meaningful way. DECOIN's Carlos Zorrilla had lived and worked in the region for decades, and DECOIN employed other trusted leaders in the communities.

"No boten el monte. Dejen para que haga sombra, no se acabe el agua

Do not clear forest. Leave it to provide shade so that the water won't run out"

- Local farmer in Intag.

Figure 8. The Intag Valley. Photo credit: Jake Brennan

Key lessons learned

In Intag, DECOIN guided communities on a path from 'forests vs. farming' to 'forests for farming'. Prior to tree planting most landholders saw forests as an exploitable resource without benefits to farming. Training and working to plant trees generated a new appreciation for forests in general, and allowing trees on farms went from being a symbol of "bad/negligent farming" to one of commitment to the land and community. Key to this was the success of the tree planting projects—they spoke to real needs of the communities and were implemented in a way that jump started natural succession processes. This case suggests a number of key lessons that apply in contexts where communities are experiencing the effects of deforestation/degradation.

- People and communities may be more interested in restoration if they are experiencing an environmental crisis. In Intag, people experienced land degradation that threatened their ability to farm and came to see forests and tree planting as an integral part of creating viable farming systems in these new conditions. Reframing restoration as a forward-looking solution to tangible environmental problems can make projects relevant and useful to local communities. NGOs can play a powerful role to make this link.

- Focusing tree planting efforts on those who stand to benefit most is a good starting point for restoration. In Intag, this was demonstrated by high participation rates and high levels of community and on-farm engagement with the projects. Farmers in particular were the most active participants, and many began using trees in new and innovative ways in rural farming systems. These communities then served as examples to increase interest and demand for restoration in the region.

- Restoring communal lands can encourage more inclusive participation and facilitate knowledge sharing. Restoring land owned and governed by the community was a relatively low risk investment. This low-risk investment allowed a broader range of community members, from the land rich to the land poor or landless, to participate and learn about the benefits of restoration to farming. Communal land allowed people the space and flexibility to learn from each other, share knowledge, and experiment with different species.

- Communal restoration can provoke planting on private land. After restoring forests on communal land, nearly 80% of the participants planted trees on private farms, and an additional number of households that had not participated in the projects also began planting on-farm trees. Secondary forest cover generally increased as people intentionally allowed forests to regenerate naturally on private land along roads and waterways.

- Restoration on communal land can achieve goals that may be out of reach to individuals but possible as a group. Restored areas—like other traditional common areas such as pastures and wild woodlands—lend themselves well to communal management and shared access even in places where agricultural plots are managed privately. Communal restoration should focus restoration around shared, communal services or goods with widespread appeal in the community.

- Restoring forests can encourage people to also conserve them. In Intag, people learned about the value of forests through restoration—both how important forests are for farming, and also how difficult it can be to bring a forest back once they are gone.

Learn more

Further information and resources

DECOIN's website: https://www.decoin.org/
UNDP Equator Initiative Case Studies. DECOIN, Ecuador: https://www.equatorinitiative.org/wp-content/uploads/2019/12/DECOIN-Ecuador-1.pdf
Earth Economics. An Ecological Study of Ecuador's Intag Region: http://internationalpresentationassociation.org/wp-content/uploads/2010/09/Final-Intag-Report_lo_res.pdf
Community-based Sustainable Development in Intag: https://youtu.be/sAz4-7hA3SE

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