Financial Analysis of a Reforestation and Payment for Environmental Services Project in Piura, Peru

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Introduction

In high altitude areas of the Andean region known as *paramo* and *puna* there are many small farms and communal areas in which the soils and slopes are not suited for agriculture, and where agricultural activities could result in negative environmental and social impacts (or externalities) that outweigh the potential income from farming. This creates opportunities for society to use payments to farmers to stimulate changes in agricultural and/or land-use management practices that enhance or protect environmental services, such as replanting and protecting streamside areas to keep water sources clean or replacing areas previously used for agriculture with tree plantations to stabilize soils (Quintero 2006). This type of payments program, known as payments for environmental services (PES), often generates income for payments by selling carbon credits related to the avoidance of carbon dioxide emissions (e.g., by using higher efficiency stoves or alternative power) and/or the sequestration of carbon dioxide (e.g., through the planting of trees in afforestation or reforestation efforts).

Peru recently passed a law and approved regulations for compensation mechanisms for ecosystem services, which provide a legal framework for current and future initiatives based on this type of scheme. There are few documented cases of PES initiatives related to the sale of carbon credits in the country, where the main actors are small producers and proposals focus on a landscape and/or territorial scale. Therefore, it is important to identify problems to avoid as well as benefits that can make these types of initiatives more attractive to upstream farmers, as well as generate information that can be used to inform future adjustments to the recently approved policy instruments.

Here we present the results of a financial analysis performed with the Green Value tool of an initiative selling carbon credits associated with reforestation activities in the mountains of Piura: the Reforestation in the Sierras of Piura project.

Reforestation in the Sierras of Piura Project

The project is implemented in the Region of Piura, in northwest Peru, and includes families who practice subsistence agriculture in a community with 10 hamlets at 3,000 meters above sea level, and families that produce coffee in an area at 1,000 to 1,200 meters above sea level (Figure 1). The project aims to establish plantations of different tree species in degraded areas in the higher elevations to help lower poverty levels among the peasant families and contribute to the conservation of water sources and streams, as well as to promote agroecological practices for coffee production in the lower elevations to help facilitate adaptation to climate change. The cultivation of coffee is a very important income source in the lower, flatter parts of the region. Climate change has already brought a marked increase in precipitation, and landslides are a serious concern.

Figure 1. Map of the study area (adapted from Google maps).

The project is implemented by the agrarian cooperative NORANDINO and the non-governmental organization PROGRESO. NORANDINO was created in 1995 and brings together more than 90 cooperatives with around 6,600 members, mainly small landowners of the sierra and coast, although some cooperatives are also in the Amazon. PROGRESO was created by NORANDINO to provide resource management and technical assistance to its grassroots organizations, as well as to pursue sources of project financing.

The project began in 2010 with a 30-year time horizon. It consists of the installation and monitoring of plantations of commercial exotic species (mainly *Pinus patula* and *Pinus radiata*) and non-commercial native species (including alders and queñua) with peasant families in suitable areas at the headwaters of the local rivers. The original purpose of the project was to establish new areas of plantation (lots) in degraded areas annually in two phases: first, an area of 213 ha between 2010 and 2015, and then an area of 500 ha between 2016 and 2020, for a total of 713 ha. Funding for the project was expected to come from the sale of certified carbon credits to European companies that buy coffee from NORANDINO members, and the volume of carbon credits was calculated based on the amount of carbon to be sequestered in the

plantations over the life of the project. These funds were expected to pay for communal labor costs, planting materials, and project management costs. Then, during the last 5 years of the project, the pine plantations would be harvested and the value of the wood would be delivered to the communities that established the plantations. Other expected benefits to communities included access to fuelwood and edible mushrooms that grown in the plantations, and services such as the regulation and conservation of water resources.

There have been changes to the project, however, as is often the case. Up to 2017, the project planted 261 ha of plantations in different hamlets: 203 ha of pine and 58 ha with native species (Figure 2). While the establishment of plantations continued and the project achieved certification for the carbon credits, the volume of carbon credits sold and consequently the income generated was less than expected. This resulted in financing difficulties and a reliance on donations to cover costs. For this reason, the project does not foresee establishing additional plantations, but will continue monitoring the established plantations and will maintain the certification. The project still plans to oversee the harvest of the pine plantations between 2034 and 2039 (years 25-30 of the project).

Figure 2. Community participants in the project (Source: Progreso)

The certification system for the project's carbon credits is the Gold Standard, and certification has helped the project sell these credits at very good prices, between US$ 12-15 per ton. The project is in the process of obtaining an additional type of certification based on a new Fair Trade Carbon Pilot standard, which it hopes will open new global markets.

This case study was conducted jointly with the PROGRESO technical team and includes information available to date from the organization and other relevant references. The study analyzes the project over its 30-year horizon, at the end of which all of the timber in the pine plantations should have been sold.

Methodology

The Green Value tool

The Green Value tool offers a simplified six-step method for monitoring and analyzing costs and revenues for small forestry and agricultural initiatives (Figure 3). It consists of a User's Guide and a series of pre-formatted worksheets (in a spreadsheet software) used to record and analyze data. Each worksheet corresponds to one of six steps. A summary sheet (Step 5) presents all costs and revenue in a single worksheet and provides the results for various indicators, such as cost per activity, cost per input type, total cost, cost per unit sold, net income (profit), and rate of return. The idea is that producers and their partners can monitor and analyze costs and revenues throughout the year, use annual results to make management decisions, and see how the results change over the next few years. Green Value materials are publicly available on the website www.green-value.org.

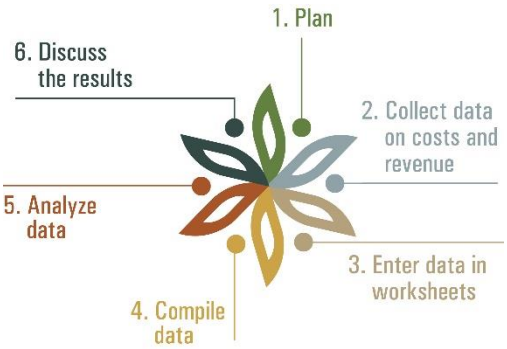

Figure 3. Green Value's six steps.

The case study

The case study analyzes the costs and income of pine and native species plantations carried out by a NORANDINO member community in the Sierras of Piura. The information for the case has been provided by PROGRESO. The information was processed and analyzed by an Earth Innovation Institute external consultant (Alvaro Cabrera).

The questions to be answered revolve around:

- How much did the sale of carbon credits contribute to covering the costs of the plantations?
- Is the project financially viable in the short or long terms?
- What can the project do to increase its viability?
- How much can the project generate in terms of income for communities?

Two scenarios were analyzed. In scenario 1, cost and revenue data recorded by PROGRESO for the first eight years of the project (2010 to 2017) were analyzed. For scenario 2, the costs and revenues for the full life of the project (30 years) were considered, allowing the plantations established between 2010 and 2017 to complete a wood production cycle of 23 to 26 years. For both scenarios, total cost and total income for each year were used to calculate the net present value of the project.

For most of the years between 2010 and 2017, the annual activities were: (1) production of seedlings; (2) planting of seedlings (i.e., plantation establishment); and (3) monitoring of activities, including the identification of new areas for plantations. In addition, from 2010 to 2014 the project also made efforts to prepare for and receive certification. In 2016, seedling production and planting were not carried out. From the 7th (2016) and 8th (2017) year, the project planned to carry out silvicultural activities in the plantations (pruning and thinning), which would generate opportunities for work and income from the sale of harvested wood. However, the details about these activities were not verified, therefore they were not included in this study's estimates of costs or income.

For scenario 2, the costs and revenues for the years 2010-2017 are the same as for scenario 1. For the years 2018-2034, the only projected activity will be monitoring of the plantations by the PROGRESO project coordinator. In the years 2035-2038, the activities will include monitoring the plantations and the harvest of some plantation lots, including measuring the volume of harvested wood. In the year 2039, the only activity will be overseeing the harvest of the last area of plantation. The traditional way to sell timber from plantations in Piura is to sell the standing trees. In this case the intermediary assumes all the responsibility for harvesting the trees and, therefore, pays a relatively low price for the wood. Costs for the years 2018-2039 were estimated based on these planned activities, the costs of previous years, and cost data from similar studies carried out with the Green Value tool in Peru.

The sources of revenue for the project up to 2017 included the sale of carbon credits to European companies and project funds from donors, such as Ecosia. Revenue for the remainder of the project (scenario 2) was estimated based on the sale of the remaining carbon credits that would be available for a total reforested area of 261 ha (48 ha more than the originally planned area in phase 1), and project funds from donations of S/ 96,000 that have been secured for 2018. In addition, we estimated the potential income to the participating hamlets from the sale of the plantation timber. In the section below on assumptions we explain how the volumes of carbon bonds and timber to be sold were calculated.

Inputs

The exercise includes all the costs to establish the plantations and for the monitoring activities by PROGRESO technical staff. The field work was organized by hamlet, and each hamlet had a committee with between 12 and 38 people who worked on the plantations.

Community members who worked on producing and planting seedlings were paid per seedling produced and per seedling planted. The payment for propagation of native plants was greater because it included the extraction and transfer of native plant material. Payment for planting seedlings included compensation for transporting them to the planting area. The construction of the fencing for each lot was carried out as an in-kind contribution of the committees. The other part of the workforce was the project coordinator and a technician, whose costs were included under the activity "Monitoring".

For machinery and equipment (i.e., items lasting more than one year), according to the Green Value methodology, a simplified method was used to determine the useful life of each item (i.e., the number of years or production cycles that each item could be used) and its annual depreciation cost. In this case, only a camera and GPS camera were used.

Administration costs for each year included 25% of the project administrator's monthly salary for 3 months and goods and services used for the project, such as office rent, office supplies, utilities, insurance, and bank charges. The costs related to the certification of carbon credits were also included under the activity "Monitoring". These included:

- Preparatory activities for certification that were carried out in 2010 and 2013.
- Payments to the certifier: first in 2013 (the certificate is good for 30 years), and then every 5 years for validation field visits (S/ 27,000).

Assumptions

For this study, some assumptions have been used that are important when considering the results of the study. In relation to materials and services, it is assumed that each day laborer uses his own machete and shovel.

With respect to carbon credits, according to the original project plan, a total of 53,163 tons (t) of CO_2 were expected to be captured in the original plantation area of 213 ha over 30 years (or an average of 249.6 t CO_2 captured per ha). According to the original assumptions of the project, 70% of the credits (37,214.1 tons of CO_2) were allowed to be commercialized, leaving 30% as a buffer. Between 2010 and 2015, the project sold 11,191 t (30% of the available credits) to European buyers at USD 12 - 15/t. For scenario 2, the total volume of bonds to sell was adjusted to match the 261 ha planted and estimated to be 45,601 t (261 ha x 249.6 t/ha x 70%). The remaining credits were assumed to be sold as follows: a sale of 1,865.12 t credits per year at an average price of S/ 39.51/t (these are the average annual volume sold and the average price received during the first years of the project). Under these assumptions, the last bonds will be sold in 2036.

To estimate the income from the sale of timber from the plantations between 2035 and 2039, it is assumed that only the planted pine (203 ha) will be harvested, while the native species will be left to stabilize the soils and contribute to ecosystem and landscape restoration. There is little information available for the volume of standing timber in pine plantations in Piura. Therefore, we used as a reference an FAO report (1997) from a study in Cajamarca, Peru, that found volumes after 25 years of 164 m^3/ha and 272 m^3/ha in *Pinus radiata* and *Pinus patula* plantations, respectively, that were below 3,450 meters in elevation and had been thinned. Since we do not know the exact areas planted for each species, we used an average of 218 m^3/ha. In addition, since some of the plantations were harvested at 23, 24, and 26 years, we assumed that the trees grew at 8.72 m^3/ha per year (218 m^3/ha/25 years). Furthermore, it was assumed that the first two lots were combined to form a larger lot for the first timber sale (in 2035), and the same was done for the third and fourth lots for the second timber sale. The remaining three lots were individually harvested in the following three years. The total estimated volume to be cut over five years is 43,176 m^3. To calculate the value of the wood, we also had to estimate its price, because it is not common to sell standing pine in Piura. Therefore, we used as a reference the price of standing pine from an exercise the authors completed at the end of 2016 with community reforestation initiatives in the high altitudes of the Apurímac Region, which was S/ 190/m^3.

Results and discussion

Table 1 presents the results of the analysis of the two scenarios. Note that in the cells for years 1-4, 9, 14, 19, 24, and 29 the costs related to Gold Standard certification have been included. In general, for some of the years at the beginning of the project when the plantations were being established, the income from carbon credits and donations were not enough to cover the costs of the activities. In scenario 1 (Table 1), which used real cost data between 2010 and 2017, the viability rate was negative seventeen percent (-17%). This means a significant loss for the NGO PROGRESO to date. In scenario 2 (Table 1), with a projection of costs for 30 years, including maintenance costs and periodic visits for certification, and annual income from the sale of carbon credits, the viability rate was 7.45%. This indicates the sale of carbon credits could cover costs between 2018 and 2034, and generate a profit of S/ 59,145.

However, it is important to recognize that the average price received for carbon credits has been very high compared to the recent average price in the voluntary market for forest management projects, which was USD 5, or S/ 16, per ton of CO_2 in 2016 (Hamrick and Gallant 2017). In addition, the project was unable to sell carbon credits in 2016 and 2017, so it is not assured that it will be able to continue selling credits. In fact, the overall volume of credits sold in the global voluntary market between 2015 and 2016 decreased by 24%, and supply was higher than demand (Hamrick and Gallant 2017). On the other hand, if the new certification based on Fair Trade standards goes through, it is possible that demand will improve and the price for the project's credits will increase to USD 16, or S/ 52 (Gold Standard undated).

It is also important to recognize the role of donated funds in the project, which represented 45% of revenues between 2010 and 2017. Without these funds, the profitability rates for scenarios 1 and 2 would have been -50% and - 24%, respectively. This means that donations have been critical for the continuation of the project. The dependence of the project on external funds and the sale of carbon credits continues to pose a great deal of risk to PROGRESO.

The analyses of each year between 2010 and 2017 also generated information on costs that is very useful for PROGRESO and others interested in replicating this type of project. During this period, the costliest activity was monitoring, which was responsible for between 39-69% of the annual total cost (the only exception was in 2016 when it was the only activity). Among inputs, labor was the most expensive, accounting for between 51-86% of the total cost per year. However, the cost

of labor also represents a benefit to the community members who were paid for participating in the seedling production and planting activities, with the total wages paid varying between S/ 24,639 - 98,699 per year.

Table 1. Net present value analysis of scenarios 1 and 2, with a discount rate of 10% (Peruvian Soles).

	Scenario 1			**Scenario 2**		
Year	**Total cost**	**Total income**	**Net income**	**Total cost**	**Total income**	**Net income**
(2010) 1	197,180.17	86,994.97	(110,185.20)	197,180.17	86,994.97	(110,185.20)
(2011) 2	121,381.67	115,432.00	(5,949.67)	121,381.67	115,432.40	(5,949.27)
(2012) 3	104,289.67	65,827.00	(38,462.67)	104,289.67	65,827.00	(38,462.67)
(2013) 4	139,096.17	147,131.00	8,034.83	139,096.17	147,131.00	8,034.83
(2014) 5	117,950.00	54,960.00	(62,990.00)	117,950.00	54,960.00	(62,990.00)
(2015) 6	95,783.67	91,825.00	(3,958.67)	95,783.67	91,825.00	(3,958.67)
(2016) 7	30,412.17	128,000.00	97,587.83	30,412.17	128,000.00	97,587.83
(2017) 8	89,385.59	112,000.00	22,614.41	89,385.59	112,000.00	22,614.41
(2018) 9				57,412.17	169,695.01	112,282.84
(2019) 10				30,412.17	73,695.01	43,282.84
(2020) 11				30,412.17	73,695.01	43,282.84
(2021) 12				30,412.17	73,695.01	43,282.84
(2022) 13				30,412.17	73,695.01	43,282.84
(2023) 14				57,412.17	73,695.01	16,282.84
(2024) 15				30,412.17	73,695.01	43,282.84
(2025) 16				30,412.17	73,695.01	43,282.84
(2026) 17				30,412.17	73,695.01	43,282.84
(2027) 18				30,412.17	73,695.01	43,282.84
(2028) 19				57,412.17	73,695.01	16,282.84
(2029) 20				30,412.17	73,695.01	43,282.84
(2030) 21				30,412.17	73,695.01	43,282.84
(2031) 22				30,412.17	73,695.01	43,282.84
(2032) 23				30,412.17	73,695.01	43,282.84
(2033) 24				57,412.17	73,695.01	16,282.84
(2034) 25				30,412.17	73,695.01	43,282.84
(2035) 26				44,632.17	73,695.01	29,062.84
(2036) 27				44,632.17	33,116.81	(11,515.36)
(2037) 28				44,632.17	-	(44,632.17)
(2038) 29				71,632.17	-	(71,632.17)
(2039) 30				44,632.17	-	(44,632.17)
Total	**895,479.11**	**802,169.97**	**(93,309.13)**	**1,770,646.82**	**2,257,797.40**	**487,150.58**
Net present value	**$637,539.40**	**$528,325.66**	**($109,213.74)**	**$794,379.40**	**$853,523.97**	**$59,144.57**
Rate of return			**-17%**			**7.45%**

Up to 2015, 350 families from the upper basin area had received economic benefits from the project's reforestation activities. We estimate that these families will also benefit from the sale of timber, which could generate an estimated total S/ 8.47 million by 2039, which has a present value of S/ 994,387 or S/ 2,841 per family. In addition, it is estimated that 240 coffee producers in the lower part of the basin will benefit in the long term from the environmental benefits of the plantations.

The financial indicators allow us to look at the feasibility of the two scenarios from a *financial* point of view. However, it is important to consider that the focus of the initiative is not to maximize profit, but rather to compensate communities for environmental services and help generate family income from sustainable productive activities in the upper elevations, while helping minimize problems such as erosion and landslides for coffee growers at lower elevations. We recognize that this analysis is limited in that it does not include the economic value of the environmental and social benefits of the project. Nonetheless, we hope it will serve as input for analysis of the investments made to date by NORANDINO and the technical assistance provided by PROGRESO to communities, and will help these organizations achieve the project's long-term goals. In addition, we hope that this study will be a reference for others interested in implementing this type of project.

The use of Green Value

In general, the use of the tool has allowed a financial analysis of the project using two scenarios. Some of the difficulties related to the use of the tool include:

- PROGRESO has computers only in the city of Piura. Therefore, to collect labor data, PROGRESO must take the printed sheets to the field and teach local leaders how to fill them out in written form.
- There is only one person within PROGRESO who knows the tool, and there is a need to train others so the tasks of entering and analyzing data can be shared.
- The technical team had difficulty integrating data collection into other activities, as it has many other responsibilities.
- The inclusion of income from other sources, such as donations, complicates the calculation of income or average price per unit sold.

Impacts of using Green Value

The tool has helped PROGRESO organize information on costs and income that were dispersed and not being used in a productive way. Now PROGRESO has a database of annual cost and income information that was generated with the Green Value tool. This study also revealed some costs for which data are not available, such as the community in-kind contributions of fence building, and that need to be monitored and included in future studies.

In addition to annual costs, the use of Green Value with the real and projected financial information allows a study of the lifetime of the project. This gives PROGRESO the opportunity to compare an early study of the project's potential cash flow and viability (the only other financial study of the project) with real cost and income data for activities to date and to prepare more realistic calculations of future costs and income.

PROGRESO is committed to using the information generated by Green Value in the future to inform the members of NORANDINO and project participants about the costs of operations versus income, and to make better informed decisions. In addition, the organization is happy to have updated projections regarding the sale of and potential income from the pine trees.

Conclusions and recommendations

Conclusions

The financial analysis of this payment for environmental services project has allowed PROGRESO to organize its financial information and analyze the chances of success using two scenarios: (1) one that analyzes the costs of establishing plantations and the certification of carbon credits, and revenues from the sale of carbon credits and donations between 2010 and 2017; and (2) another that considers the costs of monitoring and certification over the full lifetime of the project (30 years) and includes as additional income the proceeds from the sale of the rest of the carbon credits. The different results allow us to visualize the potential advantages and limitations of each alternative. In scenario 1, the results show that the sale of carbon credits each year has not been enough to cover the costs of setting up plantations, monitoring activities, and certification. Donations were used to attempt to fill gaps in the budget, but often failed, and thus this was not a sustainable strategy. In scenario 2, the results revealed that the sale of the rest of the carbon credits would be enough to

pay the annual costs and the deficit from the first 8 years and provide a profit of S/ 59,145, however, it is doubtful that the project would be able to sell all its credits and at the same price as before. The new Fair Trade certification system that the project is exploring could help improve prices and market access. In addition, the results also showed excellent benefits for families in the higher elevations who participate in reforestation activities, with payments for their labor at the beginning of the project and revenues from the sale of timber at the end.

We acknowledge, however, that a limitation of the exercise is that it does not quantify the environmental and social benefits that the project could generate, such as providing access to firewood for women from participating communities who travel considerable distances to obtain it, stabilizing soils to prevent erosion and landslides, and helping improve the landscape and restore degraded ecosystems.

This study should help PROGRESO identify new and innovative proposals to help it achieve its project goals. For example, with the baseline information for currently planned activities, PROGRESO could use Green Value to consider other scenarios, such as a diversification of income for community members from other products, including edible mushrooms and/or processed timber. Another interesting exercise would be to compare the financial benefits for community members of investment in reforestation versus other alternatives, such as livestock, medicinal and decorative plants, or firewood. There is also a great interest in using this type of analysis for other products with which NORANDINO members work, such as coffee, cocoa and bamboo, to improve the management of these activities and the information used to make decisions.

Recommendations

We recommend that PROGRESO and NORANDINO come up with a backup plan for financing the rest of the project in case they are not able to generate enough revenue from annual sales of carbon credits to different buyers. The plan might include securing a long-term purchase contract with a company and/or entering an agreement with the community to share both the costs of monitoring the plantation and/or the benefits of harvesting wood products.

There is a need to have specific personnel assigned to record cost and income information and a system to analyze and use Green Value more frequently. A Green Value training course is required for other members of the technical leadership and for community leaders to help facilitate this.

In the future, it would be useful to separate income from the sale of carbon credits from other sources, such as donations, to permit analysis of the average income per bond sold. To facilitate this, it is recommended to add to the "(2,3) Enter: Sales" worksheet an additional table to be able to separate sales revenues from revenues from other sources.

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Works cited

CNF. 2011. Cartilla de precios de productos y servicios forestales en el Perú. Lima: Cámara Nacional Forestal. www.cnf.org.pe.

FAO. 1997. Reporte técnico del proyecto Desarrollo Forestal Participativo en los Andes (DFPA).

Gold Standard. No date. www.goldstandard.org. Accedido el 21 de julio de 2017.

Hamrick, Kelley and Melissa Gallant. 2017. Unlocking Potential State of the Voluntary Carbon Markets 2017. Washington DC: Forest Trends. 52 p.

Ospina P., Carlos Mario, Raúl Jaime Hernández R., Eliana Andrea R., Freddy Alberto Sanchez O., John Byron Urrego M., Carlos Alberto Rodas P., Carlos Agosto Ramírez C., and Néstor Miguel Riaño H. 2011. Guías silviculturales para el manejo de especies forestales con miras a la producción de madera en la zona andina colombiana: El pino pátula. Bogotá: Cinecafe. 105 p.

Quintero, Marcela and Ruben Dario Estrada. 2006. Pago por servicios ambientales en Latinoamérica y sus perspectivas en los Andes. CONDESAN. Lima, Perú.

PROGRESO, 2017. Documento interno del proyecto Reforestación de la Sierra de Piura.