Restoration and management of Queñua (*Polylepis racemosa*) and Pino de Monte (*Podocarpus glomeratus*) woodlands in the Yungas of Independencia, Bolivia

Final Report

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1. Introduction

The cover of the *Podocarpus glomeratus* and *Polylepis racemosa* forests has been greatly reduced in the Municipality of Independencia. These two species are declining locally and at a global level are vulnerable to extinction. In Independencia there are large surfaces without forest that are exposed to erosion and to the plantation of exotic trees (*Eucalyptus globulus* and *Pinus radiata*). Also, there are small forest patches susceptible to burning, over-grazing of livestock, and pruning of native tress for wood and firewood. Because of this, it is important to recover the forests from extinction, generate restoration and improve the protection and use of the forest. In Independencia, the people have had positive answers for the conservation of forests with our proposals within non-profit organizations, the Municipality and the RSG Foundation. With the first project of the RSG, we began to work in reforestation of native species, creation of protected areas of forest with the indigenous communities and the environmental education of children and teachers. I considered important to continue and strengthen these topics. In this report I present the objectives, activities and results of the second project RSG.

2. Objectives

The objective of this second project was to improve the practices of management and conservation of the native forest dominated for *P. glomeratus*, *P. racemosa* and other native species in two indigenous communities of the Municipality of Independencia, Cochabamba, Bolivia. I worked in the communities of Pajchanti and Salviani, both communities had a common forest where they are the principal responsible to conserve or damage it. Then, we focused the work to: improve the traditional institutions to use the forest[1] of each community (norms to use the forest, organization, sanctions and control); create more environmental awareness on the benefits of *P. glomeratus*, *P. racemosa* and the cloud forest; and carry out practices of reforestation and monitoring of plantations in order to recover Polylepis and Podocarpus forests.

3. Activities and method

Objective 1. Improving of traditional institutions to use forest	
Activities planned	**Activities carried out**
Four workshops to analyze and plan practices of woodland protection, management and restoration will be organized for each community	We had workshops and meetings with the communities of Pajchanti and Salviani (seven with each one). They analyzed, planned and created new local norms to protect and manage their forest. All the norms are as a traditional management plan.
Supported by indigenous knowledge and GIS (Geographic Information Systems) I will make one map of the woodlands (scale 1:5000)	We made one handmade map of the forest together with indigenous knowledge. This map and some control points with GPS receiver were used to elaborate a map of native forest for each community. This map helped to plan new rules of use of the forest together with the farmers. The map has a scale of 1:25000 because I didn't have images with better resolution.
Objective 2. Creating environmental awareness	
Activities planned	**Activities carried out**
Teach about forest management, protection and restoration on 5 radio programs	I made agreements with the "Domingo Savio" radio station to produce and run radio programs. So, we have diffused until now eight programs for children, teenagers and adults, more than expected. Topics about burning, over-grazing of livestock,

[1] Traditional institutions are all the rules, practices and customs of the communities to use the common forest collectively.

	illegal logging of wood and firewood, hunting of wildlife and forest rules previously created by the municipal government were diffused.
An environmental education guide (EEG) about woodlands and threatened wildlife	I made an agreement with the local education office to facilitate the production of this guide. They organized a municipal competition for teachers. The teachers sent us their experiences in class teaching about the situation of the woodlands and other threatened species to be published.
Two workshops on "Management and restoration of Polylepis and Podocarpus woodlands"	I carried out three workshops with professionals of municipal government together with other organizations. Also, I did five workshops for university students within the class of professors of "San Simon" University.
Objective 3: Reforestation native forest	
Activities planned	**Activities carried out**
An incentives mechanism will link actions of organic agriculture and woodlands conservation	I modified the mechanism of incentives to improve it. First, the farmers received agricultural seeds, balls and sportswear to play soccer. So they had more motivation to do workshops and meetings to analyze subjects of forest conservation. These incentives helped to improve rules to use the forest, but also included themes of reforestation of native species and exotic species. Then, I bought 350 fruit plants for the farmers in exchange to reforest 5 native plants by each fruit plant. This helped to improve practices of reforestation.
Evaluation of native tree plantations of the first RSG project	We are publishing a paper in the scientific journal "Chapingo" about the use of fertilizers and biostimulants to improve the growing of seedlings of Podocarpus in the nursery. We evaluated some Podocarpus seedlings planted on land; this data is being analyzed by one volunteer.

4. Results

4.1 Improving of traditional institutions and forest use

The communities created protected areas and forest management areas with new rules of use. Now, approximately 526 acres of forest are being protected by themselves in protected areas and 1230 acres are being managed with new norms to use and protect it. Also, the communities decided that in forest management areas they will harvest wood and firewood only for domestic use (until this moment nobody has sold wood or firewood) (Fig.1, 2).

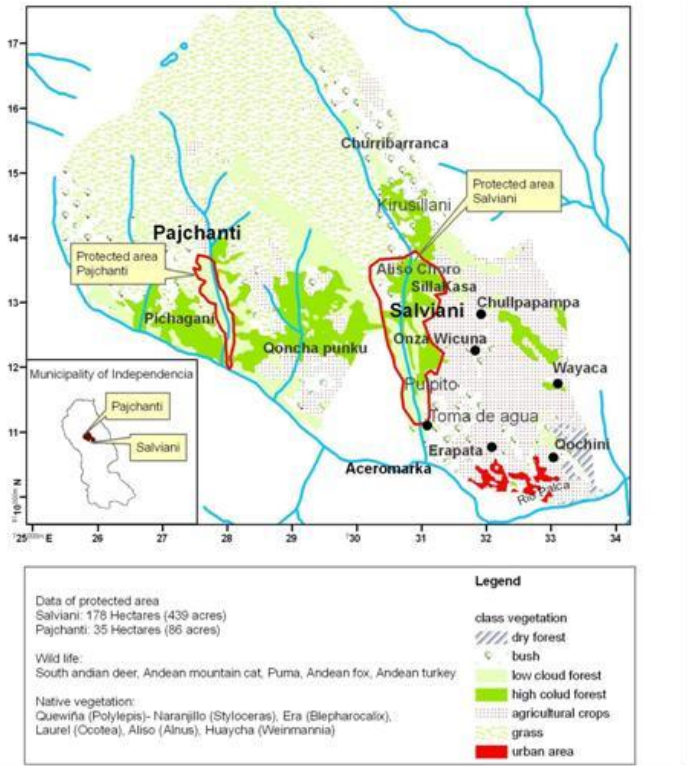

Fig. 1. Map of protected areas of Pajchanti and Salviani. The forests outside of protected areas are management areas for domestic use

They included norms of good agricultural practices (diversification and rotation of crops). With these norms, now *Polylepis racemosa* is a protected species in both communities because this species will neither be cut nor will be burned by the communities. Therefore, approximately 1010 acres will be protected. Moreover, *Podocarpus glomeratus* will not be cut to sell as before. New rules determine that this species, in areas of management, will be cut only for domestic use and will be harvested according to new rules (young and mature trees are being protected, only very old trees and naturally fallen trees will be harvested, along with other restrictions). So, approximately 881 acres of Podocarpus will be forest under management (view map of Fig 4).

Fig. 2. Community of Pajchanti making decision to use their common forest

All these new norms were written in a meeting in each community. Activities of control and heavy sanctions will be implemented to follow the norms. The community authorities have included responsibilities to sanction and control. They elected a person to denounce, control the use of the forest. Also, they decided that nobody from another community can cut trees or hunt wildlife within the communities. I helped to circulate these rules for each community through of 150 booklets distributed for each one. So all the farmers always will have these norms in home to read when they may have a problem. Also, I helped to communicate these rules through the radio station during the following two months. Therefore municipal authorities and the farmers of other communities will understand the work carried out, as well (Fig. 3).

Fig. 3. Norms to use the forest and good agricultural practices of the community of Salviani (left) and Pajchanti (right).

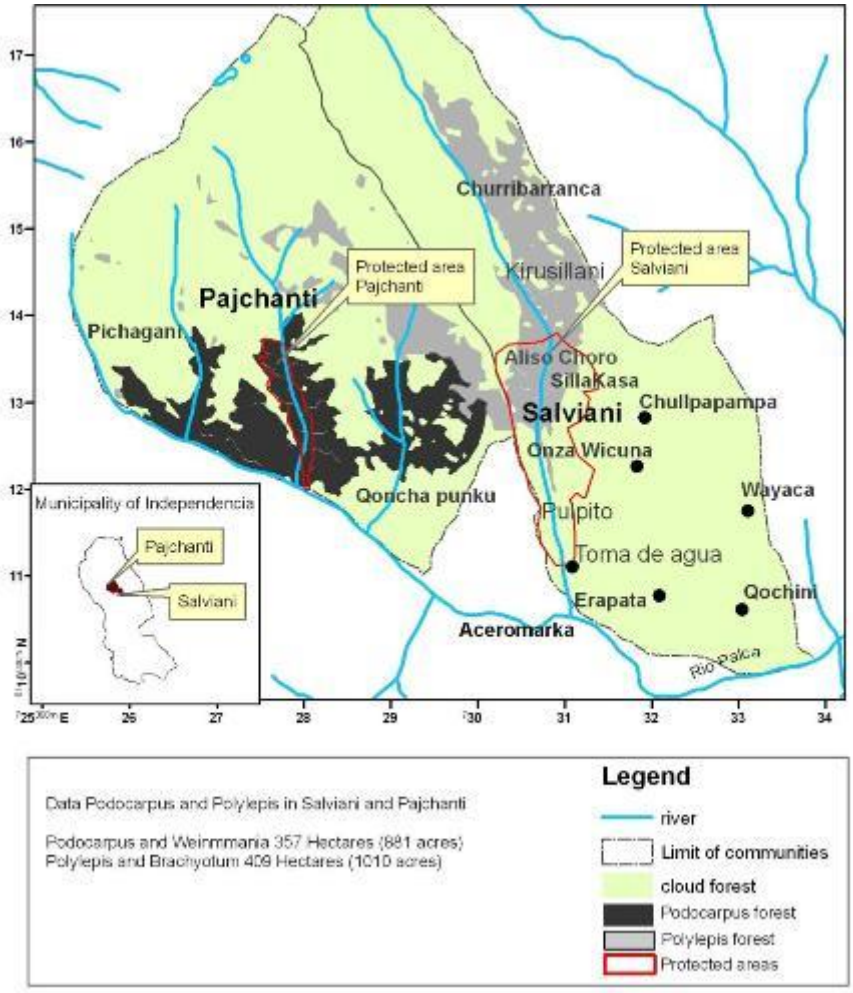

Fig. 4. Map of distribution of *Podocarpus glomeratus* and *Polylepis* racemosa in communities. Forest outside of protected areas are management areas for domestic use.

4.2 Creating environmental awareness

The environmental education for the people of Independencia was another important result. With the radio programs, at least 60% of the inhabitants now know some benefits of the Polylepis and Podocarpus forest (for example, protection of soils, the capture of water of rain in basins, production of wood and firewood). Also, we taught the effects of overexploitation of the forest. Finally, we are circulating local rules of the municipal government to protect the forest. These radio programs helped the population to follow the rules. After seven months of broadcasting of radio programs, at least 18 claims of burned forest and the illegal logging of native forest in the municipality were carried out and 80% of these were sanctioned by communities and sometimes with help of municipal government. Recently, local people have reduced the burning of the forest and illegal harvesting of wood.

Some teachers have included more environmental education classes for children and teenagers. They had the incentive of the competition and the publication of their manuscripts in the local environmental education guide (Fig. 5). 30 teachers sent us their manuscripts and they all have received certificates of participation. Therefore, approximately 150 hours were dedicated to the environmental education of close to 600 children. I wasn't able to print of the guide because I received the manuscripts very late, and that is why I suspended this activity.

Another benefit is that 60 students and three professors from the "Escuela de Ciencias Forestales" of the San Simon University have knowledge about our experiences in restoration and management of Polylepis and Podocarpus. The workshops with the municipal government were beneficial as they

Fig.5. The children's art promoting care for the forest

learned about our work, but I do not know if they will apply it, because they have serious organizational problems in order to work on the protection of the native forest.

4.3. Reforestation

The farmers this year planted 1500 native plants (70% *Alnus acuminata* and 30% *P. lanata* and *P. glomeratus*). In this project, the municipal government was responsible for the production of plants and I focused on the work with communities and schools. However, the production of Podocarpus and Polylepis plants was disappointing because there were few plants. Many plants died.

We carried out the monitoring of native seedlings planted in 2010. The survival was heterogenic among species and the places where they were planted (Fig. 6). The growing of *Alnus acuminata* was very good but *P. lanata* and *P. glomeratus* grew slowly (Fig.7). I think that we should work to improve the survival and growth of these plants in order to obtain better results.

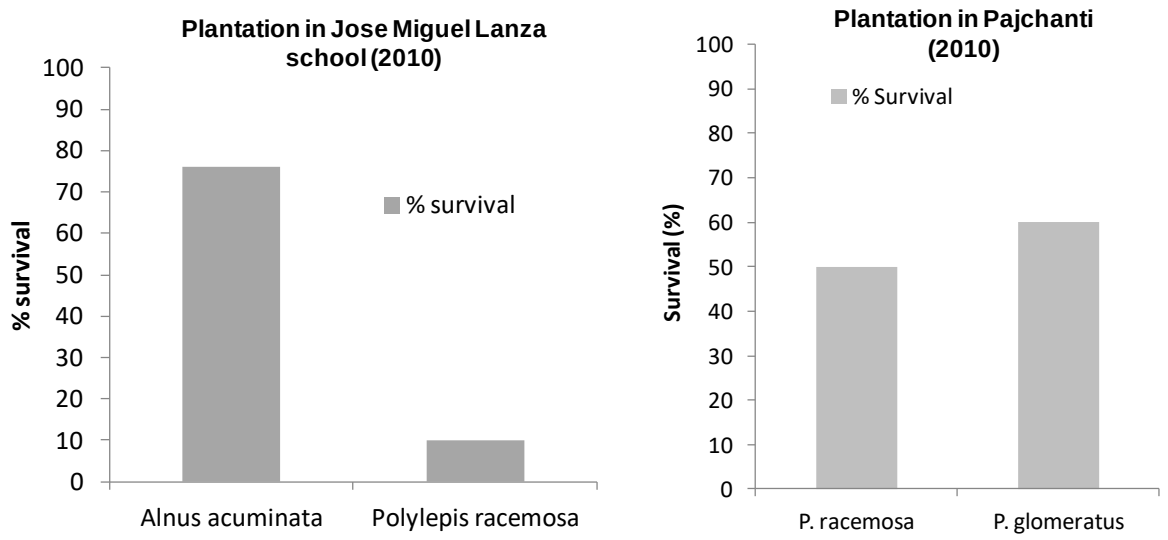

Fig.6. Survival of native seedling planted in 2010 on the property of "Jose Miguel Lanza" School and in the community of Pajchanti.

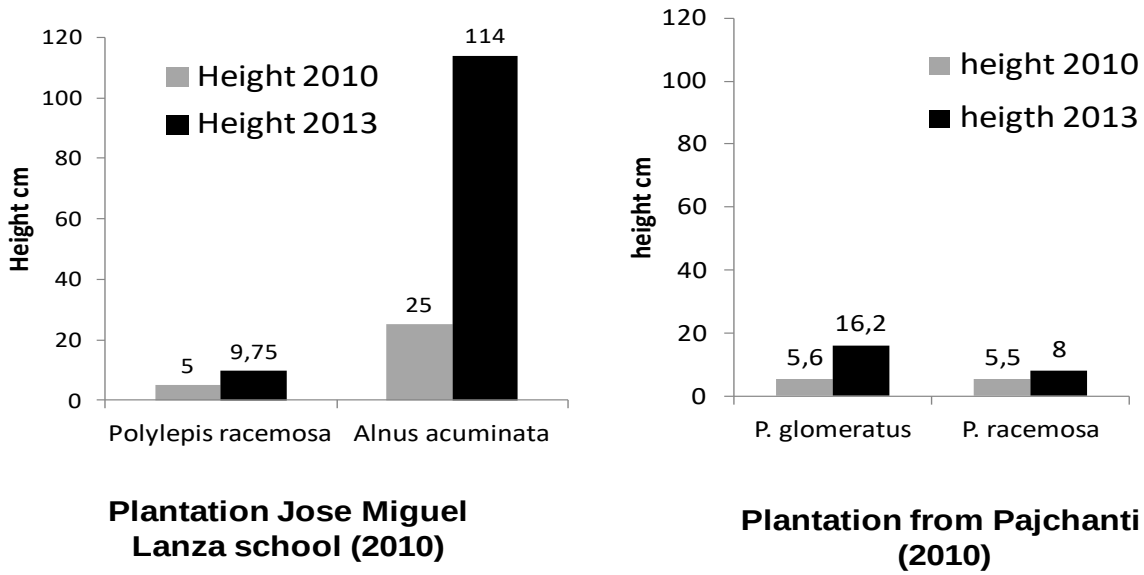

Fig. 7. Growth of native plants. Height of plants in 2010 and 2013.

5. Any unforeseen difficulties that arose during the project and how these were tackled

In 2010, new authorities took charge of the municipal government and they didn't know about our previous work. First, I tried to plan workshops with them twice, but they were not motivated to participate.

The production of the guide together with the teachers was difficult. Some teachers weren't ready to help. Because of that, we organized the competition for the teachers. The initiative is helping to motivate them and start the teaching on themes of forest conservation and other species within the class. I have been receiving manuscripts with ideas from the teachers. Because they sent me their manuscripts late, I suspend the printing of the guide.

The community of Pajchanti was not very motivated to program workshops. So, I gave them incentives to work together. I had to make modifications in the incentive program for farmers.

6. Budget.

All figures are in £ sterling. (1 £ sterling =11.1935 Bolivians)

Item	Budgeted Amount	Actual Amount	Difference
50 bus tickets (Cochabamba - Independencia)	135	145,8	-10,8
Food and lodging in Independencia (300 days). I will eat in local restaurants and I will stay in a small hotel in the principal village (Villa Independencia)	1263	1156,0	107,0
Food and lodging for volunteers in Independencia (100 Days). They will help with workshops and fieldwork.	422	358,0	64,0
Recording of 5 radio environmental education programs.	134	285,7	-151,7
Diffusion on radio (Each day the radio station will transmit the programs)	67	553,4	-486,4

Item	Budgeted Amount	Actual Amount	Difference
Print environmental education guide (100 copies of the guide will be printed in print shop)	269	0,0	269,0
Organization of workshops for professionals in Independencia	134	428,5	-294,5
Organization workshops for university students and professors	134	276,7	-142,7
Prize for teachers with the best manuscripts for environmental guide	36	38,5	-2,5
Rental of Data Projector (I will show images and information in the workshops)	134	249,9	-115,9
Writing materials for workshops (I will buy pencils, exercise books, cards, Bristol board, colored pencils and paper)	90	13,8	76,2
Camping equipment (one tent, two pairs of boots, and three raincoats for the fieldwork in the communities)	269	288,3	-19,3
Incentive program for conservation and organic agricultural actions. According to plan done with communities	1209	1098,0	111,0
Print of woodlands map (For to printing of a map [80 x 100 cm, three copies, full color])	40	294,6	-254,6
Fuel for the operation of the motorcycle.	125	44,6	80,4
Use of motorcycle (60 days). I will rent one motorcycle to travel from the main village (Villa de Independencia) to the communities.	967	156,2	810,8
Labour	150	0,0	150,0
Transportation of plants (4 Contracts). I will rent one truck to transport plants (from the greenhouse to communities)	160	174,8	-14,8
Native samplings of greenhouse. The government will produce 10.000 native plants.	33	214,2	-181,2
Products and services for project administration (Ink for printing, Cellular minutes, Paper, CD's)	220	214,2	5,8
Total	5991	**5991,4**	

7. Conclusions

I believe that the second project finished well. I carried out all of the activities and obtained positive results. There were some methodological modifications but the objectives were reached. The principle results were these achievements: 1) creation of new norms to use and protect the forest in the communities, 2) the radio programs and the contest for teachers for environment education and, 3) the plantation and the monitoring of the growing plants. I plan on continuing the work this year.