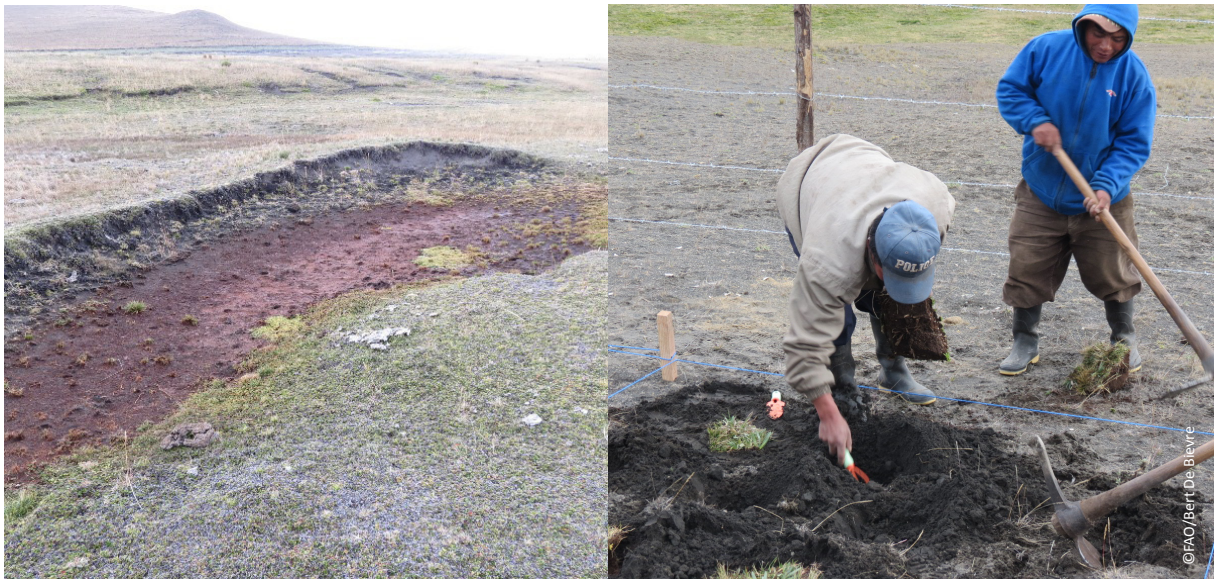
Food and Agriculture Organization of the United Nations

Restoration of overgrazed páramo grasslands for hydrological benefits

Quito, Ecuador (00° 30′ S, 78° 10′ W)

Bert De Bievre[1], Tania Calle[1], Patricia Velasco[1,2], Pablo Borja[1,3], Jorge Nuñez[4]

[1]Consortium for Sustainable Development of the Andean Ecoregion, CONDESAN, Quito, Ecuador
[2]Jardín Botánico de Bogotá, Bogotá, Colombia
[3]Universidad de Cuenca, Cuenca, Ecuador
[4]Secretaría General de la Comunidad Andina - Ministerio del Ambiente, Project PRAA, Quito, Ecuador



Dried wetlands in Antisana paramo and replanting native vegetation .

Summary

The 'páramo' is a mountain ecosystem in the Andean tropics situated above the tree line and below glaciers. It is dominated by grasslands on soils with high organic carbon content. Peat is present in these areas but not everywhere, only on the flatter areas. The slopes are covered with andosols. The ecosystem is crucial for supplying water for agriculture in inter–Andean valleys, hydropower and high-altitude cities. The city of Quito started to withdraw its water from the Andes' Eastern Cordillera in the 1970s. Most of the catchment areas were placed under the protection of National Parks. However, some areas remained in hands of families that had owned them for centuries and hold large herds of sheep and cattle. The Quito water supply company bought recently two properties (8 000 ha each) at the headwaters of tributaries that fed two distinct water supply systems. Each of the properties has a centuries–long history of overgrazing. All sheep and cattle were removed from the properties, which reduced the livestock load to some horses and occasional visits of neighbouring cattle.

This project exclusively concerns the conservation and restoration of water–related environmental services. Carbon sequestration or GHG effects are secondary. As there is not yet a large body of experience on páramo restoration, around 20 pilot and demonstration plots were set up to test different techniques, including simple fencing and the transplantation of plants from well–conserved nearby areas. A monitoring framework was also put into place to measure the hydrological benefits of the restoration activities on the future water supply.

1. Practice description

Area of the site	16 000 ha	
Current land cover/use	Degraded grassland under restoration	
Previous land cover/use	Grazing of sheep and cattle	
Origin of intervention	Purchasing of the land by the Municipal Water Supply Company of the city of Quito; funding by Global Environment Facility (GEF) /World Bank Climate Change Adaptation Project.	
Types of intervention used in the area	☑ Rewetting ☐ Drainage ☐ Cultivation of crops ☐ Grazing ☐ Forestry ☐ Aquaculture ☐ Fishery ☑ Other	
Duration of implementation	Started in March 2013	
Main purpose of the practice	Recover water regulation capacity and restore water quality	
Level of technical knowledge	☐ Low ☑ Medium ☐ High	
Water table depth from surface	Extremely variable, from –0.1 to –2 m	
Present active drainage system	Width of channels	n/a
	Distance between channels	n/a
Subsidence	Before practice	–
	During practice	–

2. Implementation of activities, inputs and cost

N	Establishment of activities	Input/materials	Duration	Cost
1	Demonstration plots with different restoration practices on sites with different levels of degradation	Fencing; transplanted plants (grasses and cusion plants); textiles to protect soil (on heavily degraded sites); hydrogel (added to planting holes during dry season).	2 years for selection of most successful practice	USD 50 000
2	Establish monitoring of vegetation and soil hydrophysical and chemical properties at the plot scale and hydrological monitoring at the microcatchment (less than 1 km2) scale. Measurement of baseline.	Soil hydrophysics andchemical analyses, rain gauges, weirs and water level sensors.	Setup: 6 months. Baseline: 1–2 years	USD 50 000
3	Upscaling of most successful restoration techniques to micro–catchment scale	Depending on selected technique	After two years from January, 2014	To be confirmed after selection of techniques

Remarks: At this time, it is a pilot project in which several restoration techniques are being tested for their effectiveness on terrain with different degrees of degradation. Selected techniques will be scaled up after two years, while the hydrological base line is being determined.

3. Environmental characteristics

Climate	☑ Tropical ☐ Temperate ☐ Boreal	
Average annual rainfall	800 mm	
Altitude	3 800–4 100 m a.s.l.	
Slope	5–30 %	
Peat depth (cm)	☐ ≤ 30 ☑ 30–50 ☐ 50–100 ☐ 100–300 ☐ >300	
Peatland type based on the water source	☐ Fen ☑ Bog ☐ Undefined	
Hydrologic network	Connected to small ponds	
Main vegetation species	Before practice	*Werneria nubigena*, *Lachemila orbiculata y Azorella pedunculata*
	During practice	Practice just started
Water quality	Water pH	Stagnant water: 5–5.5; flowing water: 6

4. Socio-economic dimension

Local stakeholders	Water Supply Company; Quito's Water Fund FONAG; Ministry of Environment
Land tenure	Recently purchased by Municipal Water Supply Company of Quito, whereas, previously was managed by large landowners.
Land, water, and other natural resource access and use rights	Unlike most páramo ecosystem areas in Ecuador, this area is owned by large landowners, rather than indigenous communities. The interest of the city of Quito grew when new infrastructure for its water supply was built in the 80's. Legal support makes it relatively straightforward to give priority to the city's water needs.
Conflicts	There was a strong conflict between the previous land owner and the city's water supply interests. This was largely solved by purchasing the land. Still, there are conflicts with neighbouring ranches whose cattle move into the property.
Conflict resolution mechanism	Land was purchased for conservation
Legal framework	–
Products derived from the peatland	Water. The project is clearly marked in a climate change framework. It is an adaptation project, since it aims to increase water regulation in degraded paramos and replace in this way water regulation capacity lost through glacier retreat and increase of climate variability.
Market orientation	Water industry

5. Assessment of impacts on ecosystem services

1 highly decreasing/ 2 moderately decreasing/ 3 slightly decreasing/ 4 neutral/ 5 slightly increasing/ 6 moderately increasing/ 7 highly increasing

Provisioning services	Agricultural production	2
	Food security and nutrition	4
	Employment	4
	Income	3
	Non-timber forest products yield	–
	Livelihoods opportunities	4
	Resilience and capacity to adapt to climate change	6
	Other (water yield)	6 (tbc)
Socio-cultural services	Level of conflicts	4
	Gender equality	4
	Learning and innovation	7
Regulating services	Waterborne carbon (DOC) loss	3
	Fire frequency	6
	Biodiversity	7
	Subsidence rate	4
Off-site benefits	Water quality	7
	Frequency of flooding	4

6. Climate change mitigation potential

1 highly decreasing/ 2 moderately decreasing/ 3 slightly decreasing/ 4 neutral/ 5 slightly increasing/ 6 moderately increasing/ 7 highly increasing

Impact	Rate	Estimate ($t\ ha^{-1}\ year^{-1}$, CO_2-eq)	Remarks
Net GHG emission	2	–	Decrease in carbon losses from soils
CH_4 emission	3	–	From elimination of cattle, however, they move offsite
CO_2 emission	2	–	Decrease in carbon loss from soils
N_2O emission	4	–	–
Carbon sequestration/ storage abovegrounds	6	–	Through soil restoration, recover carbon content in soils.

The designations employed and the presentation of material in this information product do not imply the expression of any opinion whatsoever on the part of the Food and Agriculture Organization of the United Nations (FAO) concerning the legal or development status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. The mention of specific companies or products of manufacturers, whether or not these have been patented, does not imply that these have been endorsed or recommended by FAO in preference to others of a similar nature that are not mentioned. The views expressed in this information product are those of the author(s) and do not necessarily reflect the views or policies of FAO.

© FAO, 2015

I4430E/1/02.15

© FAO, 2015