

Post-2015 Development Agenda

Colombia Perspectives



Biodiversity

SPEAKERS AND CONTRIBUTORS

Luke Brander

Luke Brander, Institute for Environmental Studies, VU University Amsterdam; and Kadoorie Institute, University of Hong Kong

Luke Brander has a background in environmental economics. He obtained his Masters degree in Environmental and Resource Economics at University College London (1997-98). From April 2000 to September 2010 he worked as a researcher in environmental economics at the Institute for Environmental Studies (VU University Amsterdam). He obtained his doctoral degree from the VU University Amsterdam in 2011.

Luke is currently working as a freelance environmental economist based in Hong Kong. He is affiliated to the Institute for Environmental Studies (VU University Amsterdam) as an associate researcher and to the Division of Environment, Hong Kong University of Science and Technology (HKUST) as an Adjunct Assistant Professor.

Gustavo Arciniegas

Gustavo received in 2012 a Ph.D. in 'Map-based decision support tools for collaborative land use planning' from IVM, VU University Amsterdam, the Netherlands. He also holds an M.Sc. degree in Geoinformatics from the University of Twente, ITC faculty, the Netherlands, (2005) and a B.Sc. degree in civil engineering from the UIS, Colombia (2000). He specializes in the integration of GIS, SDSS, PSS and geo-instruments for collaborative spatial decision-making and geodesign, focusing on sustainable and environmental planning. Gustavo is a certified CommunityViz authorized GOLD consultant.

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Summary: White Paper Report by Luke Brander and Gustavo Arciniegas

Large areas of natural habitat for a range of plant and animal species are being lost every year in countries around the world, and Colombia is no exception. This loss is mainly due to Mankind's exploitation of these areas for agriculture, fuel or minerals. Unless we can demonstrate that these areas are more valuable left as they are, we will continue to lose biodiversity at a fast rate.

The costs of leaving natural areas untouched is easily measured in terms of the loss of value which would otherwise be brought by farming or mining the land, but the benefits are often taken for granted can be harder to put a value on. In fact, environmental economics does allow us to value the services we receive from the land. These include, for example, the supply of fresh water, recreation and tourism, and biodiversity itself.

Colombia is rich in a particular unique ecosystem found in the northern Andes: the páramos. The country is home to over half (60%) of the total area, with the rest being mainly found in Venezuela, Peru and Ecuador. Páramos are generally cold and humid high-altitude wetlands which lie above the altitude of continuous forests but below the permanent snowline. In equatorial areas, this is typically at a height of 3,100 to 4,000 metres.

These areas have unique vegetation (including giant rosette plants) and provide habitat for a variety of mammals, birds, insects, amphibians and reptiles. Páramos are also a carbon sink, tying up carbon which would otherwise stay in the air as carbon dioxide. This is particularly important for the key issue of climate change, since carbon dioxide is one of the main drivers of higher global temperatures.

Another vital role for páramos is water supply. In Colombia, these ecosystems provide fresh water to 85% of the population, so their loss would have a big impact on everyday life.

Colombian páramos cover 2.9 million hectares of land, but this is only 1.6% of the country's area. Despite their importance, only a third of the area lies within National Parks and so is protected. The remaining two thirds is at risk of disappearing, mainly through human activities such as cattle raising, mixed agriculture and mining. Coal and gold are important exports and there is particular pressure to expand the mining sector to promote economic growth.

In fact, an analysis shows us that forgoing some of the direct benefits of expanding mining or farming would make better economic sense overall. It is probably impossible to stop some erosion of these ecosystems, but reducing their rate of loss by half from its current 1.2% a year would be smart. Compared to business as usual, meeting this target would mean nearly 300,000 more hectares of páramos being in existence by 2050, continuing to provide fresh water and conserve biodiversity.

The annual costs of conservation are significant, amounting to \$67-89 million in 2050. However, even the lowest estimated benefit – \$100 million a year – is greater than the highest cost, and the benefit could be as high as \$152 million. The agriculture and mining sectors would lose the potential revenue from exploiting virgin páramos, but Colombian society as a whole would benefit from the continuing supply of fresh water.

This study looks at one very specific example of an ecosystem important for Colombia, but the same principles can be applied to valuing other natural habitats. Destruction of these for short-term economic gain is not necessarily the best option for sustainable economic growth.

White Paper Report by Luke Brander and Gustavo Arciniegas

This White Paper provides an economic assessment of biodiversity conservation in Colombia and specifically focuses on preservation of páramo ecosystems. The assessment compares the costs and benefits of reducing future loss of Colombian páramos.

‘Páramos’ constitute a unique type of ecosystem. Prominent in the northern Andes of South America and the south of Central America, mainly in Venezuela, Colombia, Peru, and Ecuador, páramos are generally cold and humid high-altitude wetland ecosystems, present in regions above the continuous forest line, yet below the permanent snowline, and typically located in equatorial areas between 3100 and 4000 meters above sea level (Luteyn, 1999).

The ecological importance of the páramos has been well recognized by scientists. Páramos receive sunlight all year round, which in addition to their equatorial location enables them to develop a unique type of vegetation, notably giant rosette plants, shrubs and grasses (Luteyn, 1999). Such páramo vegetation provides in turn shelter and habitat for a variety of mammals, birds, insects, amphibians, and reptiles (Hofstede et al., 1995). Páramos are considered strategic biodiversity hotspots and play an important role as carbon sinks, helping to mitigate the effects of climate change.

Over half of the world’s páramos (60%), including the largest páramo on earth (the Sumapaz páramo), are found in Colombia. Colombia has a total of 36 distinct páramo ecosystems covering an area of 2.9 million hectares, 1.6% of the country’s territory (Humboldt Institute Colombia, 2013) (See Figure 1). These ecosystems also provide freshwater to 85% of the country’s population and are home to a rich diversity of flora and fauna. Despite their ecological importance, only 36% of Colombian páramos are found within National Parks, which makes the remaining unprotected 64% vulnerable to the consequences of human activities and developments linked to the country’s economic growth.

Figure 1. Map showing location of Colombia's 34 páramos in 5 sectors.



Currently, unprotected Colombian páramos are facing the risk of disappearance. The main threats are deforestation, the effects of climate change, and more notably, the transformation of páramo landscape as a result of human activities, among which cattle raising, mining and mixed agriculture are important (Humboldt Institute Colombia, 2013).

In particular, the mining sector in Colombia is currently playing an important role in the country's economic growth. Coal and gold exports have become major contributors to such growth, which in strict economic terms is beneficial to the country, but comes at a high price for the preservation of unprotected páramos (Kraul, 2014).

As long as there is a high international demand for these mining products and the economic growth of the country depends on the extraction of natural resources, the Colombian páramos will be at risk. Understanding the economic value of preserving these wetlands is crucial.

Economic assessment of páramos conservation

This paper provides an economic assessment of conservation of páramos in Colombia. This analysis makes a comparison of the costs and benefits of reducing current rates of loss of páramo ecosystems by half. This conservation scenario is in line with Aichi Target 5 of the Convention on Biological Diversity¹, which states that:

“by 2020, the rate of loss of all natural habitats, including forests, is at least halved and where feasible brought close to zero, and degradation and fragmentation is significantly reduced” (CBD, 2010).

The costs of conservation are estimated as the value of alternative uses of land, e.g. agriculture and mining, that cannot take place if páramos are protected. The benefits of conservation are estimated as the value of ecosystem services that are maintained into the future due to protection of páramos. These ecosystem services include the supply of water, regulation of water flows, non-consumptive recreation and biodiversity conservation. The values of these services are transferred from existing economic studies for other wetlands. A full explanation of the steps in this analysis is given in Appendix 1.

Reducing current rates of loss of páramos by half results in the conservation of almost 300,000 ha by 2050 as compared to the situation in which ecosystem loss is allowed to continue unchecked.

The annual cost of this conservation in terms of foregone economic activities on the land is estimated to be in the range of USD 67-89 million in 2050. On the other hand, the benefit from maintained ecosystem services is estimated to be in the range USD 100-152 million in 2050.

The results of the cost-benefit analysis are presented in Table 1. Four cases are considered: combining the lower bound of the benefit figures and the lower bound of the cost figures; the upper bound of the benefit figures with the lower bound of the costs; the lower bound of the benefits with the upper bound of the costs; and finally the upper bound of the benefits with the upper bound of the costs. We find that in all cases the conservation programme has a positive benefit-cost ratio (in the range 1.14–2.27). Even in the case that costs are at the high end of the expected range and benefits are at the low end, every dollar invested in conservation yields a

¹ Colombia has been a Party to the Convention on Biological Diversity since 1995.

return of 1.14 dollars. On this evidence, a conservation programme for reducing the rate of loss of páramos by half is economically justified.

Table 1: Cost-Benefit Analysis for conservation of páramo ecosystems in Colombia (2015-2050; discount rate = 3%)

	Net Present Value (USD; millions)	Benefit to Cost Ratio
Low Benefit-Low Cost	762	1.52
High Benefit-Low Cost	1,883	2.27
Low Benefit-High Cost	275	1.14
High-Benefit-High Cost	1,396	1.71

This is a first attempt at estimating benefit-cost ratios for meeting biodiversity conservation targets in Colombia. This approach could be repeated to assess the economic returns of conserving other ecosystems and types of biodiversity. Future work needs to investigate both the benefits and costs more closely, especially to take account of the specific Colombian context in more detail. Future studies should also look at who bears the costs and who benefits from investments in biodiversity and ecosystem conservation. In the case of páramos, the costs are most likely to be incurred by those who would have benefited from converting páramos to other uses (e.g. agriculture and mining) whereas the benefits of conservation are received by the broader society in the form of water supply.

Appendix 1: Cost-Benefit Analysis of Colombian páramos conservation

The assumptions, parameters and steps used in the assessment of costs and benefits of páramos conservation are:

1. The current extent of páramo ecosystems is obtained from Humboldt Institute Colombia (2013). This includes information on 36 ecosystems covering 2.9 million hectares in 2010.
2. The average baseline rate of loss in páramos area is 1.2% per year. This rate varies across páramo ecosystems reflecting differences in local pressures and historic rates of loss (the range is 0 - 7.3% loss per year).
3. The annual rate of loss in páramos area under the conservation scenario is half of the baseline rate. The gain in ecosystem area under the conservation scenario vs. the baseline scenario is represented in Figure 2.
4. The time horizon of the analysis is 2015-2050. Initial conservation investment costs are incurred in the period 2015-2020, whereas the recurrent and opportunity costs of conservation (the foregone alternative use of conserved land) and the benefits (the economic value of enhanced provision of ecosystem services) accrue in the period 2021-2050.
5. The unit value (US\$/ha/year) of the bundle of ecosystem services provided by each páramo in 2050 is estimated using the meta-analytic value function described in Hussain et al. (2011). This value function is estimated from a sample of 247 separate value estimates from 131 primary studies that cover a broad set of ecosystem services, including flood protection, water supply, water quality, habitat and nursery for fauna, recreational hunting, recreational fishing, food and material provisioning, fuel wood provisioning, non-consumptive recreation, aesthetic enjoyment and biodiversity conservation. Unit values are estimated separately for the baseline and conservation scenarios in order to reflect differences in the scarcity of ecosystems under each scenario. The benefits of conservation for each páramo ecosystem is computed as the average of unit values under the baseline and conservation scenario, multiplied by the difference in area between the baseline and conservation scenario.
6. The benefits of páramos conservation are computed by aggregating across all páramo ecosystems and over time (for the period 2021-2050) using the assumption that benefits are distributed linearly over time as the area of páramos conserved increases.
7. Estimates of the lower and upper bound unit costs of the conservation scenario are derived from CBD (2012). Lower and upper bound annualised per hectare management and opportunity costs are US\$ 640 and US\$ 850 respectively. These costs are high

compared with other estimates of protected area costs (e.g. US\$/ha/year 121, World Bank, 2002) and are considered to be a conservative (pessimistic) view of conservation costs. Ideally the opportunity costs of páramos conservation would reflect the economic rents of alternative land uses. It was not possible, however, to obtain or compute such information within the scope of this study.

8. Present value costs and benefits are computed using annual discount rates of 3% and 5%. The results using 5% discount rate are presented at the end of the Appendix in Table 2.

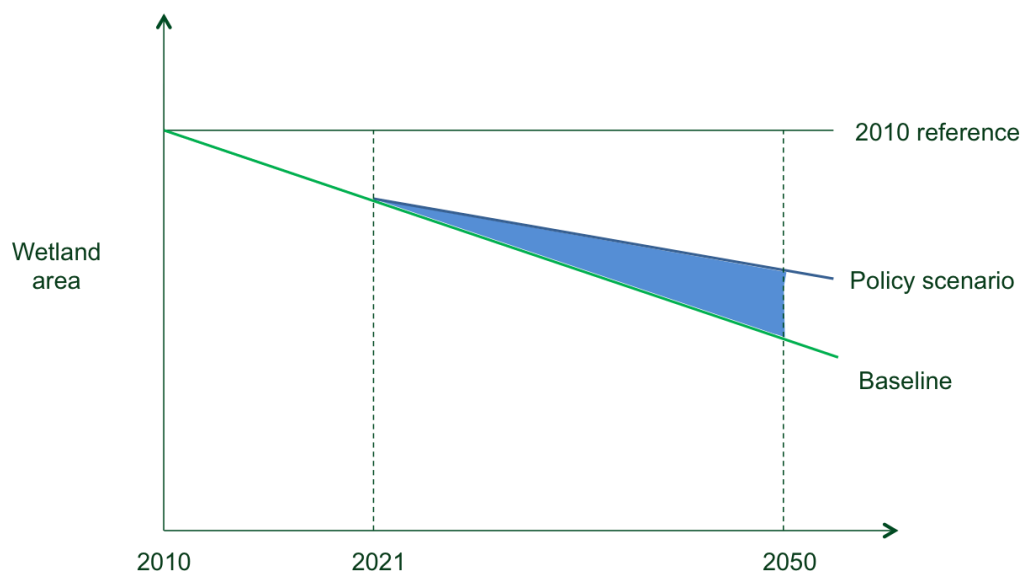


Figure 2. Gain in páramos area under the conservation scenario (represented by shaded area).

Table 2: Cost-Benefit Analysis for conservation of páramo ecosystems in Colombia (2015-2050; discount rate = 5%)

	Net Present Value (USD; millions)	Benefit to Cost Ratio
Low Benefit-Low Cost	493	1.52
High Benefit-Low Cost	1217	2.27
Low Benefit-High Cost	178	1.14
High-Benefit-High Cost	902	1.71

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Evaluación económica de la conservación de los ecosistemas de páramo en Colombia

Luke Brander

VU University Amsterdam; Kadoorie Institute, University of Hong Kong

Gustavo Arciniegas

Geo-Col: GIS and Collaborative Planning, Países Bajos

Contenido

- Ecosistemas de páramo
- Páramos en Colombia
- Amenazas
- Costos y beneficios de su conservación
- Conclusiones

Ecosistemas de páramo

- Ecosistemas de montaña fríos y húmedos.
- Ubicados en zonas ecuatoriales entre 3.100 y 4.000 m.s.n.m.
- Ubicados en zonas montañosas que reciben la luz del sol todo el año.
- Vegetación única y hábitat para gran variedad de mamíferos, aves, insectos, anfibios y reptiles.



Páramos en Colombia

- El 60% de los páramos del mundo está en Colombia
- Colombia tiene el páramo más grande del mundo: El Sumapaz, con 266.250 ha
- 36 páramos en total: 2.9 millones ha, 1.6% del territorio colombiano
- Riqueza ecológica y biodiversidad
- Sumideros de CO₂
- Fuente de agua dulce para el 85% de la población colombiana



Amenazas

- Sólo el 36% del territorio de páramos se encuentra dentro del área del Sistema Nacional de Parques Naturales
- Los páramos no protegidos son vulnerables a:
 - Efectos del cambio climático
 - Transformación de uso de suelo en: ganadería, minería, y cultivos mixtos.
- Sector minero: en crecimiento desde 2009

Análisis de costo-beneficio

- Comparación de los costos y beneficios de reducir a la mitad la tasa de desaparición de páramos para el año 2050
- **Costo**: el valor de los usos de suelo alternativos (ganadería, minería y agricultura) que no pueden implementarse en páramos protegidos
- **Beneficio**: valor de los servicios del ecosistema que se mantienen gracias a su protección

Resultados

- Reducir a la mitad la tasa actual de pérdida de páramos lleva a conservar apróx. 300,000 ha para 2050.
- El costo anual de esta conservación está en el rango de 67-89 millones de dólares para 2050.
- El beneficio de mantener estos servicios del ecosistema está en el rango de 100-152 millones de dólares para 2050.

Resultados

Conservación de páramos en Colombia
(2015-2050; tasa de descuento = 3%)

	Valor presente neto (Millones de dólares)	Relación Beneficio a Costo
Beneficio Bajo – Costo Bajo	762	1.52
Beneficio Alto – Costo Bajo	1883	2.27
Beneficio Bajo – Costo Alto	275	1.14
Beneficio Alto-Costo Alto	1396	1.71

Conclusiones

- Primera evaluación de los costos y beneficios de conservar los páramos en Colombia
- Estos ecosistemas son valiosos: los beneficios superan los costos
- Se justifican programas de conservación
- Vale la pena investigar más sobre el valor de conservar ecosistemas de páramos y humedales en general