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Incorporating Ecosystem Services to the study of ecosystems in EIA

A case study from Peru

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Project framework



What were the issues?

- A proposed mine development to affect >40 ha of highland wetlands (“bofedales”) ≈ peatbogs → EIA carried out in 2012.
- Highland wetlands → are considered as the “oasis” of the High Andes.
 - Occur only in Peru at elevations above 4,000 m (similar ecosystems in Ecuador, Bolivia, Chile).
 - Great value → **only** source of green vegetation during dry season (6 months)
 - Face many issues from unsustainable practices (i.e. overgrazing, soil compaction, cutting to extract organic matter for fuel, transformed to cropland).
 - Are recognized as a source of many “environmental services” but there is no official list or studies.

Our approach



We carried out a “mini” EIA to address wetland issues and impacts → based on the Authority’s observations to the EIA.

- **Baseline studies:**
 - Regular characterization of biological traits (terrestrial & aquatic species richness, abundance, diversity, etc.);
 - Identification and characterization of ecosystem services (based on priorities for the local population).

+ information from other physical & social studies
- **Impact assessment:**
 - Impacts to vegetation cover and native species.
 - Impacts to priority ecosystem services.
- **Mitigation & compensation measures**

Identifying ES

To correctly identify all ES many international publications were reviewed:

- MEA (2005), ICMM (2006), TEEB (2010), IPIECA (2011) and Landsberg et al. (2013).
- Based on international publications we produced a list of 22 potential services.
- The list was discussed by biological, physical and social specialists.
 - A final list of 14 services remained.
 - These services were prioritized based on the knowledge gathered while conducting the EIA.

Impacts on ES

Findings: Project could potentially impact 3 priority services.

- Highland wetlands as grazing areas for livestock
 - ▶ provisioning services.
- Highland wetlands as reservoirs of clean water
 - ▶ provisioning and regulating services.
- Highland wetlands as carbon storage areas
 - ▶ regulating services.



Measuring impacts on ES



➔ First challenge!

- Quantifying highland wetlands as grazing areas for livestock.
 - Wetlands already showed signs of overgrazing.
 - Study of the ecosystems' carrying capacity.
 - Patches with different 'quality' levels.
 - Forage species with poor nutritious values.
 - However → great significance during dry season.
 - ▶ Final estimations in terms of grazing land hectares available.
- **How was the impact finally measured?**
 - ▶ Loss of grazing land (despite wetlands were poorer in quality vs. other ecosystems such as grassland).

Measuring impacts on ES

➔ Second challenge!



- Quantifying highland wetlands as reservoirs of clean water
 - Very difficult to estimate.
 - Specific study to quantify depths of wetlands → highly variable.
 - Many assumptions based on sparse literature (no studies on highland wetlands available).
 - ▶ Gross estimate of water stored in wetlands (over 1M m³).
- How was the impact finally measured?
 - ▶ Loss of water storage capacity and its role as aquifer recharge sources (minimum).

Measuring impacts on ES



➔ Third challenge!

- Quantifying highland wetlands as carbon storage areas.
 - Difficult to estimate.
 - Specific desktop study to quantify carbon content on wetland soils.
 - Many assumptions based on sparse literature (no studies on highland wetlands available).
 - ▶ Gross estimate of carbon and CO₂ stored in wetlands.
- **How was the impact finally measured?**
 - ▶ Tones of carbon and CO₂ stored in directly affected wetlands.
 - ▶ Discussion of potential release of carbon and CO₂ back to the atmosphere.

Outcomes – compensation measures



Results allowed to develop/ improve specific plans to mitigate/compensate impacts on highland wetlands.

- In the end only the first TWO ES were included in compensation plans (C storage was too difficult to compensate and locals didn't find this as an issue).
- Two types of compensation measures were formulated to address the first ES:
 - Social measures: irrigation systems and livestock improvement programs.
 - An **innovative plan** to improve remaining wetlands' conditions and to expand existing wetlands based on artisanal techniques practiced by Andean people in different locations around Peru.
- A complete water compensation plan was developed (also needed for other impacts of the project).
 - Included the creation of two large clean water reservoirs.

Thank you.



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