Summer 8-9-2021

Geoindicators for Assessing Illegal Gold Mining Environmental Impacts In Choco, Colombia

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GEOINDICATORS FOR ASSESSING ILLEGAL GOLD MINING ENVIRONMENTAL IMPACTS IN CHOCO, COLOMBIA

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ABSTRACT

In Choco, **artisanal gold mining** has taken place for centuries. However, since 2009, with the rise in gold prices, alluvial mining has been **mechanized**, causing social and environmental devastation.

Colombia´s T-622 (2016) ruling calls for the restoration of affected areas. Geoindicators could be used to assess the environmental impacts before restoration.

INTRODUCTION

To remediate mining impacts, establishing a **baseline** and **measure water and soil quality** is the first step. Geoindicators could provide a good understanding of the cycling of potentially toxic elements released due to mining, like mercury and other metals.

Designed geoindicators can be measured systematically, with low-cost instruments and involving local communities, which are the most directly affected by these impacts.

Figure 1.

A. Pacific Rainforest

- High humidity ~14,000 mm/yr.
- Global biodiversity Hot Spot.

B. African-Colombians (90%) and indigenous (5%) people **[1]**.

C. Alluvial gold mining: Artisanal, Illegal or Criminal **[5].**

Figure 2. Gold mining in the Atrato river - Choco by using dredges and adding mercury. **Source: [1].**

WHAT ARE GEOINDICATORS?

"Measures (*magnitudes, frequencies, rates, and trends*) of geological processes occurring at or near the Earth's surface and subject to changes that are significant for understanding rapid environmental changes, 100 years or less" (p.37**, [2]).**

RESULTS IN ATRATO RIVER, CHOCO

Physical

- Lowering water table.
- High load of suspended sediments (up to 5 MT/yr), before mining (~1 MT/yr) **[4].**
- Deforestation rate in 2015 122 km^2/yr. **[5]** .

Chemical

- High acidity or low pH (6.45) **[3].**
- Moderate to high content of mercury in fishes (0.62-2.01 ppm), people (0.87-116 ppm), air (24,610 µg/m^3) and sediments (0.03-0.14 ppm) **[1]**
- Moderate to high content of lead and arsenic **[1].**

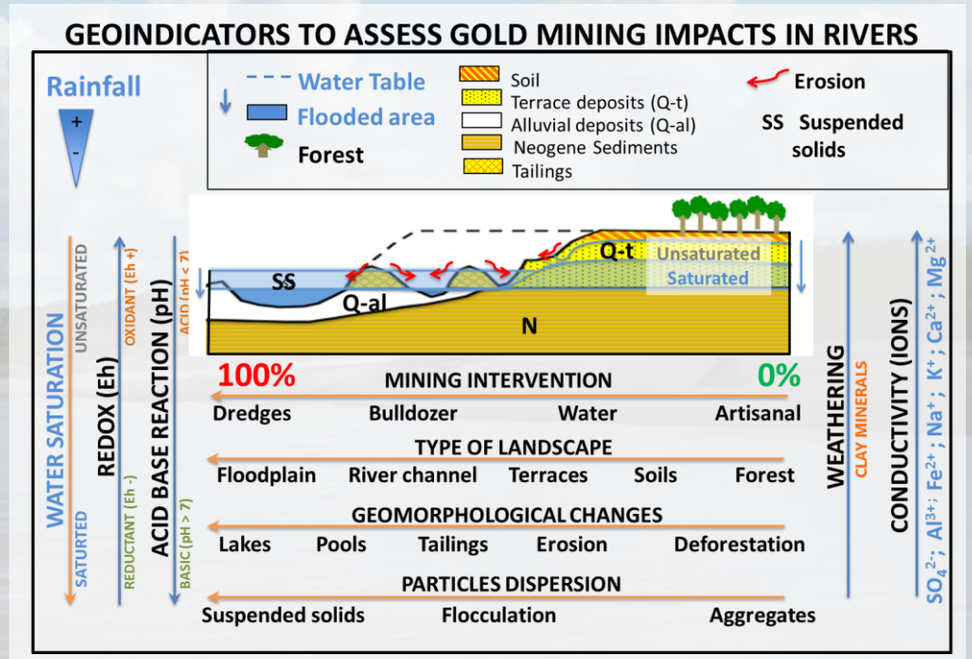

Figure 3. Geoindicators designed for alluvial gold mining . **Source:** Modified from **[4].**

CONCLUSIONS

The **illegal mining** activities lead to **deforestation** on the terraces, generating , increasing sediment transport, **lowering the water table**, and consequently exposing new oxidation zones that **increase acidity**, releasing and transporting potentially **toxic metals, including mercury**, in the aqueous medium.

The proposed geoindicators measure the **physical and chemical changes**: **Land cover, alluvial geomorphology, water, and soil quality**. Through pH, conductivity, and mineral content, these geoindicators could be implemented to assess environmental impacts with community monitoring.

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