## Exploring planetary health from Space: Utilizing Remote Sensing to Detect Alterations in Paramo Vegetation for Contamination Studies and Remediation Planning

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Paramos, unique and biodiverse ecosystems confined to the high mountain regions of the tropics, are under threat [1]. These tiny ecosystems, particularly in Colombia, are not only key carbon repositories but also crucial sources of drinking water. Over the decades, the vegetation of these paramos has been deteriorating rapidly, primarily due to mining and agricultural activities. This decline is likely to accelerate due to increasing anthropic pressure mainly related to climate change and increasing wildfires.

Recent studies have revealed contamination in the drinking water sources of paramos, attributed to coal mining activities [2]. The widespread wildfires in early 2024 have likely intensified the dual problems of vegetation loss and water supply contamination, thereby jeopardizing Colombia's primary drinking water source [1]. We use satellite remote sensing as a tool to support geochemical studies of soil and water contamination in the most affected paramos of central Colombia, by identifying the location and extent of land cover change from both direct human interventions such as land clearing for agriculture and mining (which are also potential local contamination sources), and indirect damage to paramo vegetation from coking coal soot, wildfires, and smoke. Anthropic activity often results in removal and/or burning of paramo vegetation likely affecting soil properties such as soil chemistry or physical structure, which may drastically reduce its ability to filter contaminants. These soil alterations, in turn, are likely to affect vegetation patterns.

While soil properties and contamination are not directly measurable from space, the land cover changes and alterations in the spectral signature of vegetation caused by soil and air contamination provide a map for targeted soil and water geochemical studies. This approach facilitates efficient remediation planning, thereby contributing to the preservation of these unique ecosystems.

References:

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