

Peru & Bolivia Climate

Estimating Soil Organic Carbon using Earth Observations to Inform Irrecoverable Carbon Reserve Management

Abstract

Irrecoverable carbon (IC) reserves contain large stores of the element, are at risk of being released due to human activity and consequentially contribute to global warming upon eviction. The Amazon, which covers about 0.5% of Earth's surface, contains the largest and highest-density reserves of IC. Conservation International (CI) works with local communities to establish and expand protected areas to prevent the loss of these reserves. This project's research strived to help CI better understand soil organic carbon (SOC) stocks and supplement their ability to monitor SOC changes in South America through a remote sensing lens.

Earth observations utilized included the Soil Moisture Active Passive Level 4 Carbon Net Ecosystem Exchange (SMAP L4C) product and Level-2A true color imagery from Sentinel-2 MultiSpectral Instrument (MSI). SOC distribution maps and trend analyses were generated for Peru and Bolivia between 2016 and 2022. SMAP L4C SOC estimates were then compared to SoilGrids, CI's current SOC data source. Additionally, a methodology for monitoring SOC utilizing SMAP will allow CI to monitor future changes.



with Mann-Kendall

Time series of SOC by

plant functional type

Peru and Bolivia SOC Latitude Profile

0

Root mean square

error SMAP vs

SoilGrids for

2021, and 2016-

2021



The project determined that trends of significantly decreasing SOC generally occurred within the extent of the Atacama Desert while most area outside had increased. Overall, SOC increased across the entire study period for each plant functional type and the overall mean. SMAP agrees with SoilGrids in the eastern portion of the study area and within the Bolivian Amazon, but disagrees along the Andes range and in northeastern Peru.

Objectives

- Estimate soil organic carbon stocks for Peru and Bolivia annually between January 1, 2016 – November 8,2022 and analyze change over time.
- Compare outputs data of soil organic carbon stocks between SMAP L4C and SoilGrids.
- Visualize soil organic carbon abundance in Peru and Bolivia.

Earth Observations



Results

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Peru and Bolivia SOC Distribution

(2021)

Study Area





A N N I V E R S A R Y

Conclusions

SMAP L4C shows increases of SOC over the study period with desert regions being the exception However, SOC stocks are generally larger in arid and mountainous regions.

The SMAP L4C outputs do not agree with SoilGrids closer to the equator which may have to do with the models underlying the two datasets. Further analysis could increase the granularity of the SOC outputs and connect changes in land cover with SOC. Overall, this methodology will help CI monitor changes in SOC and connect what they find with their partners on the ground.

Project Partners

The NASA DEVELOP team partnered with Conservation International (CI).

Combining scientific research, fieldwork, and collaborations, CI aims to protect and restore nature for climate through collaboration and partnership with Indigenous peoples and local communities.

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