

Data-driven Modelling to Quantify Soil Organic Carbon in Burnt Croplands: An Integration of Remote Sensing and Machine Learning

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Background

Burnt croplands often result from stubble burning (SB), which is a deliberate ignition of vegetative materials in an agricultural field after the economic portion is harvested



Prevalence

- Globally: ~81 million ha per year
- India: Punjab & Haryana ~72 Mt per year

Negative impacts

- Depletion of soil nutrients *
- Deterioration of air quality
- Socio-economic impacts

* ~30% loss of soil organic carbon (SOC), 25-70% nitrogen

Research Gaps & Objective

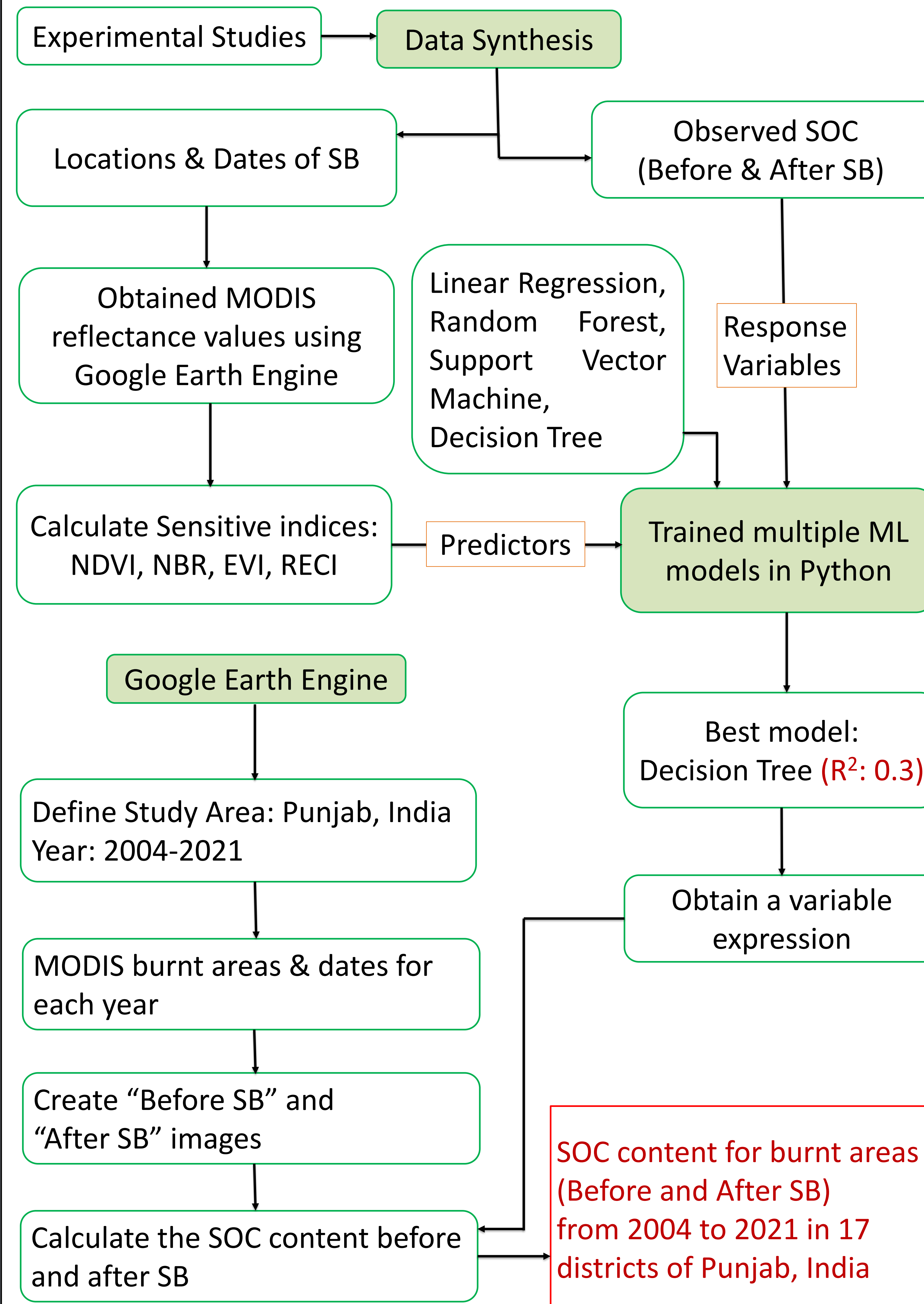
Research Gaps

- Limited long-term studies on stubble burning and SOC, and findings remain contradictory
- Modelling studies are absent

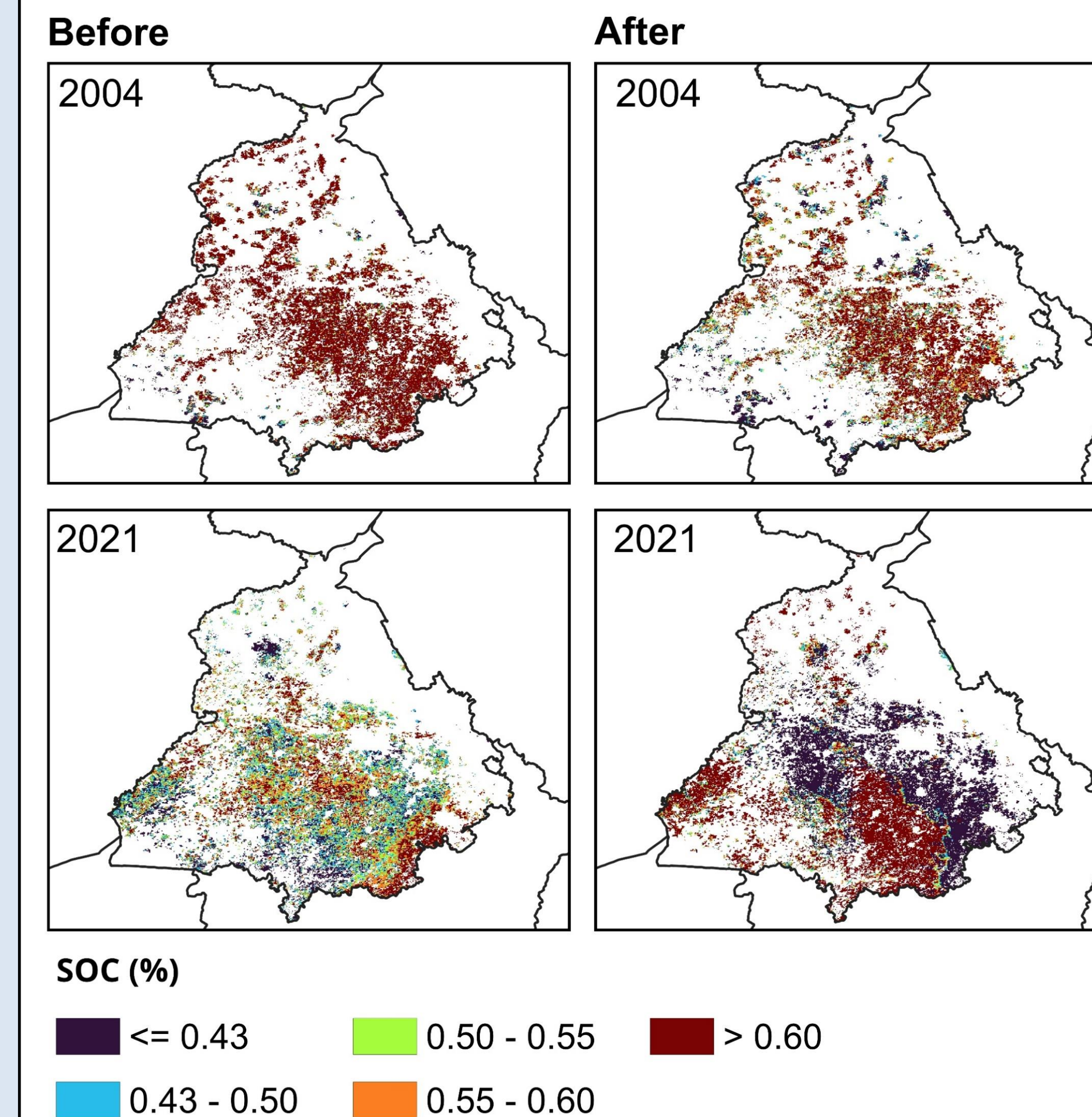
Objective

- Track long-term change of soil organic carbon (SOC) due to stubble burning in Punjab, India
- By integrating satellite-derived indices + Machine Learning models

Methodology

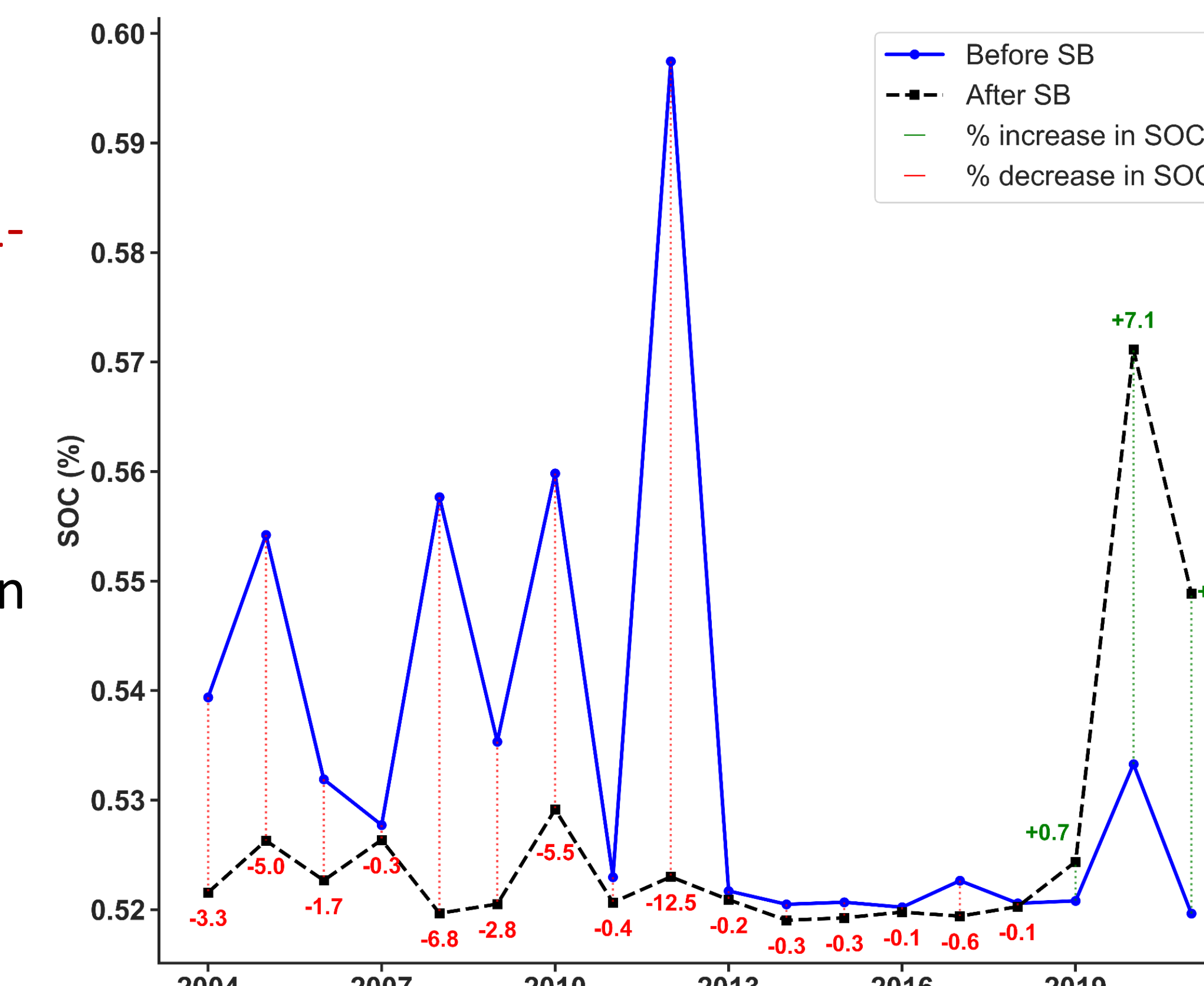


Results



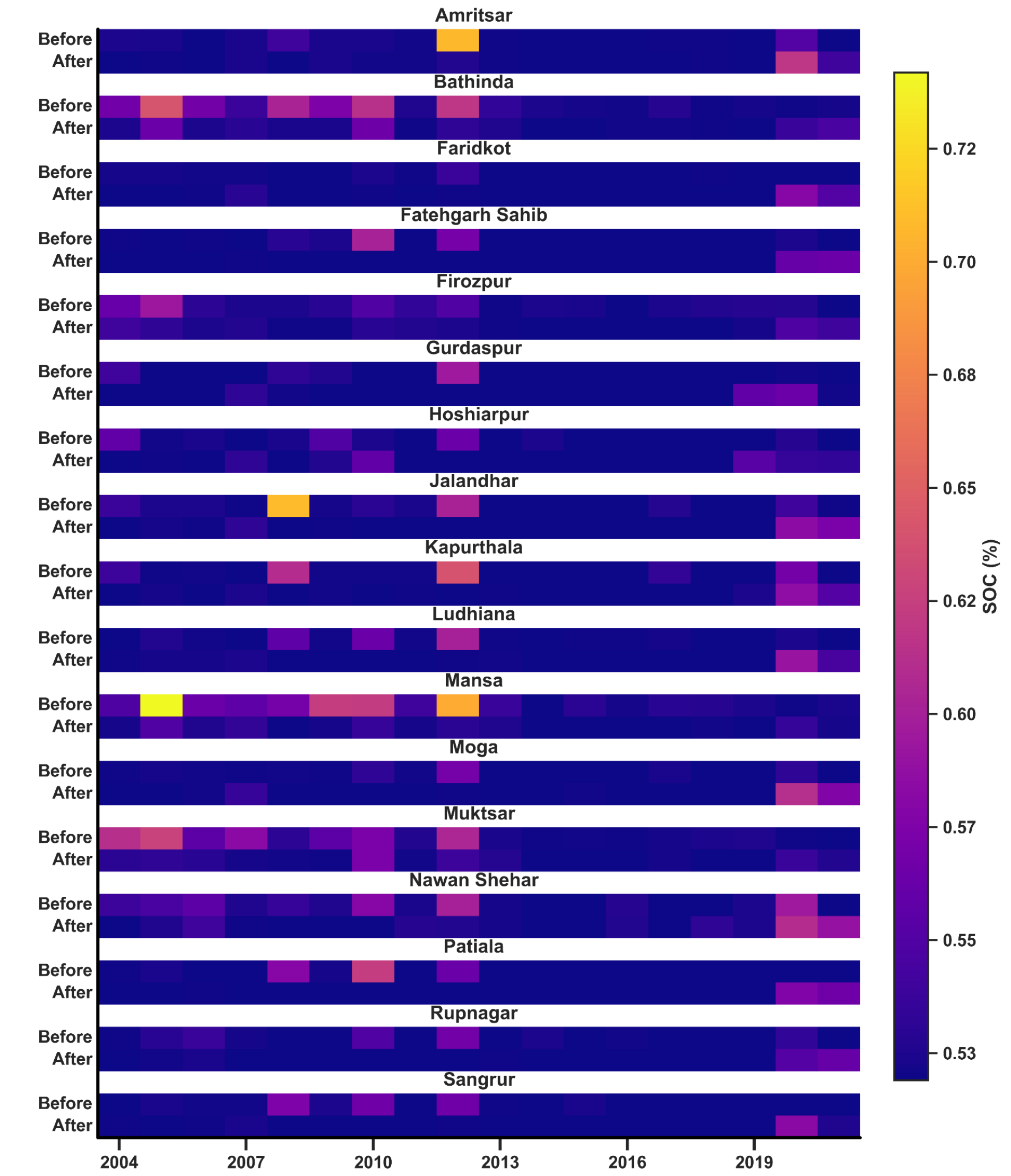
Remote sensing images of SOC status in 2004 and 2021, before and after SB

SOC loss (0.1-12%) driven by combustion-induced mineralization



State-level change in SOC after SB from 2004 through 2021

Change in SOC after SB in districts of Punjab, India



SOC gain (0.7-7.1%) from ash deposition and incomplete combustion of organic matter