Estimating the Impacts of Land Degradation on Changes in Crop Yields and Soil Carbon Stocks in Sub-Saharan Africa

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**Impacts of Land Degradation**
- Studies have investigated the impacts of land degradation on productivity (FAO, 2002, den Bakker et al., 2004) and soil quality (Li et al., 2004) of croplands and further linked them with important socio-economic issues like food security and economic cost (Boojo 1996) in regional and global scales.
- Through these studies, land degradation has been identified as one of the most serious threats to food production especially in Sub-Saharan Africa (SSA) where some 200 million population is trapped in a vicious poverty cycle between land degradation and the lack of resources or knowledge to generate adequate income and opportunities to overcome the land degradation (Baron et al., 2004).

**Land Degradation**
- Over the past few decades, greater attention has turned to the impacts of land degradation on the productivity of land and its ability to provide ecosystem services (Nkonya et al., 2013).
- **Definition of land degradation**
  - A decline in the current and potential capability of soils to produce quantitatively and qualitatively goods and services (FAO, 1979). More recent definition of the United Nations Convention to Combat Desertification (UNCCD) 1996 extended land degradation to spatial and time dimensions and listed important processes caused land degradation.
  - Soil erosion caused by wind and water.
  - Deterioration of the physical, chemical, and biological properties of the soil.
  - Long-term loss of natural vegetation.

**Key components**

**Modeling Framework**
1. **Prepare data for agronomic, climatic, and soil data**
2. **Analyze yield trend to estimate the impacts of soil fertility on yields**
3. **Reconstruct yield trend for the period of 1981 to 2010**
4. **Run Surrogate CENTURY soil organic C (SOC) model to inversely model soil carbon**
5. **Reconstruct soil carbon change for the period of 1981 to 2010**

**Reference**