

# **Enhancing Climate Change Mitigation and Adaptation: A Comprehensive Review of Natural Climate Solutions, With Emphasis on Tree-Based Systems and Trees Outside Forests (TOF) In The SARI Region**

## **1. Synthesis Of Observation Data on Tree Cover Extent, Rates, And Hotspots**

David Skole will coordinate the observation and remote sensing synthesis activities. Each Investigator will co-lead these efforts with regional collaborators. Each Investigator will co-lead these efforts with regional collaborators.

### **1.1 Assessing Trends in Tree Cover Change**

Objective:

The primary objective of this phase is to synthesize observational data obtained through remote sensing and inventories to identify trends in Land Cover and Land Use Change in the SARI region. By analyzing current data, we aim to address the following questions:

- What are the recent trends in Land Cover and Land Use Change, especially regarding forests, trees outside of forests, and agricultural cover and use in the SARI region?
- What do the best projections suggest about the future directions of these land cover changes?

Approach:

- Assess changes in cover for all types of Tree-Based Systems (TOF), including natural forests, planted forests, agroforestry systems, and other tree-based landscapes.
- Focus on trends in plantation systems, which play a vital role in the region's economy.
- Emphasize smallholder tree-based systems, while also considering the increasing significance of orchards and other commercial tree-based systems in the SARI landscape.

- Compile and analyze existing LCLUC projects and literature to gain insights into the basis for the observed trends and future projections.

#### Responsibilities:

- David Skole: Coordinate the assessment of forest and overall TOF cover changes.
- Randolph Wynne: Lead the assessment of plantation systems.

### 1.2 Identifying Important Types of TOF and Hotspots

#### Objective:

This phase aims to identify important types of Tree-Based Systems (TOF) and "hot spots" with significant increases in biomass and carbon stocks from tree cover in the SARI region.

Identifying such regions is crucial as they may have a significant impact on atmospheric carbon dioxide removal.

#### Approach:

- Utilize datasets from the project and official sources to identify geographic locations where notable changes in tree cover have occurred compared to other areas.
- Analyze these regions to determine the drivers behind the observed changes and their potential implications for climate change mitigation.

### 1.3 Assessing Impact on Biomass

#### Objective:

The goal of this phase is to investigate the impact of observed changes in tree cover on biomass in Tree-Based Systems (TOF) outside the official Recorded Forest Area (RCA) in rural landscapes.

#### Approach:

- Utilize methods developed in recent LCLUC projects (Skole et al., 2021b) to assess individual tree biomass.
- Evaluate whether changes in tree cover are accompanied by changes in biomass, particularly in economically significant TOF systems.

#### 1.4 Reporting on Advances in Methods for TOF

##### Objective:

This section will provide an overview of the current state of practice for large-scale monitoring, measuring, and mapping Tree-Based Systems (TOF) cover and biomass using remotely sensed data. Additionally, we will explore potential methodological advances to enhance monitoring capabilities.

##### Approach:

- Conduct a comprehensive review of existing methodologies and technologies used for monitoring TOF cover and biomass.
- Identify potential areas for improvement and propose future methodological advancements.

## **2. Synthesis Of Drivers for Observations from Monitoring**

DeFries will coordinate the synthesis of drivers and processes, focusing on land and forest degradation and tree cover regeneration.

### 2.1 Synthesizing Explanatory Drivers and Processes

##### Objective:

This phase aims to evaluate the relationship between tree based (TOF) landscapes and livelihoods in rural areas, considering a range of social and economic indicators. By comparing

landscapes with and without tree-based systems, we seek to understand differences in TOF abundance and changes in intensively cropped areas.

Approach:

- Downscale economic and census indicators to village clusters for a more localized assessment.
- Analyze livelihood and income indicators to understand how tree-based systems impact rural economies.
- Conduct a comparative analysis of landscapes with and without tree systems to identify specific drivers of tree cover change.

Responsibilities:

- Aditya Singh: Lead the assessment of social and economic processes related to tree cover drivers.
- Joshua Gray: Analyze the processes driving tree cover change in intensive cropland landscapes.

## 2.2 Examining Specific Drivers: Farmers' Promotion of TOF

Objective:

This phase aims to investigate whether observed increases in Tree-Based Systems (TOF) are directly and actively promoted by farmers. Additionally, we seek to understand how socio-economic drivers, livelihood strategies, and benefits from ecosystem services influence farmers' decisions regarding tree cover.

Approach:

- Utilize econometric models to analyze market and non-market farmer choices.

- Identify opportunities to promote tree cover through leveraging traditional practices and incentivizing ecosystem services.

#### Responsibilities:

- DeFries and Skole: Coordinate the assessment of drivers related to ecosystem services valuation.

### 2.3 Analyzing Specific Drivers: Institutions, Governance, and Policy

#### Objective:

This phase will evaluate how policies, governance, and farm-level decision-making impact the formation and retention of tree-based landscapes and increased levels of biomass in non-forest landscapes.

#### Approach:

- Conduct an in-depth analysis of institutions and non-econometric factors affecting tree cover.
- Evaluate the effectiveness of governance and policies in supporting tree-based systems.
- Consider non-income or non-economic factors that influence farmers' decisions regarding tree cover.

#### Responsibility:

- Forrest Fleischman: Lead the assessment of policy, governance, and political drivers of tree cover establishment and change.

## 2.4 Identifying Effective Models for Climate Change Mitigation and Adaptation Policies

### Objective:

This phase aims to identify effective policies and measures for climate change mitigation and adaptation that improve livelihoods, enhance resilience, and promote sustainable tree-based landscapes.

### Approach:

- Evaluate existing policies and market forces to identify successful interventions.
- Propose evidence-based strategies and measurement methods to assess the effectiveness of these policies.
- Focus on AFOLU (Agriculture, Forestry, and Other Land Use) measures and explore their integration within the REDD+ framework.