Untangling the drivers of land conversion in Sub-Saharan Africa, Latin America, and Southeast Asia: A systems approach

INTRODUCTION

Globally, agriculture-driven land conversion is one of the most pervasive threats to biodiversity conservation[1]. At the same time, nearly one in three people worldwide did not have access to adequate food in 2020[2]. While many sustainability-oriented agriculture interventions such as conservation agriculture and sustainable intensification are implemented with the goal of reducing land conversion, evidence of their programmatic effectiveness remains elusive. Reconciling the need for land for agriculture and land for conservation is one of the most significant development challenges we face. This presents a complex issue that requires a holistic understanding in order to design effective programs that simultaneously mitigate land conversion while supporting food security and nutrition.

Systems Mapping
A process that combines multiple perspectives and data sources to identify the factors affecting a particular issue and how the interconnections between these factors drive outcomes of interest. When developed through a consultative process, the map can build a shared understanding of the context within which the issue exists.

The United States Agency for International Development (USAID) commissioned a research study to investigate what drives smallholder farmers to convert natural lands to agriculture production spaces in three high biodiversity regions: Latin America, Sub-Saharan Africa, and Southeast Asia.

The purpose of this technical brief is to highlight findings from the research study and entry points for action in the context of USAID programming.

Using a systems mapping approach, researchers sought to address the following research questions;

- *What factors drive smallholders to convert biodiversity-rich landscapes into agricultural landscapes?*

- *How are these factors connected? And through these connections, which of these factors serve as potential leverage points (areas for intervention) in reducing land conversion?*

- *How do these factors and their relationships vary across broad regional and global contexts?*

A Systems Approach to a Complex Issue

Data Collection

Peer and Gray Literature

Expert Perspectives

Research Approach

Researchers iteratively collected data through structured literature database searches and key expert interviews. A cross-sectoral Steering Committee, composed of agriculture and biodiversity experts across USAID, helped identify key evidence and validate findings for each region.
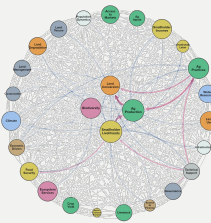
The researchers built systems maps for each region by qualitatively coding references to causal statements in the literature that connect two factors together. The team then combined these references to explore how frequently each factor-on-factor interaction was identified across literature sources.
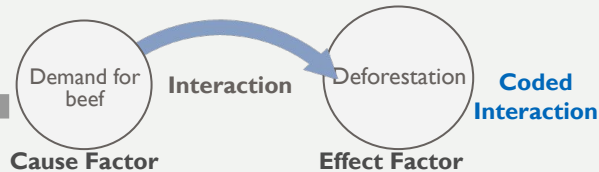
Data Analysis

Qualitative Coding

Systems Map

Qualitative Coding Example

"Deforestation is driven by the demand for beef"

Causal Statement

Demand for beef — **Interaction** → Deforestation — **Coded Interaction**

Cause Factor   **Effect Factor**

Meaning Making

Participatory Vetting Sessions

Regional Systems Maps

Sub-Saharan Africa   Latin America   Southeast Asia

Finally, the researchers organized three regional workshops with stakeholders, including researchers and practitioners, to corroborate and enhance the systems maps. The vetted maps were then analyzed using systems tools that examine the structure of the system and the drivers of the land conversion outcomes.

Using this process, the team identified over 2,000 interactions across 1,200 context-specific factors, which they grouped into 27 aggregate factors and 470 interactions. Notably, the team found that the roles these factors play in driving land conversion and their interactions vary substantially across the geographies studied. The team also found gaps in the evidence which practitioners might fill to improve programming.

Systems Analysis: Influence Mapping

There are many ways to analyze and graphically represent a system of factors and interconnections. This study used *influencing mapping*, an approach that classifies factors by the different roles they play in the system, with the goal of identifying factors to target with interventions to improve the systems' outcomes. In the influence map below, factors are plotted based on the number of references as a cause factor (vertical-axis) and the number of references as an effect factor (horizontal axis). Dividing the map into quadrants categorizes the factors into four types: leverage factors, core factors, outcome factors, and sensitive factors, each described below. Influence maps for each region are shown on the following pages.

Influence Map
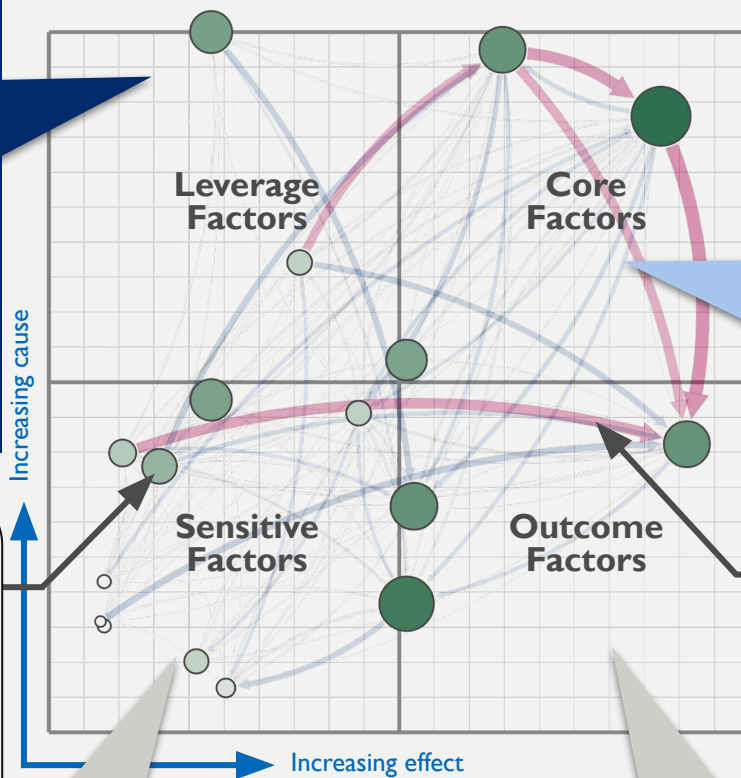
Leverage Factors identify where small changes might transform how a system functions because they affect many factors but are not affected by the factors themselves. These factors represent the key areas to target for interventions.

Core Factors are at the center of the system because they both affect and are affected by many other factors. Thus, they cannot be easily influenced directly by interventions, but will be shifted by systemic changes.

Leverage Factors

Core Factors

Sensitive Factors

Outcome Factors

Increasing cause

Increasing effect

Factors are any element that directly or indirectly influences the system. Factors can be technical, financial, institutional, environmental, or social (e.g., governance, coordination). Factors are sized and colored relative to how many connections they have: the larger and darker in color the circle, the more connected the factor is to the system overall.

Interactions are the influences that factors exert on one another. They are represented by arrows pointing from the factor causing the effect to the factor being affected. They are sized and colored relative to how frequently they are referenced in the literature: the thicker the lines, the stronger the connection. Strongest interactions are red.

Sensitive Factors are neither influential nor highly influenced, but are sensitive to changes in the rest of the system. These factors are not labeled in the following maps because they are not likely to lead to change or impact.
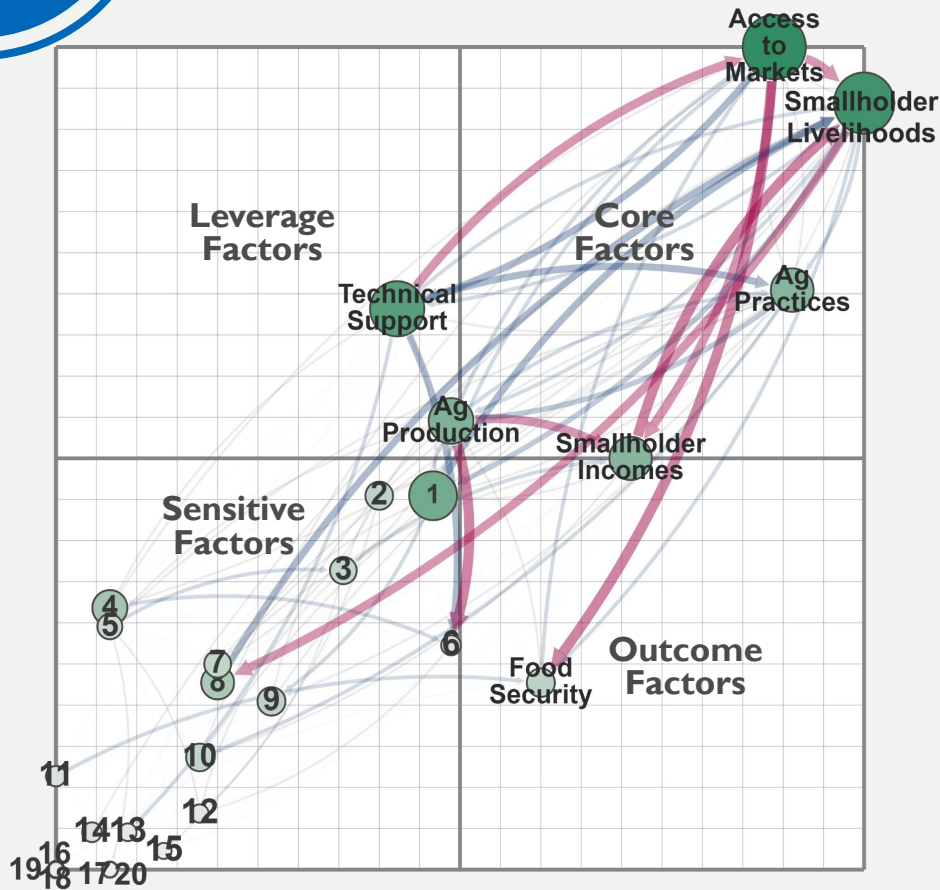
Outcome Factors are the factors that are most strongly affected by the system. Because of this, they are the most important factor to monitor to gain a better understanding how the system responds to change over time.

Findings: Sub-Saharan Africa

Sensitive Factors
1. Ag Inputs
2. Land Tenure
3. Livestock
4. Governance
5. Climate
6. Land Conversion
7. Smallholder Labor
8. Access to Finance
9. Crop Yield
10. Economic Drivers
11. Population Dynamics
12. Biodiversity
13. Ecosystem Services
14. Land Management
15. Land Degradation
16. Socio-Cultural Factors
17. Water Resources
18. Conservation
19. Infrastructure
20. Land Use

Leverage Factors

Core Factors

Sensitive Factors

Outcome Factors

Access to Markets

Smallholder Livelihoods

Technical Support

Ag Practices

Ag Production

Smallholder Incomes

Food Security

KEY FINDINGS

In Sub-Saharan Africa, **smallholders' livelihoods** *(*including their health, security, and resilience, separate from *smallholder incomes)* and their **access to markets** are at the core of land conversion. This is due to these factors' connections to **food security** and **smallholder incomes.** Improving market access and increasing incomes may reduce economic pressures that drive smallholders to convert land.

Technical support to smallholders to improve agriculture and biodiversity outcomes is a clear leverage factor in this context. To address this factor, experts noted that resources must be tailored to local contexts and integrate farmers' existing knowledge.

The influence map shows that **food security** is a key outcome of this system. This suggests that monitoring progress on this factor will capture system-wide changes in the drivers of land conversion.
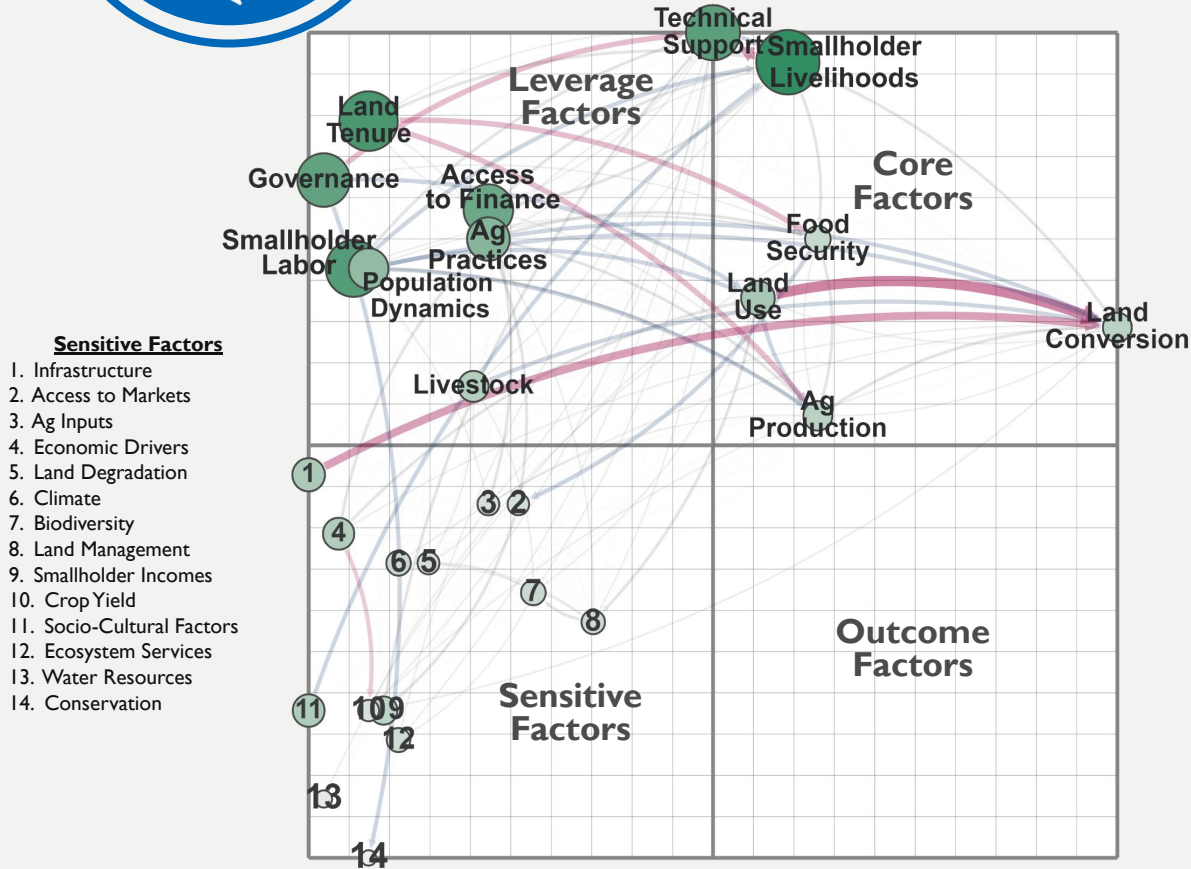
Expert Perspective

❝ *The dominant methods of agriculture extension are still fundamentally top-down with little recognition of farmer needs. Farmer adaptation of practices or feedback on practices is rarely taken into account* ❞

Findings: Latin America

Leverage Factors

Core Factors

Outcome Factors

Sensitive Factors

Technical Support · Smallholder Livelihoods · Land Tenure · Governance · Access to Finance · Ag Practices · Smallholder Labor · Population Dynamics · Food Security · Land Use · Land Conversion · Livestock · Ag Production

Sensitive Factors
1. Infrastructure
2. Access to Markets
3. Ag Inputs
4. Economic Drivers
5. Land Degradation
6. Climate
7. Biodiversity
8. Land Management
9. Smallholder Incomes
10. Crop Yield
11. Socio-Cultural Factors
12. Ecosystem Services
13. Water Resources
14. Conservation

KEY FINDINGS

In Latin America, **smallholders' livelihoods**, **food security,** and **land use** policies and enforcement are at the center of land conversion.

There are many opportunities for leverage in this region including; **technical support, land tenure, governance, access to finance, smallholder labor, population dynamics,** and **livestock**.

These factors point to the need to focus technical support programs on integrated agricultural cropping systems to reduce land impacts from **livestock**, map existing governance and legal structures to identify entry points for land tenure reform, and improve land use planning to focus on **infrastructure** siting and land use changes.

Expert Perspective

"*Integrated crop-livestock systems could help increase crop productivity and nutrition outcomes. However, livestock also provides the means to increase farm size and opens new land with ploughing.*"

Sensitive Factors
1. Population Dynamics
2. Land Management
3. Climate
4. Livestock
5. Technical Support
6. Conservation
7. Water Resources
8. Access to Markets
9. Infrastructure
10. Smallholder Incomes
11. Land Use
12. Land Tenure
13. Land Degradation
14. Smallholder Labor
15. Ag Inputs
16. Food Security
17. Ecosystem Services
18. Access to Finance
19. Biodiversity
20. Crop Yield
21. Socio-Cultural Factors
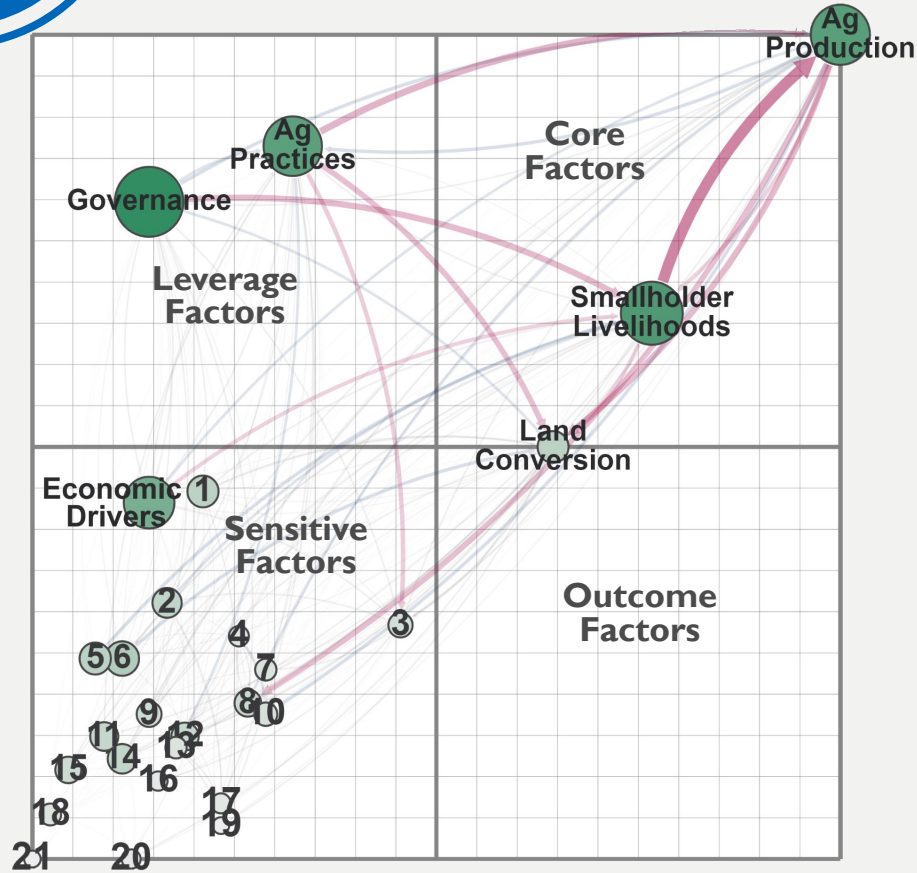
KEY FINDINGS

As in Sub-Saharan Africa and Latin America, **smallholders' livelihoods** is a core factor, but in Southeast Asia, **agricultural practices**, a leverage factor that includes destructive forestry practices identified in the literature and by experts, drives land conversion. This suggests that reducing harmful forestry approaches could support livelihoods while reducing land conversion.

The influence map also highlights the role of **governance** as a clear leverage factor in this region. The analysis suggests that practitioners can map the policy landscape at a regional level to identify the most impactful mechanisms to reduce land conversion.

The findings also suggest that where local governments lack planning and enforcement capacity, practitioners could strengthen local community members to play those roles. Finally, it indicates that identifying **economic drivers** could change the financial incentives to inhibit land clearing and speculative deforestation.

Expert Perspective

" *In many places, local people need to be a part of the enforcement. This is true in community forestry, where some people do their own policing, as countries don't have budgets to enforce policies.* "

Implications for Programming

The systems mapping analysis highlighted the highly context-specific nature of the factors that drive land conversion outcomes and the connections between them. While this points to a need to understand how these drivers exert themselves within a given locality, the analysis also identified factors that can be leveraged across all regions for systems-level change, listed below.

Smallholder Livelihoods
The resilience of smallholders' livelihoods is central to reducing the economic pressures that drive land conversion. To be sustainable, biodiversity and agriculture programs must ensure that measures to reduce land conversion also improve smallholders' food security and well-being.

Access to Markets
Expanding access to markets and finance can make agriculture more profitable and reduce economic pressures to convert land. To protect against unintended consequences of unconstrained land conversion, programs need to verify that conducive governance and economic enabling conditions are in place before designing market access activities.

Land Tenure
Ensuring rights and access to farmland can improve agricultural outcomes by protecting against land grabbing, thus giving smallholders the confidence to invest in sustainable practices. Strengthening national institutions and local governance to improve land tenure systems for smallholders is critical.

Governance
The actions of local, regional, and national governments impact nearly all aspects of systems driving land conversion through legal, economic, and policy mechanisms. Strengthening legal frameworks for land tenure, creating beneficial market conditions, and enforcing conservation policies are all potential systems-wide levers for change.

Technical Support
Knowledge transfer of sustainable approaches such as conservation agriculture is critical to reducing negative impacts to biodiversity from harmful agricultural practices. However, technical support needs to be tailored to local needs to be impactful and promote uptake of new practices.

Agriculture Practices
Smallholders' farming and cultivation approaches are central factors influencing land conversion. Improving the profitability of agriculture activities can increase incomes, but practitioners should ensure adequate protections are in place to deter further land conversion.

Opportunities for Knowledge Sharing

In mapping the systems driving land conversion in different regions around the world, the researchers identified key areas where knowledge sharing could improve the impact and effectiveness of context-responsive interventions. To promote systems-scale change, researchers, practitioners, and sector actors can share lessons learned in reducing land conversion, including;

- The role of **Indigenous And Local Knowledge** (ILK) in managing landscapes is increasingly acknowledged as a priority for land managers, yet these perspectives remain largely absent in the sector literature.

- Existing **Land Tenure Systems** are often the legacy of historic norms. While smallholders' rights to use and manage lands is a critical precondition for promoting investment in sustainable agriculture practices, what rights are most important in different contexts is still unknown.

- **Land Sparing Practices** show great potential for improving yields and reducing land conversion pressures, however long-term evidence of which practices are most effective is lacking.

CITATIONS

1. Brondízio ES, Settele J, Díaz S, Ngo HT, editors. The global assessment report of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES); Bonn: 2019.
2. The State of Food Security and Nutrition in the World 2021. FAO, IFAD, UNICEF, WFP and WHO; 2021. Available from: http://www.fao.org/documents/card/en/c/cb4474en.

For more information about this study, including the detailed methodology, full list of factors, and papers included in the analysis, see the published manuscript or contact Sara Carlson at scarlson@usaid.gov.

For more information about USAID's biodiversity programming, see biodiversitylinks.org.

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