Assessing the downstream socioeconomic and land health impacts of agroforestry in Kenya

Inception Workshop on Under-evaluated Areas of CGIAR Research

Organized by the CGIAR Independent Science and Partnership Council's
Standing Panel on Impact Assessment (SPIA)
Hosted by the **International Food Policy Research Institute (IFPRI)**
at
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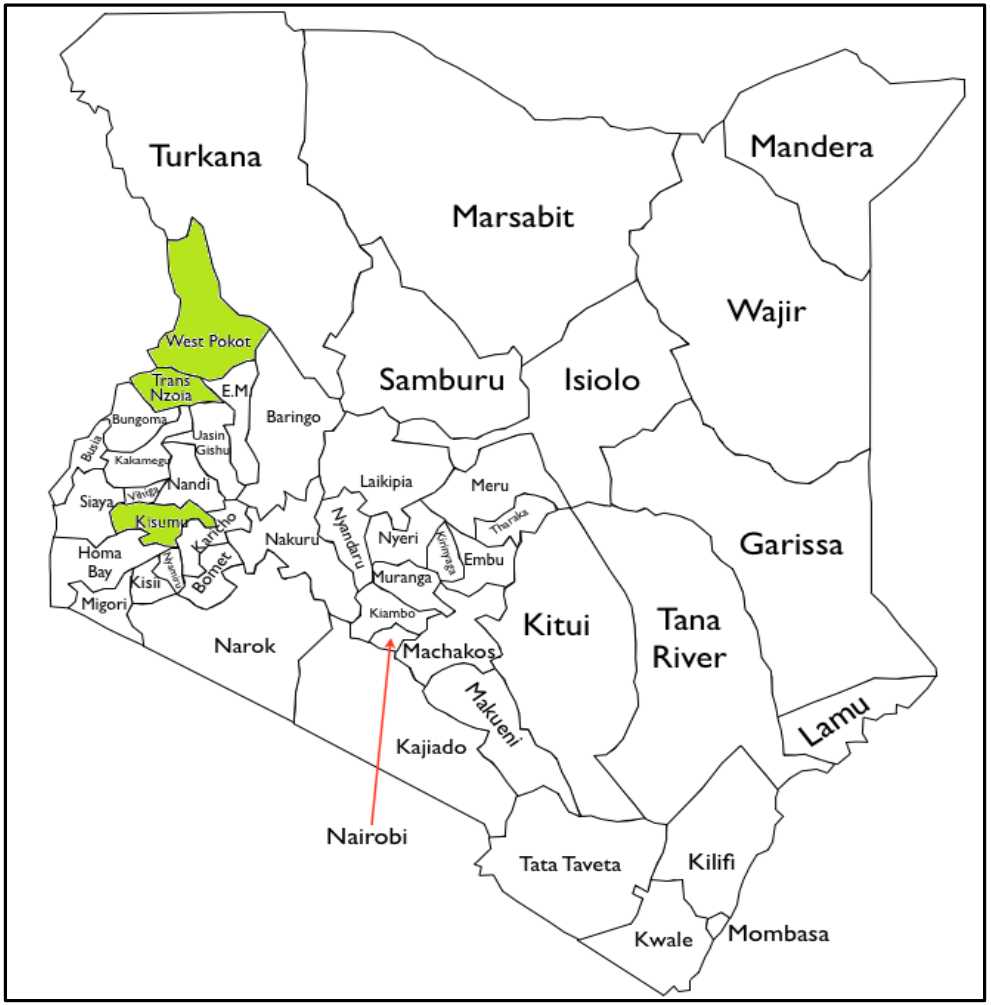
1. Introduction

- **Study is challenging in that it seeks to assess the longer-term (and interactive) effects—socio-economic & environmental—of integrated agroforestry (AF) practice *in absence of a planned impact assessment design*.**

- **Work of Vi selected because (a) it has been intensively promoted integrated AF (alone) in selected areas for considerable time; and (b) significant collaboration took place with ICRAF scientists over the years**

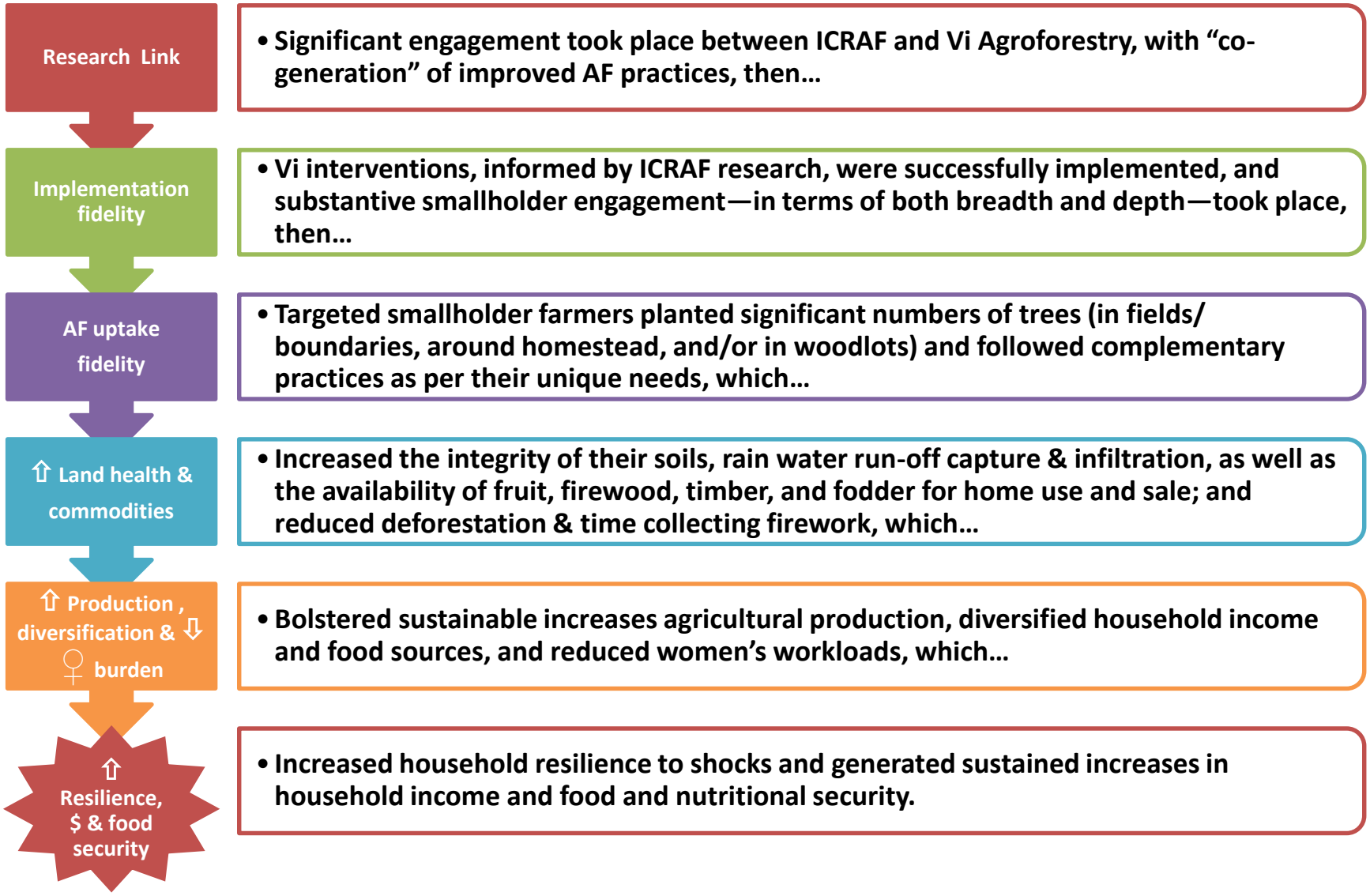
- **3 Kenyan counties selected, given that they have been a significant focus of Vi's work and are considerably different both agro-ecologically and socio-culturally**



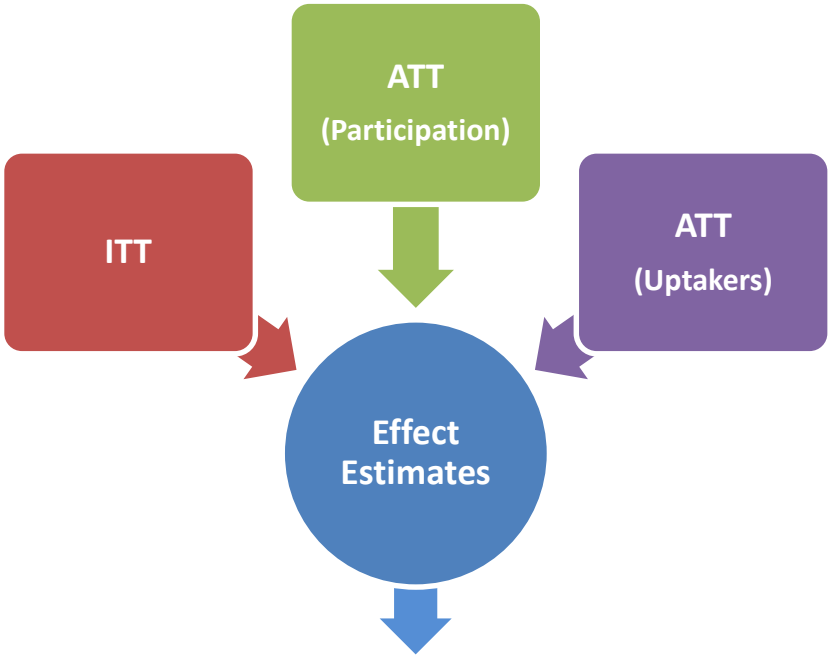
2. Research Questions

CGIAR/ICRAF Link	• To what extent and in what ways have Vi's extension efforts been influenced by ICRAF's research on agroforestry, particularly with respect to the interventions promoted in the study's three sites?
Agroforestry Uptake ('Adoption')	• What are the rates of agroforestry practice uptake where it has been intensively promoted vis-à-vis areas where it has not?
Treatment adaptation	• To what extent and in what ways have smallholder farmers modified promoted agroforestry practices in general and adapted them to local conditions in particular?
Heterogeneity of treatment uptake	• Is the uptake of agroforestry and related practices differentially distributed among different categories of farmers and, if so, what are the main factors driving this?
Drivers of uptake and 'dis-adoption'	• What are the key reasons why farmers have chosen to practice, not to practice, or discontinue practicing promoted agroforestry practices?
Socio-econ. ITT & ATT (or LATE?) effects	• Do households in areas where specific agroforestry practices have been explicitly promoted tend to be better off in their socio-economic status and, if so, to what extent can this be plausibly attributed to their uptake of such practices?
Land health ITT & ATT (or LATE?) effects	• To what extent does the uptake of integrated agroforestry practices improve land health, e.g. increase soil fertility and reduce soil erosion?
AF practice heterogeneity	• Is there evidence that the uptake of specific agroforestry practices yields more impact than the uptake of others?
Treatment effect heterogeneity	• To what extent are the impacts of agroforestry differentially distributed across different biophysical and sociocultural contexts and specific categories of farmers, e.g. male and female headed and those relatively poorer and richer?
Impact pathways (mechanisms)	• If longer term impacts of agroforestry are identified in one or more of the study's sites, what are the impact pathways likely responsible?

3. Overarching Impact Pathway
(Main Steps Along Causal Chain)



4. Identification Strategy



Purposive matching of intervention & comparison villages	• **Key matching criteria: setting; accessibility; agro-ecological & bio. features; pop.; settlement patterns; and other?** • **Comparison villages: No substantive efforts to promote AF**
Dif.-n-Dif. combined with PSM	$(\Delta Y_i^1, \Delta Y_i^0) \perp T_i \mid P(X_i)$, **but still IV hunting**
Theory-based & qualitative methods	• **Both factual & counterfactual analysis along causal chain** • **Qual. methods: identify covariates; triangulation; mechanisms; interrogate unexpected results (42 semi-structured interviews)**

5. Power Calculation & Sampling Strategy

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. clsampsi .125 .05, k1(42) k2(42)  m1(20) m2(30) rho(.14813)
calculate power for specified number of clusters k and cluster sizes m

Estimated power/sample size using the Satterthwaite approximate F test for
two-sample comparison of proportions with clustering

Test Ho: p1 = p2, where p1 is the proportion in population 1
                  and p2 is the proportion in population 2

Assumptions:       alpha =   0.0500   (two-sided)

                            Sample 1      Sample 2

          Proportion (p)       .125           .05
   Number of Clusters (k)         42            42
        Cluster Size (m)         20            30
  Cluster Size Var.(varm)          0             0
         Sample Size (N)        840          1260
Coefficient of Var. (cv)    1.01829       1.67764
Intra-Cluster Corr. (rho)     .14813        .14813
       SD (summary level)    .144431       .091569

                Total Sample Size:  2100
          Allocation ratio (N2/N1):  1.5
Ratio of Number of clusters (k2/k1):    1
     Ratio of Cluster sizes (m2/m1):  1.5
 Satterthwaite's degrees of freedom:  69.38
   Sample size (ni) for integration:  10000

                Estimated power: 0.8002
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- **ICC was computed from asset data associated with another study in eight districts across Kenya's former Nyanza Province in 2009 (Hughes 2012)**

- **Poverty declined in Kenya from 51% to 47% (1997-2005/6)**
- **Study powered to detect 15% drop above comparison group**
- **50% AF adoption rate assumed, so need 2X power for ITT (7.5% drop)**

- **Calculation based on cluster RCT design**
- **14 intervention & 14 comparison villages in each of the 3 counties = 84 villages in total**
- **Even with village matching, possible for covariate imbalance at HH level, so 50% more comparison households sampled**
- **All smallholder HH (<ha) in sampling frame if resided in village at baseline**

6. Indicators & Measurement

HH Wealth (Poverty) Status

- **Big challenge ⇨ No baseline data for differenced measures**
- **Assume asset ownership can be a) reliably recalled (with use of historical markers); and b) used to measure HH wealth/income status**
- **Skepticism in lit. on using assets to estimate consumption ⇨ "Just any old basket will not do!"**
- **Approach: a) collect data on current consumption & ownership of a large number of context relevant assets; b) see which basket bests estimates the former; and c) compare relative changes in ownership of these assets over time**
- **Progress Out of Poverty Index (PPI) does not seem to predict consumption well, but use same approach to estimate reductions in poverty over time**

6. Indicators & Measurement (Cont.)

Multi-dimensional Poverty Index (MPI)

- Growing interest in other dimensions of poverty, such as health status and access to essential services
- Assume that most components that make up MPI can be recalled for both baseline & endline, thereby allowing comparison of multi-dimensional poverty graduation between treatment groups

Livelihood Diversification

- Can be associated with adaptation to increasing conditions of uncertainty and risk (Asfaw et al. 2015)
- Data will be captured on the number and types of livelihood pursuits of HH both currently and at baseline, which will then be differenced over time
- Assumption: Respondents can accurately recall HH livelihood pursuits at baseline

6. Indicators & Measurement (Cont.)

Adapted Coping Strategies Index (CSI)

- **Qualitative work in each site to identify one or more significant climatic shocks experienced by both inter. & comp. villages**
- **Respondents asked to recall time of shock and measures they took to cope**

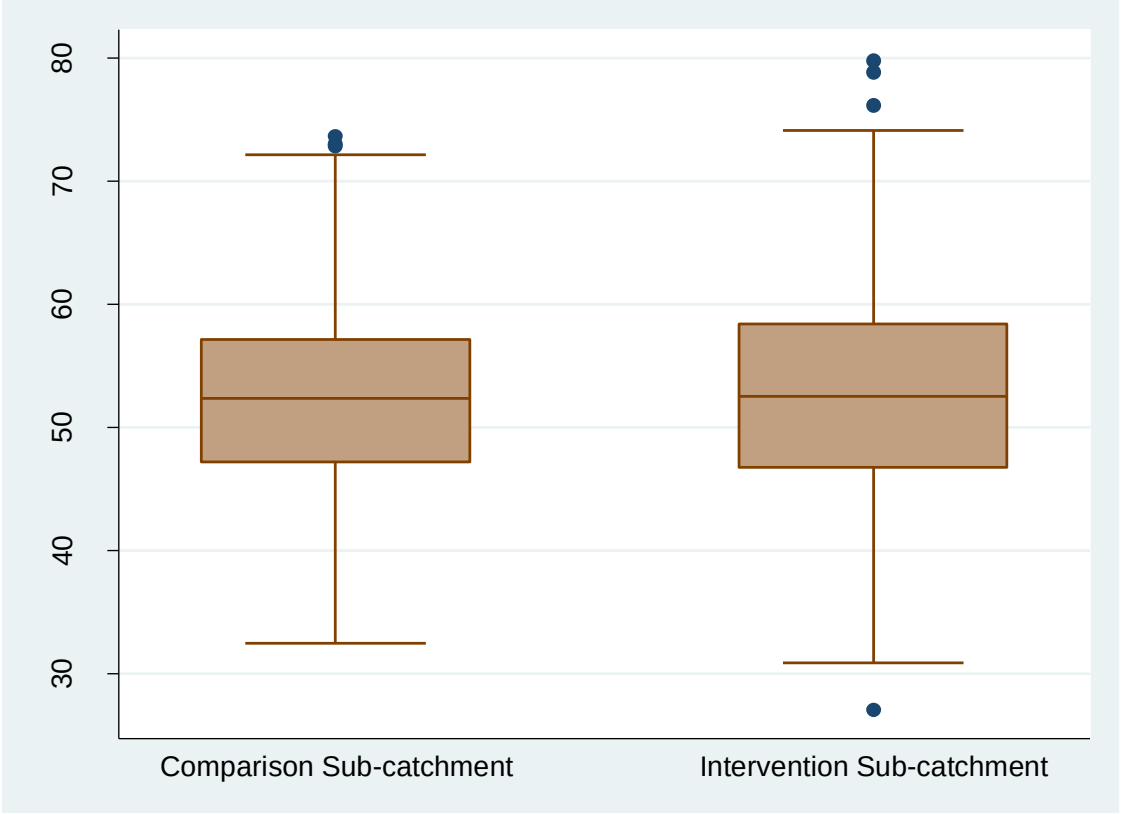
Perception-based Measures (for discussion)

- **Self-reported changes since baseline in:**
- *Food shortages*
- *Ability to meet household basic needs*
- *Crop productivity*
- *Time spent collecting firewood*

6. Indicators & Measurement (Cont.)

- **Differenced measures constructed from satellite imagery (30m resolution) based on LDSF field and lab measurements.**
  Examples:
  - Soil organic carbon
  - Soil erosion
  - Fractional vegetative cover
  - Soil pH
  - Root depth restriction

Example: Predicted Soil Erosion Differences @ Baseline:
Intervention & Comparison Sites, Samre District, Ethiopia



# of sampled fields	**800**
Avg. baseline difference	**0.48002**
t-stat.	**0.83**
Interpretation: • **% of estimated soil erosion per pixel; high in both groups**	

6. Indicators & Measurement (Cont.)

Program Participation & AF Uptake ('Adoption')

- **ITT effects will be relatively straightforward: directly compare sampled HHs in intervention & treatment villages**
- **Estimating the two ATT effects more challenging**
- **Can HH be considered treated if a representative attended a one-off training event?**
- **Most smallholders integrate trees into their farming systems at least to some degree, but can all be said to be practicing AF?**
- **Determining reasonable participation & AF practice cut-offs will take place in early phases of study, and will likely not be uniform across sites**

7. Heterogeneity (Practice & Sub-group effects)

- Specific hypotheses not finalized
- To be primarily identified through statistical interaction tests, reinforced by qual. methods

Specific Practice Effects

- Challenging, given selection
- Explore whether specific practices were promoted in particular areas or whether some exogenous factor(s) influenced uptake of specific practices
- Extension approach effects, given that Vi's approach changed over time?

Sub-group Effects

- County effects: Initial plan was to have stand alone effect estimates for each county, but budget will not allow
- Other possibilities: landholding size; tenure security; sex of HH head; baseline land health conditions

8. Links to CGIAR Research

- **Currently only anecdotal reports of significant historical collaboration between Vi and ICRAF scientists**

- In-depth interviews with long-term Vi staff & ICRAF scientists
- Documentation analysis

Process Tracing Tests

9. Key Points for Discussion

- **LATE analysis even if no plausible IV is identified (to get effects on AF uptakers)?**
- **Self-reported measures—should we even bother?**
- **Remote sensing land health measures—should we construct an index, rather than having individual multiple measures?**
- **How to specify AF practice cutoffs & ensure they are site relevant?**
- **Advice of village matching parameters?**
- **Other issues?**