# Combatting hardened soils for agricultural productivity: A proposal for measuring farmer preferences for soil and water conservation in Dosso, Niger

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# COMBATTING HARDENED SOILS FOR AGRICULTURAL PRODUCTIVITY: A PROPOSAL FOR MEASURING FARMER PREFERENCES FOR SOIL AND WATER CONSERVATION METHODS IN DOSSO, NIGER

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## INTRODUCTION

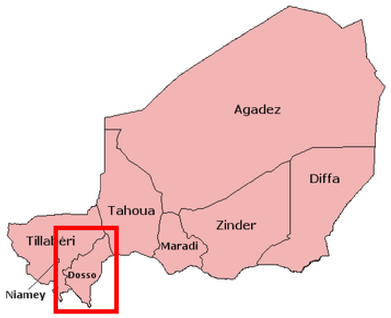
- Land degradation is caused by ***extensive agriculture, over-grazing, and wind & water erosion.***
- Land degradation can lead to ***crusting*** and ***soil compaction*** of the soil surface (***hardened soils***).
  - Soil is susceptible to further erosion and reduced water infiltration; hampers seedling emergence

## MOTIVATION

- Niger's land area is characterized by degraded, lateritic soils, susceptible to crusting.
- Niger has had some success with Farmer Managed Natural Regeneration (FMNR) to combat degradation.
- Adoption of other soil and water conservation (SWC) methods to combat erosion and prevent hardened soil is still very low.

## THE STUDY AREA: DOSSO, NIGER

- Dosso is one of seven administrative regions in ***southwestern Niger***.
  - Population: approx. 2.5 million (2012 census)
- Economy largely based on multi-crop ***subsistence agriculture*** and ***livestock production***.
- ***Security concerns in other parts of Niger*** due to extremist groups in neighboring Nigeria, Mali, and Burkina Faso.




## SWC PRACTICES FOR HARDENED SOILS

- **Planting Pits (Zai)**
  - Microcatchment technique for water harvesting
  - Breaks up surface crust to encourage water infiltration and allows for central placement of amendments
- **Manure**
  - Increases soil organic matter and soil fertility by adding needed nutrients (nitrogen, phosphorus, and potassium)
  - Low livestock ownership constrains production and availability
- **Contour Bunds**
  - Soil or stone constructions along land's natural contours
  - Limit surface runoff, retain water, and control infiltration
- **Farmer Managed Natural Regeneration (FMNR)**
  - Form of agroforestry whereby farmers nurture existing, non-planted trees and shrubs in crop-growing areas
  - Increases water infiltration, provides wind block, shades crops from direct sun, and supports soil fertility

## DISCRETE CHOICE EXPERIMENT (DCE)

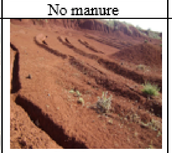
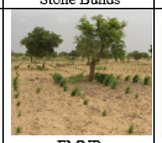
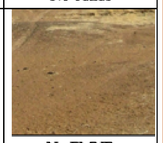
- Farmers will choose amongst hypothetical packages of SWC practices with five attributes (***Figure 1***)
- Farmers will be shown one of three blocks of 8 choice tasks
- Choice tasks will be illustrated (***Figure 2***)
  - Accommodates ***varying literacy*** levels
  - ***Reduces cognitive burden***
- **Data collection planned for October 2021**
- Objectives of the DCE:
  - Measure farmers' ***relative preferences*** for each SWC practice
  - ***Quantify trade-offs*** made by farmers
  - ***Quantify impacts*** of direct compensation and site-specific information on farmer choices.

**Figure 1. Attributes and levels of the experimental design**

| Attribute | Levels |
|---|---|
| Planting Method (ZAI) | - Zai Pits<br>- **Flat Planting** |
| Manure Use (MANURE) | - Yes<br>- **No** |
| Contour Bunds (BUNDS) | - Stone Bunds<br>- Soil Bunds<br>- **None** |
| Farmer Managed Natural Regeneration (FMNR) | - Yes<br>- **No** |
| Implementation Cost (COST) | - **0 FCFA**<br>- 125,000 FCFA<br>- 166,000 FCFA<br>- 208,000 FCFA |

Note: Opt-out levels in **bold** and variable names in parentheses.

**Figure 2. Sample choice task**

| Attribute | Option A | Option B | Opt-out |
|---|---|---|---|
| Planting Method |  Zai Pit System |  Flat Planting |  Flat Planting |
| Manure Use |  Manure |  No manure |  No manure |
| Contour Bunds |  Stone Bunds |  Soil bunds |  No bunds |
| Farmer Managed Natural Regeneration (FMNR) |  FMNR |  No FMNR |  No FMNR |
| Cost | 208,000 FCFA | 125,000 FCFA | 0 FCFA |

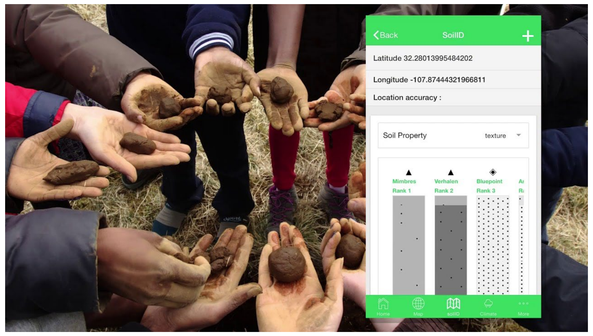
## COMPENSATION TREATMENTS

- Despite benefits to SWC practices, ***implementation costs may be prohibitive*** to adoption
  - Additional incentives or support may be necessary
  - Literature is mixed on use of direct and indirect incentives
- Three groups:
  - **Control**
  - **Partial Compensation**
    - 50% of initial implementation costs
  - **Full Compensation**
    - 100% of initial implementation costs

## INFORMATION TREATMENT

- Equipping farmers with ***site-specific information may increase willingness to use SWC*** practices
- LandPKS is a mobile-phone based toolkit for sustainable land management practices
  - Provides information related to site-specific soil ranking, vegetation, and land restoration options
- Two groups:
  - **Treatment**
    - Extension agent or trained enumerator to walk through LandPKS assessment on one of farmer's plots ***BEFORE*** completing the choice experiment
  - **Control**
    - LandPKS walk-through completed ***AFTER*** completing the choice experiment

LandPKS

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