Assessing the socio-economic determinants for adoption of conservation agriculture practices among smallholder farmers: A case study in the mid-hills of Nepal

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Agricultural Adoption Issues

- Introduced agricultural practices often abandoned for traditional methods

- Factors influencing adoption can be personal, social, economic, and cultural, including:

  - Age   - Gender
  - Education   - Economic status
  - Social responsibility   - Knowledge of natural resources

- No universal determining factors identified

- Highly contextual due to varying local and ecological conditions and individual goals/motivations

(Bunch 1999; Knowler & Bradshaw 2007; Pannell et al. 2006)

Study Area: Central Mid-hills, Nepal
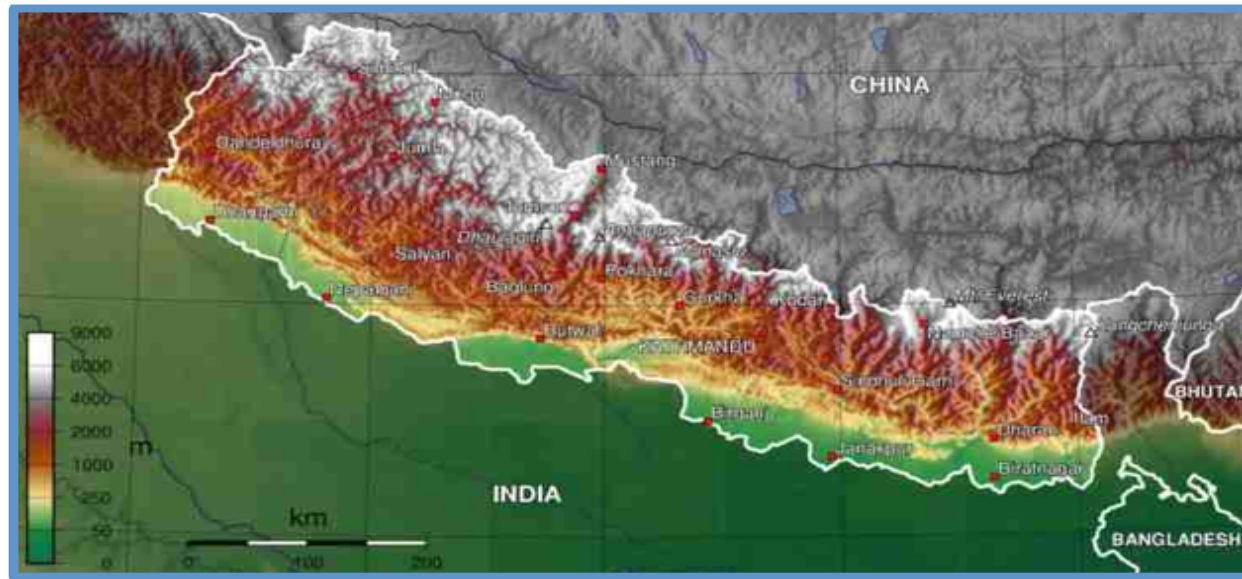
- Mid-hill agriculture supports half of Nepal's population
  – Important for food security
- Selected villages characterized by:
  – Size (26-42 HH), food insecurity, subsistence farming, marginal, small landholdings (<1 ha)
- Cultivate highly sloping, degradation-prone land
- Practice continuous cultivation, terracing, and mono-cropping

Research Questions

□ What are the significant socio-economic factors contributing to individual farmers' likelihood of adoption of CA?

□ What are the major constraints leading to non-adoption of CA?

Farmer Characteristics: Methods

① Conduct individual surveys to measure:

- Farmer characteristics
- Resource/economic characteristics

② Use self-reported history of CA implementation (dependent variable) to identify adopter and non-adopter groups

③ Conduct Cronbach's alpha to test internal consistency of latent variables (indices)

④ Use a Logit regression model to determine contributing factors that characterize adopters and non-adopters

o 56 surveys representing 82% of households

Binomial logistic regression model

- Incorporates multiple independent variables
- Determines the degree and direction of influence each variable has on a dependent variable
- Dichotomous dependent variable
    - ADOPTER or NON-ADOPTER
    - Hedgerow technology used as proxy
        - Introduced 10 years ago
        - Analogous to CA due to similar soil conservation benefits and minimal inputs
- 12 explanatory (independent) variables

Theoretical Logit model

Variable	Definition	Predicted direction of influence
Dependent variable		
Y_i	1 = ADOPTER, has implemented hedgerow technology on farm	
	0 = NON-ADOPTER, has never implemented hedgerow technology on farm	
Explanatory variables		
Farmer characteristics		
AGE	Age of farmer in years	-
GENDER	1 = Female, 0 = Male	-
EDUCATION	Years of formal education completed	+
TRUST	Index of trust in NGO staff, projects, and expertise	+
Resource/economic characteristics		
INCOME	Total on- and off-farm annual household income	+
FARMSIZE	Total hectares of farm	+
LABOR	Number of adult household members contributing to agricultural labor	+
FOODSECURITY	Household Food Insecurity Access Scale	-
INFORMATION	Level of interaction with agriculture extension or NGOs in past 2 years: 0 = none/low, 1 = moderate, 2 = high	+
EXPERIENCE	Number of years involved in farm decision-making (shared or total control)	+
ENVIROCONCERN	Index of farmer perception of environmental degradation and need for conservation	+
LANDTENURE	1 = owns land title, 0 = does not own land title	+

Index of TRUST in NGOs

- 12 questions related to goals, values, accountability, expertise of NGO projects and staff

Sample questions:
- *Do you think that the goals of NGO projects are the same as your own goals for your farm?*
- *When someone from an NGO makes a promise, does it usually happen?*
- *In general, do NGO projects meet their stated goals?*
- *Do NGO workers provide technical knowledge or expertise?*

Household Food Insecurity Access Scale

- 9 questions related to household food availability, quantity, and diversity over the past month
- Uses a Likert scale: 0-no, 1-rarely, 2-sometimes, 3-often
- Higher scores indicate greater food insecurity (MAX=27)

Sample questions:

- *In the past 4 weeks (due to lack of food) did you or any household member:*
  - *Eat a smaller meal than you felt you needed?*
  - *Eat fewer meals in a day?*
  - *Eat a limited variety of foods?*
  - *Go to sleep hungry?*

(Coates et al. 2007)

ENVIROCONCERN Index

- 12 questions regarding concerns over crop yield, soil quality and erosion, and water availability

Sample questions:

- *How has the amount of your crop yields changed in the past 5 years? (increasing/decreasing)*
- *What is the condition of soil erosion on your farm in the past 5 years? (increasing/decreasing)*
- *Do you think there is a need to improve water availability on your farm? (yes/no)*
- *Do you think the actions you take can affect soil quality? (yes/no)*

Adjusted Logit model equation

- ENVIROCONCERN index was removed due to inconsistency found in Cronbach's Alpha (0.454)
- LANDTENURE & EXPERIENCE removed due to lack of significance in stepwise regression analysis
- 9 explanatory variables in the adjusted Logit model

$$Y_i = \beta_0 + \beta_1 AGE_i + \beta_2 GENDER_i + \beta_3 EDUCATION_i + \beta_4 TRUST_i + \beta_5 INCOME_i + \beta_6 FARMSIZE_i + \beta_7 LABOR_i + \beta_8 FOODSECURITY_i + \beta_9 INFORMATION_i + \varepsilon_i$$

Results: What are the significant Farmer Characteristic factors contributing to individual farmers' likelihood of adoption of CA?

- Overall model was significant
  - 29.9-43.4% of the variance (Cox & Snell R^2; Nagelkerke R^2)
  - 81.8% of cases correctly classified
- All farmer characteristic variables significant

Variable	β	S.E.	Sig.	e^{β}
Farmer characteristics				
AGE	-0.096	0.055	0.082[b]	0.908
GENDER	-1.906	1.076	0.076[b]	0.149
EDUCATION	-0.559	0.260	0.031[a]	0.572
TRUST	0.383	0.226	0.090[b]	1.466

[a] Significant at 5%
[b] Significant at 10%

Results: EDUCATION

- >53% of respondents no formal education
- 1 respondent had >6 years education
- Skewed distribution of data may affect directionality
- Existing literature generally considers higher levels of education than represented in this study
- The model showed that with every additional year of education, farmers were 0.57 times less likely to become CA adopters
- This could be a function of less education leading to greater reliance on external information, such as NGOs, and a greater willingness to adopt

(D' Souza et al. 1993; Knowler and Bradshaw 2007)

Results: What are the significant Resource/Economic factors contributing to individual farmers' likelihood of adoption of CA?

- FOODSECURITY highly significant
- FARMSIZE, LABOR, INFORMATION not significant
- INCOME significant, opposite direction of influence

Variable	β	S.E.	Sig.	e^{β}
Resource/economic characteristics				
INCOME	-0.017	0.009	0.048[a]	0.983
FARMSIZE	2.459	2.200	0.264	11.689
LABOR	0.399	0.295	0.176	1.490
FOODSECURITY	-0.193	0.083	0.020[a]	0.825
INFORMATION	0.574	0.556	0.302	1.775

[a] Significant at 5%
[b] Significant at 10%

Results: INCOME

- Wide range of values, from <500 NPR (5.09 USD) to almost 300,000 (3,043 USD)
  - Average income: 87,150 NPR (887 USD).

- Higher incomes from livestock and off-farm wage earning
  - Some remittance from family members (16% households)

- This indicates that, as households earn more income through livestock or off-farm activities, they may become less invested in improving cultivation

Farmer Characteristics: Conclusions

- Improving food security in the short-term can allow for longer-term conservation efforts
- Identification of demographic factors (age, gender) inhibiting adoption can contribute to understanding farmer perspectives and priorities
- Trust is critical to co-management of resources, though transfer of information may require improved implementation strategies
- The dynamics between education, off-farm wage-earning, and investments in conservation on smallholder farms are areas for further research

Thank you / Mahalo / Dhanyabad