

Are South Indian farmers adaptable to global change?

A case in an Andhra Pradesh watershed

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Introduction

Elements of context

- Population is growing
- Urbanization is increasing (Dorin *et al.*, 2009)
- Farmers are shifting from subsistence to economic activity (APGWD, 2008)
- Government policies are still converging towards productivity and production (OCDE, 2007)
- Which put high pressure on natural resources (water, soil)
- Hard rocks makes the aquifer recharge sensitive to climate variability and change (Maréchal *et al.*, 2003)

Introduction

Objectives

Assess and discuss farmers' adaptive capacity (AC)
to global change (GC)



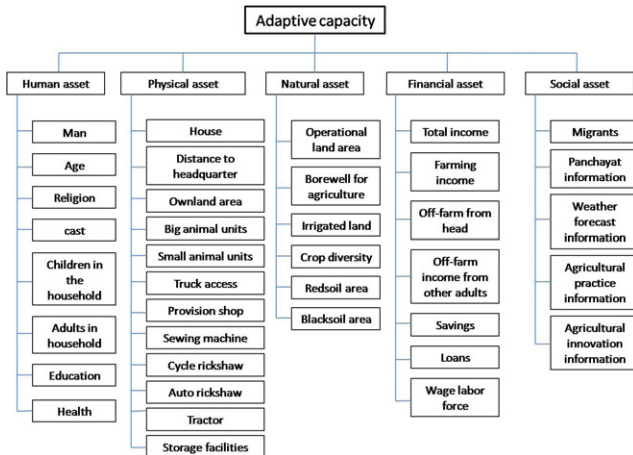
Methodology

AC description and weighting process

- AC = Combination of 5 capital assets: human, physical, natural, financial and social assets
(Sustainable Livelihood Approach - SLA (Scoones, 1998; Orr *et al.*, 2001))
- Organization in a hierarchic matrix according to Analytic Hierarchic Process
(AHP is a Multi-Criteria Decision Analysis or MCDA (Eakin *et al.*, 2008))
- Possibility to weight indicators thanks to experts' pairwise comparisons. In this paper we will focus only on equal weights

Methodology

AC hierarchic matrix



Methodology

Creation of AC index

- Measuring the indicators: farmers' surveys
- Standardizing indicators value to go through incommensurate data
- Aggregating weights and values of indicators through Compromise Programing (CP)

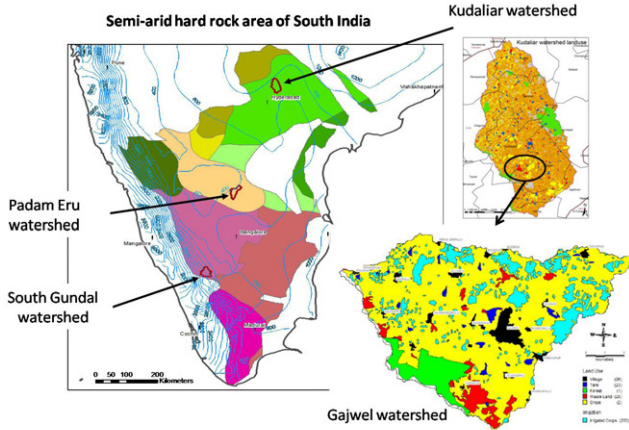
$$d_i = \left[\sum_j^J w_j^p (1 - x_{ij}^p) \right]^{1/p} \quad (1)$$

where d_i is the distance to the anti-ideal point of the i^{th} farmer, w_j the weight of the j^{th} indicator, x_{ij} the standardized score of the i^{th} farmer for the j^{th} indicator, and p a constant metric indicating how compensated a decrease/increase in one indicator can be by the increase/decrease in another indicator.

Finally, a score of AC ranging [0,1] is obtained by farmer.

Case study

Gajwel watershed



Case study

Farmers' analysis

- Farmers individual survey
- Farming system typology (K-means cluster analysis)
- 6 relevant groups of farmers identified
- Groups fit with Scoones 3 main SLS:
 - ① Migration strategy: Group 1 (30%)
 - ② Extensification / intensification strategy: Groups 3, 4 and 6 (40%)
 - ③ Diversification strategy: Groups 2 and 5 (30%)

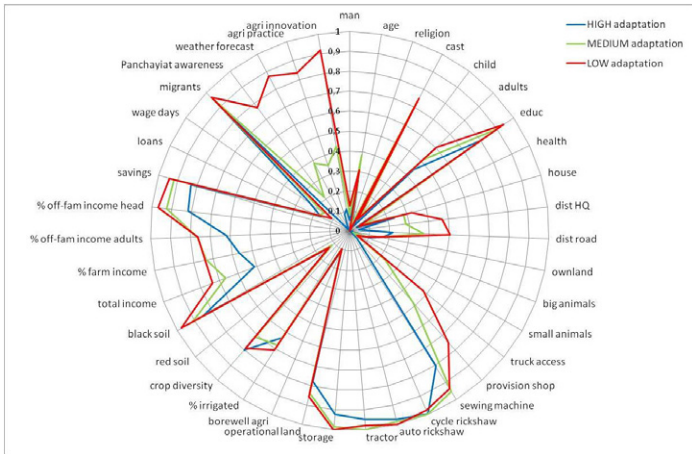
Results and discussion

Are farmers adaptable?

- High adaptive capacity: 27%
- Medium adaptive capacity: 31%
- Low adaptive capacity: 42%

Results and discussion

Why are farmers low adaptive?



Results and discussion

Who are low adaptive farmers?

- Rural more than urban
- Marginal and small more than semi-medium and medium
- Ext./int. strategies more than diversification or migration

Results and discussion

Impacts of GC on SLS

Looking back at the external forces that influence a farming system:

- All farmers should gain of a development of infrastructures and services.
- Farmers living on farm income are in debt. More investment to enhance productivity are unlikely. Cropping diversification being based on irrigation development, they are likely to suffer from groundwater depletion.
- Large farmers should lose from the future increase of agricultural land price.

Results and discussion

Impacts of GC on SLS

- Farmers with diversification strategies could see their AC score lowered because of a decrease or shift of government subsidies.
- Finally, off-farm income is maintaining 60% of the farmers in a state of high to medium adaptive capacity. But jobs opportunities are subject to variations due to population and urbanization growth.

Thus, whatever the AC level, farmers are likely to be weakened by tomorrow external changes, but in different ways.

Conclusion

- Sensitive index combined with AC index to improve the discussion on GC impacts on SLS (Vulnerability index)
- Weighting process
- Standardization of indicators
- Factor p for compensatory mode
- Fuzzy logic to classify farmers' AC

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