Farmers' vulnerability assessment to global changes in South India. Preliminary results in Gajwel small watershed

Stéphanie Aulong, F Bome, Yvan Caballero, B Chaudhuri, Fabrice Dazin, Benoît Dewandel, L Dinis, S Galab, J. Guerrin, Verma Himanshu, et al.

SHIVA Project

supported by ANR (National Research Agency, FRANCE)

ANR annual seminar, 2-3 December, 2009, Orléans

Farmers' vulnerability assessment to global changes in South India

Preliminary results in Gajwel small watershed

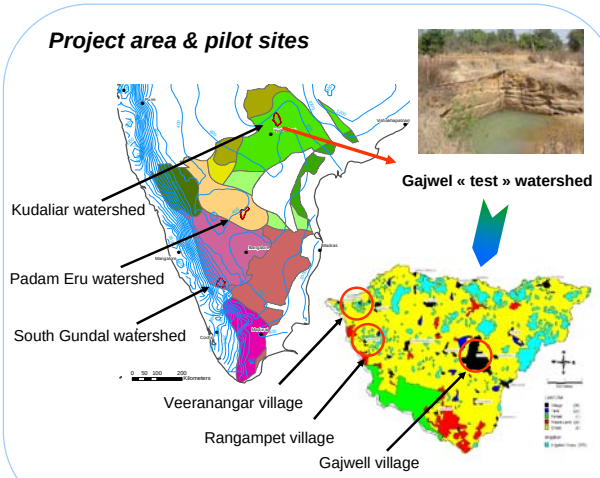
The SHIVA-ANR project aims at assessing the vulnerability of rural water users under stressors of global changes in the hard rocks area of South India. Determining present and future vulnerability of farmers to global changes calls for the creation of a context specific vulnerability index. A method is tested in small watershed of Gajwell (Andhra Pradesh).

Context

The project focuses on a particularly **water stressed area of South India**. This area is characterized 1) by a hard rock geology with naturally low recharge capacity and small surface water availability; and 2) by a semi-arid climate where farming activities are very dependant on monsoon schedule and rainfall. In past decades, irrigated surfaces have doubled with an increased number of borewells. Consequently, a high number of watersheds have been declared as over-exploited for groundwater depletion. It is the case in the three pilot sites of the project and as a matter of fact of the small watershed of Gajwell where this economic study takes place.

Thus, this area is particularly prone to global change hazards. **Climate change scenario** shows a likely increased rainfall amount during monsoon season with a reduction of rainy days, but this seems to be geographically more or less underlined, meaning that farmers should be unequally affected according to their localization. **Human change** in developing world are operating rapidly: state support to farming prices and productions has contributed to country development and it remains very important even though in contradiction with globalization or market liberalization. Urbanization, demographic growth, resources depletion will affect farmers as the whole population differently according to households characteristics and adaptive capacity.

Project area & pilot sites



Land cover analysis (SIRS, 2009)

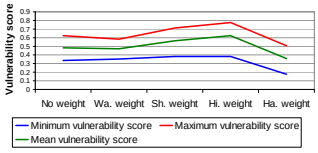
Objectives

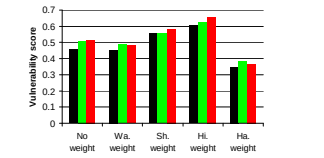
In this context of exposure, the objectives of the research is to **assess the vulnerability of farmers to global change** from now to a medium term period (2030-2050). What are the factors contributing to vulnerability? What are those which increase adaptive capacity? Is it possible to quantify vulnerability of farmers? What can be said on disparities between farmers? Is there geographic disparities? What are the reasons?

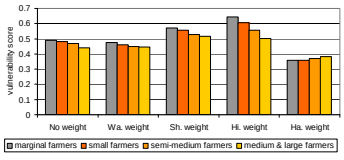
To answer these questions, a method to assess and discuss vulnerability has been tested on a sample of 153 farmers within Gajwel watershed. The method is actually evaluated before an implementation over the three pilot sites.

Method

A **multi-criteria decision analysis method** is used to assess farmers' vulnerability to global change. Vulnerability is described through 63 indicators characterizing either farmer's sensitivity to global change, either farmer's adaptive capacity. Indicators identification are the results of a review of the literature and discussions with local and international experts. Indicators are organized within a hierarchical matrix according to **Analytic Hierarchy Process** (AHP, method developed by Saaty, 1991). A number of experts also contributes to the pairwise comparison between indicators which finally leads to several weighted matrix. A weighted matrix lists the weighted coefficients of each indicators. As a comparison, a matrix composed of equally weighted indicators will serve as reference for results analysis. A questionnaire was tested over 153 farmers of the small watershed of Gajwel in order to test the AHP method for assessing vulnerability. After a normalization procedure of the indicators (impact functions or distance from the best and worst performers methods), a vulnerability score is calculated for each farmer, corresponding to present state of vulnerability. Vulnerability scores are then analyzed and discussed. The four experts' weighted matrix serve as sensitive analysis of vulnerability scoring.

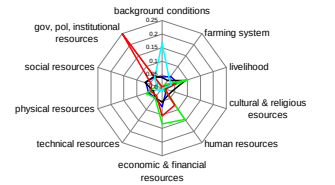


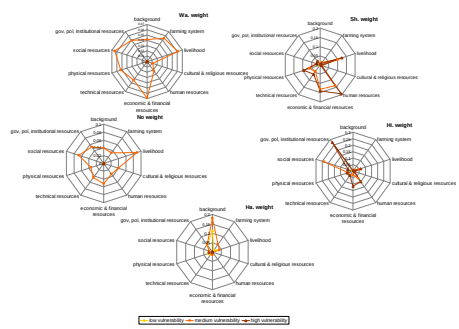




Results & conclusion

- Looking at the five vulnerability assessment schemes, one can observe that mean vulnerability is quite similar with small variance within the sample. Two profiles presents some extreme whereas the two others look like the non weighted results.
- A comparison between the 3 villages shows that Gajwel farmers are definitively less vulnerable than the two other more rural ones. This is true whatever the matrix of reference.
- A comparison between farmers' categories confirms the hypothesis that large farmers are less vulnerable than smaller ones but the result is not robust to one of the expertise.
- Looking at the contribution of indicators to vulnerability, it seems that the causes of higher vulnerability must be sought within human and economic resources and also in livelihood conditions. The two extreme profiles are clearly separated from the others: one give strong importance to government and institutional resources, which are measured through secure land tenure and representation in institutions; the other give insights to background conditions, that is to past experience of global change hazards and farm environment.
- A first try, taking 3 equal classes of vulnerability distributed between 0 and 1 score, shows that medium vulnerability constitutes the major part of the sample. Thus, with 2 of the weighting profiles, only one class of vulnerability appears. This can be due to the sample size, or this can indicate the need of deeper analysis to determine vulnerability classes (fuzzy method for example).





Authors

Aulong S.[1], Borne F.[4], Caballero Y.[2], Chaudhuri B.[5], Dazin F.[6], Dewandel B.[2], Dinis L.[3], Galab S.[7], Guerrin J.[3], Himanshu[5], Ladouche B.[2], Maire E.[8,9], Maréchal JC.[2,9,12], Muthusankar G.[4], Perrin J.[2,5], Prudhvikar Reddy P.[7], Ramesh BR.[4], Sannier, C. [6], Sekhar M.[9,10], Shakeel A. [3,11], Vigaud N. [2]

1 BRGM-EAU/RMD-socioeconomic cell. 2 BRGM-EAU/RMD. 3 Indo-French Cell for Groundwater Research (IFCGR). 4 Institut Français de Pondicherry (IFP). 5 Centre des Sciences Humaines (CSH). 6 Systèmes d'Information à Référence Spatiale (SIRS). 7 Center of Economic and Social Sciences (CESS). 8 GEODE. 9 Indo-French Cell for Water Sciences (IFCWS). 10 Indian Institute of Science (IISc). 11 National Geophysical Research Institute (NGRI)-IFCGR. 12 Laboratoire des Mécanismes et Transferts en Géologie (LMTG).

www.shiva-anr.org

With the participation of

A project funded by ANR