Climate Vulnerability Assessment and Sensitivity Analysis in Rain Fed Farming Communities of Kerala, India

Raghavan Sathyan A[1], Funk C[2], Aenis T[3], Winker P[2,4], Breuer L [1, 4]
[1]Institute for Landscape Ecology and Resources Management, Justus Liebig University of Giessen, Germany
[2] Department of Statistics & Econometrics, Justus Liebig University of Giessen, Germany
[3] Extension and Communication Group, Humboldt University of Berlin
[4] Centre for International Development and Environmental Research, Justus Liebig University of Giessen, Germany

Introduction

- India ranks first among rain fed agricultural countries of the world with 66% of its total cropped area
- Smallholder farmers are disproportionately vulnerable to climate change
- Watershed Development Programs (WDPs) are tools to reduce vulnerability, enhance resilience and build adaptive capacities
- The study analyses and compares the effectiveness of the WDPs against climate vulnerability by developing a composite index and applying sensitivity analysis to identify significant components of vulnerability

Material & Methods

- Study area: Palakkad district, Kerala
- Tools: Household survey 07-12/2015
- Sampling: Multistage cluster sampling
- Sample size: 215 households
- WDPs by Self Government, Non-Governmental Organisation & Local Government

Climate Vulnerability Index (CVI ^{RFT})

- Theory driven and deductive
- Location specific indicators
- Standardisation of subcomponents
- Balanced weighted approach
- Bootstrapping

$$CVI = \frac{\sum_{i=1}^{10} W_{mi} M_{wi}}{\sum_{1=1}^{10} W_{mi}}$$

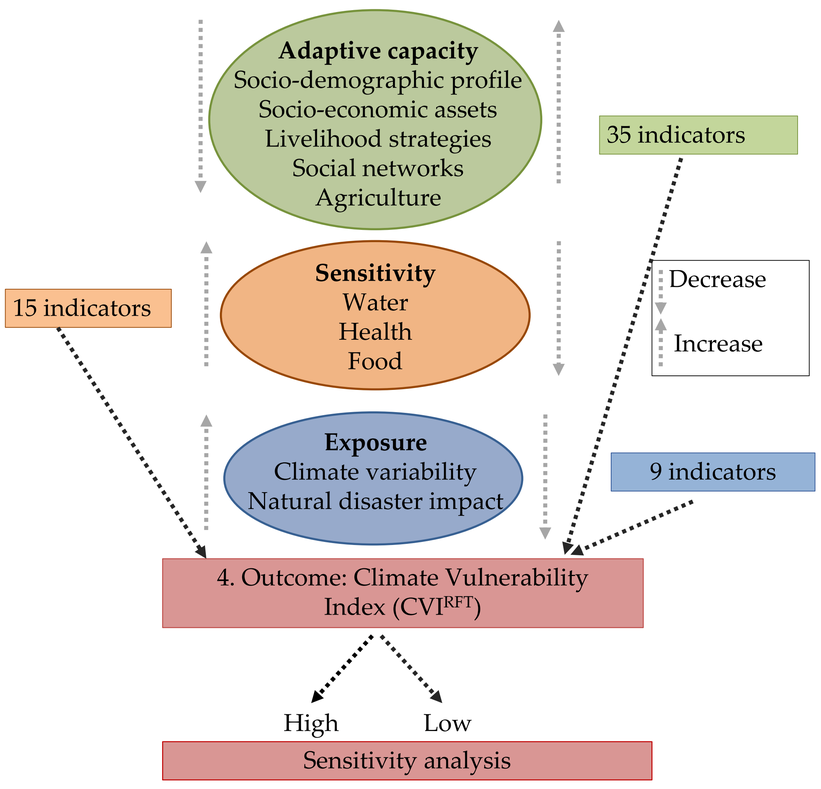

Fig. 1 Dimensions and major components of CVI ^{RFT}

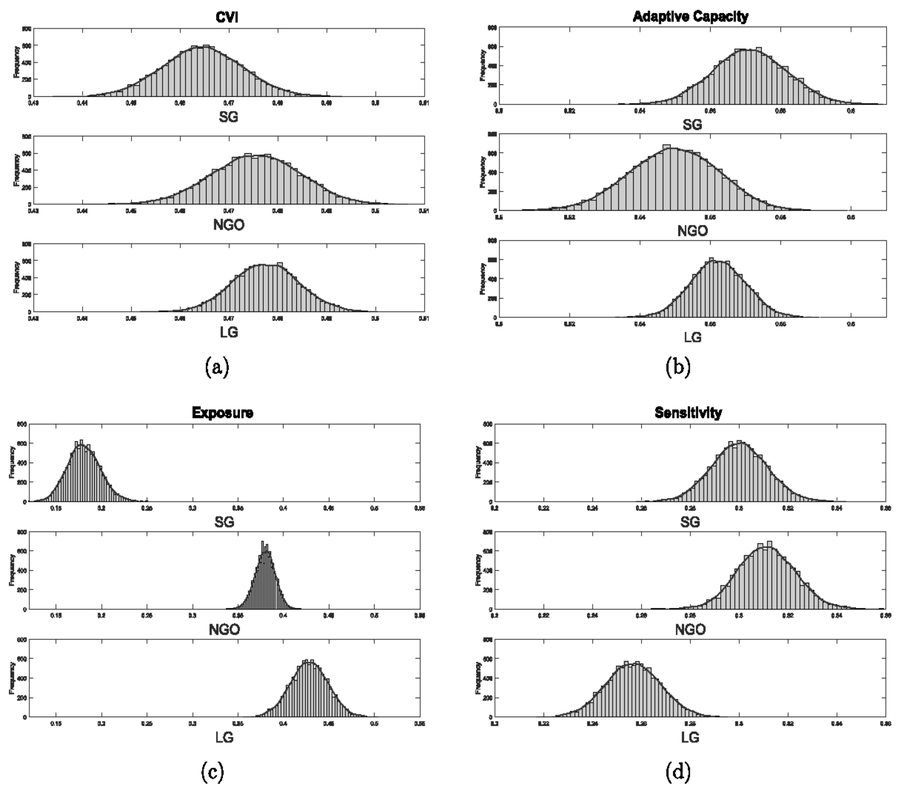

Fig. 2 Histogram and Kernel Density Plot of the CVI (a) and the dimensions adaptive capacity (b), exposure (c) and sensitivity (d).

Results & Discussion

Division	Subdivision	$\hat{\theta}_{SG} - \hat{\theta}_{NGO}$	$\hat{\theta}_{SG} - \hat{\theta}_{LG}$	$\hat{\theta}_{NGO} - \hat{\theta}_{LG}$
Major components	Socio-Demographic Profile	**-0.0632**	**0.0519**	**0.1152**
	Socio-Economic Assets	0.0049	-0.0247	-0.0296
	Livelihood Strategies	**0.0643**	0.0175	**-0.0468**
	Agricultural	-0.0355	0.0190	0.0544*
	Social Network	**0.1379**	-0.0184	**-0.1564**
	Water	**0.0773**	**0.0975**	0.0202
	Health	**0.1516**	**0.1489**	-0.0027
	Food	**-0.2620**	**-0.1158**	**0.1462**
	Natural Disaster	0.0250**	**-0.2209**	**-0.2459**
	Climate Variability	**-0.4235**	**-0.2747**	**0.1488**
Dimensions	Adaptive Capacity	0.0217	0.0091	-0.0126
	Exposure	**-0.1993**	**-0.2478**	**-0.0486**
	Sensitivity	-0.0110	**0.0435**	**0.0546**
Index	CVI	-0.0110	-0.0130	-0.0021

Bold values denote a significance level of P<0.01, ** and * 0.05 and 0.1, respectively.

Fig. 3 Significant differences between major components, dimensions an the CVI ^{RFT}

1. No significant differences in the adaptive capacity of the three watershed small holder communities

2. Significant differences in sensitivity and exposure dimensions

3. 'Livelihood Strategies' and 'Social Network' are the most influencing major components of vulnerability among smallholder farmers in the watersheds

Future directions

- An analysis of the farmer's perception and knowledge about the existing adaptation strategies
- Binary logistic modelling to identify the main drivers of adaptation strategies by the farmers
- More profound uncertainty and sensitivity analysis / Quality assessment of indicators

Conclusion & Recommendations

- A single aggregate index representation of climate vulnerability may be appealing for policy makers but is inaccurate and highly misleading without sensitivity analysis

- Policy makers may enact measures to promote diversification of livelihoods

- People's participation should be ensured in the development programs along with promotion of capacity building programs to augment social capital

Acknowledgements : We would like to gratefully acknowledge funding from DAAD, Bonn, Germany (ST42- for Development- Related Post Graduate Courses, 50077057 & PKZ: 91538032) for conducting this research. We honour the valuable time and contribution of inhabitants in the watershed areas for their kind support and participation during the data collection.

References

Raghavan Sathyan, A., Aenis, T., & Breuer, L. (2016). Participatory vulnerability analysis of watershed development programmes as a basis for climate change adaptation strategies in Kerala, India. *J Environ Res Develop*. 11 (1): 196-209.

Email: Raghavan.S.Archana@agrar.uni-giessen.de