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Author(s)	Orencio, Pedcris Miralles; Fujii, Masahiko
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Developing a Composite Index for Vulnerability of Coastal Communities in Baler, Aurora, Philippines

Pedcris M. Orencio¹ and Masahiko Fujii²

¹Hokkaido University Graduate School of Environmental Science

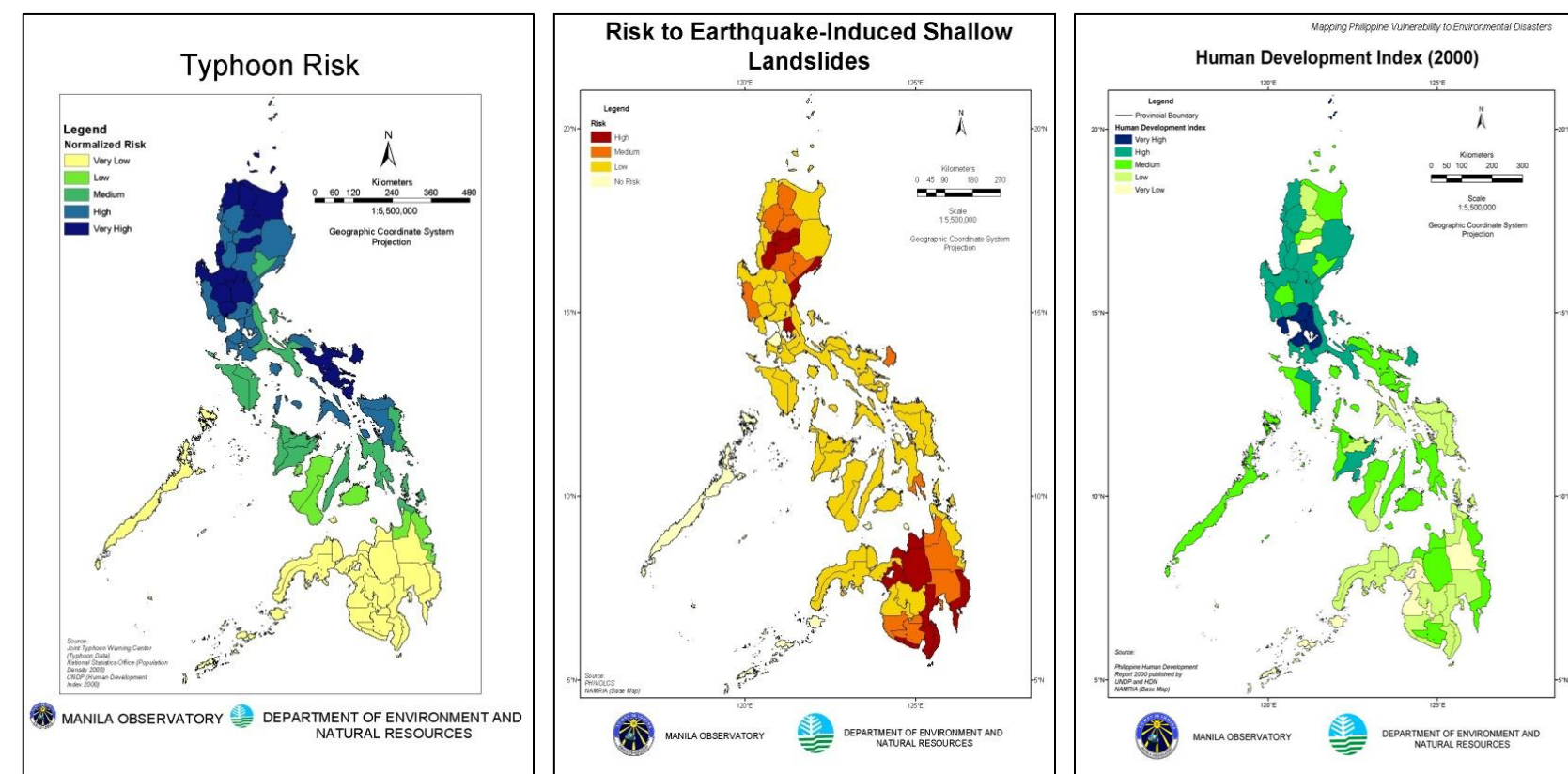
²Hokkaido University Faculty of Environmental Earth Science

Introduction



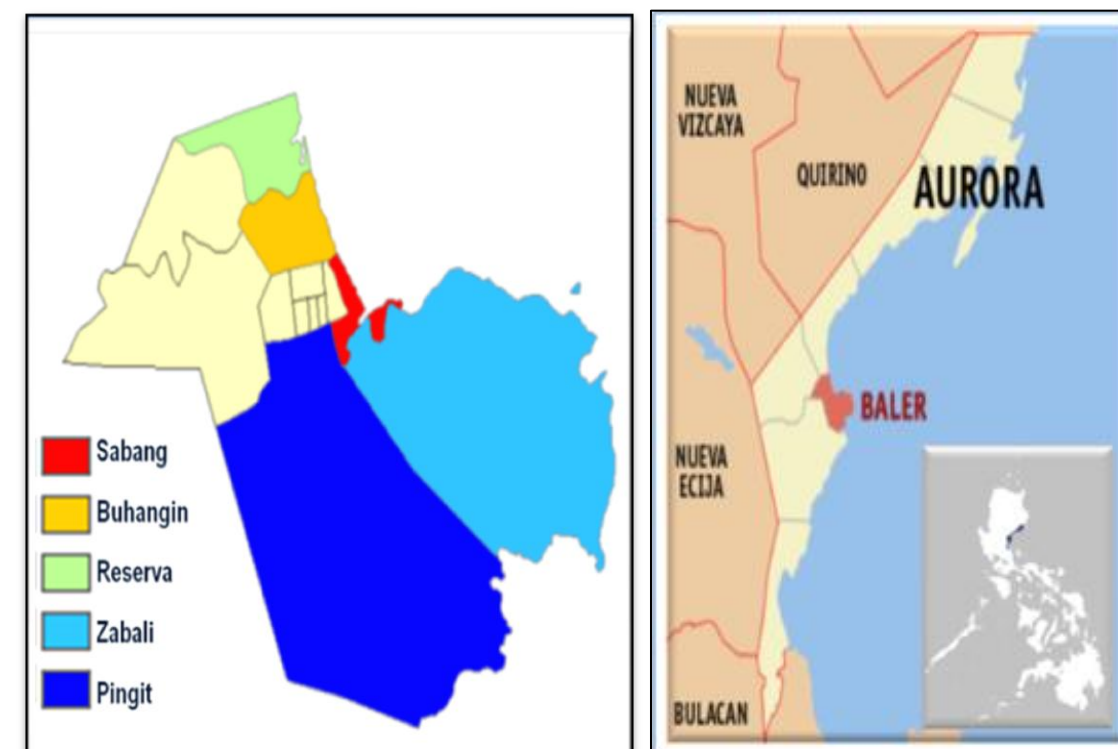
- Coastal communities of today, around the world, are experiencing unprecedented rate of effects from hazards due to changes in social and environmental systems such as increasing population, anthropogenic disturbances and global climate variations.
- The effects of changes are placing communities at increasing vulnerability from hazards. However their vulnerabilities vary according to factors inherent to them.

- The Philippines is among the areas in the world that are vulnerable to the effects of hazards because of social and environmental changes
- 822 of its 1502 municipalities (55%) are coastal, accounting for ~60% of the 90M populace.



Overview of Study Area

- Baler is one of the seven coastal municipalities in the Province of Aurora, Philippines
- Its coasts measure around 35 kilometers and shared by 5 villages (*barangays*)
- Characterized by social conditions shaped by factors such as unique geography with high natural ecology that is exposed to both natural and social hazards

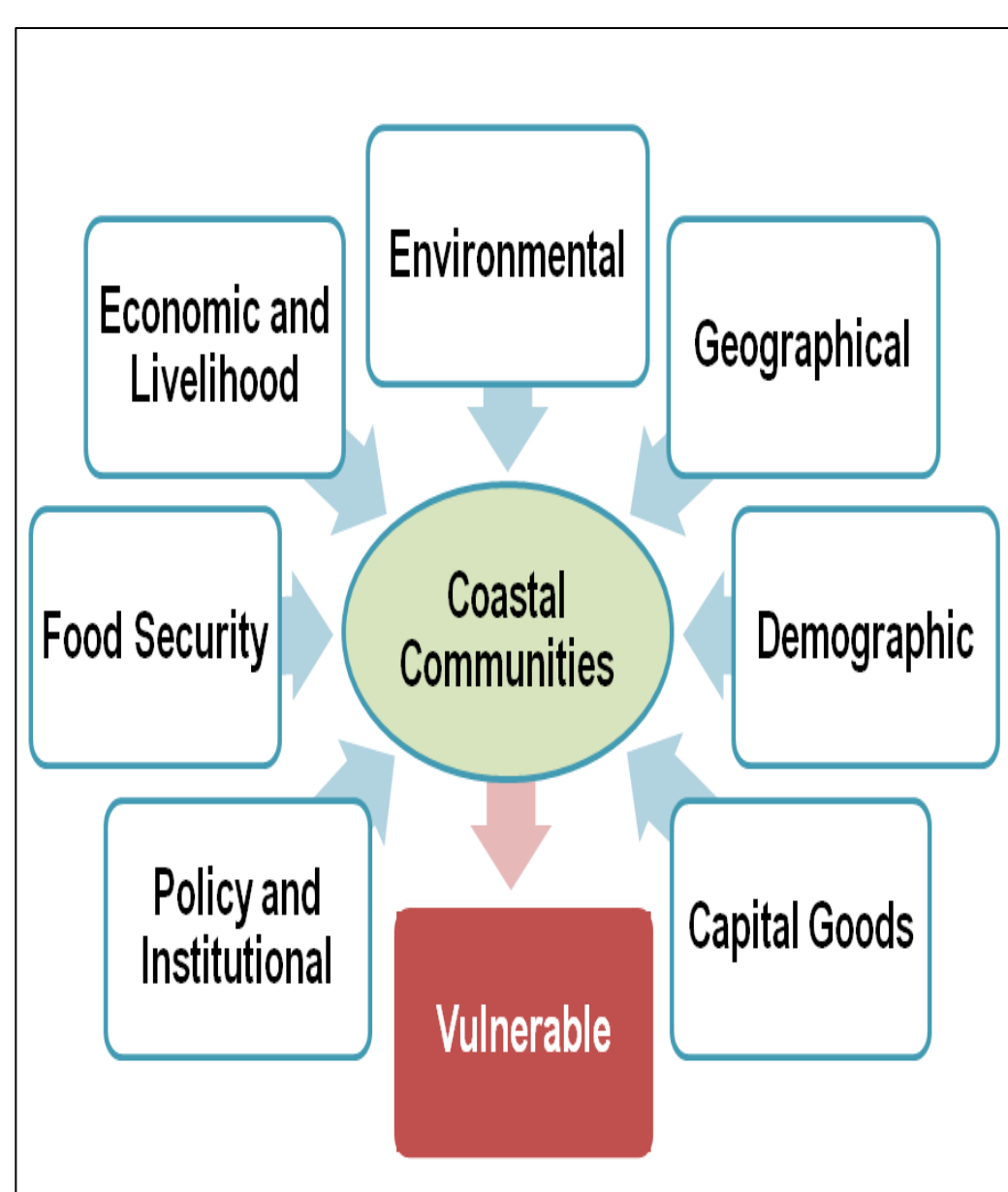


Objective:

Determine the factors that moderate the vulnerability of coastal communities to propose measures for adaptation and mitigation

- Establish vulnerability criteria from its determinants
- Categorize communities based on vulnerability index
- Propose measures for community adaptation and local government planning

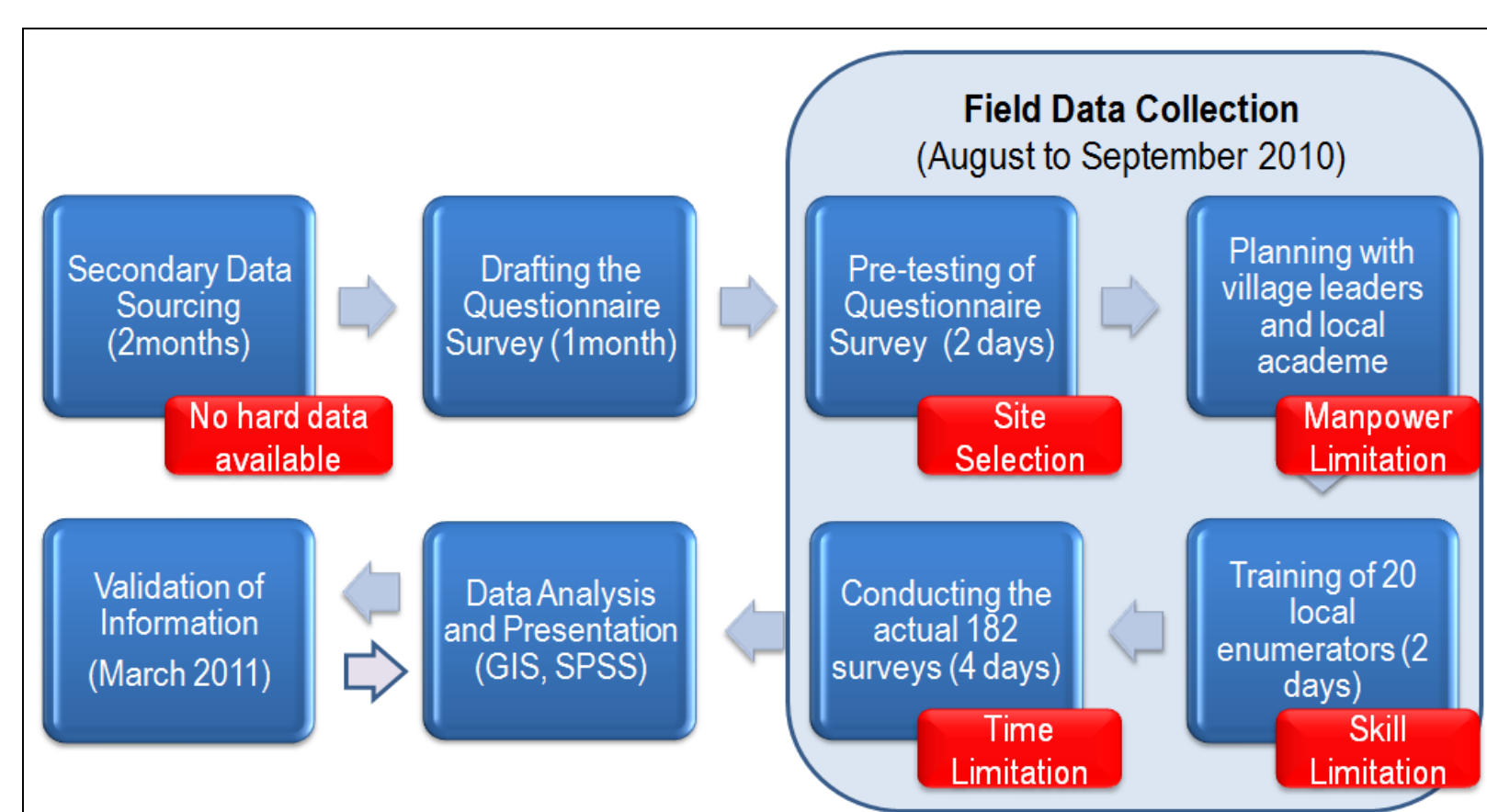
Methodological Concepts



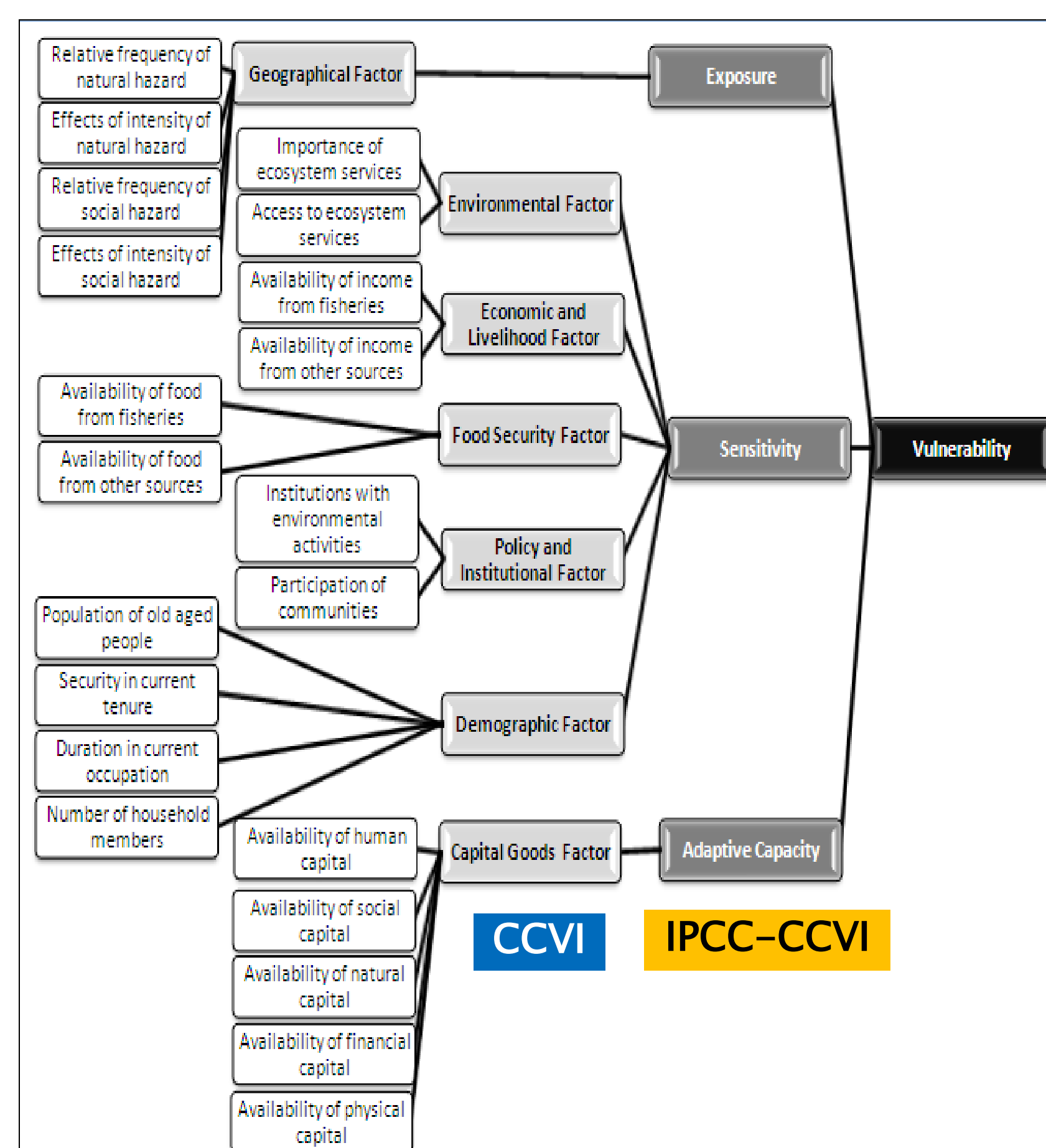
Factors moderating vulnerability of coastal communities (modified from Buckle et al. 2001)

- Two composite indices of vulnerability were designed:
 - Coastal Community Vulnerability Index (CCVI)
 - Intergovernmental Panel for Climate Change-Coastal Community Vulnerability Index (IPCC-CCVI)

Steps in Data Collection:



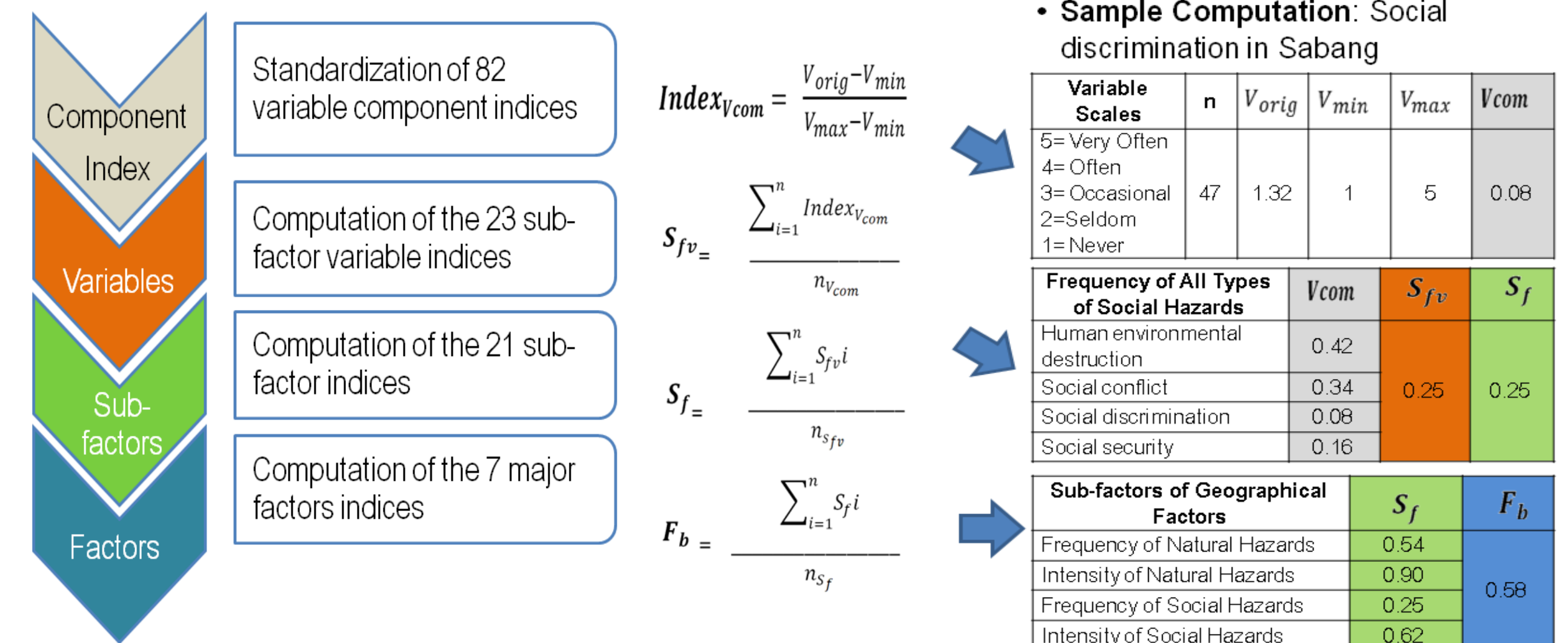
Inter-Linkage of Index Levels in Developing the Two Vulnerability Indices:



Process:

- Assign indicators and variables for the seven major factors
- Establish scales for measuring variables
- Aggregate respondent's scores based on the scales and compute for the index

Process for Computing Index Values



Computing the CCVI and IPCC-CCVI

Computing the CCVI:

Coastal Community Vulnerability Index (CCVI) is computed based on the weighted average of the major factors

$$CCVI_b = \frac{\sum_{i=1}^7 W_{Fbi} F_{bi}}{\sum_{i=1}^7 W_{Fbi}}$$

Major Factors	Sub-factors
Geographical Factors	4
Environmental Factors	2
Food Security Factors	2
Economic and Livelihood Factors	2
Policy and Institutional Factors	2
Demographic Factors	4
Capital Good Factors	5

Sample Computation: CCVI Sabang

Major Factors	F _b	W _{Fb}	W _{Fb} F _b	ΣW _{Fb} F _b	ΣW _{Fb}	CCVI _b
Geographical Factors (GF)	0.58	4	2.32			
Environmental Factors (EF)	0.54	2	1.08			
Food Security Factors (FF)	0.74	2	1.48			
Economic and Livelihood Factors (ELF)	0.62	2	1.24	11.21	21	0.53
Policy and Institutional Factors (PIF)	0.60	2	1.2			
Demographic Factors (DF)	0.51	4	2.04			
Capital Good Factors (CGF)	0.37	5	1.85			

Computing the IPCC-CCVI:

IPCC major factors (Exposure, Sensitivity and Adaptive Capacity) were established as new factor categories computed based on the weighted average of all major factors

$$IPCCF_{bi} = \frac{\sum_{i=1}^n W_{Fbi} F_{bi}}{\sum_{i=1}^n W_{Fbi}}$$

IPCC Major Factors	Total Major Factor Composition	Sub-factors
Exposure (E)	Geographic Factors Environmental Factors Food Security Factors	4
Sensitivity (S)	Economic and Livelihood Factors Policy and Institutional Factors Demographic Factors	12
Adaptive Capacity (A)	Capital Goods	5

$$IPCC-CCVI (V) = (E-A) * S$$

Sample Computation: IPCC CCVI Sabang

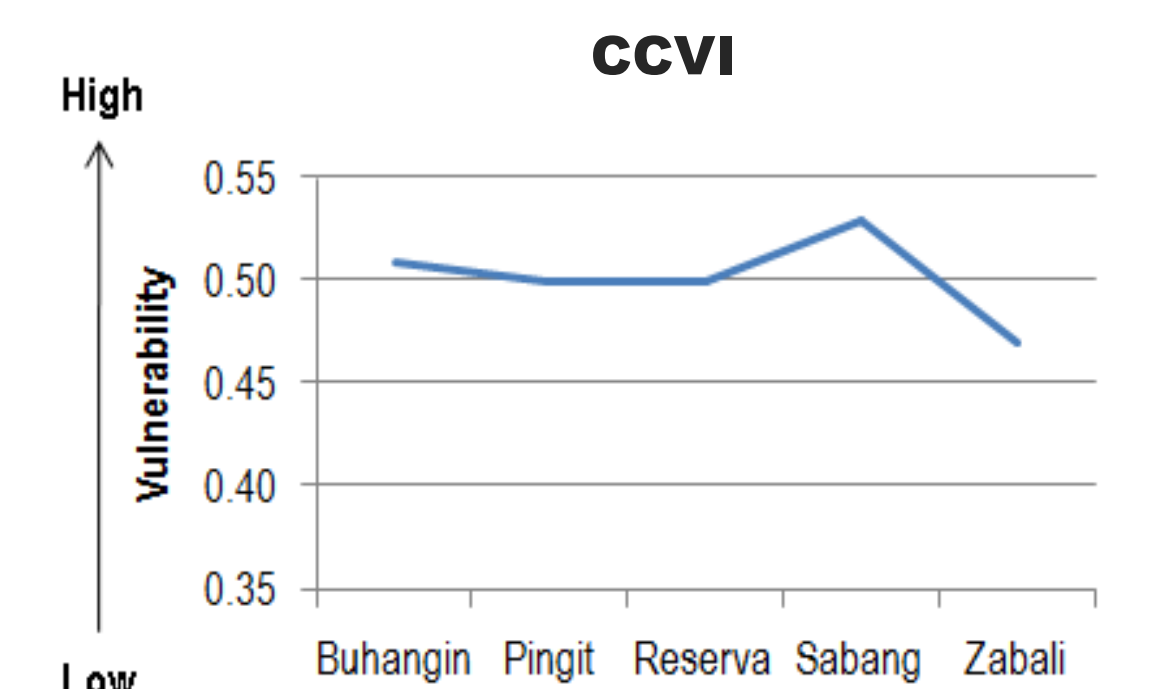
Major Factors	F _b	W _{Fb}	W _{Fb} F _b	ΣW _{Fb} F _b	ΣW _{Fb}	IPCCF _b	IPCC-CCVI
Geographical Factors (GF)	0.58	4	2.32	2.32	4	0.58	
Environmental Factors (EF)	0.54	2	1.08				
Food Security Factors (FF)	0.74	2	1.48				
Economic and Livelihood Factors (ELF)	0.62	2	1.24	7.04	12	0.59	0.12
Policy and Institutional Factors (PIF)	0.60	2	1.2				
Demographic Factors (DF)	0.51	4	2.04				
Capital Good Factors (CGF)	0.37	5	1.85	1.85	5	0.37	

Results and Conclusions

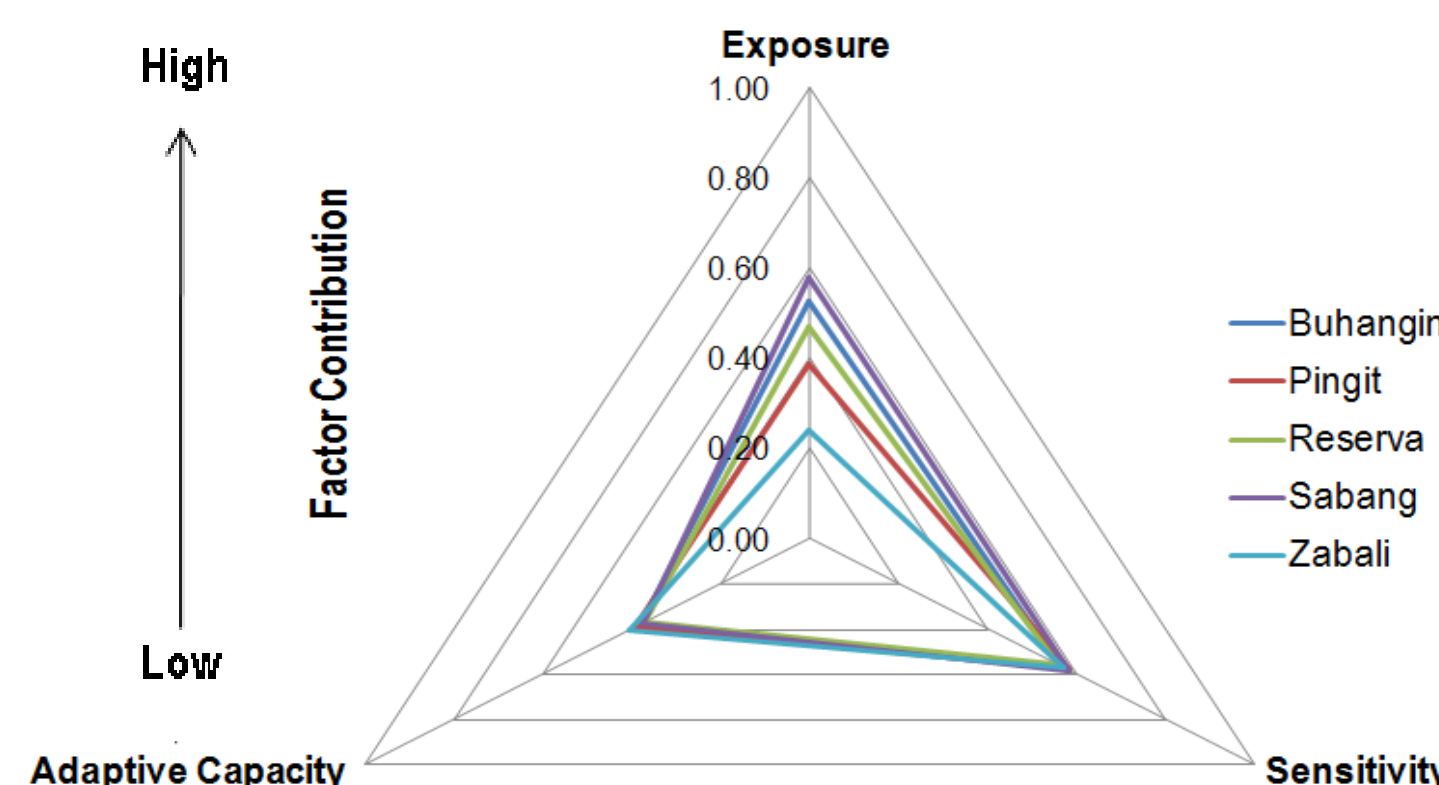
Indices of Major Factors, CCVI and IPCC-CCVI in Five Coastal Communities:



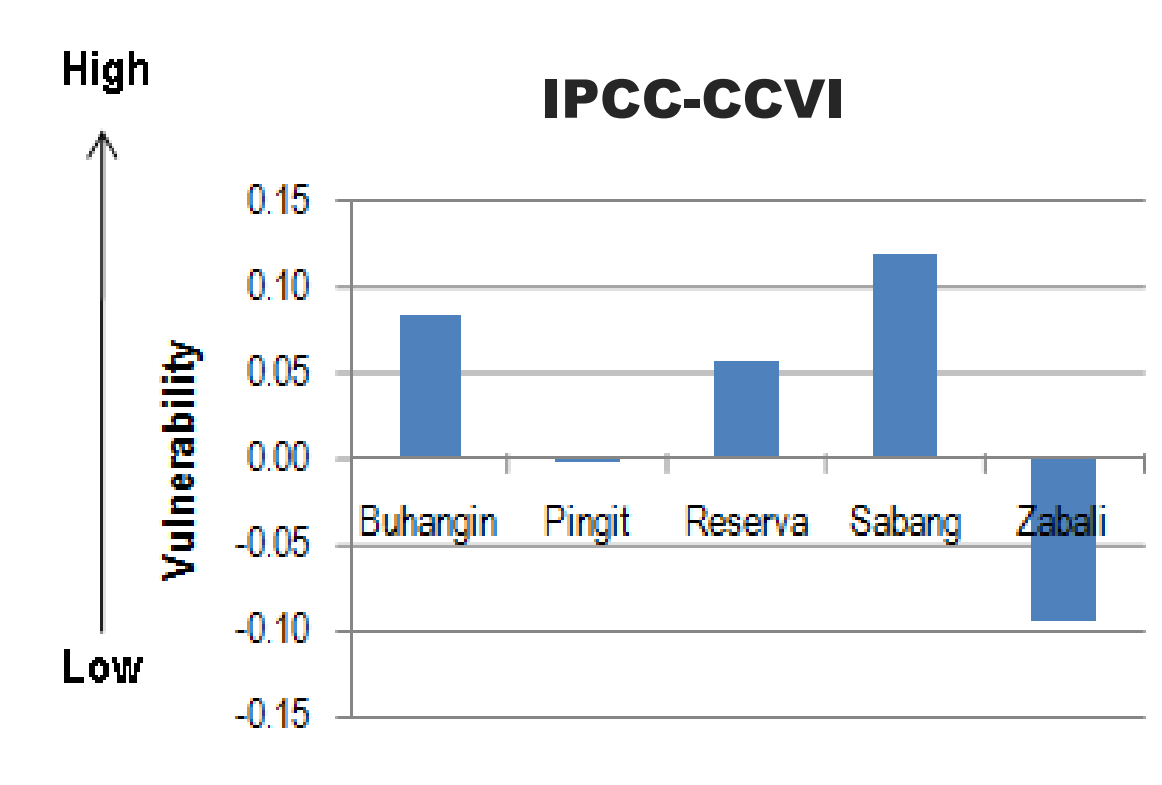
Variations in factor contribution to resulting CCVI in five coastal communities



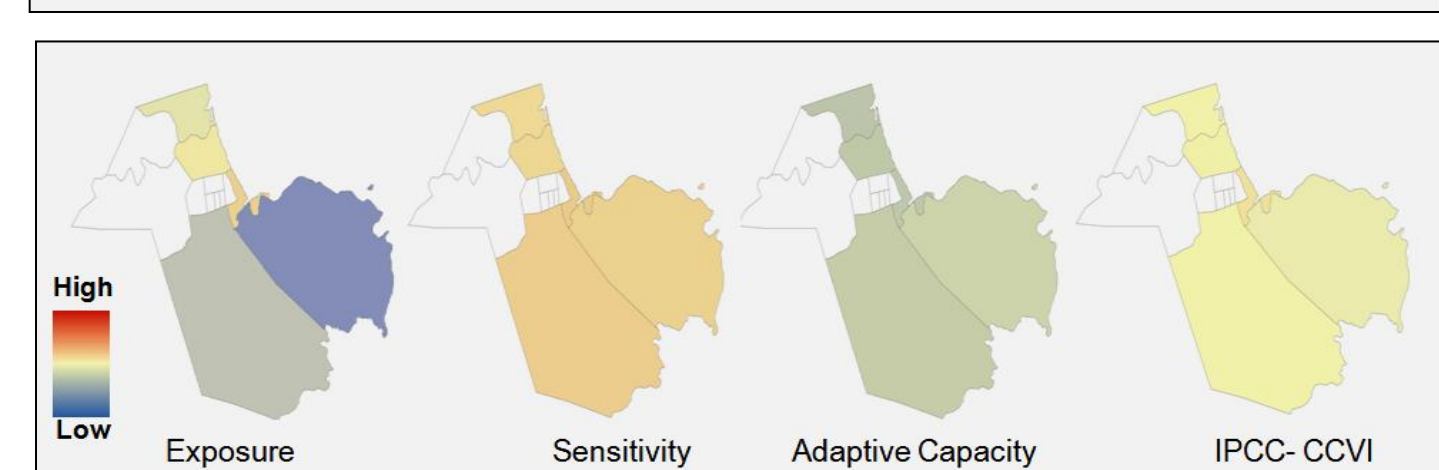
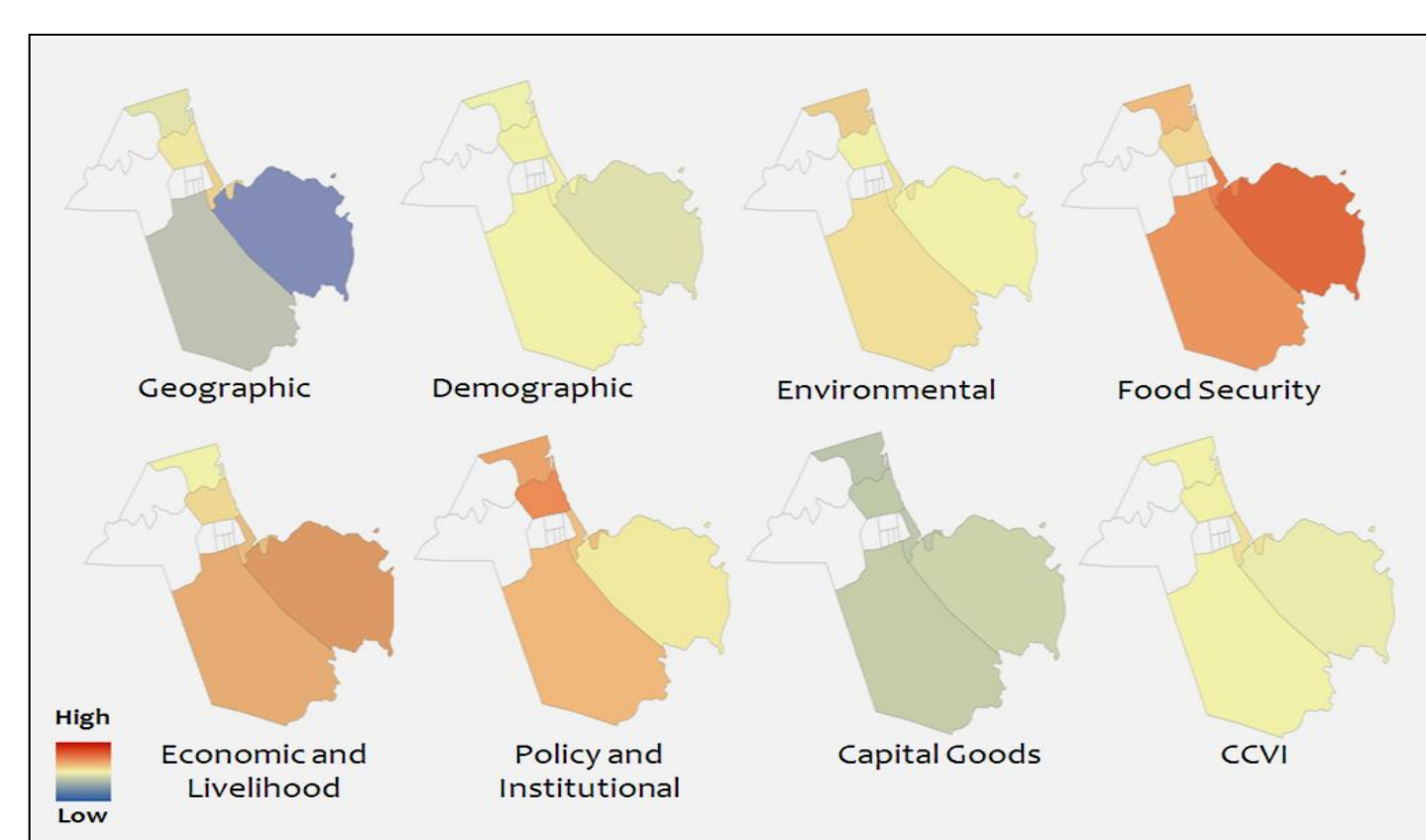
The resulting CCVI showing Sabang (0.53) having the highest among coastal communities



Variations in factor contribution to resulting IPCC-CCVI in five coastal communities



The resulting IPCC-CCVI showing Sabang (0.12) having the highest among coastal communities



Indices of factors, CCVI and IPCC-CCVI in spatial form

Conclusion:

- Sabang is the most vulnerable community based on the resulting CCVI and IPCC-CCVI
- The CCVI values do not show much difference since the high value factors were cancelled out by low value factors during the combination process
- The high contributing factors in CCVI include food security, economic, and policy and institutional factors
- The high contributing factors in IPCC-CCVI include exposure and sensitivity
- The method may be effective for rapid appraisal but its strength depends on the quality of data surveyed within a specific timeframe
- Future study must focus on development of methods:
 - for identifying suitable and objectively-set variables and indicators
 - for data gathering and analysis of relevant indicators, and with the use of statistical tools (i.e. factor analysis, PCA, regression analysis, etc.)