

A Conceptual and Methodological Framework for Studying Sustainability of CHES and its

Applications in the Poyang Lake Region of China

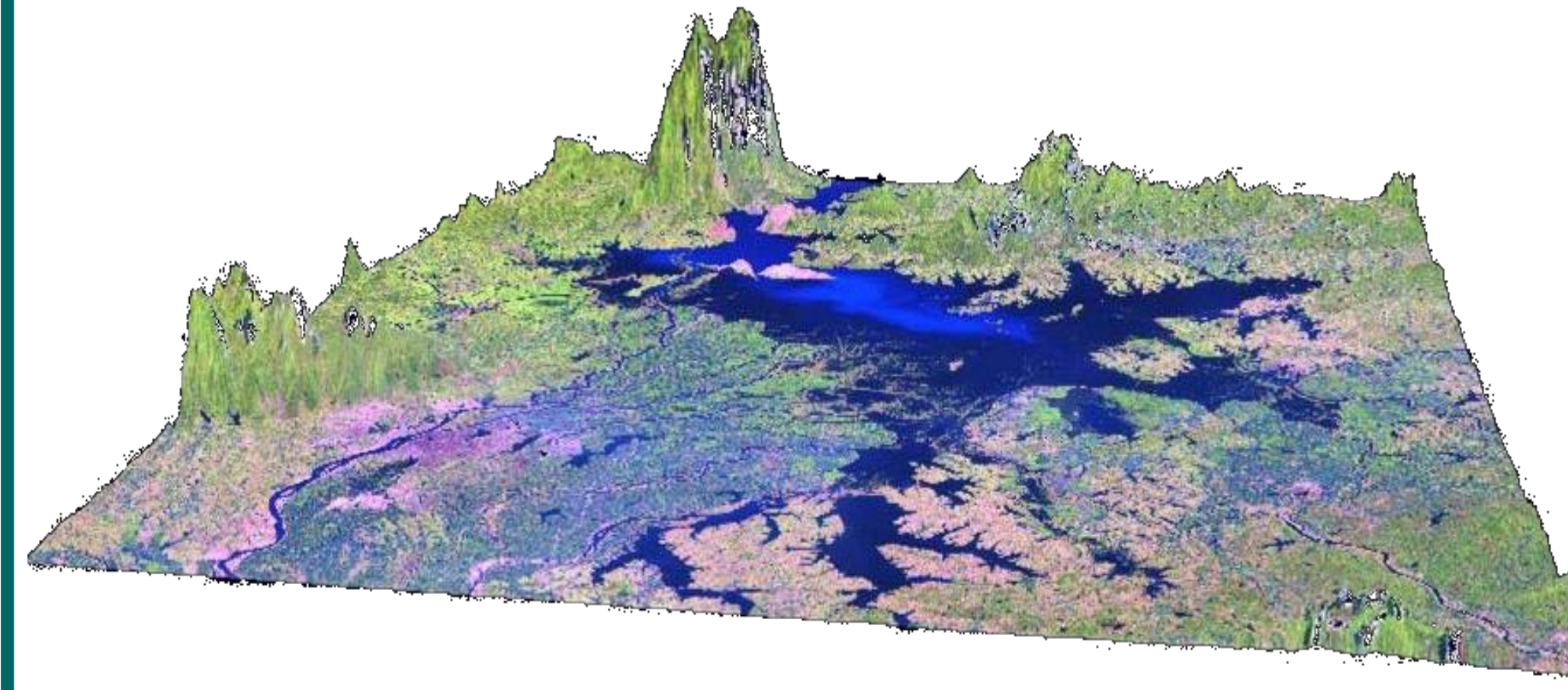
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II

Practical Goals:

- Provide a scientific basis for government development policy making in the context of flood hazards;
- Generate insights into how the farmer households in PLR can better respond to the uncertainty of flood dynamics and social-economic-political changes.



- A poor rural area in Jiangxi province
- Subjected to flooding from the largest fresh water lake in China
- Experiencing rapid and dramatic social-economic-political changes



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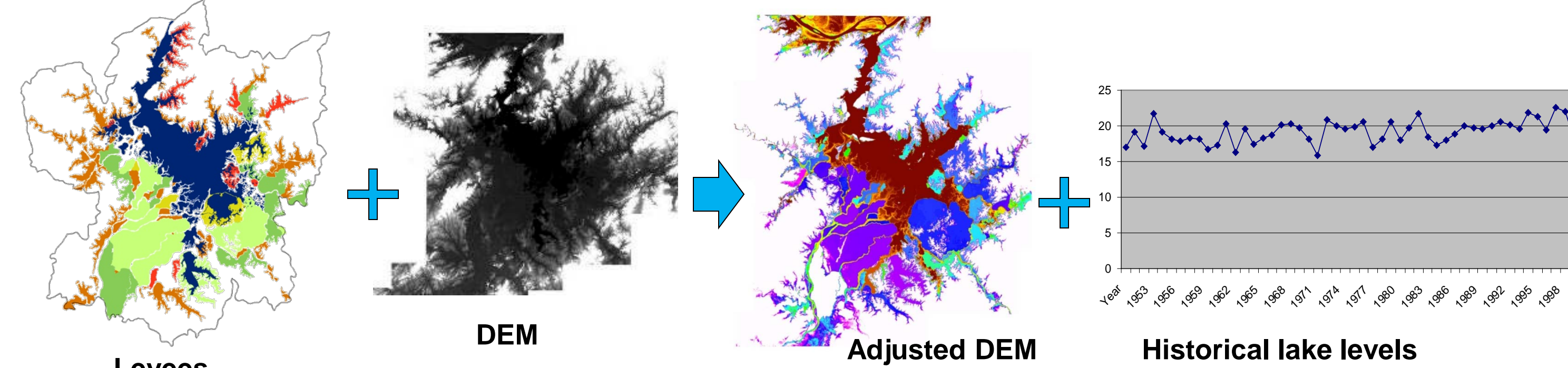
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- Farmers around Poyang Lake

This dissertation builds upon a NASA-funded project on land use and vulnerability in PLR, led by Dr. Dan Brown.

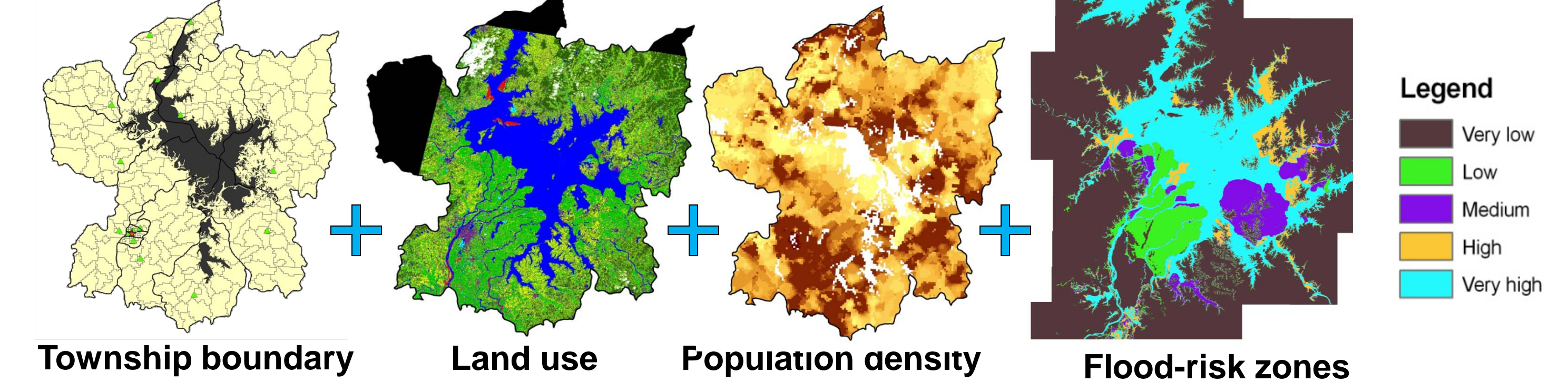
Part I A Regional Assessment of Well-being Combining GIS, Remote Sensing and Social-Economical Data

Objective: To provide scientific information for development policy making in the context of flood hazards in PLR.

Mapping Flood-Risk Zones



Deriving Variables for the Assessment



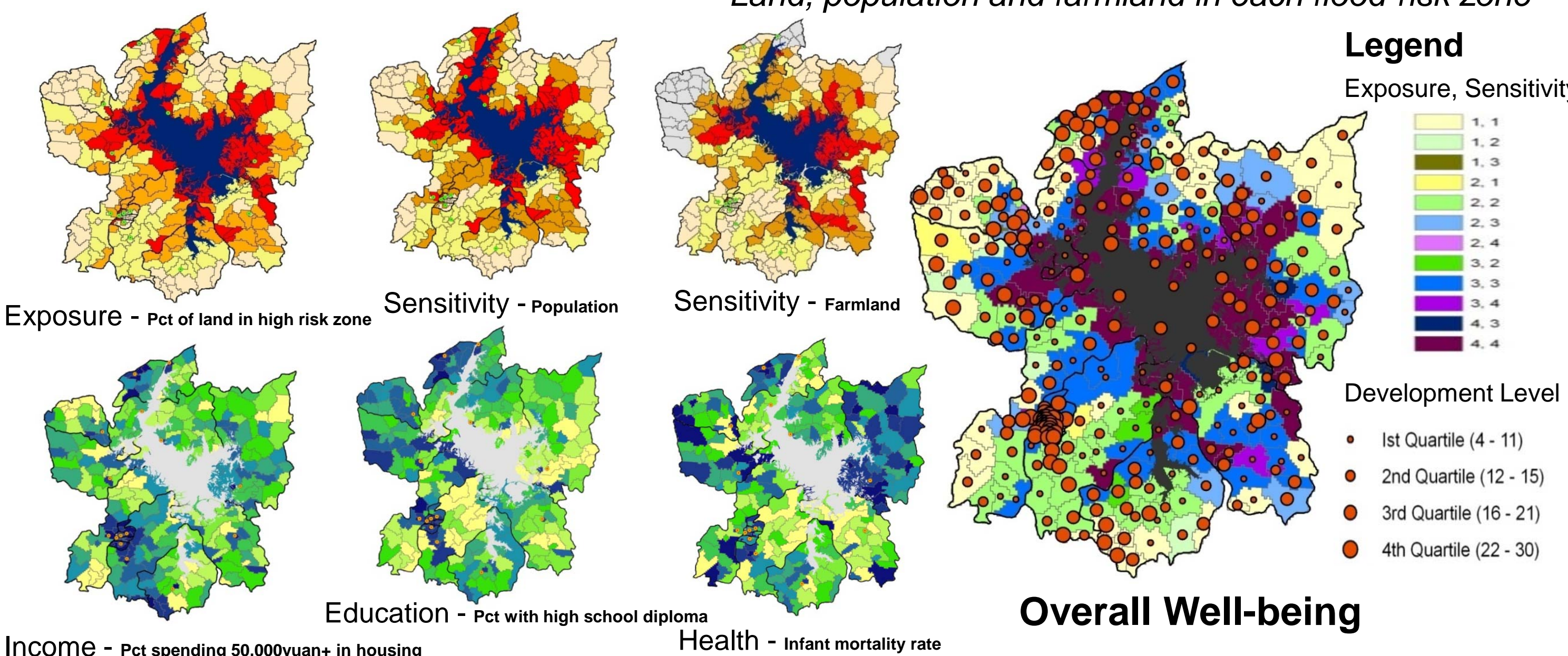
For each town (total of 298):

- Percentage of land in high flood risk zone
- Percentage of farmland in high flood risk zone
- Percentage of population in high flood risk zone

Flood-Risk Zone	Area of Land	Population	Area of Farmland
Low risk	63.3%	68.2%	73.8%
Medium risk	7.4%	8.6%	15.5%
High risk	29.3%	23.2%	21.6%

Land, population and farmland in each flood-risk zone

Assessment Results:



Exposure	Sensitivity	Development Level	Implications for Different Types of Towns
High	High	Low	Candidates for wetland restoration or natural reserves
H	Extremely H		Induce or help people migrate away in the long run
H		H	Promote flood-damage-reduction agricultural practices
H	H	H	Examine development carefully & make adjustments accordingly
L		L	Look for reasons seriously in the human system

Part II An In-depth Analysis of Well-being at Finer Scales and its Underlying Causes based on Surveys and Interviews

Question: WHAT factors (household characteristics, the large social-economic-political setting and physical environment) and HOW these factors interacting with each other affect the well-being of a household through its land-use & livelihood decision-making process?

Approach: Quantitative + Qualitative

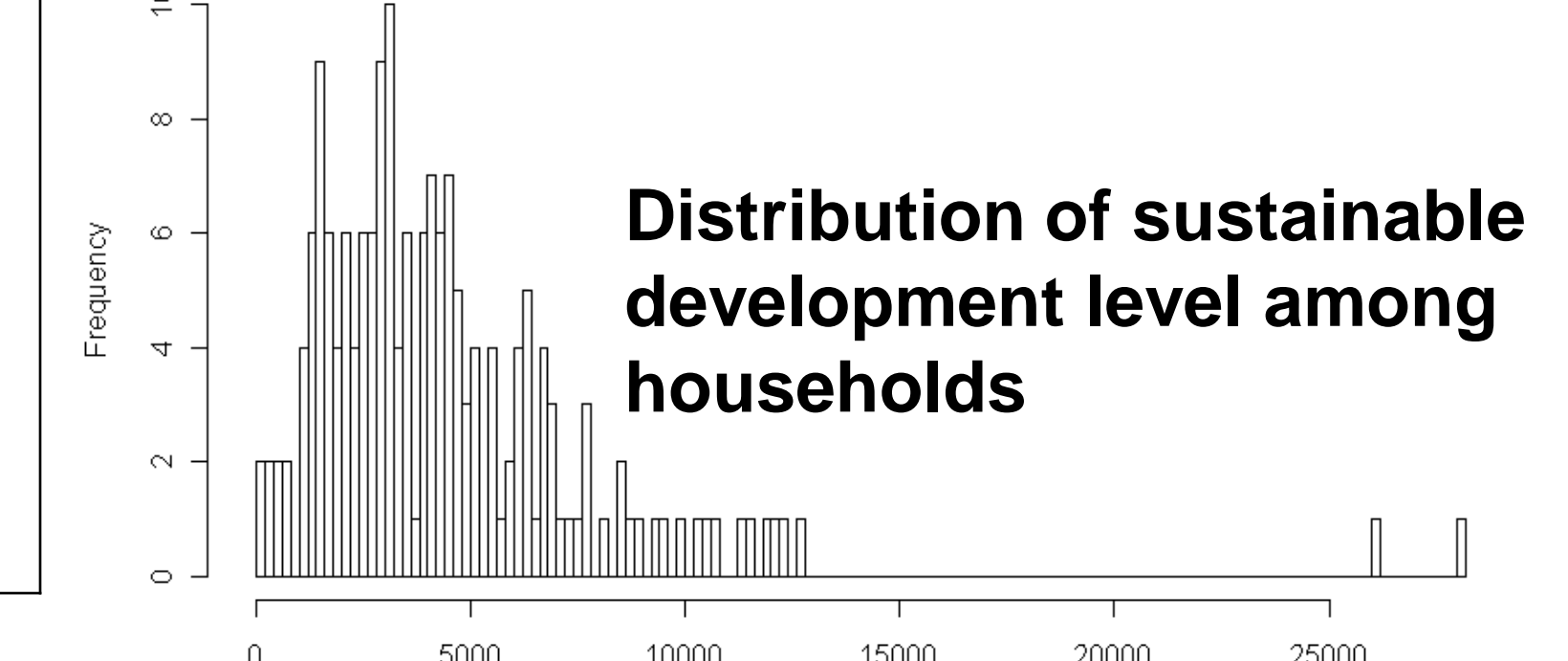
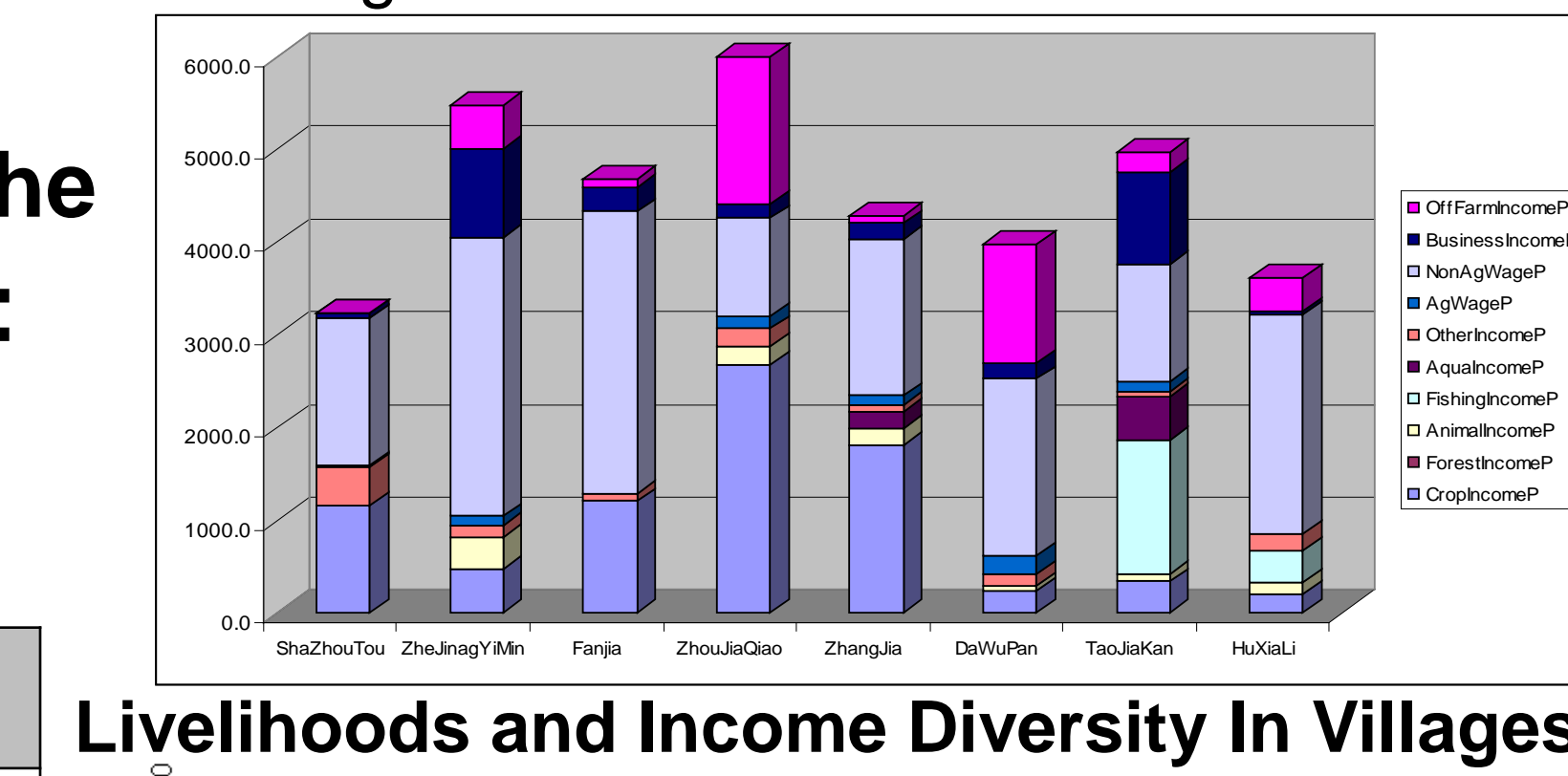
- (i) Synthesize perspectives from social vulnerability analysis, sustainable livelihoods analysis & development economics,
- (ii) Focus on the livelihoods of people,
- (iii) Examine and explain the variations between communities, groups and households in well-being,
- (iv) Look into flood impacts on the current land-use practices (the sensitive part of the livelihoods to flooding) and land-use drivers,
- (v) Examine the land-use & livelihood decision-making process of households to understand how the factors interacting with each other affect the well-being of the households.

Number of surveyed villages	8
Number of Surveyed Households	193
Number of Households Interviewed (with open-ended questions)	40+
Number of local government officials & scientists interviewed	10+

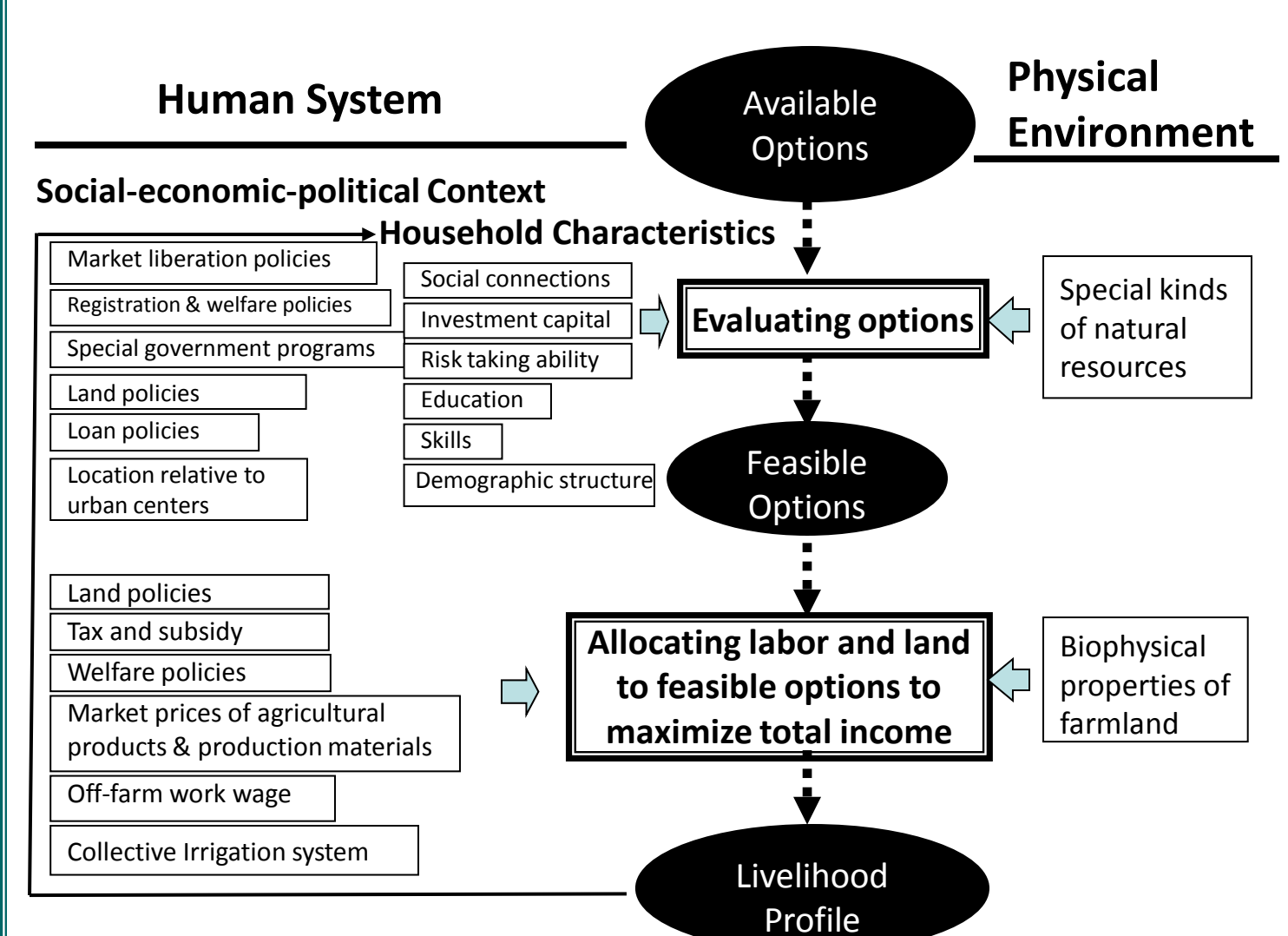
Some of the Analyses:

Representing well-being at the household level

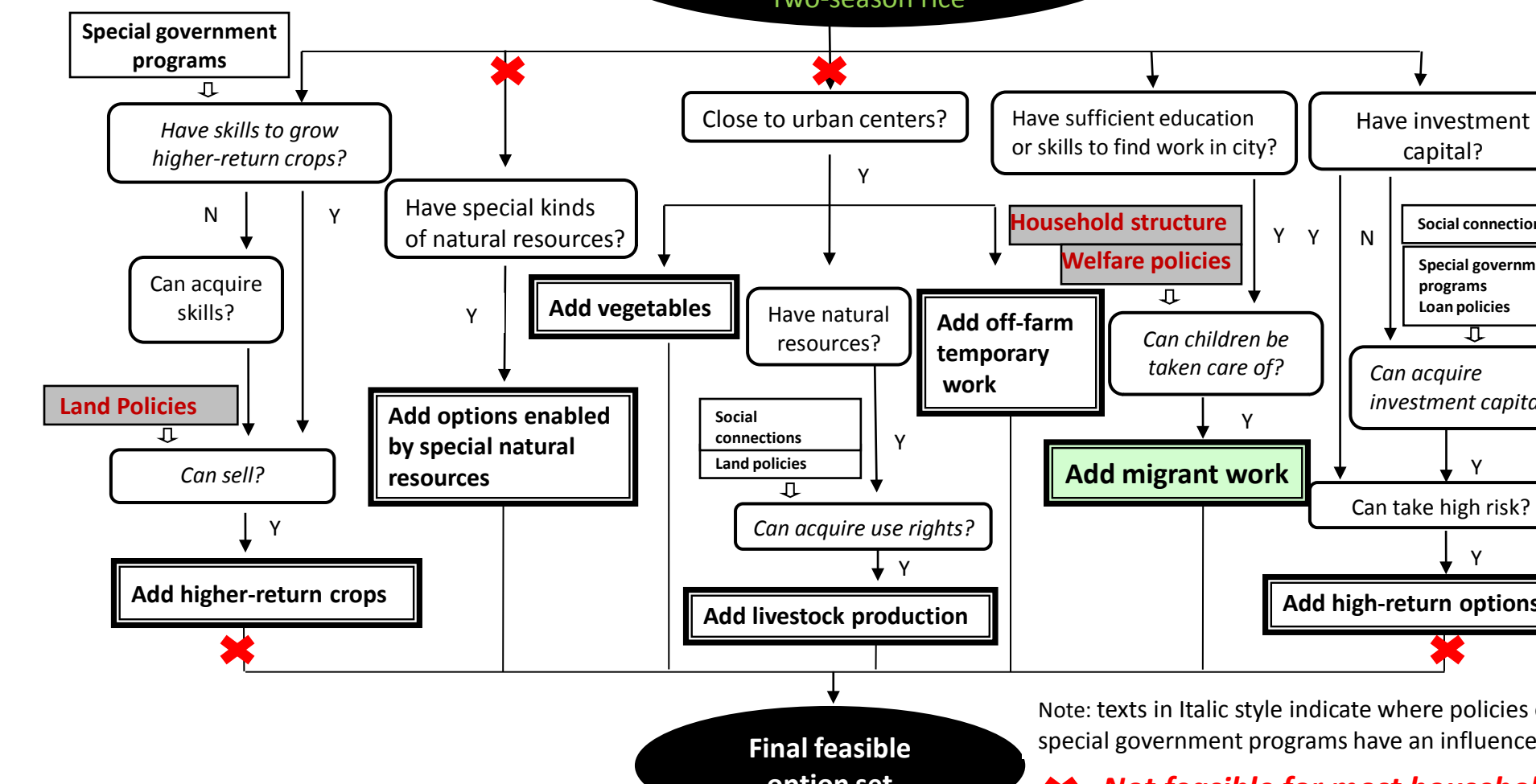
Well-being	Variables	Measurement Scheme of Sustainable Development Level
Exposure	Flood-Risk Zone	Used to discount farming-related income. The discount rates for different degrees of exposure are: 1: 99%; 2: 95%; 3: 90%; 4: 75%; 5: 60%
Sensitivity	Income Composition	Reflected in different discount rates for different income sources
Development Level	Farming Income Non-agricultural Wage Business Income Salary-based Income	Income Type 1 = (Farming Income + Agricultural Wage) * Discount Rate Income Type 2 = (Non-agricultural Wage + Business Income + Salary-based Income)



Land-use & Livelihood Decision-making



Evaluating Options



Conclusions: (i) The livelihoods of farmer households are not greatly sensitive to flood impacts (due to large amount of off-farm income), but the current land-use system is. (ii) The differences between villages are not significant (due to large between-household variations within villages), and each village has its unique characteristics suggesting different sustainable development pathways. (iii) Different groups of households exist, but the level of well-being of a household is essentially determined by its livelihood profile. (iv) Four major types of livelihood profiles are identified, and each can lead to high levels of well-being. (v) Which type of livelihood profile a household has and to what degree it is successful in executing the profile are mostly determined by its characteristics (social connections, education, labor, risk taking and hard working). (vi) The livelihoods of a household are also influenced by some factors at the community level (location, and more importantly the social capital of the village). (vii) The livelihoods of rural households are greatly affected by policies and macro-level processes (reforms at the national level, land policies and urbanization process of China).

Part III Exploring the Dynamics of Sustainability Using Agent-based Modeling

Build upon Insights from the Household Analyses:

- The Key Issue of Sustainability in PLR & Rural China is BAD Resilience: low development (in rural income & agricultural production) but resilient;
- Households are economic agents with few feasible options constrained by limited land resources, their own characteristics & large social settings;
- The small land holding of households (resulting from past land policy) is now a significant barrier to agricultural productivity and rural development;
- Rural development is tightly linked to the urbanization process in China.

Major Policy Recommendation:

- ❑ Implement appropriate migration policies to absorb some migrant workers formally to the urban system;
- ❑ Promote local urbanization by developing featured local industries (that suits the natural environment and integrate agriculture into the overall development plan) to further absorb the surplus of rural labor;
- ❑ Further reform land policies to consolidate fragmented farmlands, and increase land-use efficiency and rural income through large-scale farming.

Objective:

- (i) Explore if these recommended policies can break the bad resilience;
- (ii) Identify conditions under which they will or will not work.

Design:

The Future of the System	Conditions			
	Wage Increase Rate	Agricultural Product Price Increase Rate	Off-farm Work Opportunity	
Status Quo (private negotiation of leases)	5%	10%	100%	90%
Formal Land Rental Market				
Land Rental Market & Migration Policy				

Representations:

- ❖ Formal Land Rental Market Version I: Auction-Based
- ❖ Migration Policy
- ❖ Households (Agents)
 - Attributes:
 - Members (Age Group & Education Level)
 - Plots (one-season rice, two-season rice, cotton)
 - Asset
 - Decision Making:
 - Attempt to maximize total income combining simple rules with an evolutionary approach.

Results: coming soon ...