

Quantitative Approach for Evaluating Risk, Social Vulnerability and Adaptation Measures to Climate Change Impact

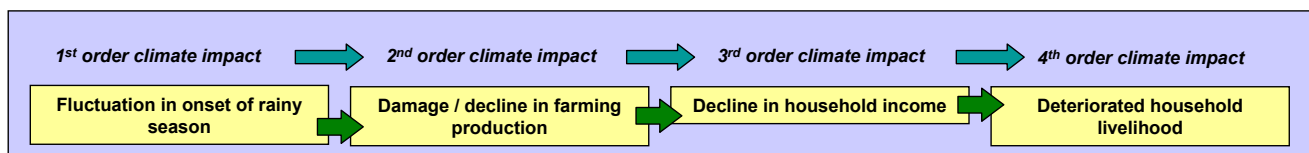
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Background

Principle concept in V&A study:

- Climate impact could be a **chain of consequences**
- Vulnerability is the function of **sensitivity, exposure and coping capacity** and is result of **multiple stresses**, climate and non-climate
- Adaptation strategy is **placed-based** and **time-specific** and possibly **response to multiple stresses**, and influenced by **culture, socioeconomic, physical condition and government policy** and can also be implemented at **multiple levels**, which aims to **minimize vulnerability** by increase capacity to better manage the future risk

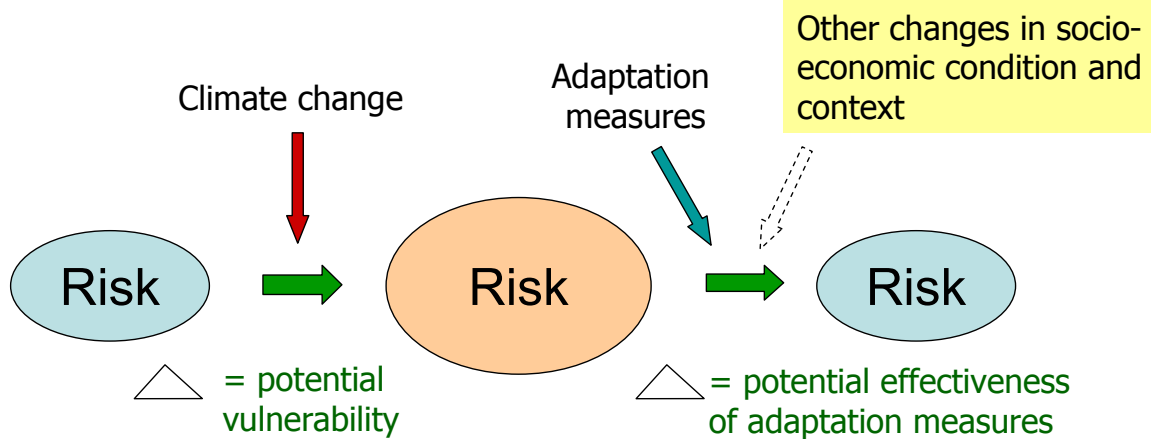


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Quantitative Approach for Evaluating Risk, Social Vulnerability and Adaptation Measures to Climate Change Impact

Overall concept is based on risk assessment and risk comparison

A method originally improvised for the quest to understand risk and social vulnerability to climate change impact

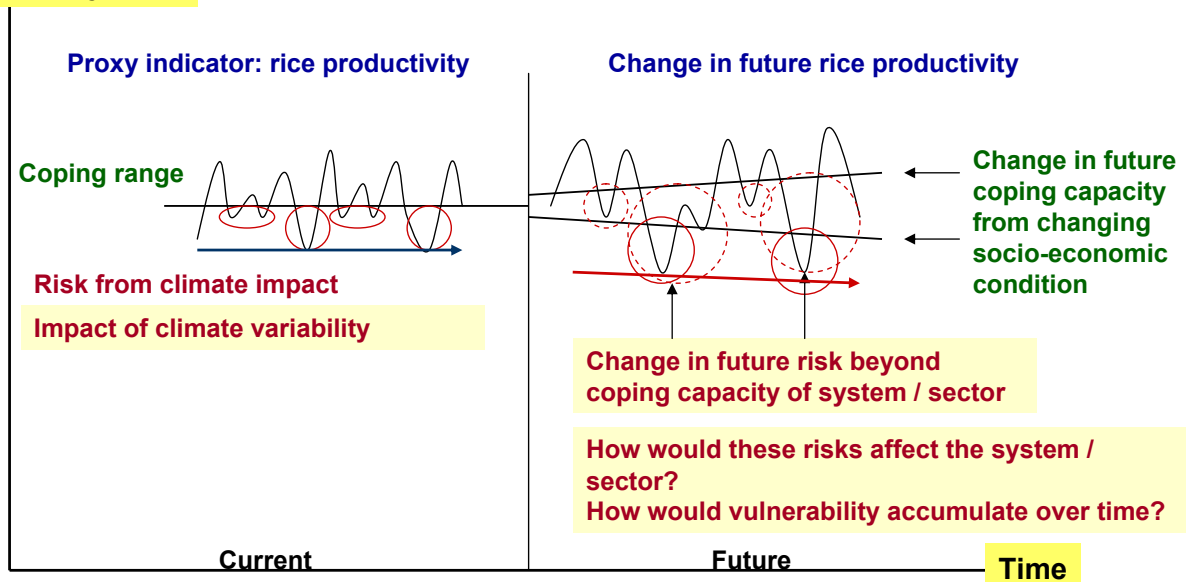


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Quantitative Approach for Evaluating Risk, Social Vulnerability and Adaptation Measures to Climate Change Impact

Impact of climate on bio-physical system

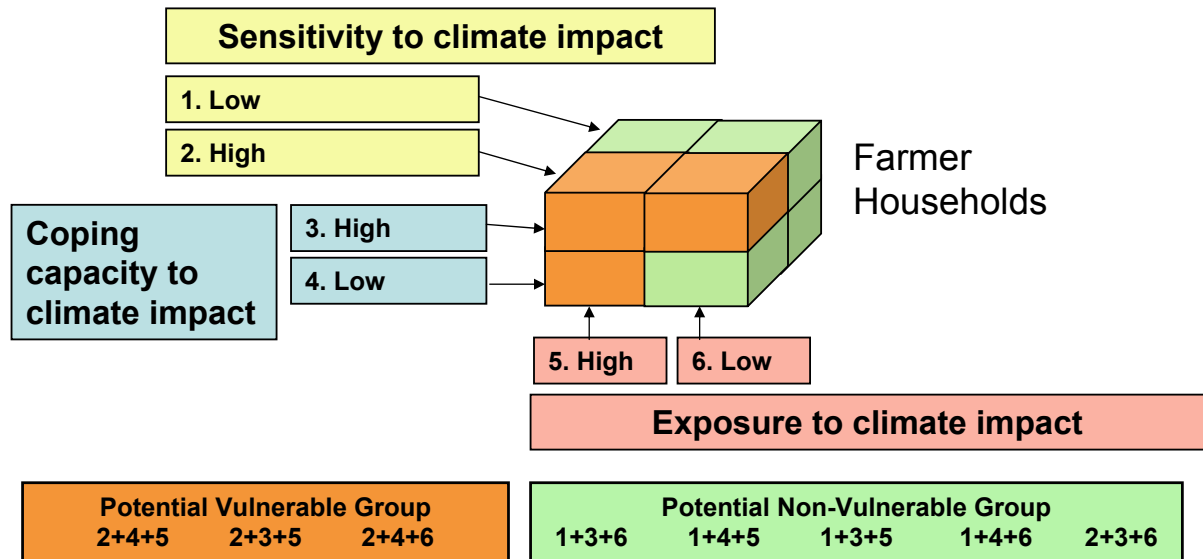
Risk could change over time
Compare risk from climate impact: current vs future



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Quantitative approach for evaluating climate risk

Multi-criteria analysis for risk assessment

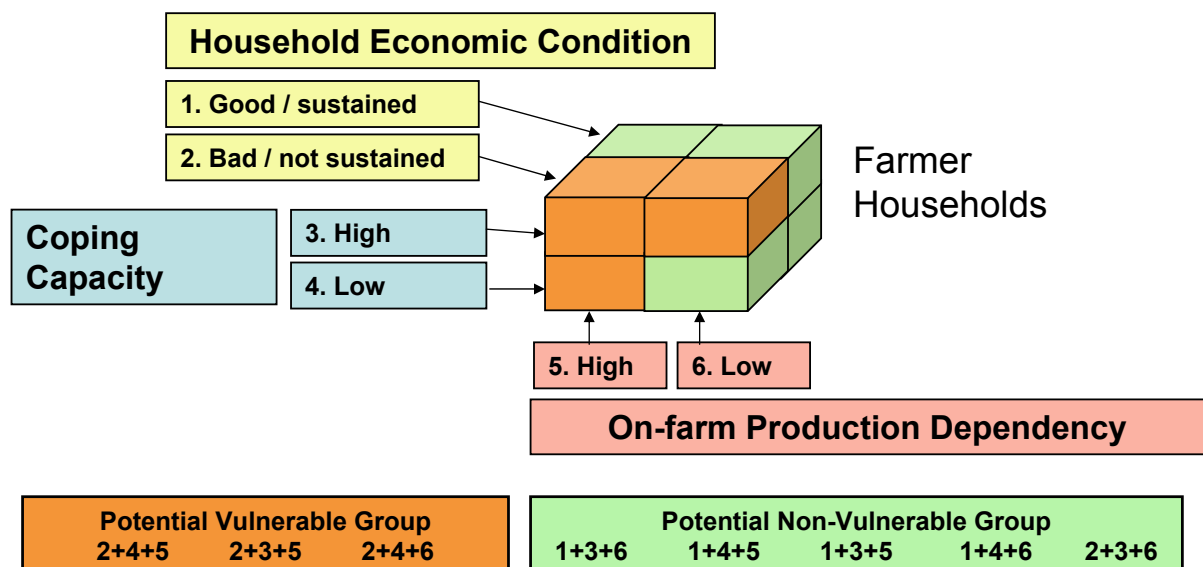


The system/sector that get most impact not necessary the most vulnerable.
The poorest in the society are not necessary the most vulnerable.

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Climate risk assessment: Use of multiple indicators in multi-criteria analysis



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Quantitative approach to evaluate risk and social vulnerability: Multi-criteria/Multiple indicators approach

Sensitivity to climate threat

Criteria	Indicator	Measurement	Scoring	Min score	Max score
Household Economic condition	Household Sustainability condition	Total household production (or total household income) / Total household consumption (or total household expenditure)	>1=0, 1-0.7=1, <0.7=2	0	2
	Household Production Resource Condition (1)	Farmland own / rent	Own = 0, Rent = 1	0	1
	HH production Resource Condition (2)	Farmland/capita (ha) (use 0.65 as threshold in this analysis - size of farmland that can produce productivity to support annual food consumption for one family member)	>= 0.65 = 0, < 0.65 = 1	0	1
Sub-total				0	4

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Exposure to climate threat

Criteria	Indicator	Measurement	Scoring	Min score	Max score
Household Dependency on On-Farm Production	Ability to use non-climate sensitive income to support household livelihood	Total household consumption / Income from livestock + Fixed off-farm income	>1=0, 1-0.7=1, <0.7=2	0	2
	Dependency on rice production to sustain basic needs	Total rice production / Total food expenditure (or Total household fixed expenditure)	=1=0 <1-.7=1 <0.7=2	0	2
Sub-total				0	4

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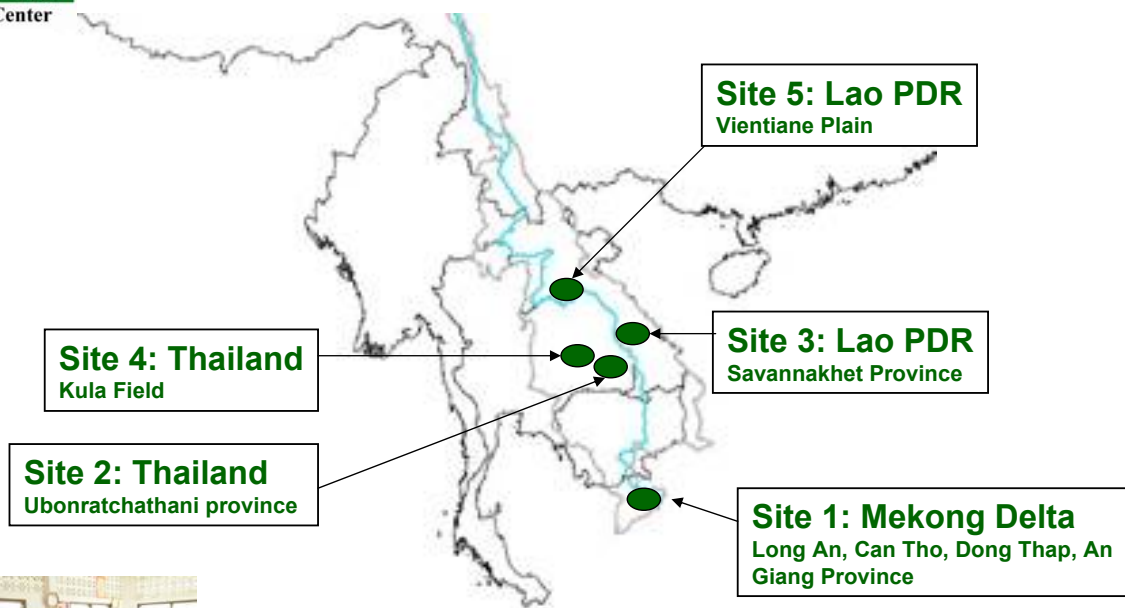
Coping capacity to climate threat

Criteria	Indicator	Measurement	Scoring	Min score	Max score
Coping Capacity	Ability to use non-farming income to maintain livelihood	Total household consumption + Total cost of production / Total household saving + Total off-farm income + Income from livestock + Extra income	$\leq 1 = 0$, $>1-1.3 = 1$, $>1.3 = 2$	0	2
	Ability to use non-farming income to maintain household basic needs	Total food expenditure (or Total household fixed expenditure) / Total household saving + Total off-farm income + Income from livestock + Extra income	$\leq 1 = 0$, $>1-1.3 = 1$, $>1.3 = 2$	0	2
Sub-total				0	4

- The household which risk score is between 0-4 is classified as **low risk category**.
- The household which risk score is between 5-8 is classified as **moderate risk category**.
- The household which risk score is between 9-12 is classified as **high risk category**.

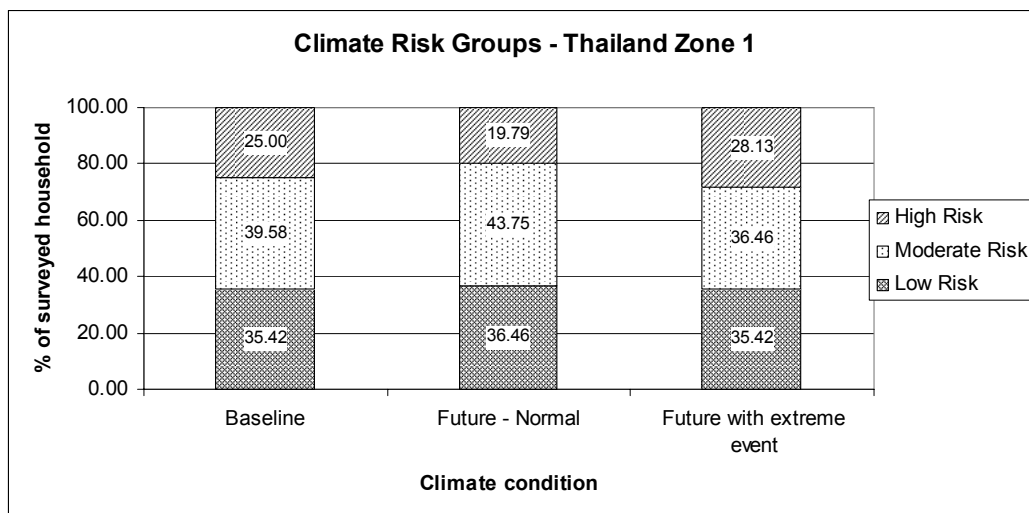
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Quantitative approach for evaluating risk: Case study



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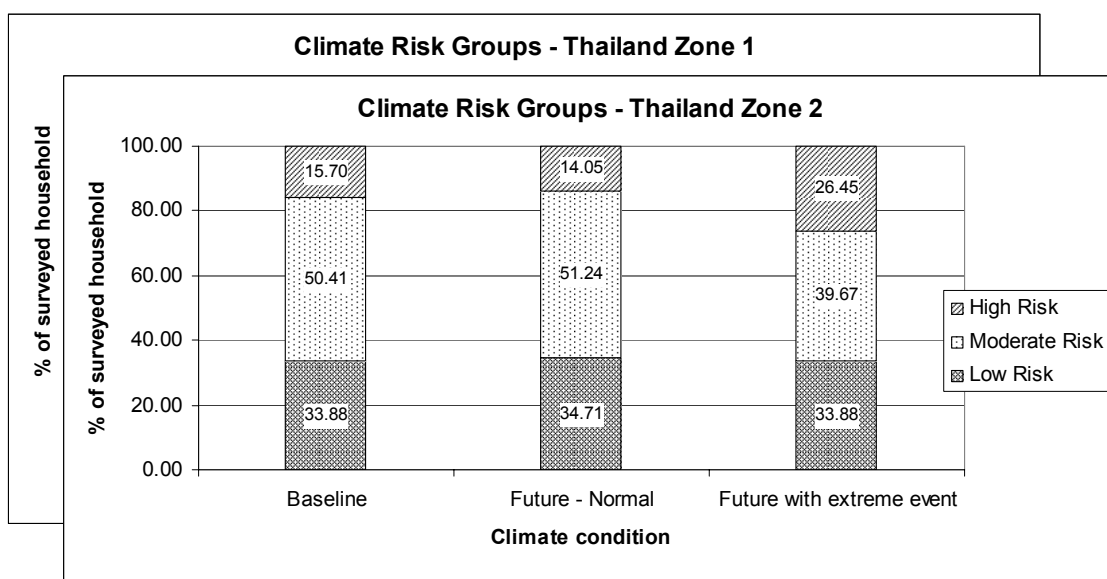
Quantitative approach for evaluating climate risk: Case study example



- Those low risk households seem to be resilience to climate change impact
- The moderate risk group will move upward to high risk group

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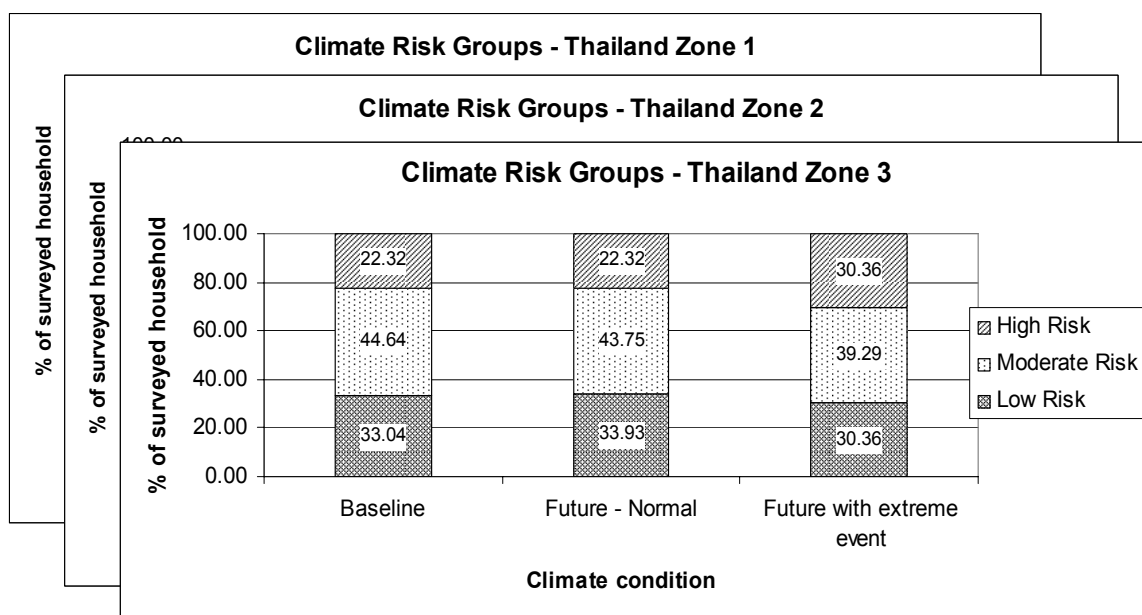
Quantitative approach for evaluating climate risk: Case study example



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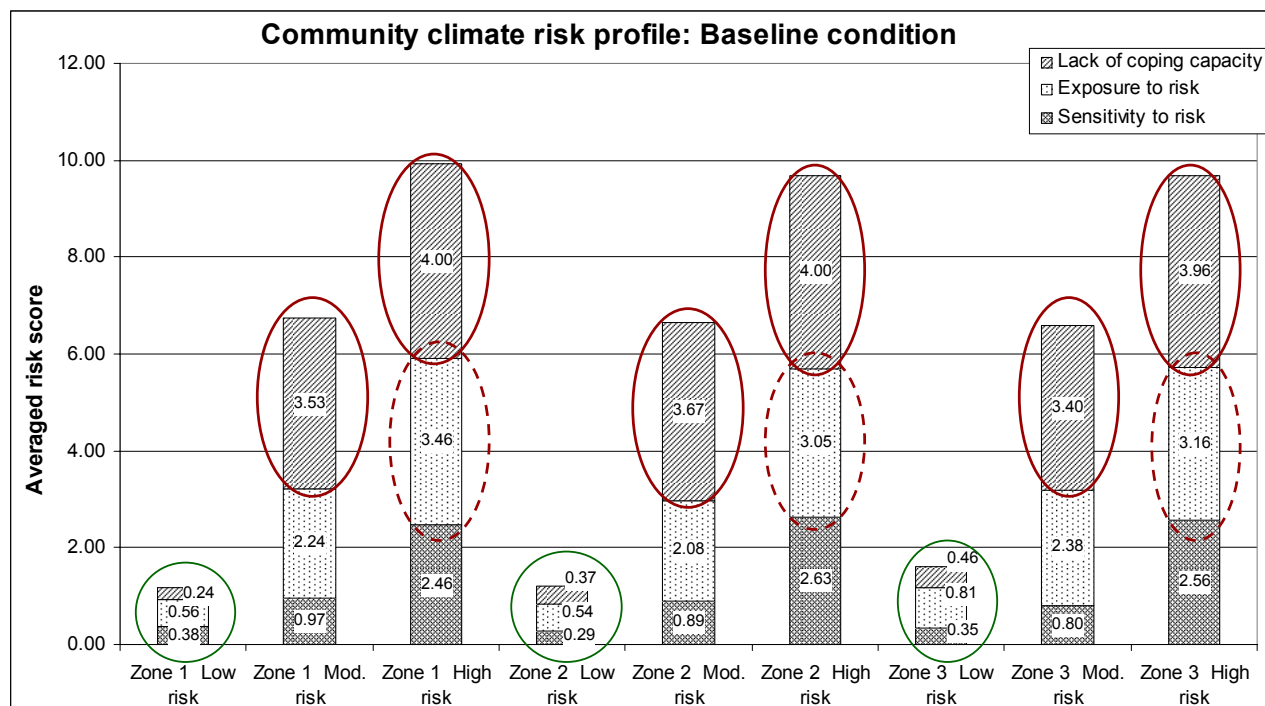
Quantitative approach for evaluating climate risk: Case study example



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Quantitative approach for evaluating climate risk: Case study example

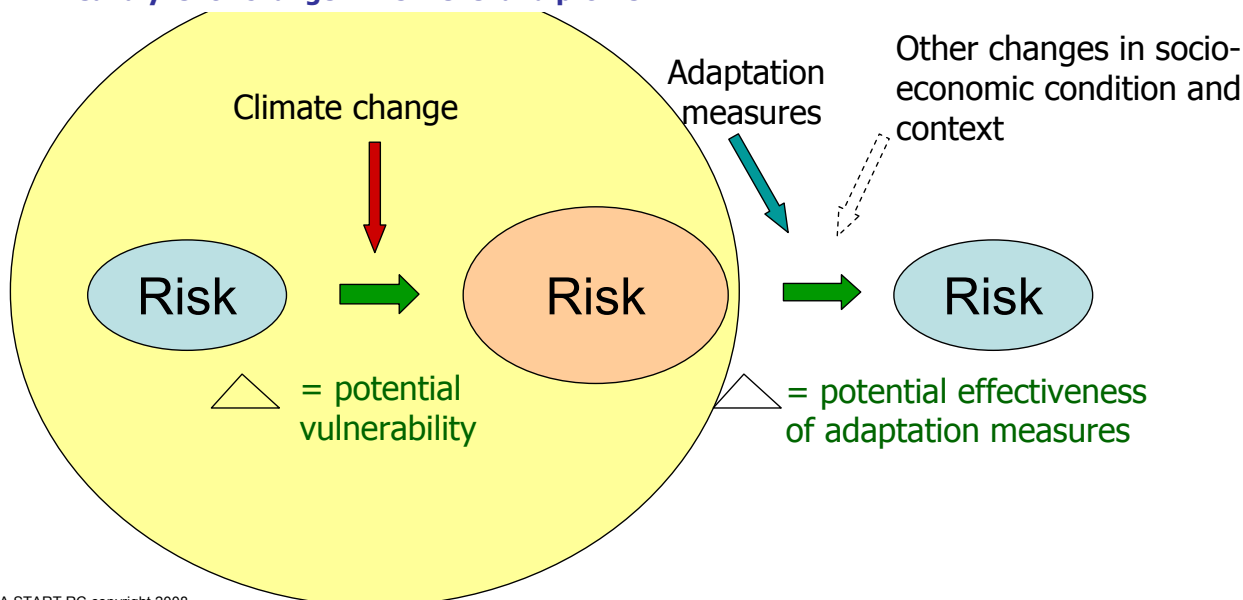


- Those low risk households seem to be resilience to climate change impact
- Those who are at risk: lack of coping capacity + exposure to risk

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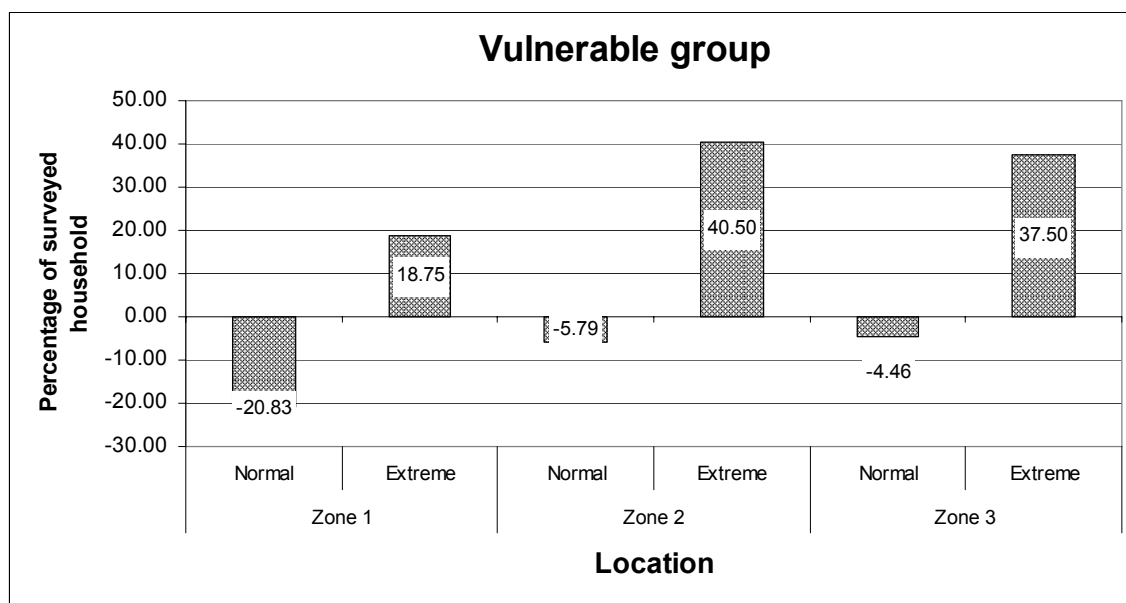
Quantitative approach for evaluating climate risk: Social vulnerability analysis

Use proxy for climate change impact, e.g. change in rice production and its affect on the parameters used to measure each indicator, e.g. HH production, HH income, etc. and reanalyze for change in risk level and profile



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Quantitative approach for evaluating climate risk: Social vulnerability analysis



Those households whose risk score change between baseline and future

Zone 2 & 3 is more vulnerable than Zone 1

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Quantitative approach for evaluating climate risk: Social vulnerability analysis

Gaps – issues need to be further modified

- Able to explain risk and vulnerability of household and community in site-specific assessment – good for community-base study, but captures too much of local context – need modification for assessment at the macro level
- Data gathering was based on field interview – difficult to verify
- Used only single proxy of climate change impact – but could be added
- Not yet capture the dynamism of future socio-economic development – need socio-economic scenarios in the process
- Not yet capture multi-years accumulative impact of climate threat

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Quantitative approach for evaluating climate risk: Adaptation measures analysis

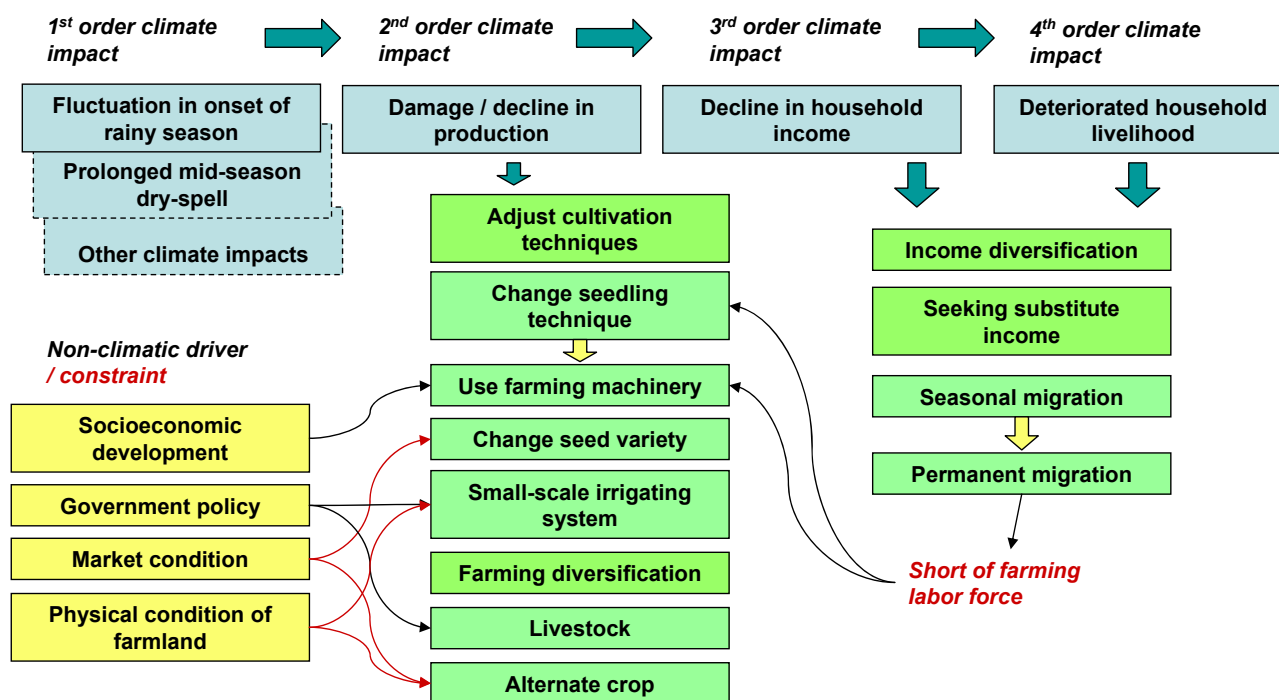
Adaptation to climate change: Objectives

- **Reduce sensitivity** – increase household productivity e.g. off season alternate crop, infrastructure dam & dyke, new variety of rice – more resilience to climate / higher yield, etc.
- **Reduce exposure** – less dependency on on-farm production or restructure on-farm production e.g. livestock
- **Increase coping capacity** – e.g. alternate source of food, safety net, external support, etc.



Quantitative approach for evaluating climate risk: Adaptation measures analysis

Holistic view upon adaptation measures – matter of context

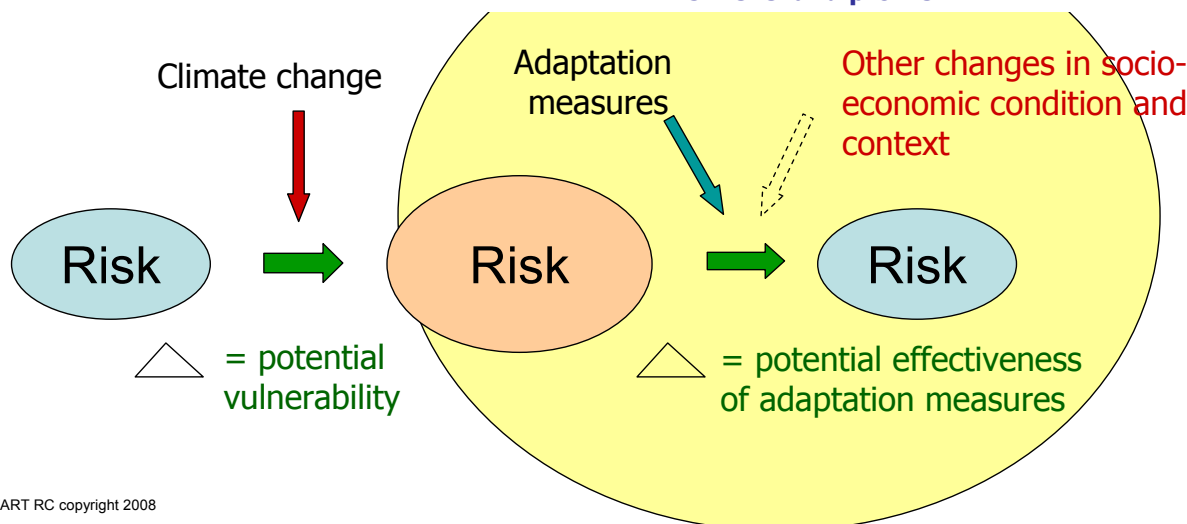


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Quantitative approach for evaluating climate risk: Adaptation measures analysis

Adaptation measures evaluation: Quantitative evaluation – risk reassessment

Assess the affect of adaptation measures on the parameters used to measure each indicator, e.g. HH production, HH income, HH production resources, HH saving, cost of production, etc. and reanalyze for change in risk level and profile



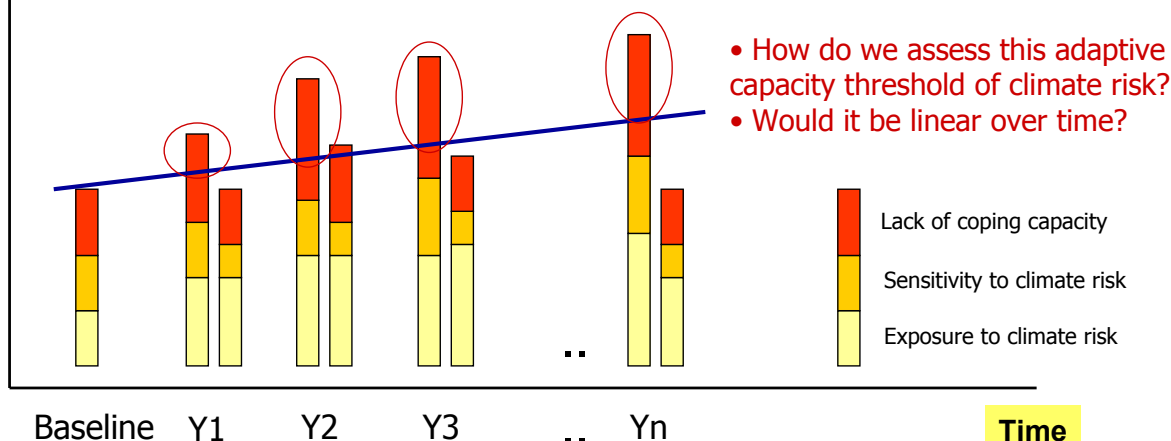
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Quantitative approach for evaluating climate risk: Adaptation measures analysis

Total risk and profile on climate impact

Risk from climate impact: current vs future

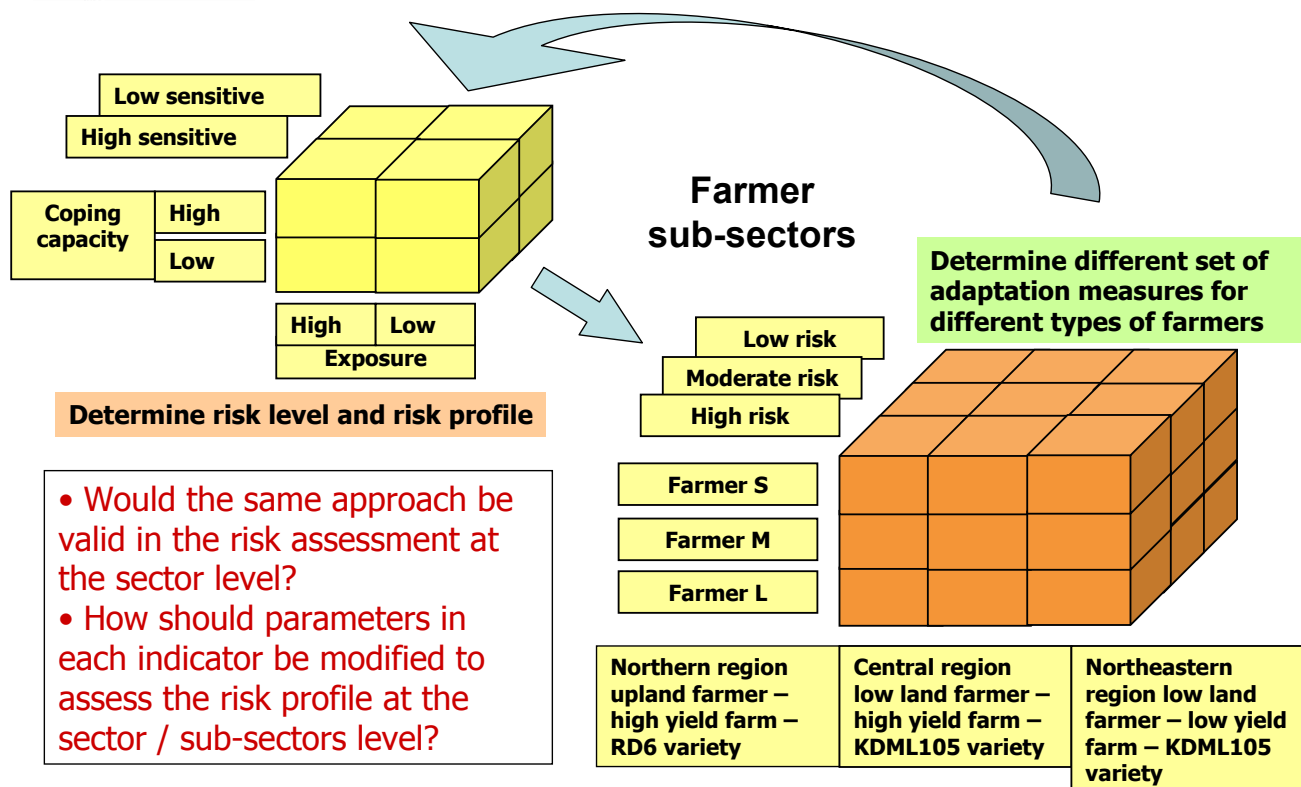
- How do we take accumulative deficit in climate risk management into consideration?
- Multi-year accumulative cash-flow type of analysis?



Risk profile without VS with adaptation measures
Target to manage future risk to be below certain threshold

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Formulating adaptation measures for farmer household/community: Assessment at sector level



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Qualitative approach in evaluating adaptation measures

Adaptation measures evaluation: Qualitative evaluation

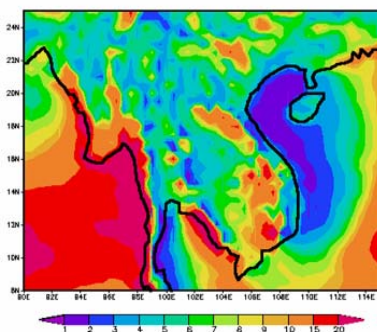
Example: Multi-criteria evaluation

Sufficient / appropriate indicators ?

	Sustainability	Timeliness	Effectiveness	Technical Feasible	Financial Feasible / Cost Effectiveness	Social / Cultural Acceptable	Others	Enabling Factors / Critical Success Factors
Adaptation Options (example)								
New rice variety	Y	N	Y	Y	Y	?		
Switch to new crop / alternate crop	Y	Y	N	Y	Y	?		
Small-scale irrigation system	Y	?	Y	Y	Y	?		
Mixed farming system	Y	N	Y	Y	Y	Y		
Move to new farmland	N	N	Y	Y	N	N		
Seasonal migrating	N	Y	Y	Y	Y	N		
Large-scale infrastructure	?	N	Y	?	N	N		
Medium-term climate forecast	Y	N	?	?	Y	Y		

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Thank You



Research partners:

Lao PDR – National University of Laos, STEA, NAFRI, WRCC, Meteorology & Hydrology Dept.
Thailand – Chiang Mai University, Ubon Ratchathani University, Khon Kaen University, Dept. of Agriculture, Land Development Dept., Meteorological Dept.
Viet Nam – Institute of Meteorology, Hydrology and Environment, Viet Nam