2012 International SWAT Conference

Indian Institute of Technology Delhi

New Delhi, India

Assessing Climate Change Impacts and Adaptation in Central Vietnam using SWAT and Community Based Approach: Case study in Vu Gia watershed, Quang Nam province – Vietnam

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Content

Quang Nam Problem Identification

Water Problems/Disasters

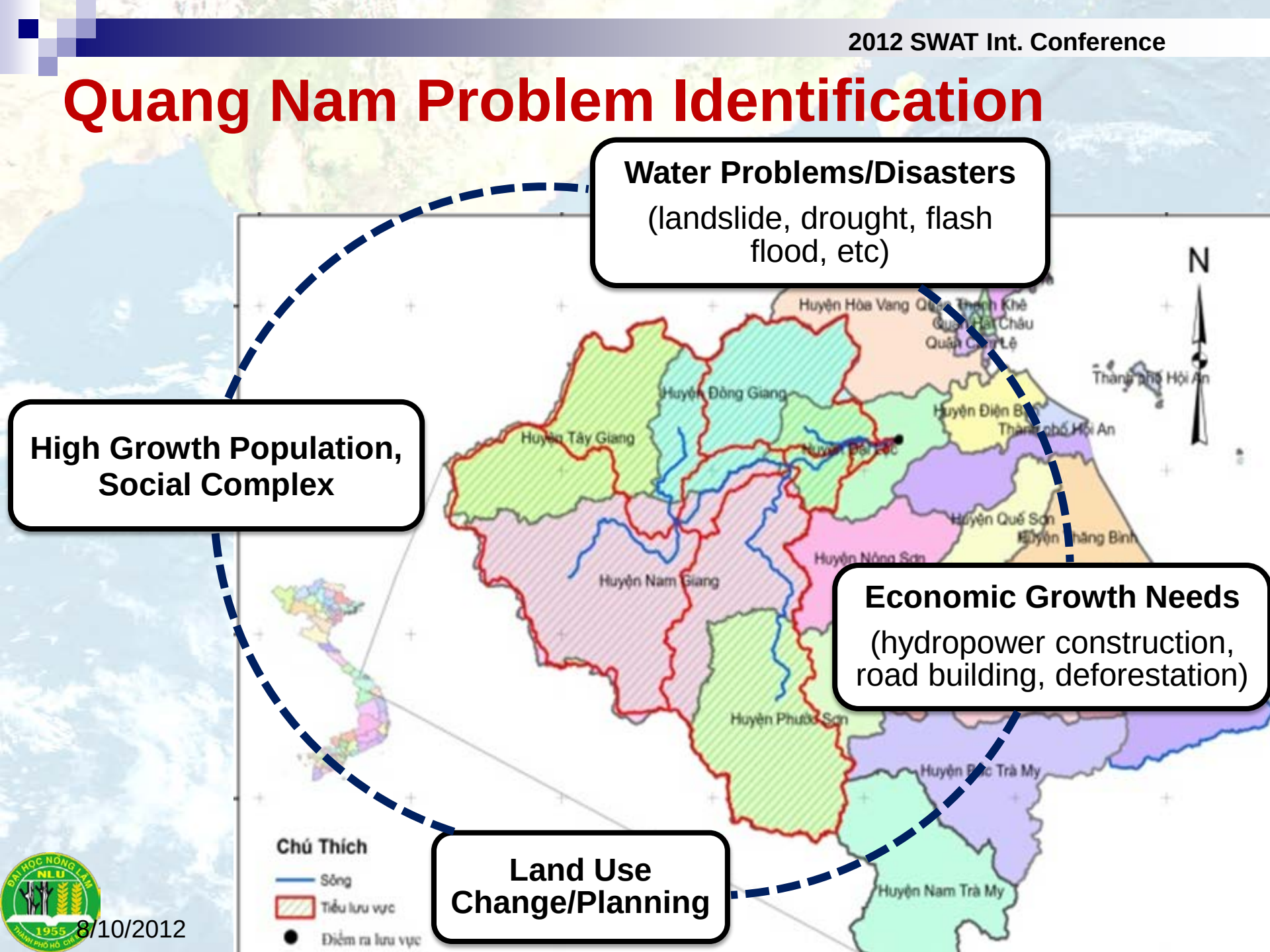
(landslide, drought, flash flood, etc)

High Growth Population, Social Complex

Economic Growth Needs

(hydropower construction, road building, deforestation)

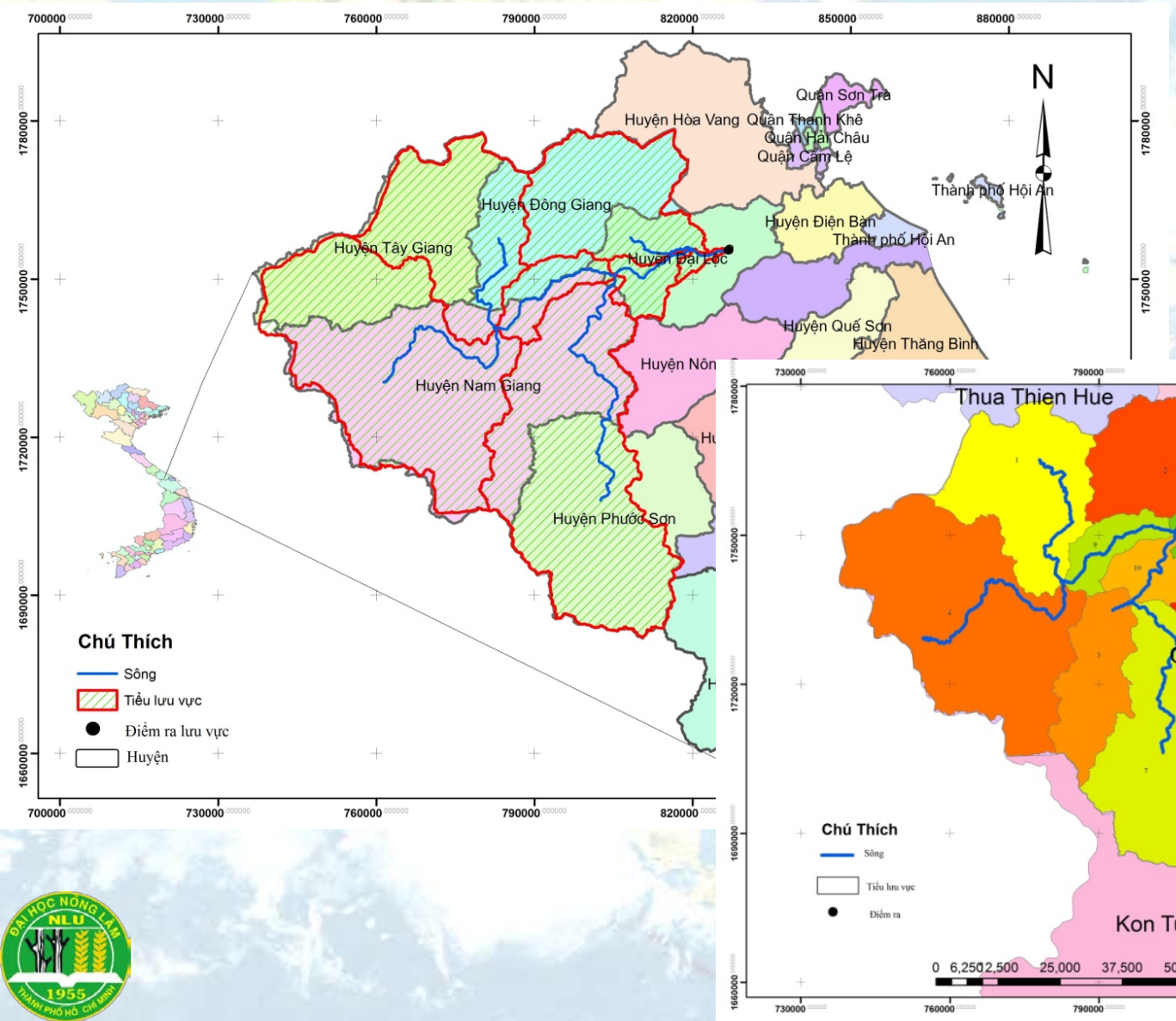
Land Use Change/Planning

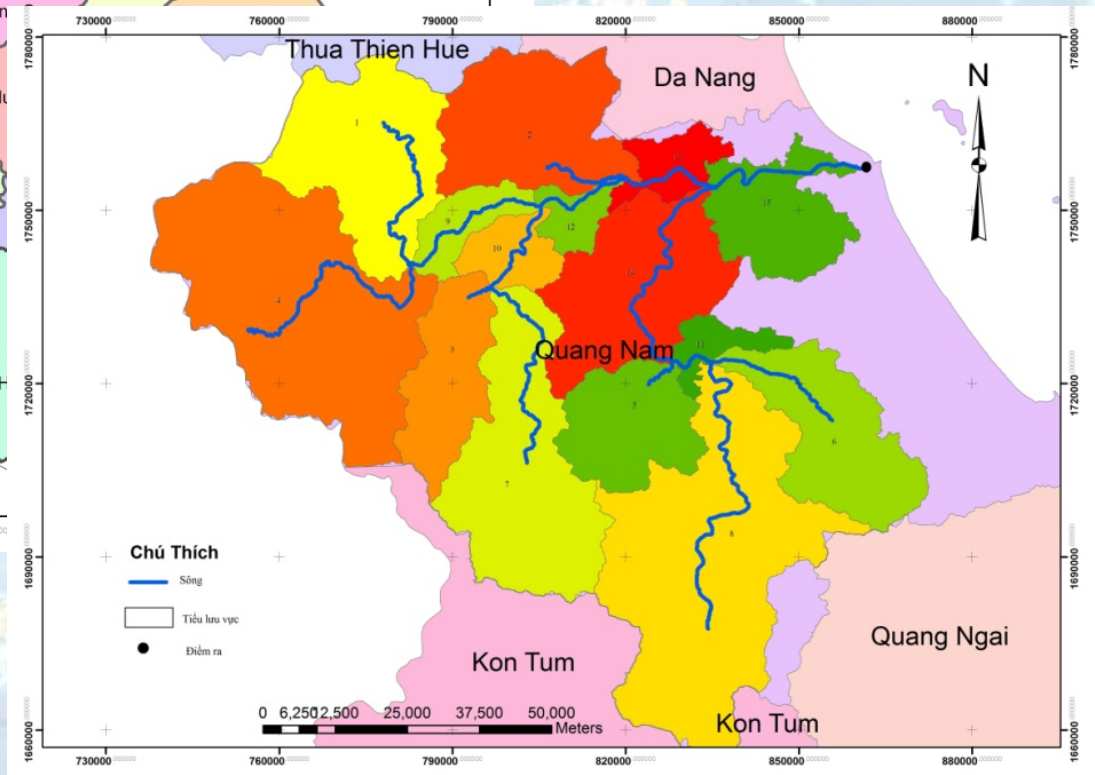


Objectives

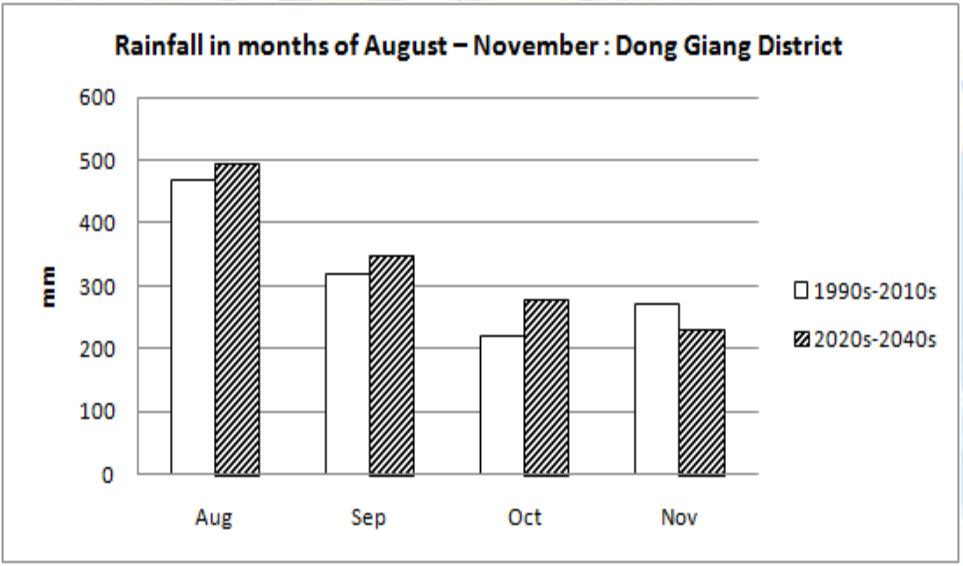
- To assess climate change impacts on ecosystems and livelihood in Dong Giang district, Quang Nam province;
- To make policy recommendations to decision maker on climate change impacts to adapt in the new context.

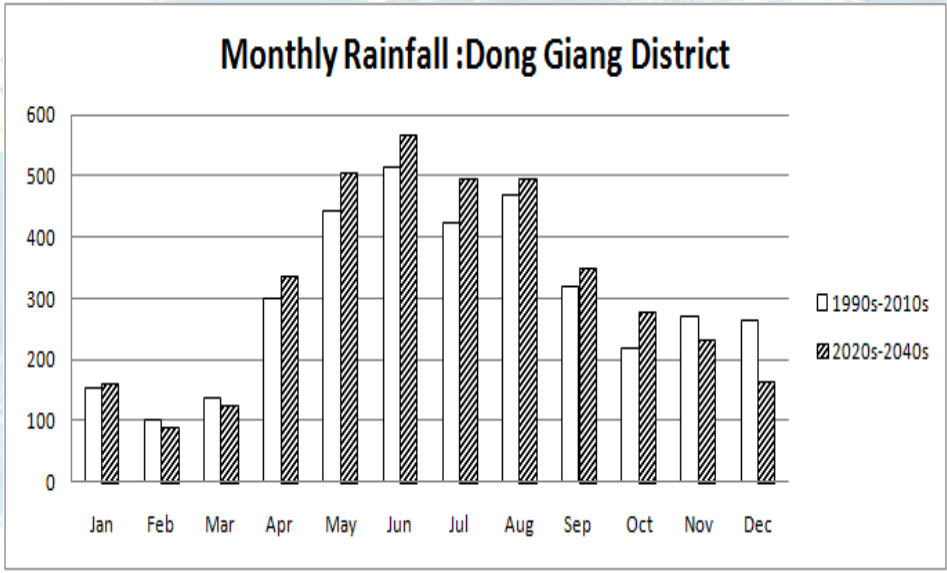
Study area description

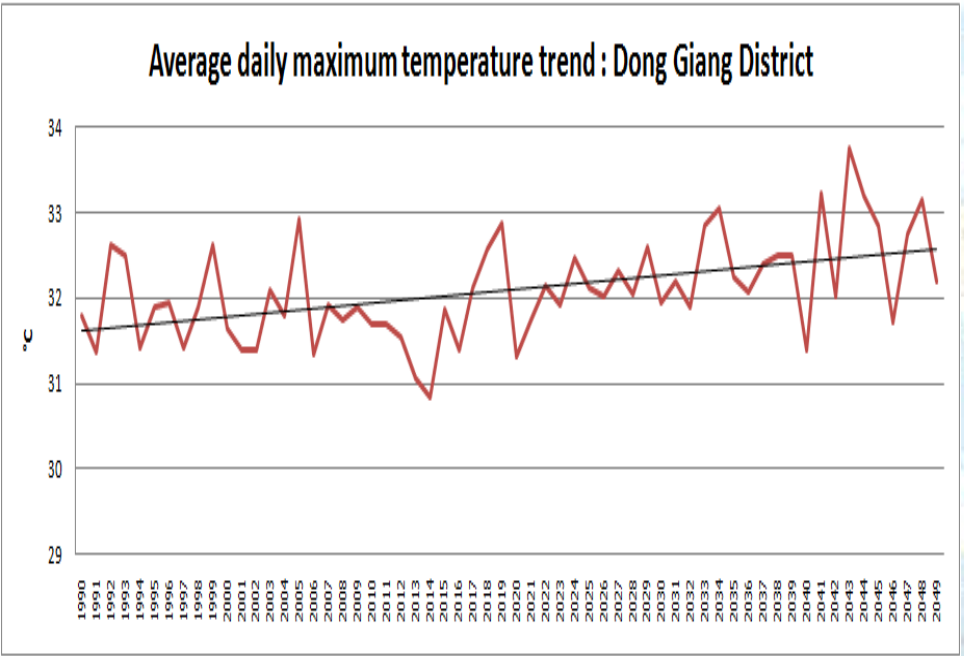


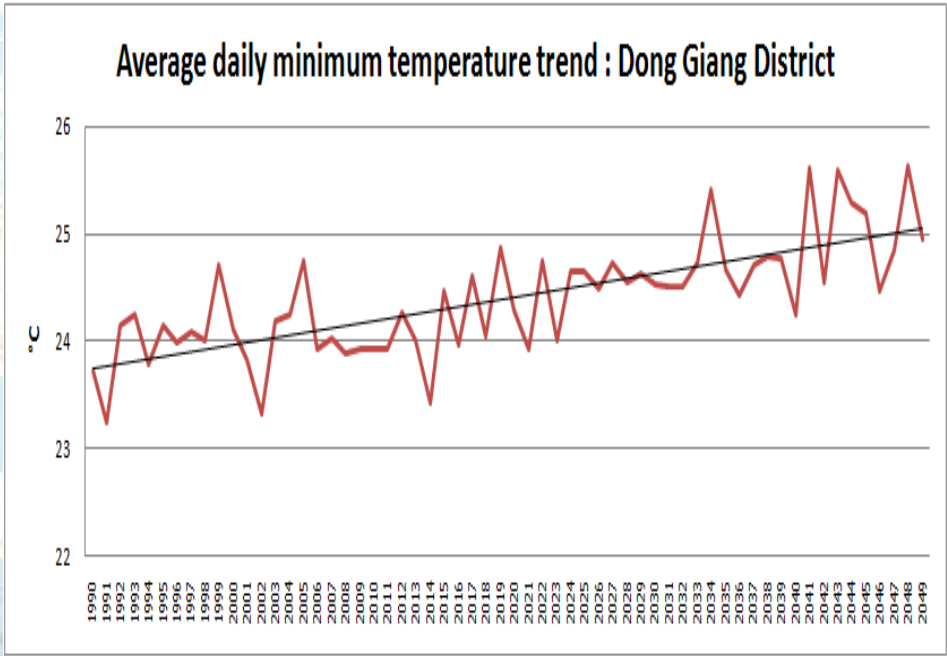


Climate Trend in Dong Giang district

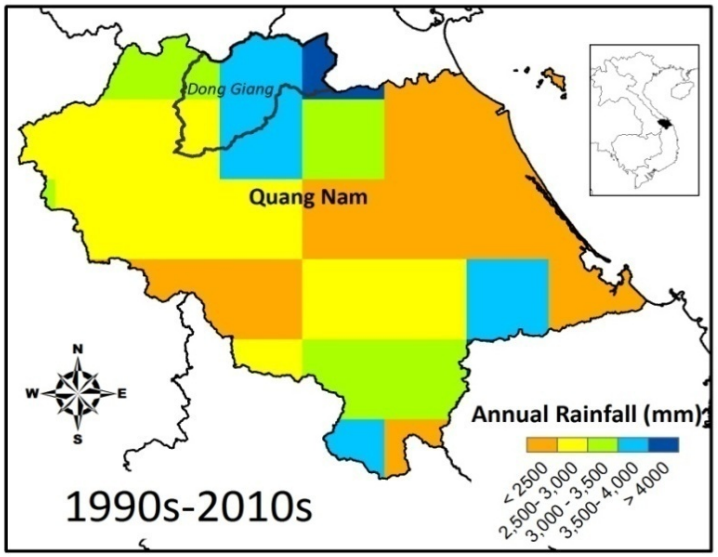


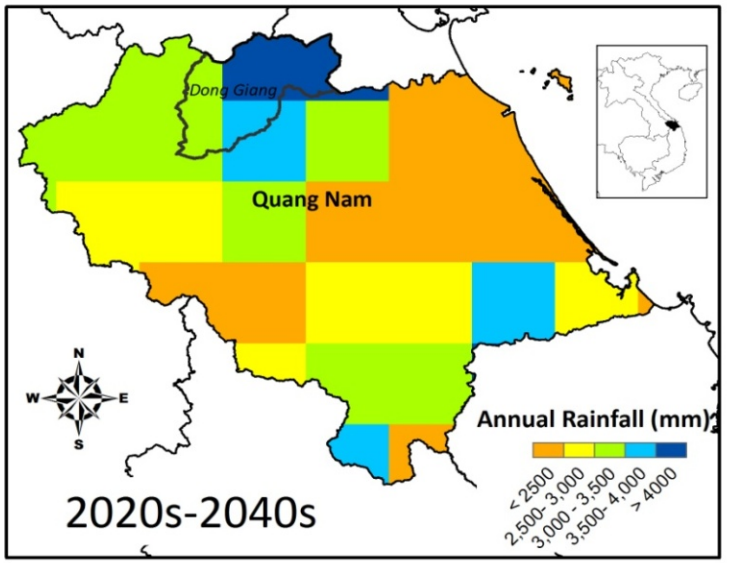


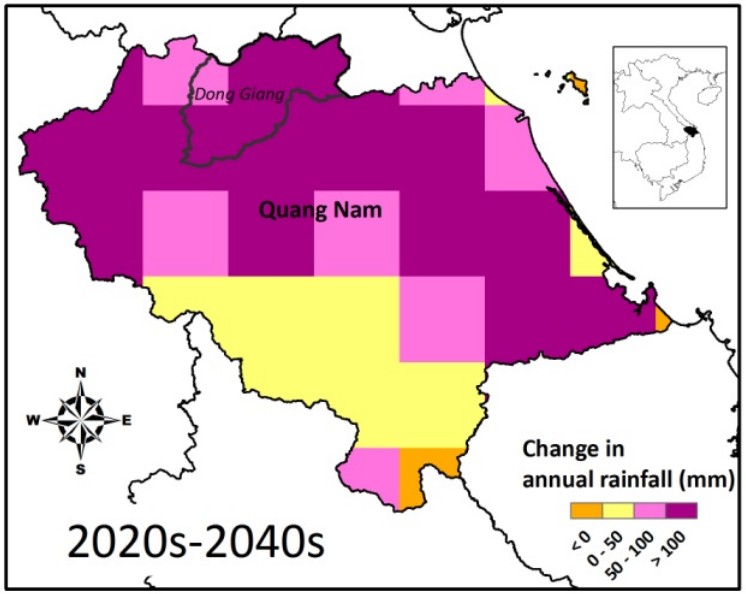




Rainfall Trend in Dong Giang district

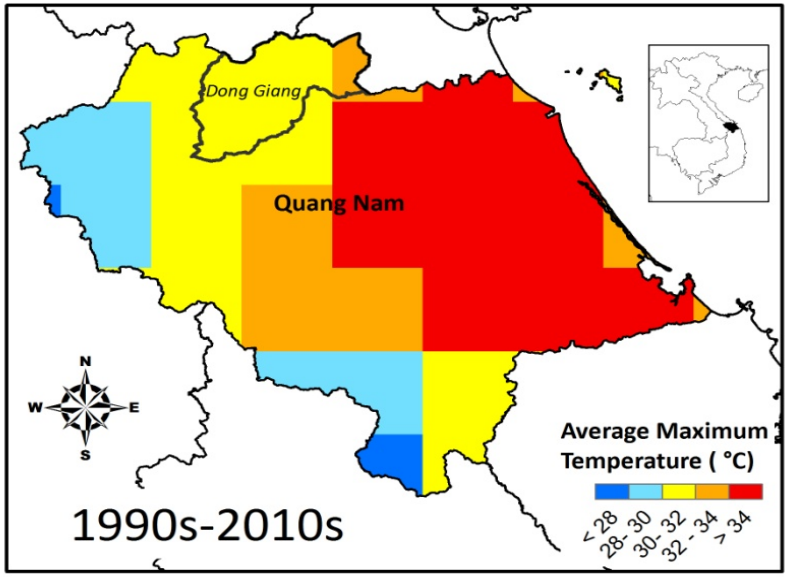


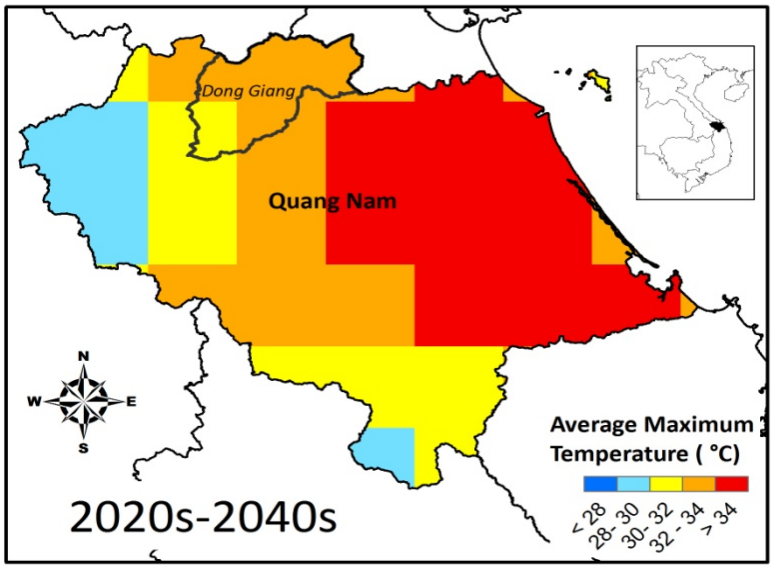




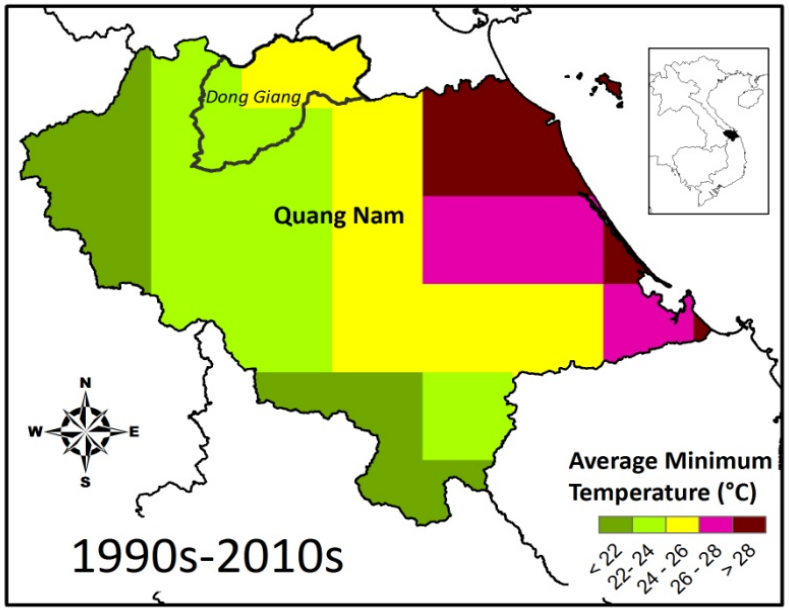
Source: SEA-START Center, RCCC-NLU, Dragon Inst.

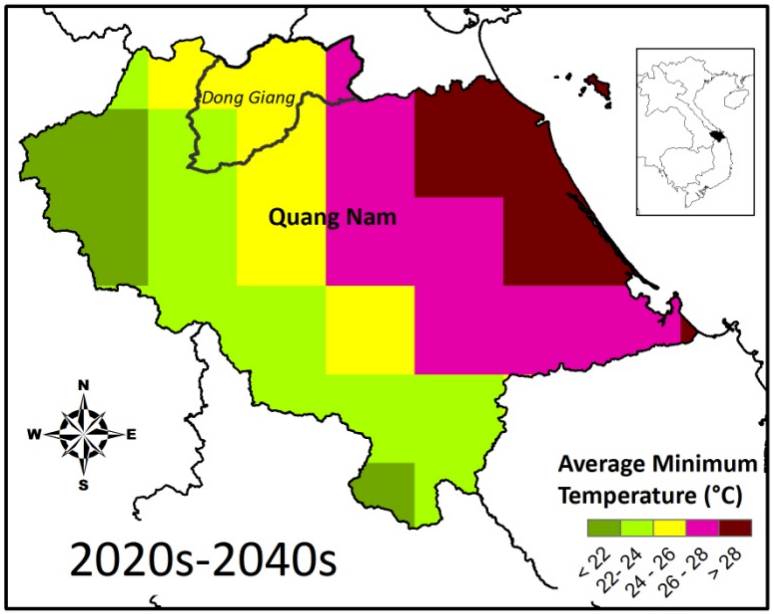
Temperature Trend in Dong Giang district





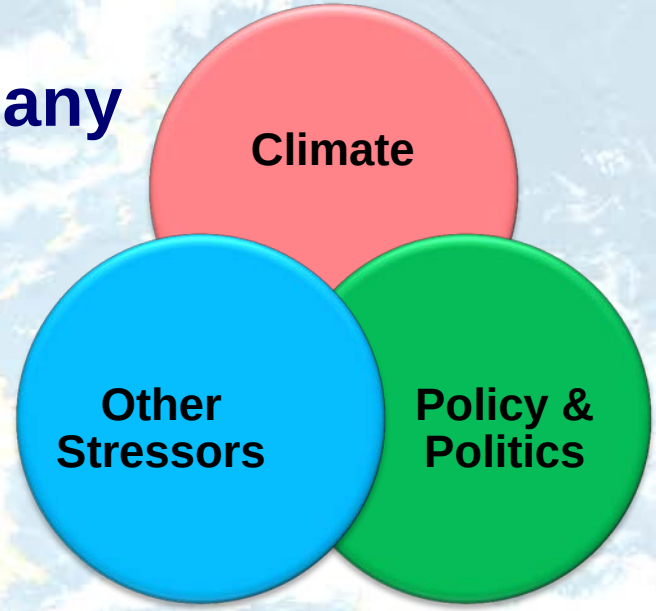
Source: SEA-START Center, RCCC-NLU, Dragon Inst.





Being prepared for climate change: If adaptation is the answer, what is the question?

- How should we plan for adaptation?
- Issues of concern:
  - ✓ Climate is one input among many
  - ✓ Multiple Stressors
  - ✓ Multiple Stakeholders



Milind Kandlikar
Institute for Resources, Environment and Sustainability,
University of British Columbia
Ambuj Sagar
John F. Kennedy School of Government,
Harvard University

Climate Change Adaptation in Context of Sustainable Development

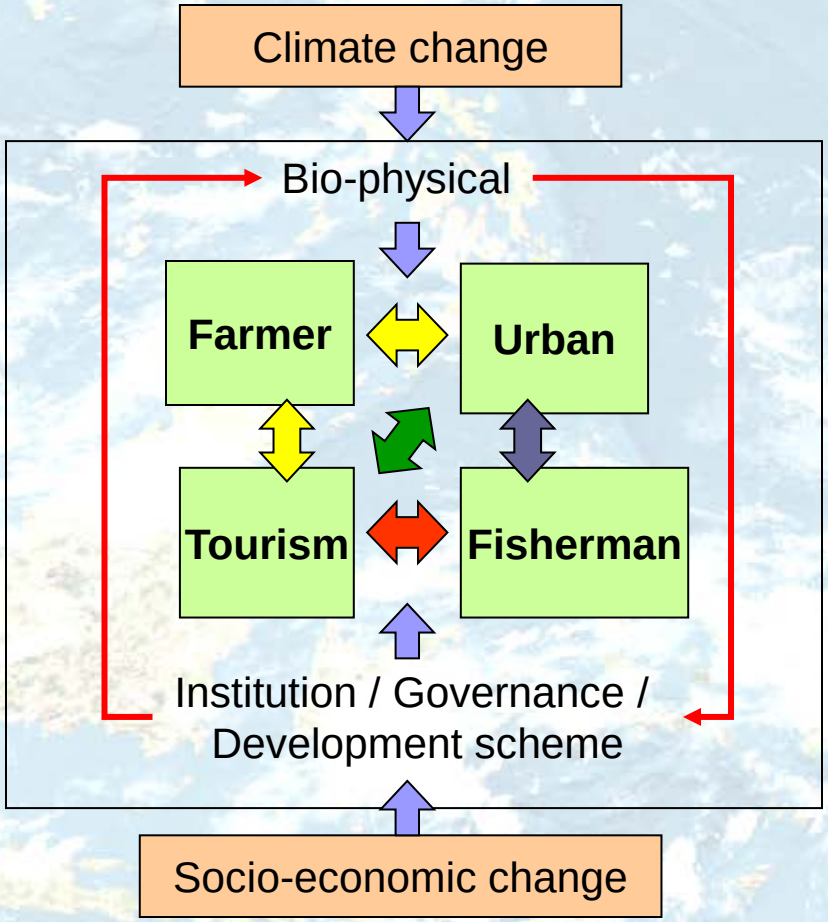
Holistic view on climate change risk:
We cannot consider single sector nor look at climate change as isolate issue

Shift and change in seasonality / rainfall distribution / etc.

Water resource / ecosystem integrity / Natural hazard / etc.

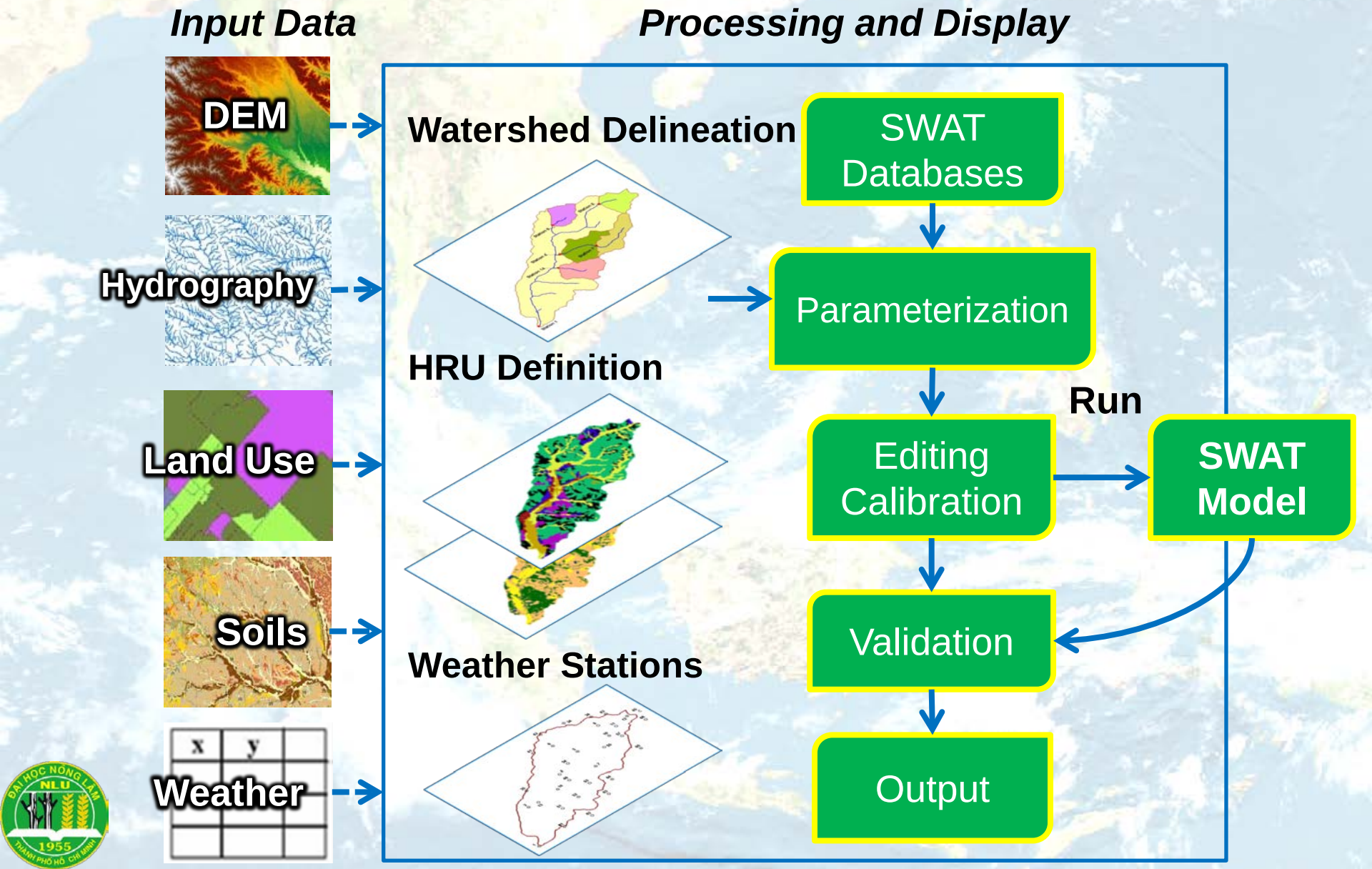
Agriculture / Fisheries / Forest ecosystem / Tourism / Urban / Etc.

Water allocation policy / market condition / migration / public infrastructure / etc.



Source: Suppakorn, 2010

SWAT model


Input Data
Processing and Display
DEM
Hydrography
Land Use
Soils
Weather
x
y
Watershed Delineation
HRU Definition
Weather Stations
SWAT Databases
Parameterization
Editing Calibration
Run
SWAT Model
Validation
Output

Data Collection

Types of data	Sources of data
• Precipitation, Temperature • Topography • Soil erosion parameters • Land use maps	• Quang Nam Meteorological Department • Institute of Water Resource Research in HCMC • Department of Land Development • Department of Agriculture and Rural Development

Methodology

- The Markov Chain model was applied this research for land use prediction.

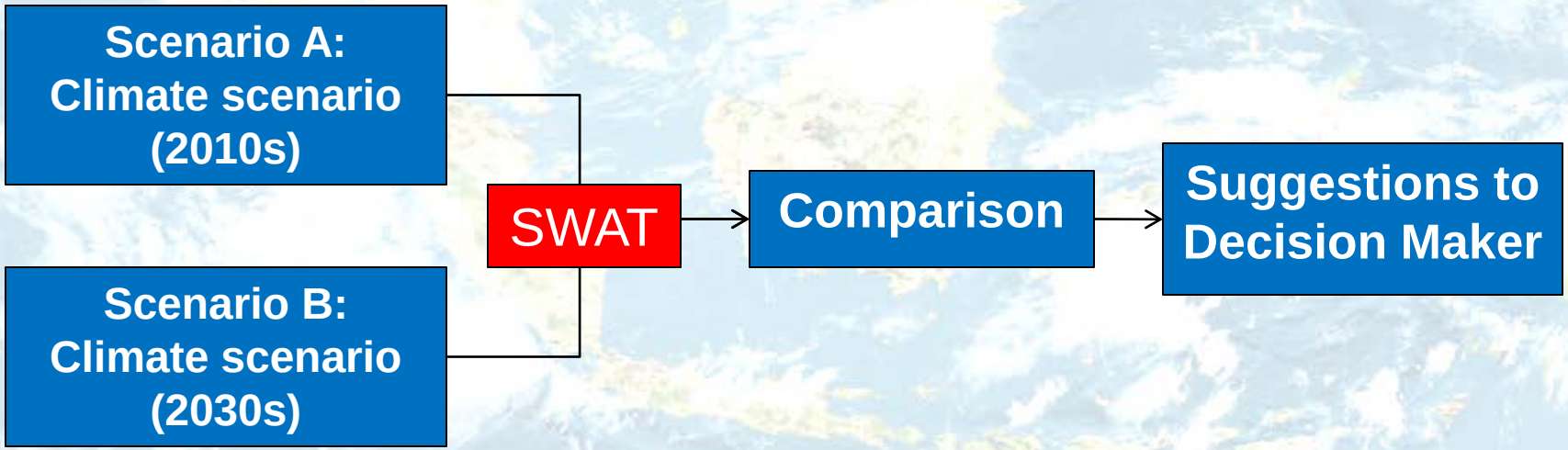
Proportion of land use of the first date * **Matrix of probability of land use change** = **Proportion of land use of the second date**

- This can be transformed in general matrix multiplication as:

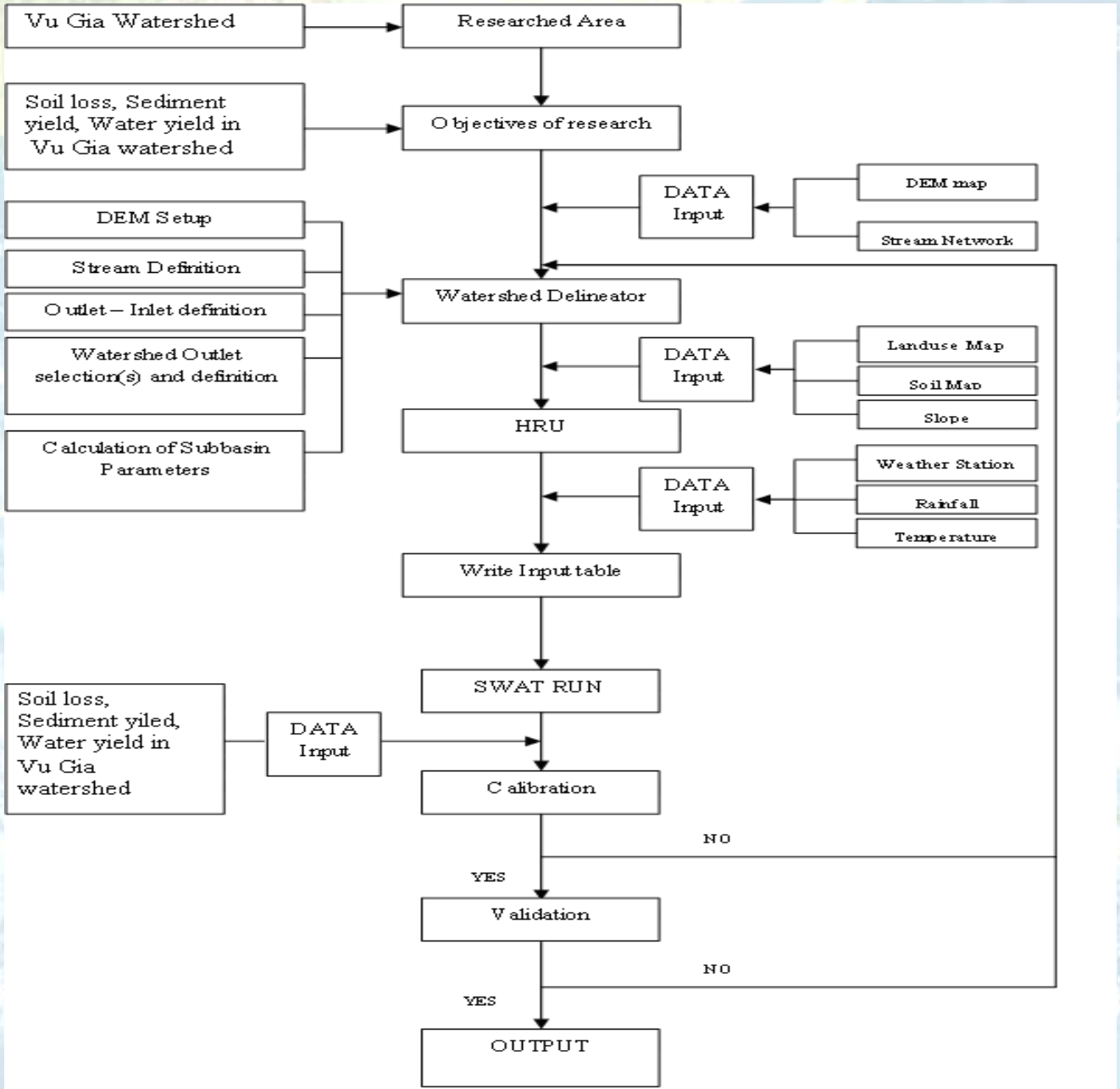
$$[V_1, V_2, V_3, V_4, V_5]_{t+1} = \begin{pmatrix} \gamma_{11}, \gamma_{12}, \gamma_{13}, \gamma_{14}, \gamma_{15} \\ \gamma_{21}, \gamma_{22}, \gamma_{23}, \gamma_{24}, \gamma_{25} \\ \gamma_{31}, \gamma_{32}, \gamma_{33}, \gamma_{34}, \gamma_{35} \\ \gamma_{41}, \gamma_{42}, \gamma_{43}, \gamma_{44}, \gamma_{45} \\ \gamma_{51}, \gamma_{52}, \gamma_{53}, \gamma_{54}, \gamma_{55} \end{pmatrix} * [V_1, V_2, V_3, V_4, V_5]_t$$

Methodology

- The next step of the planning process is to formulate two scenarios. Two climate scenarios are formulated for Vu Gia watershed as input of SWAT model.
  - ✓ Scenario A: Climate scenario (2010s).
  - ✓ Scenario B: Climate scenario (2030s).



Application of SWAT model for Vu Gia watershed



Results and Discussion

- Probability of Land Use Changes 2000 to 2008

Initial Proportion Area in 2000

F	A	U	O	S
[0.2941	0.4928	0.0174	0.0775	0.1161] *

(2000)

Matrix of Land use change from 2000 to 2008

0.7600	0.2129	0.0000	0.0270	0.0000
0.1040	0.8887	0.0005	0.0011	0.0019
0.0000	0.0188	0.9811	0.0000	0.0000
0.3401	0.0276	0.0000	0.2869	0.3455
0.0006	0.0810	0.0084	0.1501	0.7600

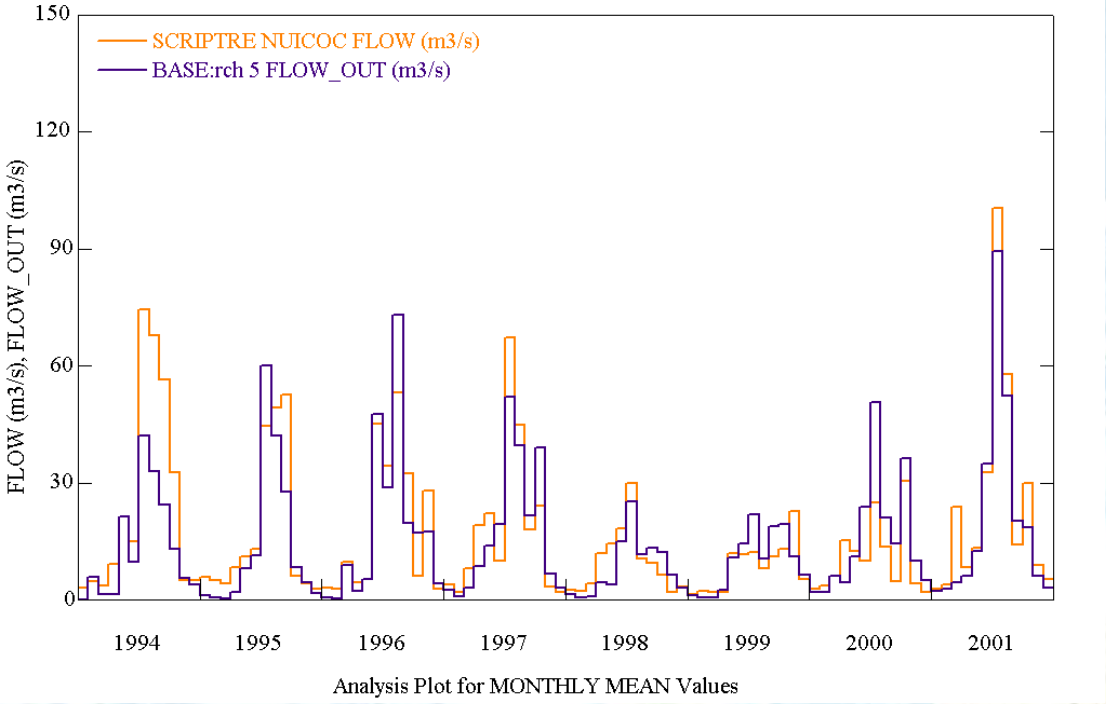
[0.3014	0.5145	0.0180	0.0482	0.1159]
F	A	U	O	S

(2008)

Computed Proportion Area in 2008

Results and Discussion

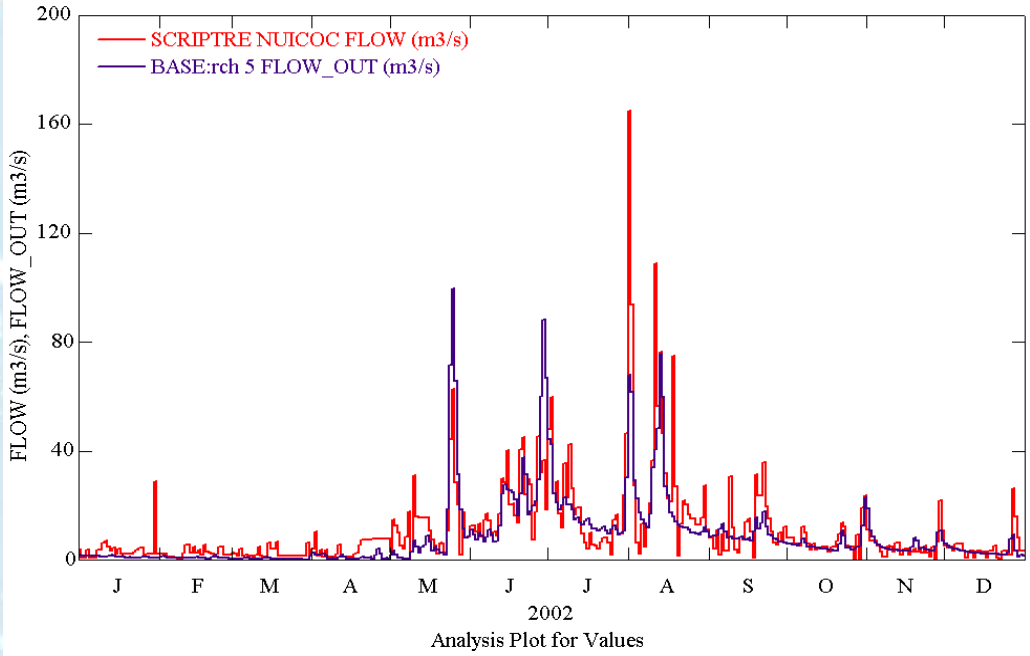
Monthly stream flow calibration (1994 – 2001)



Statistics	2000-2005 Monthly stream flow (m^3/s)	
	Measured	SWAT Calibration
Mean	16.7	14.79
Max	101	89.5
Min	1.4	0.1
Range	99.6	89.4
Standard deviation	19.13	17.11
Correlation coefficient	0.65	

Results and Discussion

Daily stream flow validation - 2002



Statistics	2002 daily stream flow (m^3/s)	
	Measured	SWAT Validation
Mean	10.78	8.79
Max	165	99.7
Min	0	0.2
Range	165	99.5
Standard deviation	15.79	13.47
Correlation coefficient	0.66	

Results and Discussion

- The SWAT output for Vu Gia watershed using Climate data 2010s (Scenario A) and 2030s (Scenario B)

Month	Rainfall (mm)		Surface runoff Q (mm)		Sediment yield (ton/ha)	
	Scenario A (2010s)	Scenario B (2030s)	Scenario A (2010s)	Scenario B (2030s)	Scenario A (2010s)	Scenario B (2030s)
1	11.90	21.10	0.01	0.70	0.00	0.59
2	81.01	26.90	17.03	0.26	11.74	26.26
3	66.96	71.78	7.19	11.03	18.42	13.65
4	183.50	183.50	49.18	70.79	45.50	51.41
5	195.47	195.47	57.69	80.41	19.62	78.94
6	126.83	126.83	49.84	89.08	11.50	5.40
7	328.80	398.80	99.53	190.34	0.23	15.48
8	435.76	465.76	90.40	210.54	61.08	130.04
9	393.16	393.16	91.34	196.34	13.56	156.40
10	482.41	482.41	110.65	219.87	28.82	118.87
11	328.80	228.80	70.32	87.87	0.16	91.91
12	68.35	58.15	8.05	7.50	8.84	10.95

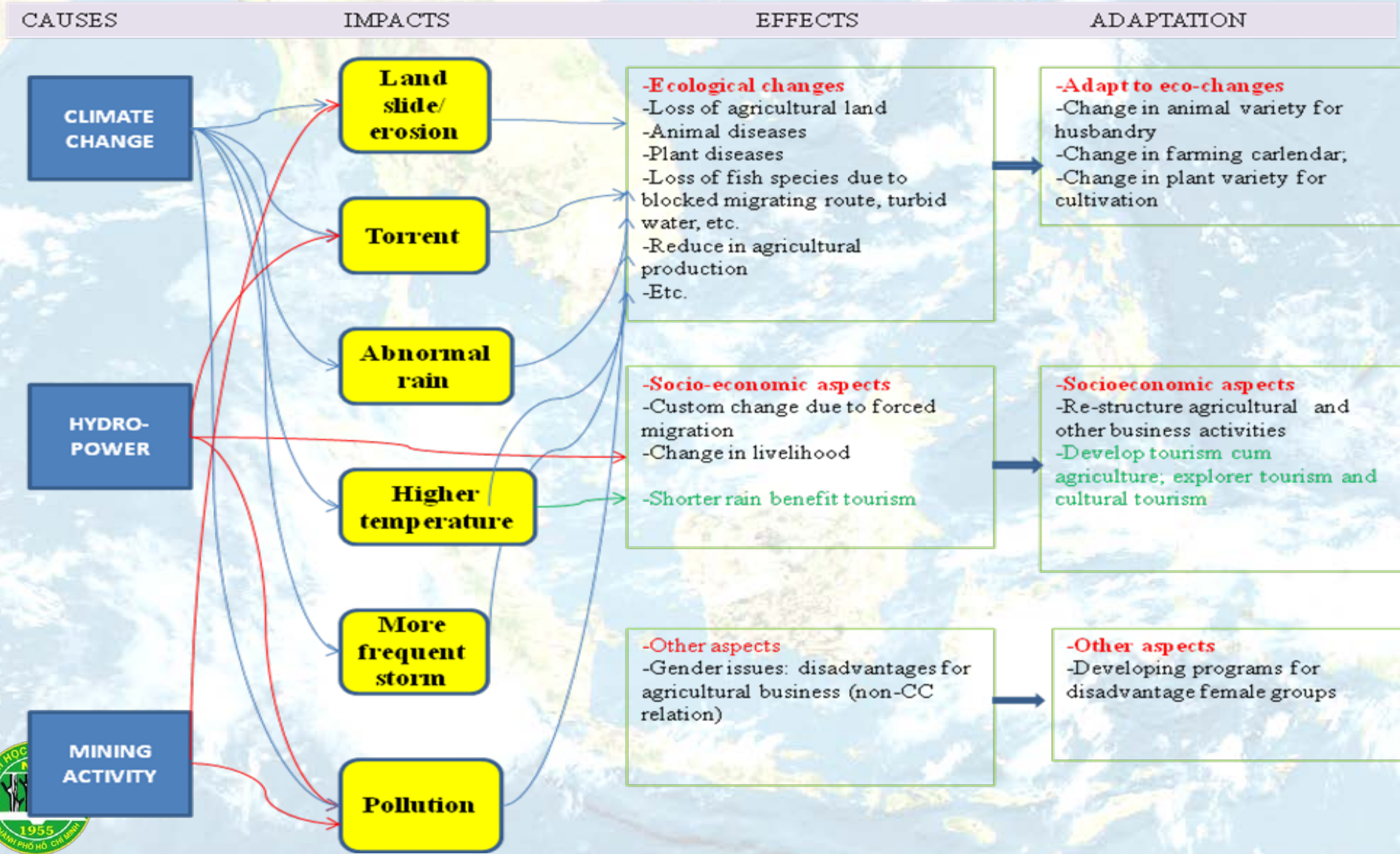
Results and Discussion

- Comparison SWAT output from two scenarios

No.	Parameters	Units	Scenario	
			Scenario A	Scenario B
1	Precipitation	mm	1202	1308
2	Surface runoff	mm	24.44	31.89
3	Sediment yield	ton/ha	24.96	38.66

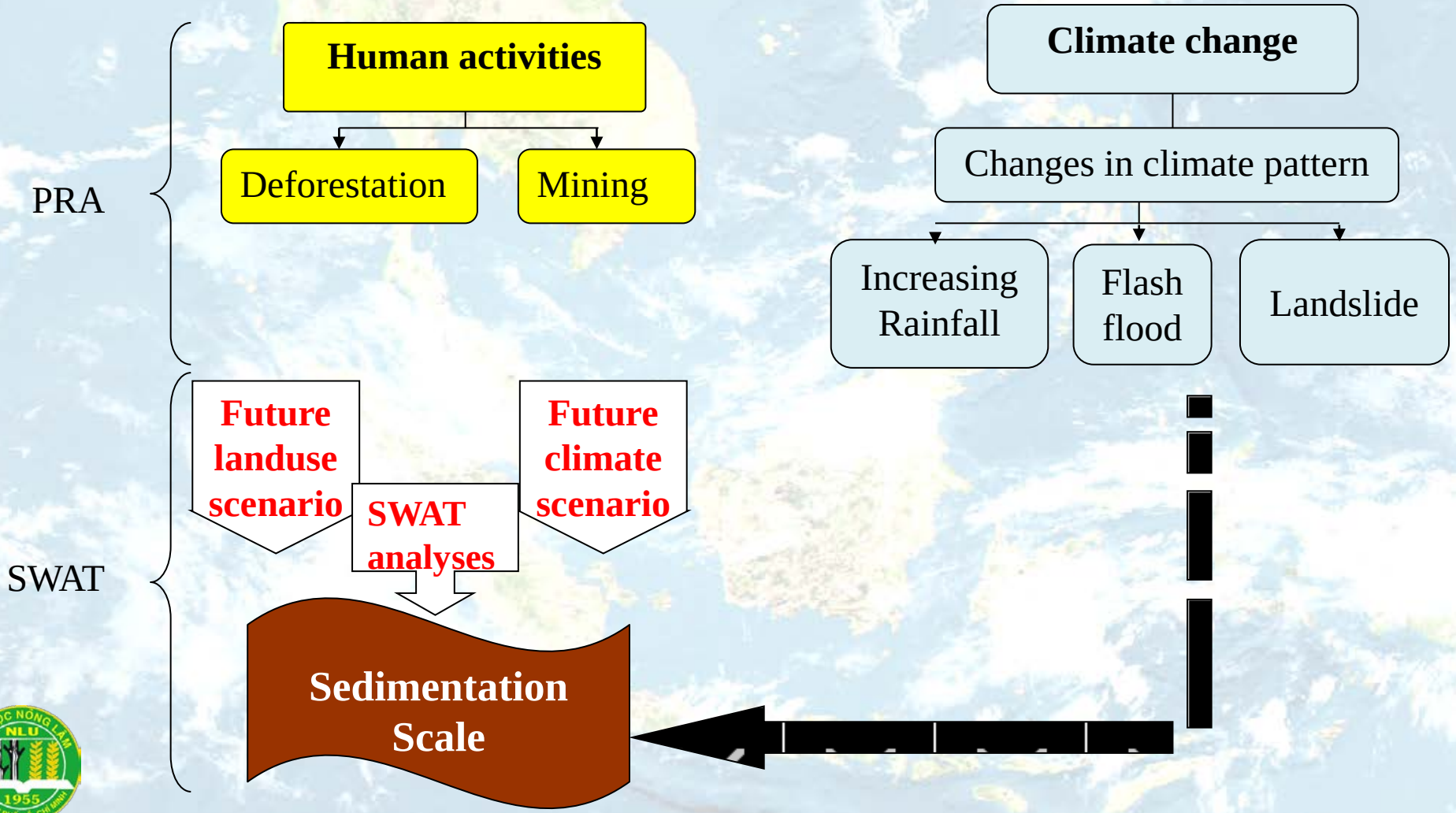
Results and Discussion

- Effect of extreme weather phenomenon on natural and socio-economic conditions of Vu Gia watershed



Results and Discussion

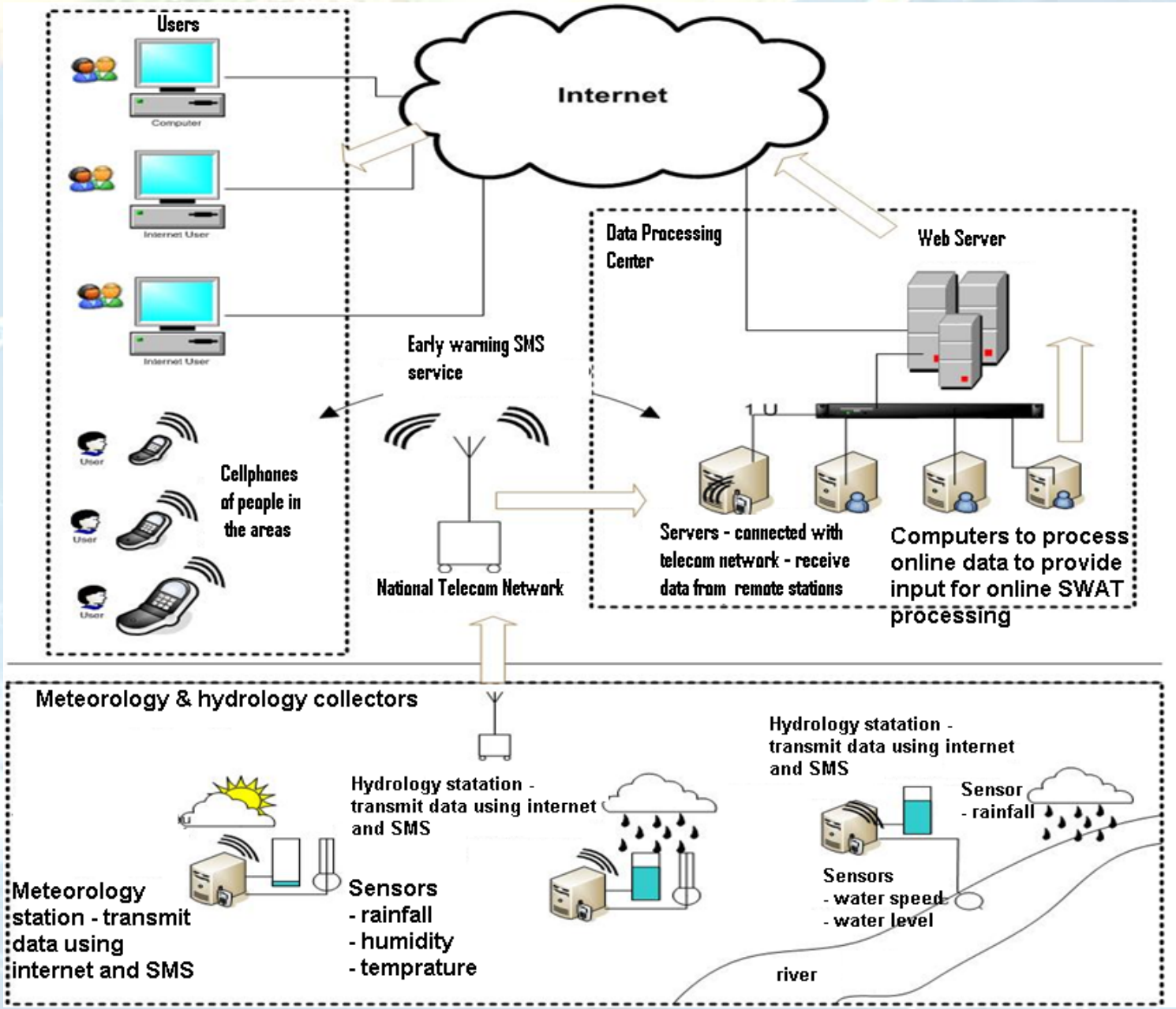
- Analyses process for ecological modifications driven by climate change and human activities



Conclusions

- This research is the first step apply SWAT in Vu Gia watershed.
- The SWAT model performed well in simulating the general trend of surface runoff, sediment yield in the watershed over time for daily, monthly intervals.
- The results shown that the Climate Change will be affected surface runoff, sediment yield.
  - ✓ An increase about 30% in surface runoff occurs between 2010s and 2030s.
  - ✓ Meanwhile, sediment yield increase about 54.8% compared between 2010s (24.96 ton/ha) and 2030s (38.66 ton/ha).
- The recent adaptation to deal with changes in ecology and socio-economics requires further attention from the authority for more appropriate policies and strategies to support local people for better livelihoods.

Future research directions



Acknowledgements

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- Nong Lam University (NLU), Ho Chi Minh City, Vietnam
- Ministry of Science and Technology (MOST), Vietnam

Acknowledgements

- The authors acknowledge the APN (Asia-Pacific Network for Global Change Research) funded "**Building research capacity on assessing community livelihood vulnerability to climate change impact in central Vietnam and Mekong River delta**" project for funding this research.

The 6th Multi-Disciplinary International Workshop on Artificial Intelligence

MIWAI 2012

Ho Chi Minh City, Vietnam, December 26-28, 2012

Website: http://khamreang.msu.ac.th/miwai12

Theme: "AI for Climate Change"

"...it is the major, overriding environmental issue of our time, and the single greatest challenge facing environmental regulators. It is a growing crisis with economic, health and safety, food production, security, and other dimensions."

Ban Ki-Moon
UN Secretary General

In the last several years, we have witnessed all kinds of changes in the world's climate. These changes have affected our lives profoundly. The catastrophic flood in Thailand in 2011, for example, was one of the worst in that country's and the world's history. There were 12.8 million affected people, hundreds of thousands lived their lives under water for more than a quarter of the year, while many others were homeless. The flood also struck Thailand's economy heavily. Most of the industrial estates in central Thailand were under water, and, as a consequence, hundreds of thousands of jobs were floated away. The World Bank estimated that the economic loss was 1.44 trillion Baht—more than half of the country's annual

Important Dates

Papers due:	July 15, 2012
Author notification:	September 15, 2012
Camera-ready due:	September 30, 2012
Tutorial day:	December 26, 2012
Workshop dates:	December 27-28, 2012

Call For Papers

Artificial intelligence is a broad area of research. We encourage researchers to submit papers in the following areas but not limited to:

- Agent-based simulation
- Agent-oriented software engineering
- Agents and Web
- Game theory
- Genetic Algorithms
- Internet/WWW intelligence

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underpinning technology, can promptly respond to help leverage the full computational power to deal with the problem.

Thus, MIWAI-2012 invites papers on advances in AI techniques and related fields, e.g., GIS, neural networks, decision trees, genetic algorithms, fuzzy logic, etc., for climate change. Of course, papers in other areas of AI are also welcome as usual. We do hope that the works presented in the workshop will not only provide observation and recommendations, but also help the community to bestow better problem solvers in the area at the same time.

About MIWAI

The MIWAI series of workshops aims to be a meeting place where excellence in AI research meets the needs for solving dynamic and complex problems in the real world. Through the workshops, the academic researchers, developers, and industrial practitioners will have extensive opportunities to present their original work, technological advances and practical problems. Participants can learn from each other and exchange their experiences in order to fine tune their activities to help each other better. The main purposes of the workshops are as follows:

- To provide a meeting place for AI researchers and practitioners.
- to raise the standards of practice of AI research via the presence of outstanding international invited speakers and feedback from an internationally renowned program committee.

- Distributed AI
- E-Commerce and AI
- Fuzzy logic
- Uncertainty in AI
- Web services

Proceedings Index

The MIWAI 2011 proceedings were published in Springer's LNAI series. This year, we are in the process of negotiating with Springer about publishing the MIWAI 2012 proceedings in the LNAI series again.

Submission Requirements

Submissions of the following categories are invited:

Category A: Regular papers

Papers presenting new original work. Submitted papers should not exceed a length of 12 pages in the Springer LNAI format style. Regular papers will be reviewed on overall quality and relevance. Reviewing of category A papers will be double-blind. In order to make blind reviewing possible, the authors should follow that:

- The authors' names and institutions should not appear in the paper. Unpublished work of the authors should not be cited.
- Using "we" or "us" in reviews of literature should be avoided, e.g., "In [1] we have proposed..." should be changed to "In [1] the authors have proposed...".
- The program committee will evaluate Category A papers as either "rejected" or "accepted as long paper" or "accepted as short paper". All accepted category A papers (long and short) will be fully published in the proceedings.

The authors can submit their papers via this link: https://www.easychair.org/account/signin.cgi?conf=miwai2012

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Thank you for your attention!