CLIMATE CHANGE AND IMPACTS ON AGRICULTURE, PRIVATE AND PUBLIC RESPONSES, AND FUTURE POLICY OPTIONS: THE CASE OF THAILAND

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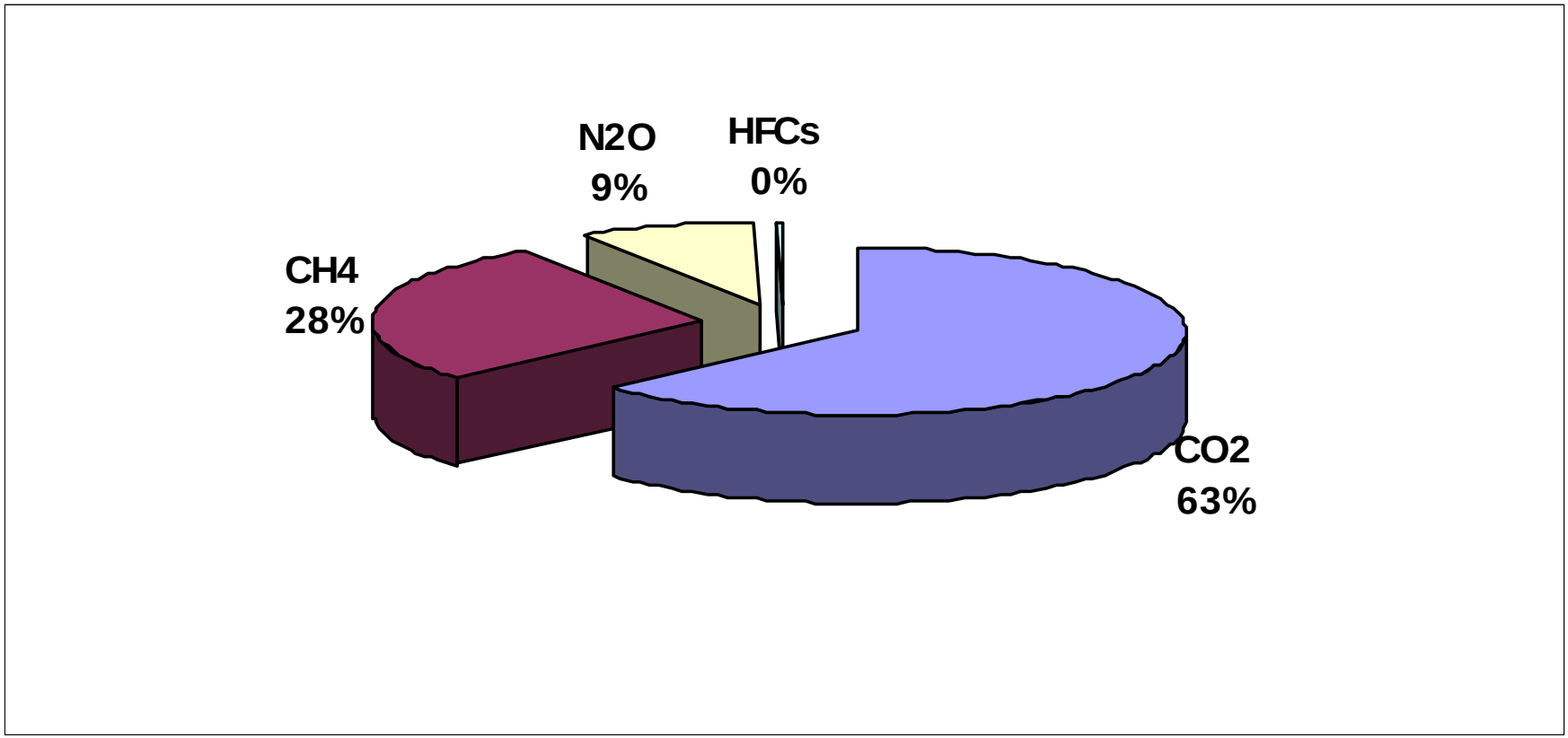
OUTLINE

- Climate change in Thailand
- Impacts of climate change on Thai agriculture
- Private and public responses
- Future policy options

CLIMATE CHANGE IN THAILAND (1)

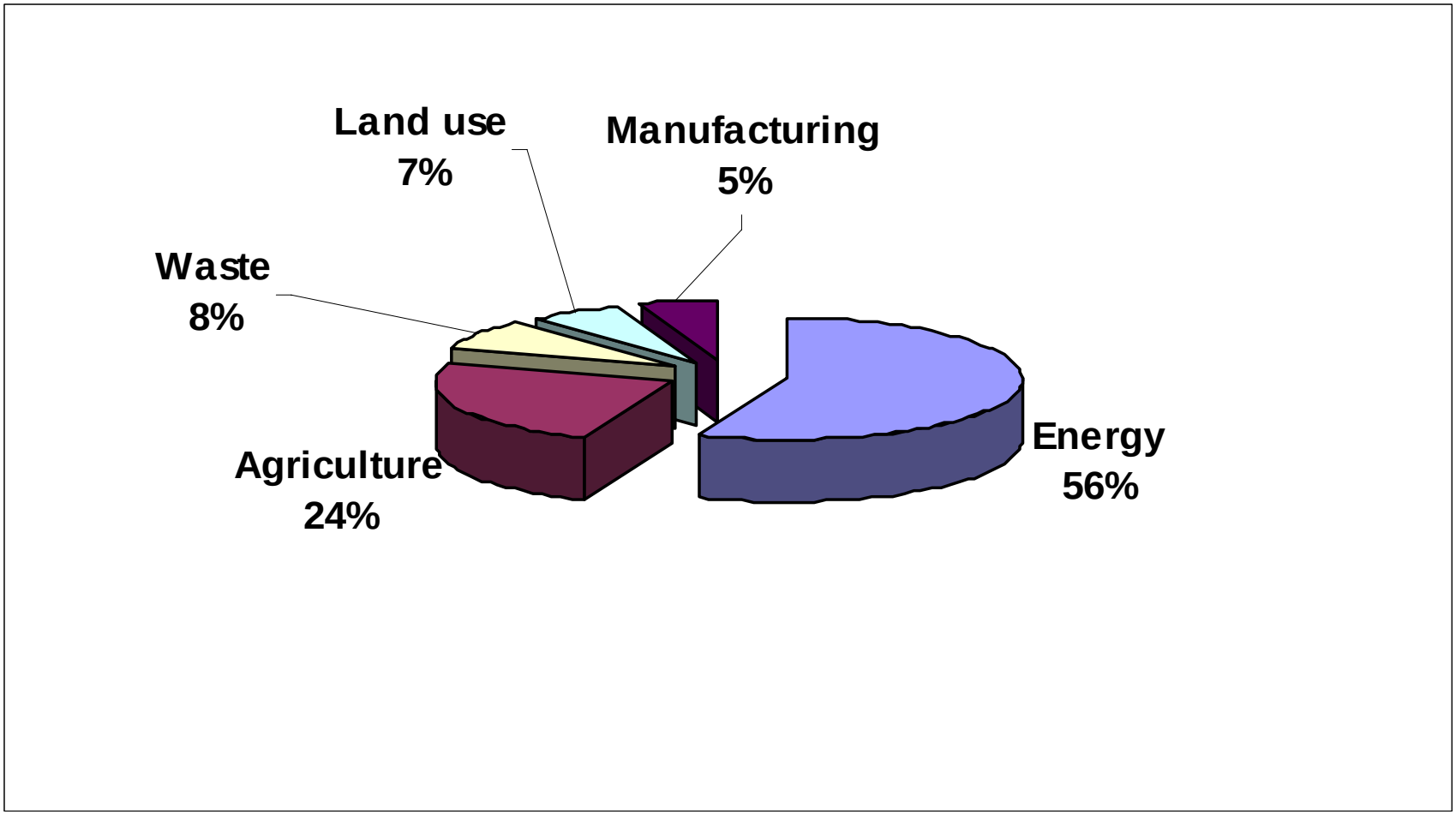
- Thailand GHG Emission
  (as estimated by Ministry of Energy)
  - In 2000
    - 454.3 ton CO_2 equivalent/ US$ one mill. GDP
    - 0.75% of the world GHG emission
    - ranked as the 31st or 109th in term of per capita GHG emission
  - In 2003
    - 344.2 ton CO_2 equivalent/ US$ one mill. GDP

Thailand GHG mission, 2003
Total = 344.2 ton/US$1 mill. GDP



Source: Ministry of Energy, Thailand, 2005

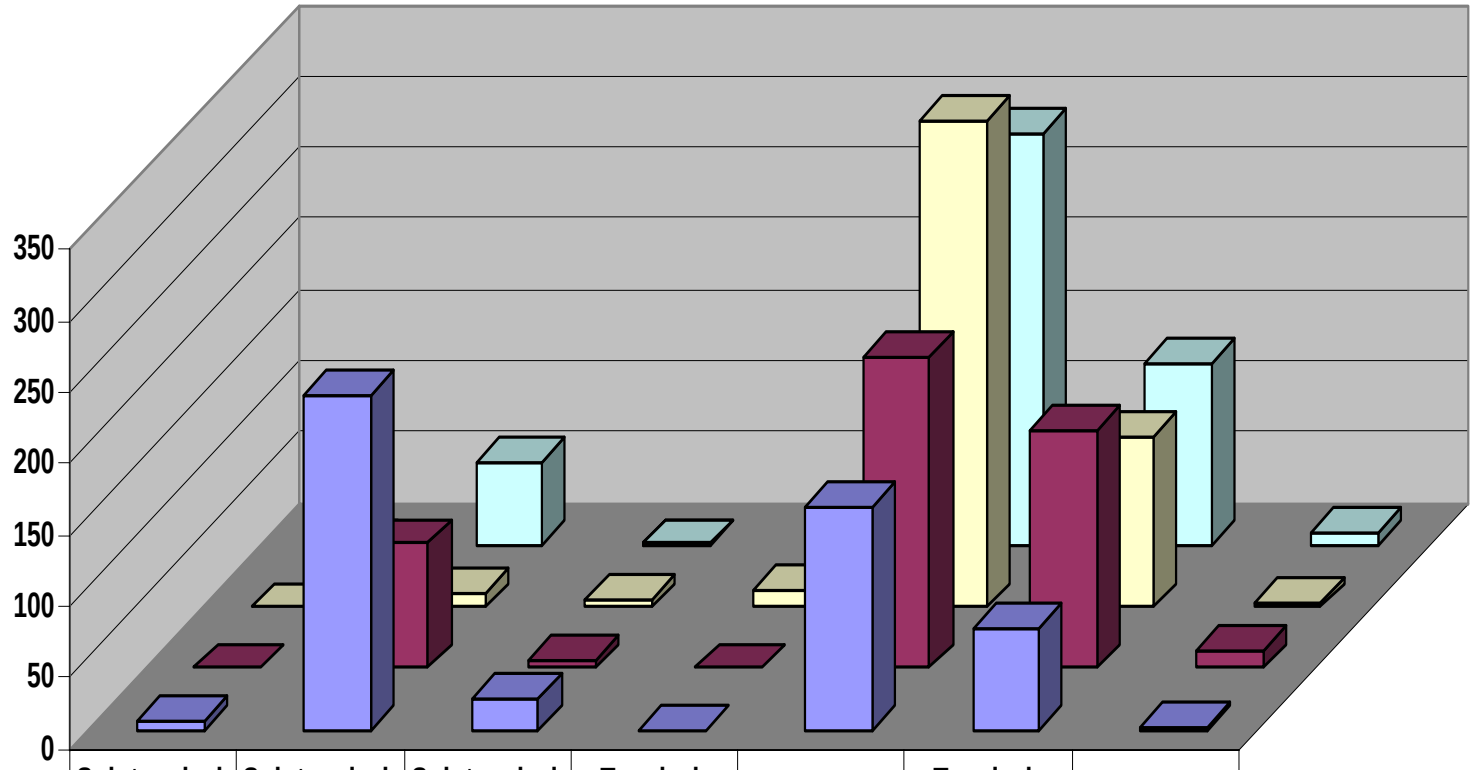
Thailand GHG emission by source, 2003



Source: Ministry of Energy, Thailand, 2005

CLIMATE CHANGE IN THAILAND (2)

Change in forest areas (th sq km) as CO_2 is doubled
As estimated by Thailand Environment Institute



	Sub tropical dry	Sub tropical moist	Sub tropical wet	Tropical very dry	Tropical dry	Tropical moist	Tropical wet
Present	5.9	234.5	22.2	0	156.5	71.5	1.6
UK89	0	87.7	6.5	0	218.6	166.8	12.6
GISS	0	9.5	5.3	11.9	341.3	120.5	3.7
UKMO	0	59.4	1.8	2.9	290.1	128.1	10

CLIMATE CHANGE IN THAILAND (3)

- **Temperature**
  - **Increased by 1degree during the last 45 years**
  - **Less rain volume and number of raining days in summer but longer in winter monsoon**
  - **Increasing high temperature days in summer and less lower temperature days in winter**
  - **2 – 4 degree increase in temperature can lead to change in direction and degree of typhoon by 10 – 20%**

- **The impact of higher temperature**
  - **Water evaporation, more frequent but concentrated rain in specific areas, leading to flood in the south but drought in the north and northeast.**
  - **Changes in water flow thus the ecosystem and biodiversity.**
  - **Loss of some marine species, coral bleaching.**

CLIMATE CHANGE IN THAILAND (4)

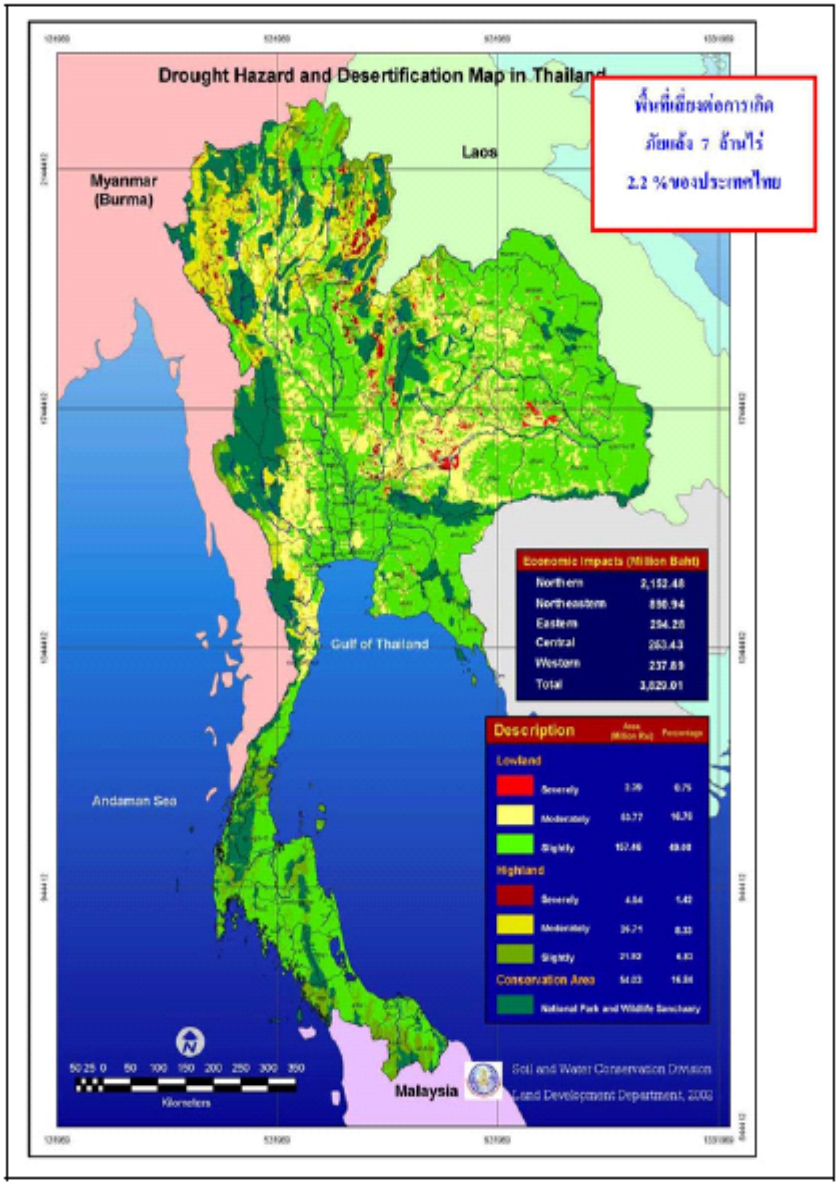
- **Sea water level**
  - Increased by 3 mm/yr during 1940-1960, followed by 20 mm/yr afterward
  - In 2020, the increase in the Gulf of Thailand was estimated to be 17 – 49 mm/yr
  - Impact on lower Chao Phraya River
- **The impact from higher sea level**
  - Bangkok will be only 1 m. above sea level, in risk of flood and damages on public utilities
  - 40 km intrusion of sea water into fresh water – increasing salinity, impact on agriculture in the lower central plain
  - Less shorelines along the coasts in the south
  - Loss of mangroves and agricultural and shrimp farm areas in the south

CLIMATE CHANGE IN THAILAND (5)

- Volume of rain
  - **Estimated to decrease from 960 – 1,290 mm/yr to 800-900 mm/yr, with greater variation – impact on agriculture**

- Impact of lower rainfall
  - **Lack of water in major river basins.**
  - **More frequent and severe flood in lower plain.**
  - **Greater drought in the north, and northeast and more flood in the south**
  - **Water sources**
    - **Reduce by 5 – 10%, main impact on paddy production but lessen by the irrigation system.**
    - **Less aquatic abundance**.

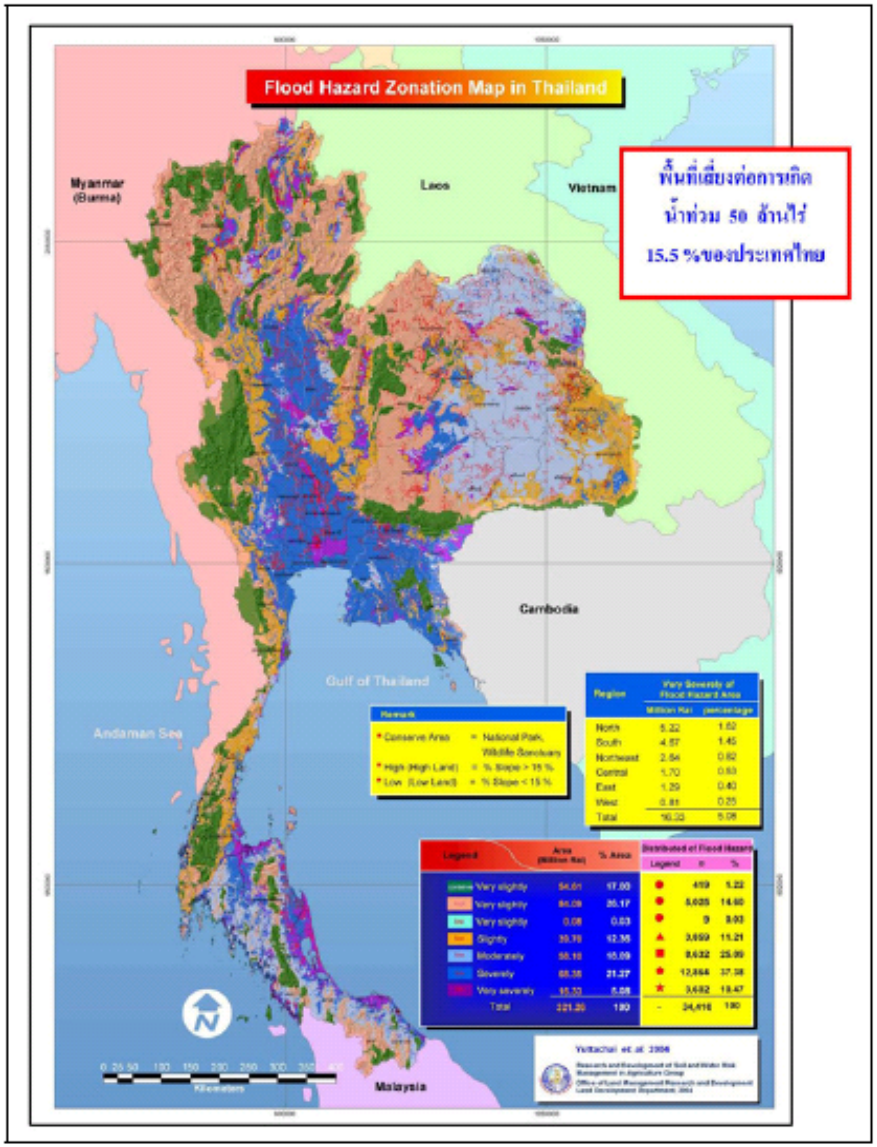
Drought hazard and desertification



- **Total risk area = 2.2% of country area**
- **Share of risk area by region (% of total risk area)**
  - North 56.21
  - Northeastern 23.27
  - East 7.69
  - Central 6.62
  - West 6.21

Source: Soil and Water Conservation Division, Land Development Department

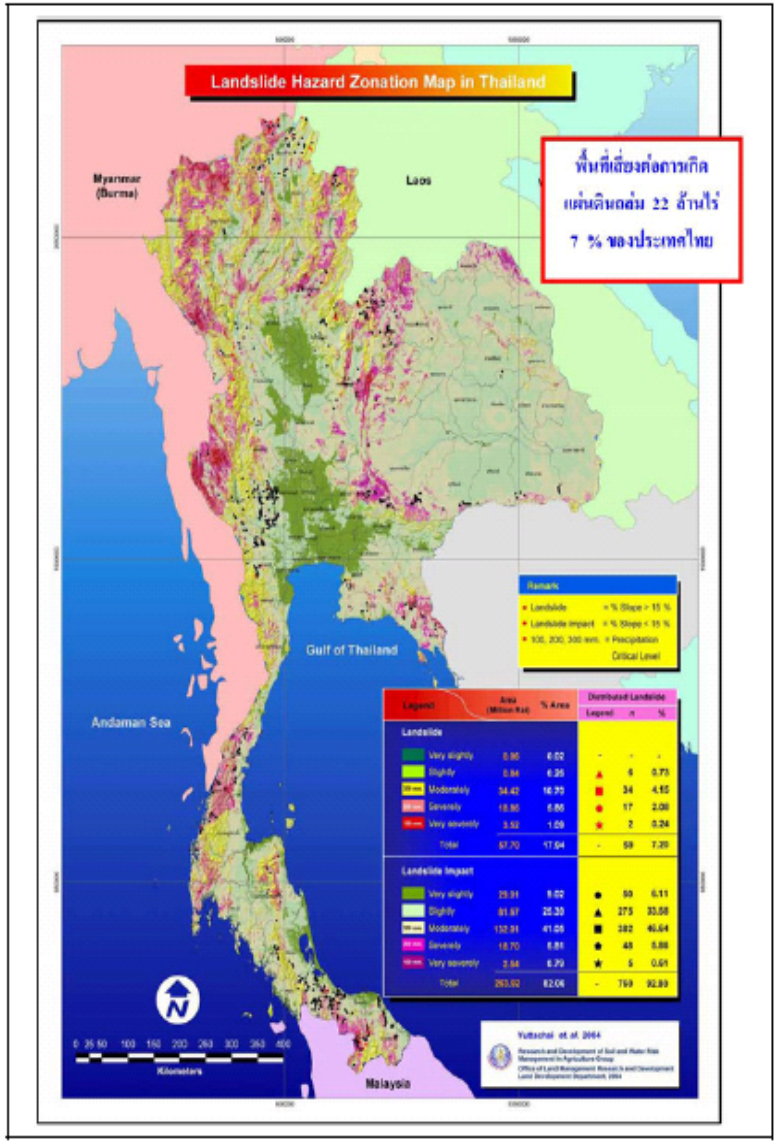
Flood hazard



- Total risk area = 15.5% of country area
- Share of severely flood hazard area by region
  - North 1.62%
  - South1.45%
  - Northeast 0.82%
  - Central 0.53%
  - East 0.40%
  - West 0.25%

Source: Yuttachai et al 2004, Land Development Department

Land slide hazard



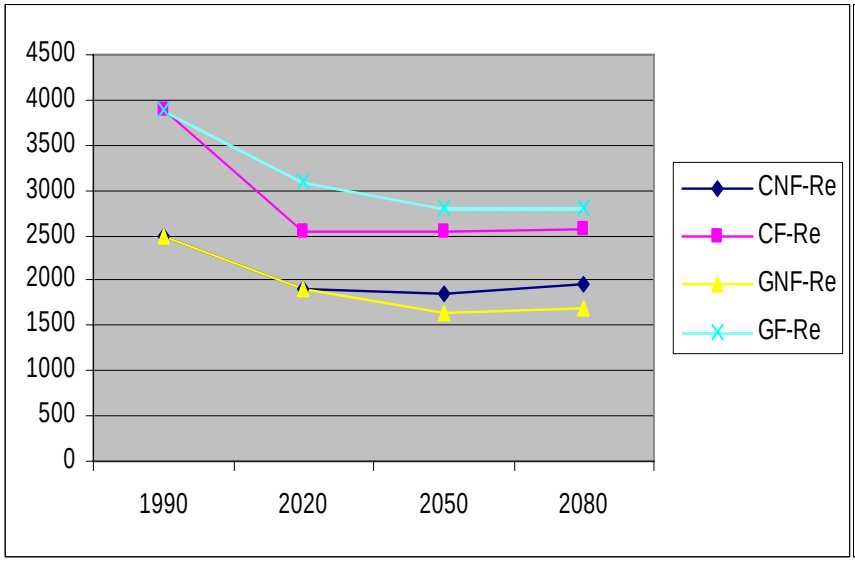
- Total risk area = 7% of country area
- Share of land slide area (% of total risk area)
  - Very slightly 0.02
  - Slightly 0.26
  - Moderately 10.70
  - Severely 5.86
  - Very severely 1.09
- Share of land slide impact area (% of total risk area)
  - Very slightly 9.02
  - Slightly 25.39
  - Moderately 41.05
  - Severely 5.81
  - Very severely 0.79

Source: Yuttachai et al 2004, Land Development Department

IMPACTS OF CLIMATE CHANGE ON THAI AGRICULTURE

- OEPP estimation
  - CGCM,CGCM1,ECHAM4
  - 1989-2009,2010-2039,2040-2069,2070-2099
  - Fragrance rice in Roi-et and Surin
  - Maize in Nakhonsawan and Nakhonratchasima
  - CERES model
  - W/o fertilizer,with fertilizer
  - Controlled VS GHG Emission (1% increase in CO_2 /yr)

OEPP - CGCM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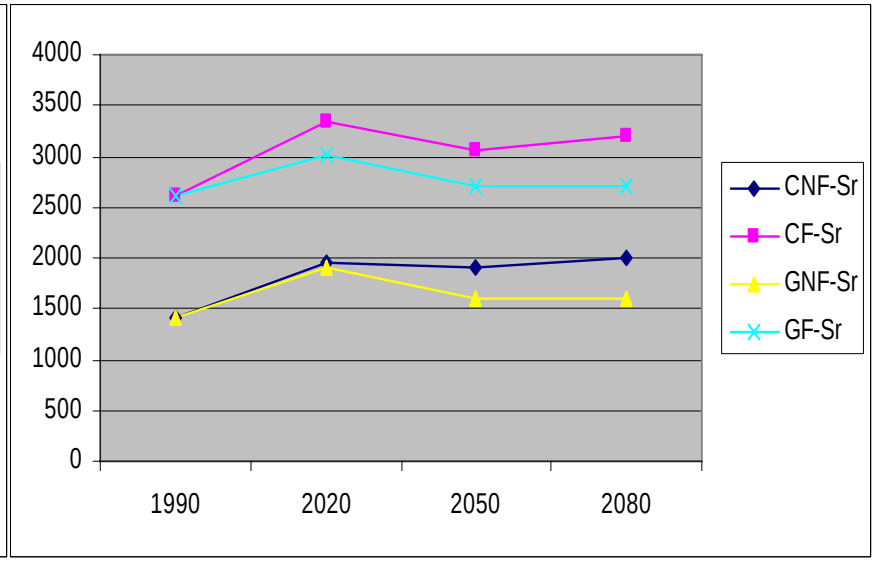
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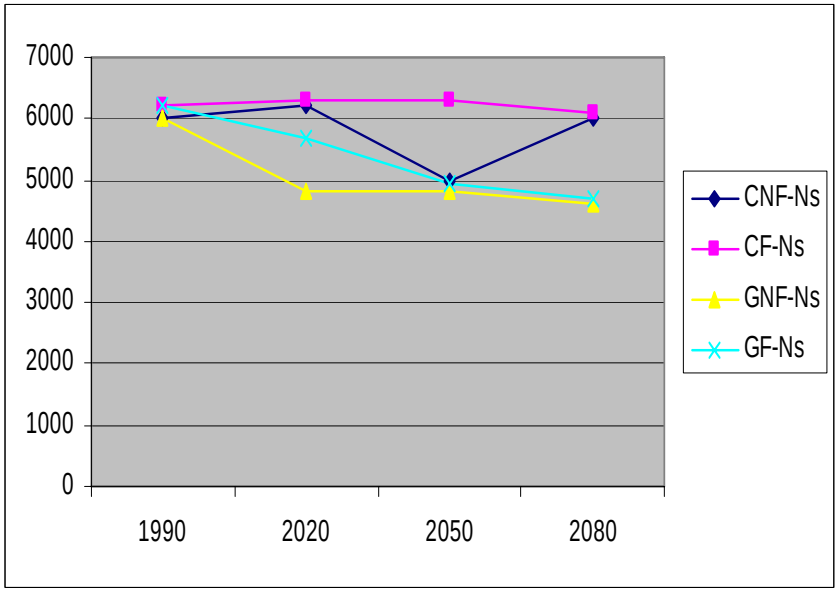
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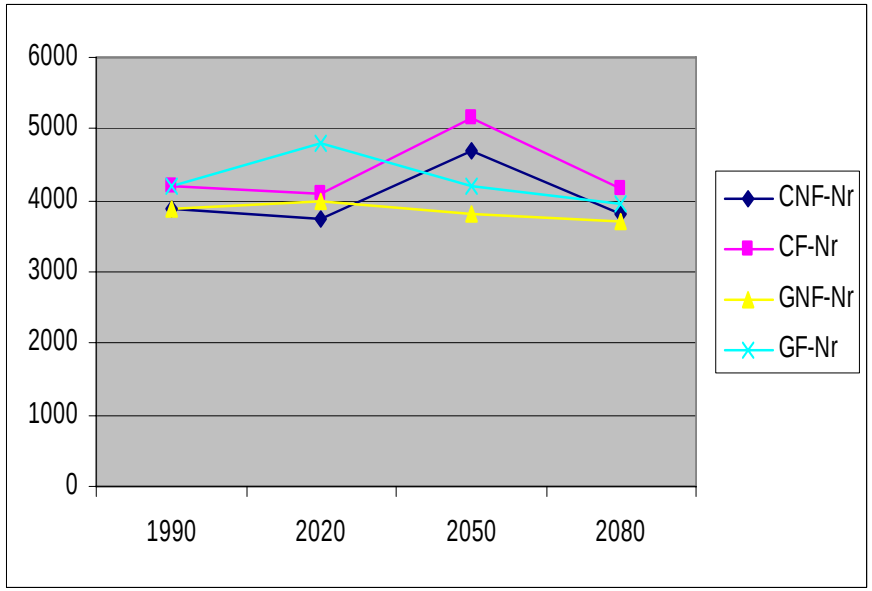
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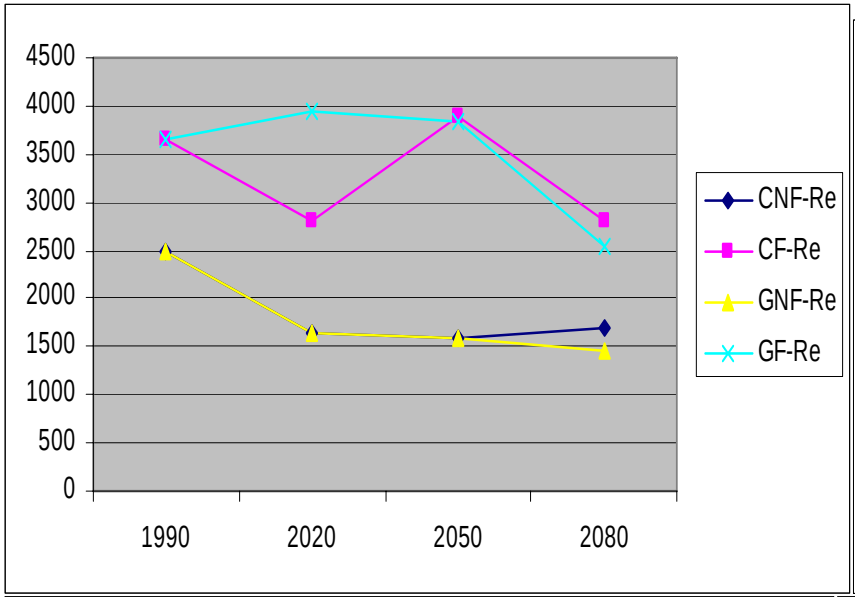
OEPP – CGCM 1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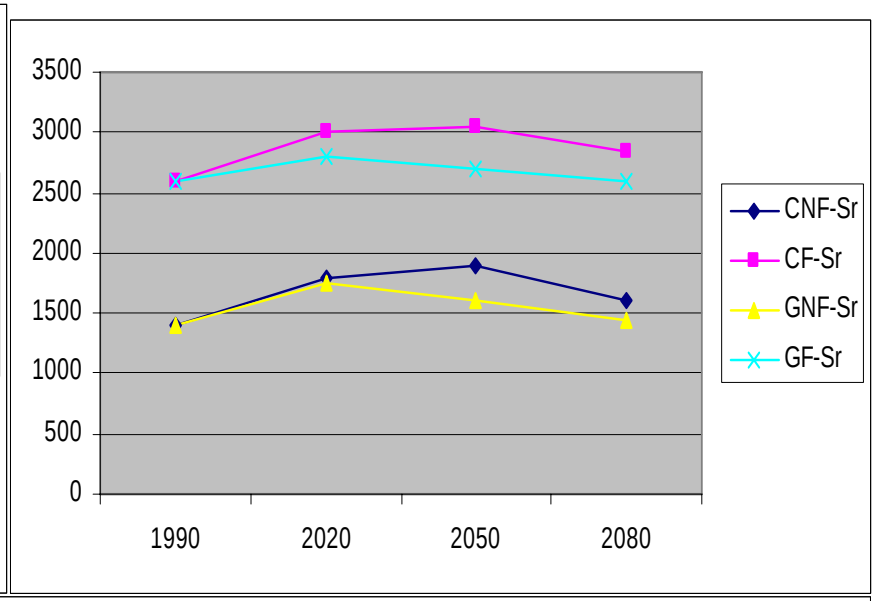
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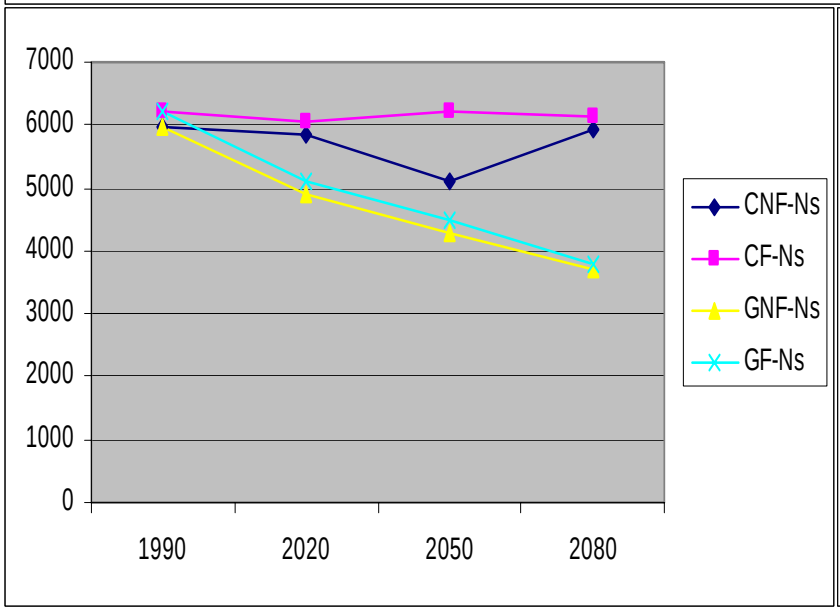
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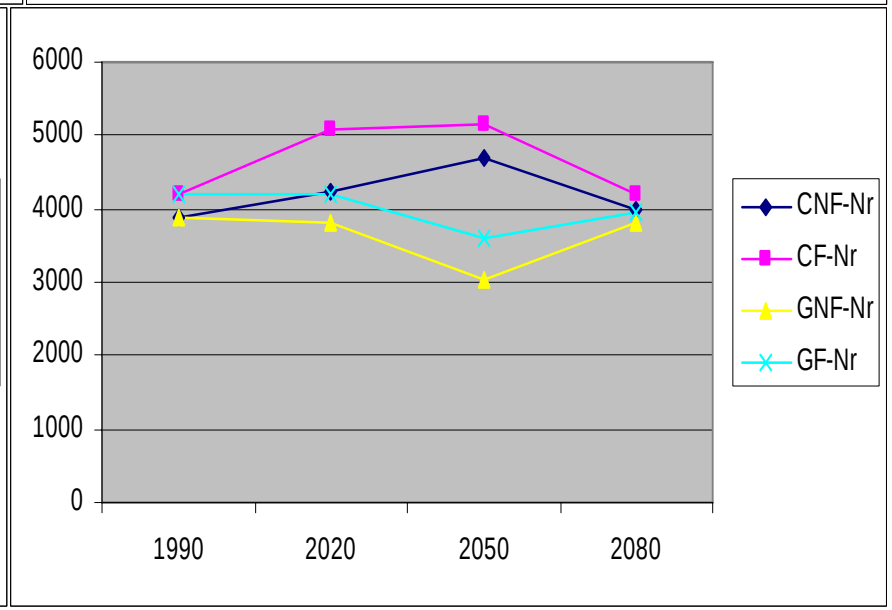
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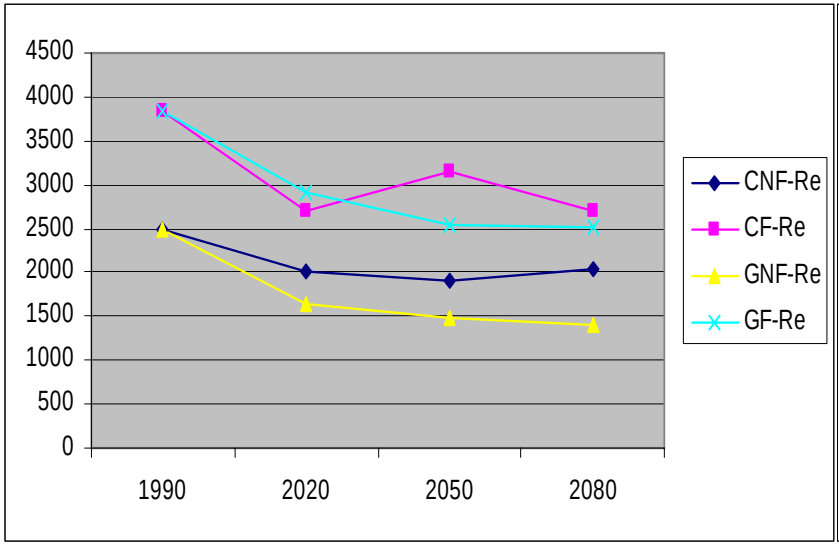
OEPP – ECHAM4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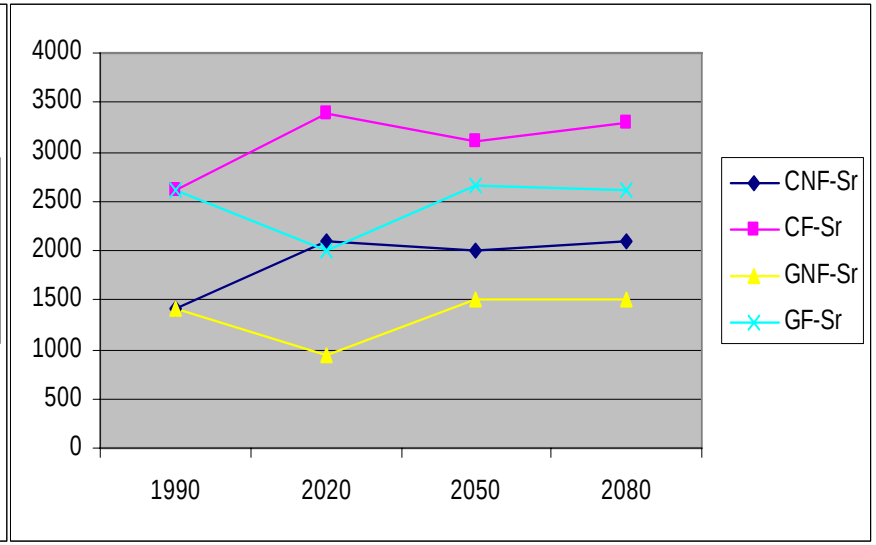
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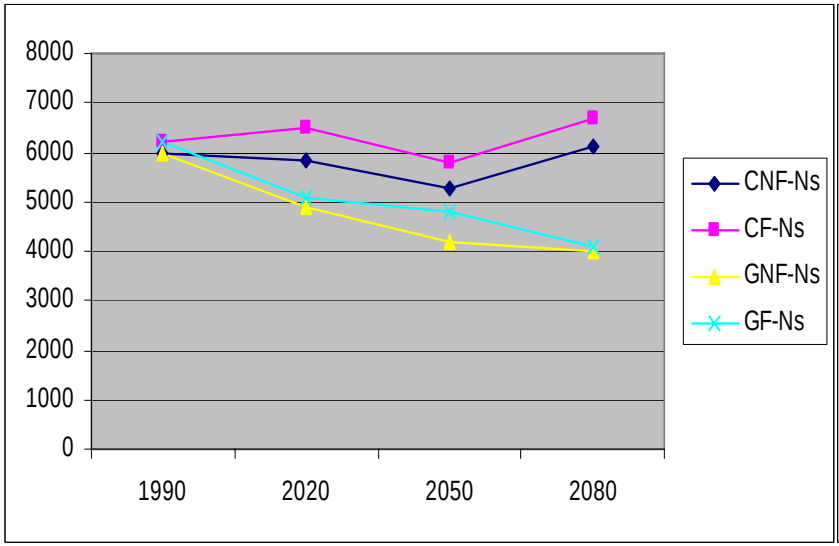
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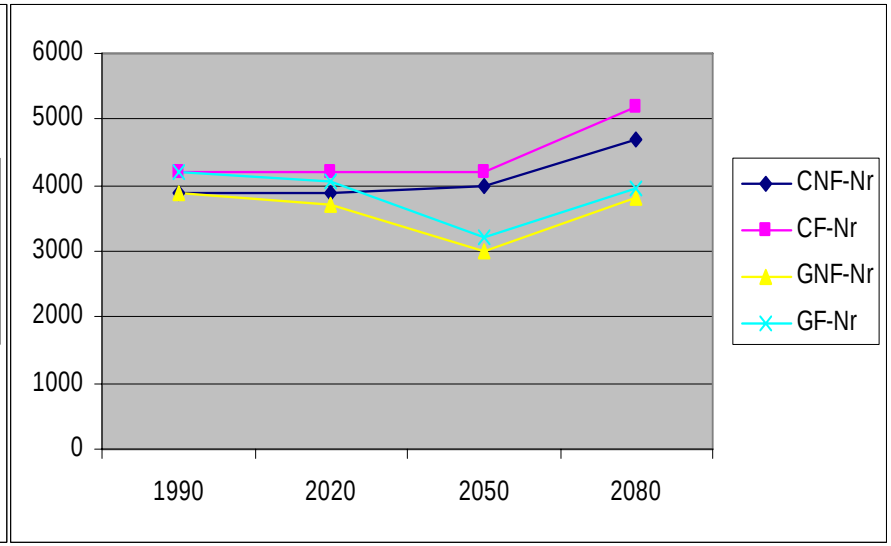
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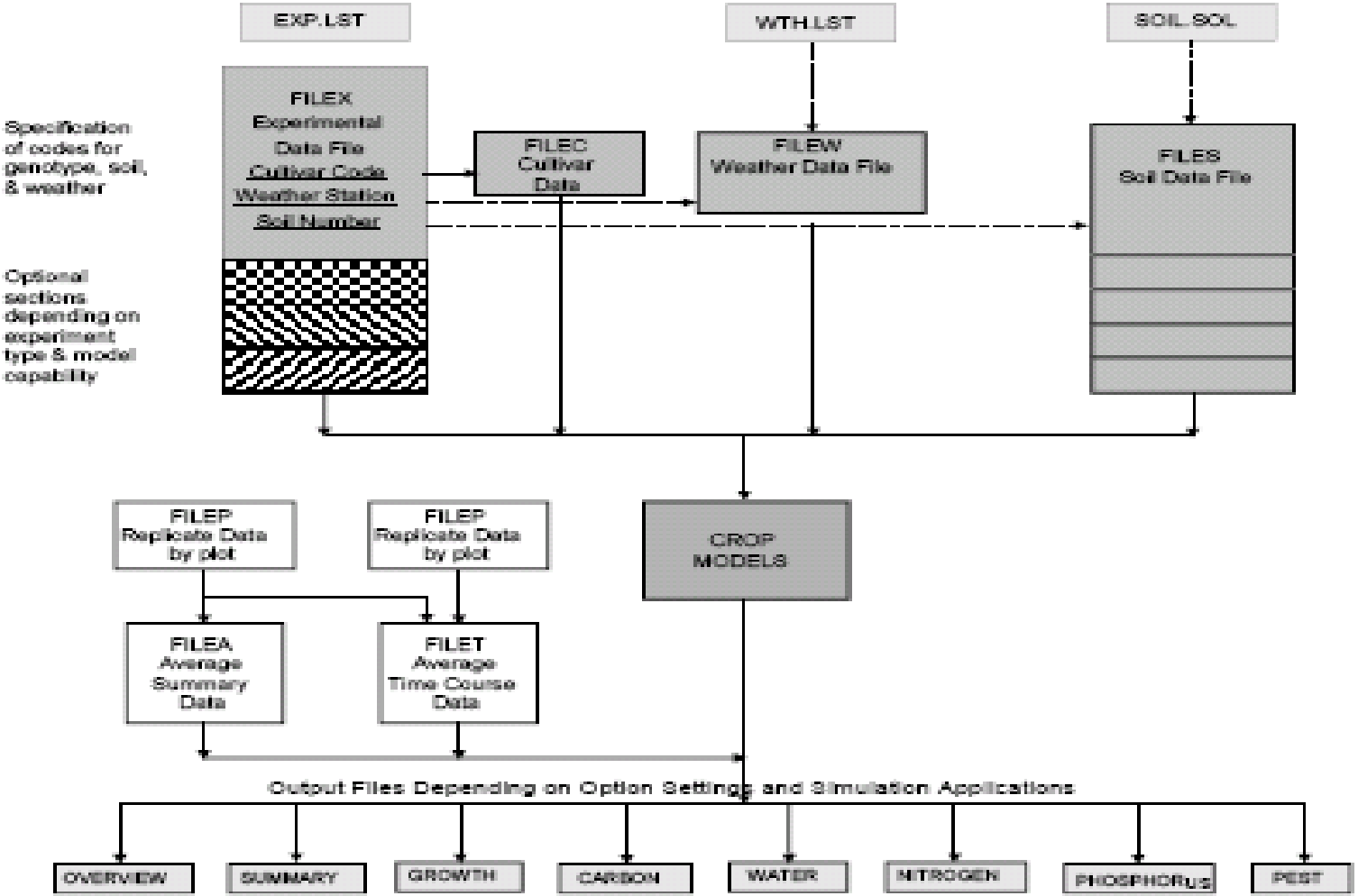
Impact on maize, sugar cane, and cassava in the northeast

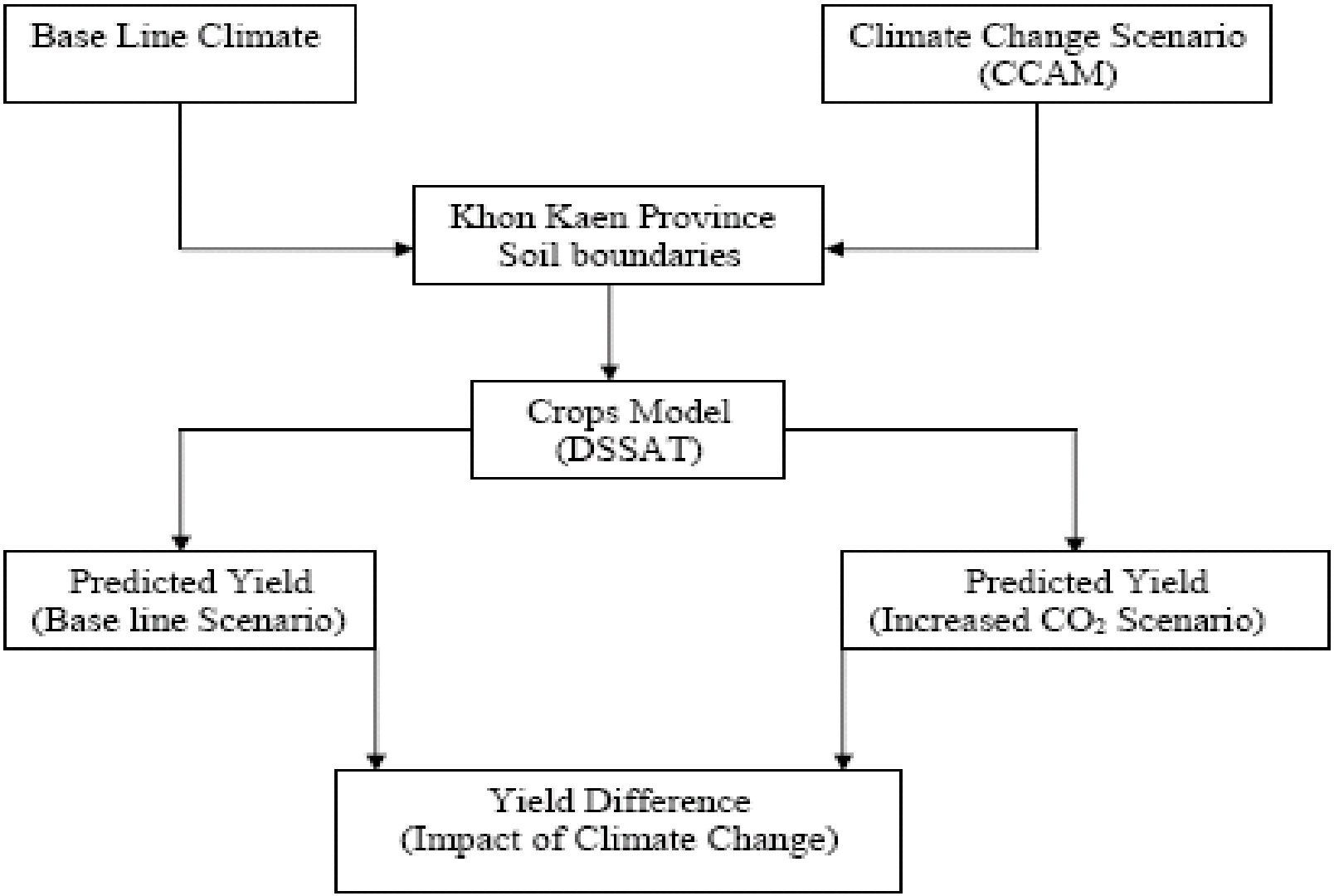
- Source: Sahaschai Kongton et al, 2004
- CCAM using 1980-9, 2040-9, 2066-75
- CERES Maize, GUMCAS Cassava, CANEGRO Sugar cane
- DSSAT for 1x, 1.5x and 2x CO_2

Framework of DSSAT



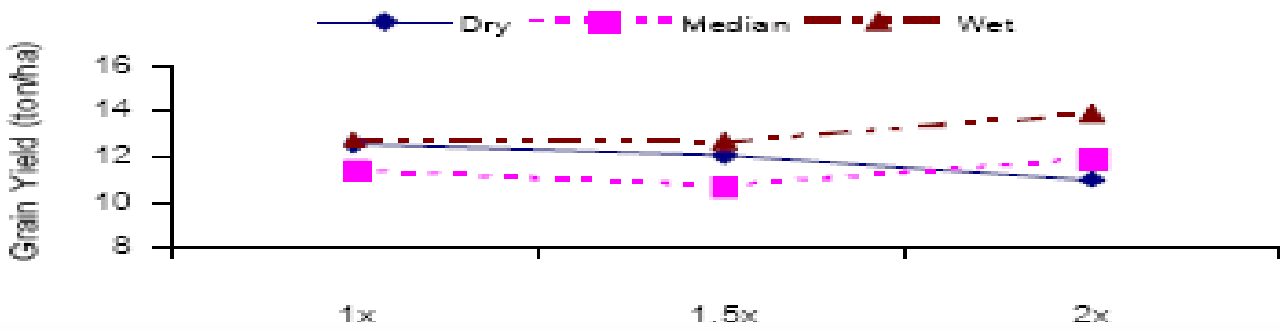
Source: Tsuji et al ,1994

Sahaschai framework

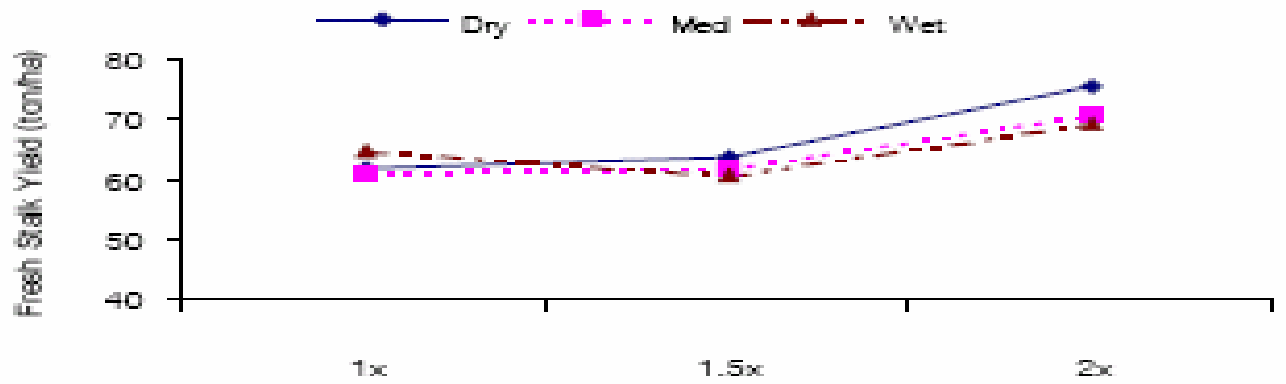


Sahaschai estimation

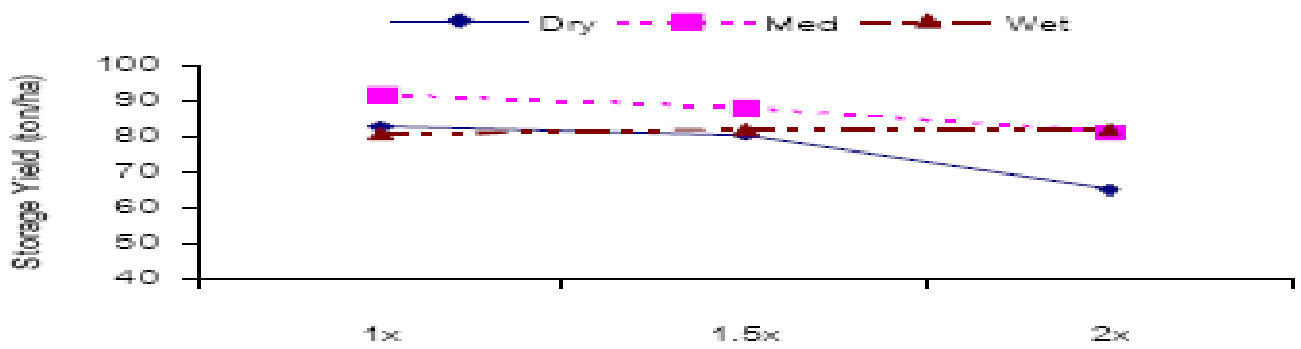
Maize



Sugar cane



Cassava



Rain-fed farmer vulnerability and adaption to climate change impact

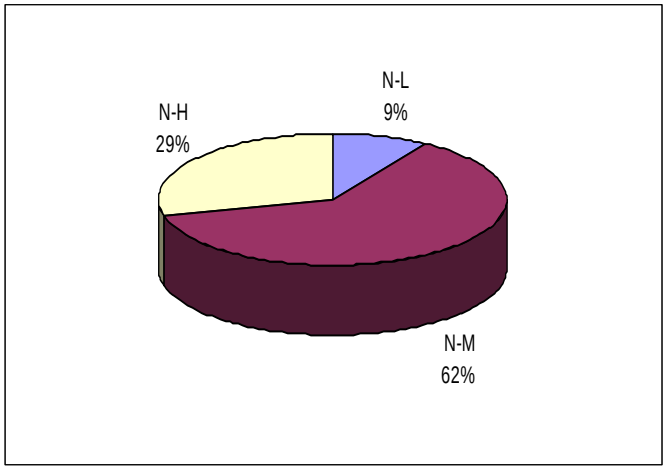
- Source: Wichien Kerdsuk et al, 2005
- Rain-fed rice farmers in Kula field, northeastern Thailand
- 45.5% loss in rice yield due to climate change
- High risk 10%, medium 56.2%, low 33.8%
- 76.8% vulnerable
- 43.4% adaptation

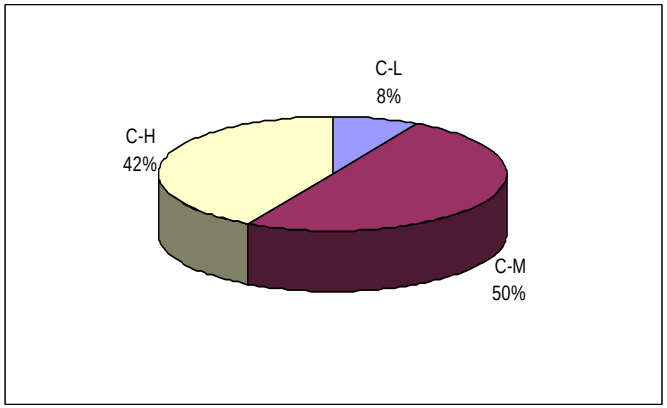
Criteria	Indicator	Measurement	Scoring	Min score	Max score	Weight	Weighted min score	Weighted max score
HH Economic condition	Sustained HH consumption	Total HH consumption / Total HH production	<1 = 0, =>1-1.2 = 1, >1.2 = 2	0	2	1	0	2
	Sufficient production resources	Total production resources (sufficient vs insufficient)	sufficient = 0, insufficient = 1	0	1	2	0	2
	Debt vs Total HH saving	Debt / Total HH saving	0 = 0, >0-0.2 = 1, >0.2 = 2	0	2	1	0	2
Coping Capacity	Abilty to cope with climate impact	Total HH consumption + Total cost of production / Total HH saving + Total off-farm income + Extra income	<=1 = 0, >1-1.3 = 1, >1.3 = 2	0	2	1	0	2
	Food security - Reserved food	Total food consumption / (Reserved rice + preserved food + natural product)	<=1 = 0, >1-1.3 = 1, >1.3 = 2	0	2	1	0	2
	Access to external support (source of fund)	Sufficient / insufficient / not available	S = 0, I = 1, N.A. = 2	0	2	1	0	2
On-Farm Production Dependency	Income diversification - use of off-farm income to support HH livelihood	Total HH consumption / Fixed off-farm income	<=1 = 0, >1-1.5 = 1, >1.5 = 2	0	2	2	0	4
	Food security from on-farm production	Total food consumption / Total rice production + natural product	<=1 = 0, >1-1.3 = 1, >1.3 = 2	0	2	1	0	2
							0	18
			Low risk				**0**	**6**
			Moderate risk				**>6**	**12**
			High Risk				**>12**	**18**

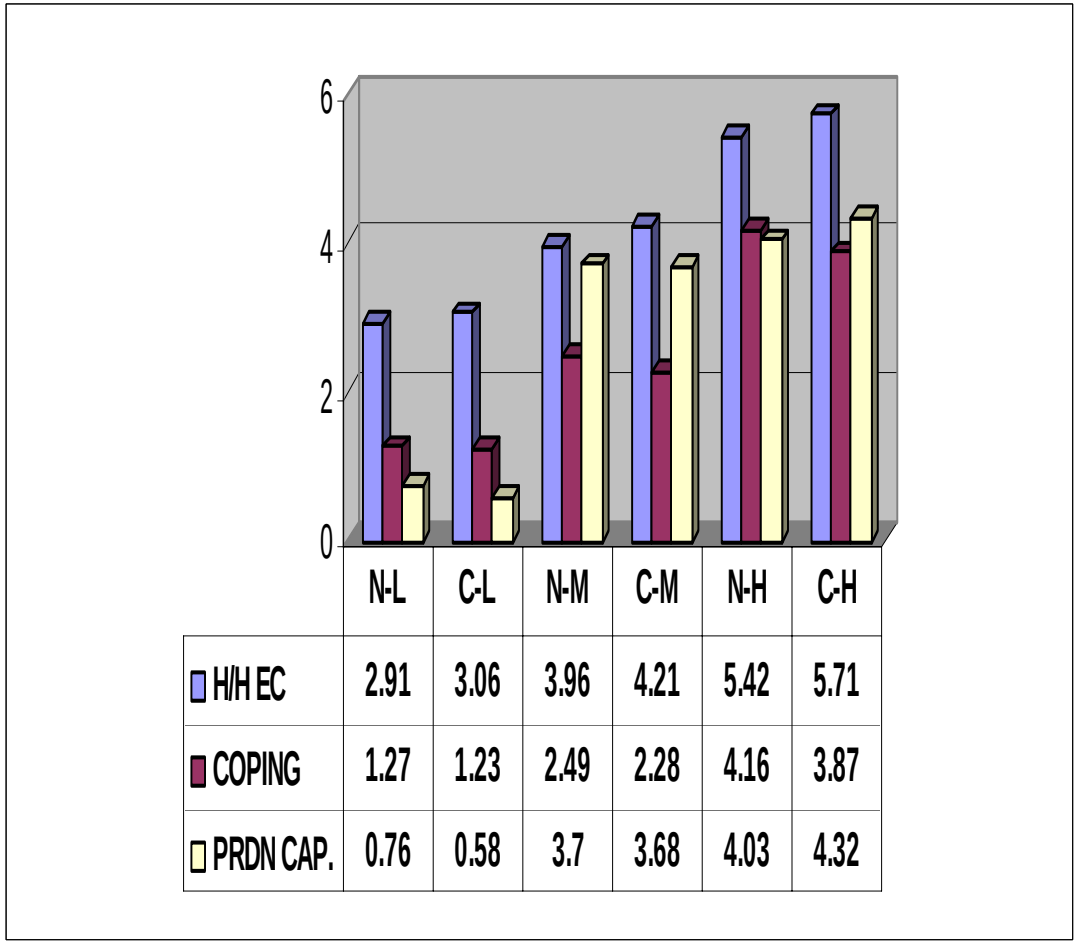
Source: Wichien Kerdsuk et al, 2005

Risk evaluation by criteria

Share of household





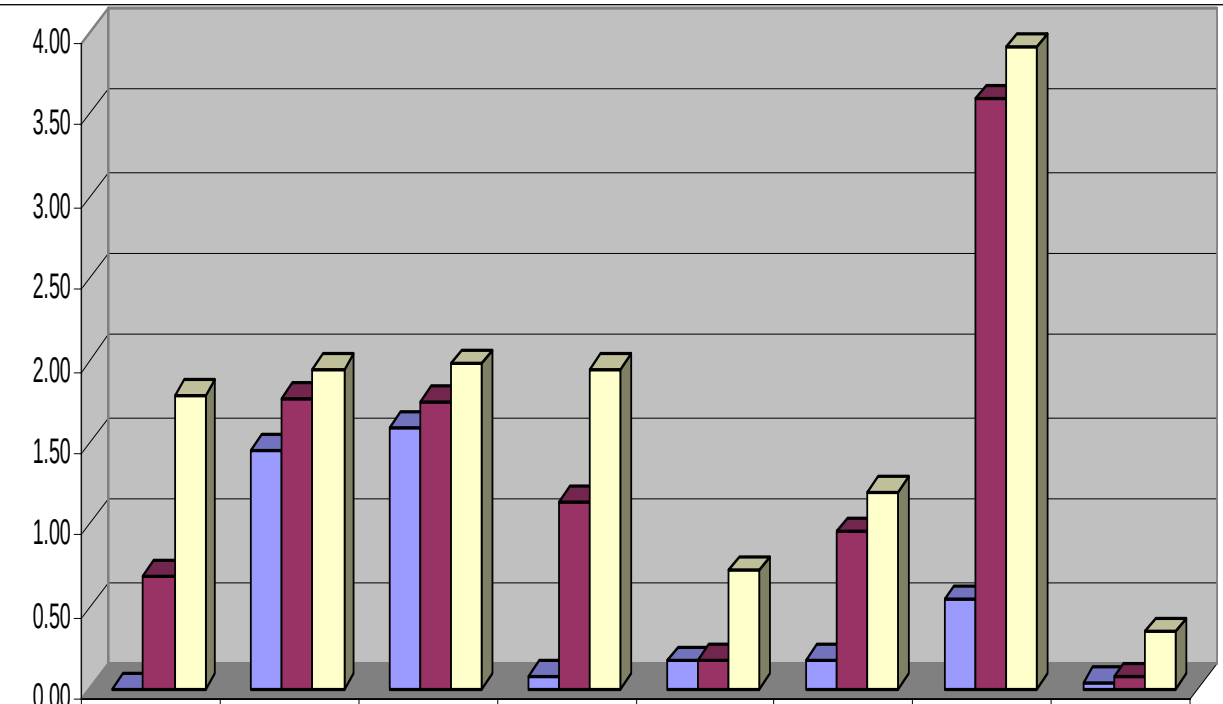


	N-L	C-L	N-M	C-M	N-H	C-H
H/H EC	2.91	3.06	3.96	4.21	5.42	5.71
COPING	1.27	1.23	2.49	2.28	4.16	3.87
PRDN CAP.	0.76	0.58	3.7	3.68	4.03	4.32

Source: Wichien Kerdsuk et al, 2005

Note: N=Normal condition, C=Climate Change, L=Low risk, M=medium risk, H=high risk

Evaluation on risk indicators under CC



	Sustained consumption	Sufficient resources	Debt/Saving	Ability to cope with CC	Reserved food	External support	Income diversification	On-farm production
C-L	0.00	1.46	1.60	0.08	0.17	0.18	0.54	0.04
C-M	0.69	1.77	1.75	1.14	0.18	0.96	3.60	0.07
C-H	1.79	1.95	1.98	1.95	0.72	1.20	3.91	0.34

Source: Wichien Kerdsuk et al, 2005

Economic valuation on impact CC
Somporn Isvilanon et al 2008

- ECHAM4, Crop DSS
- Comparing 1980-1997 to 2010-2020
- Paddy production in the North, Northeast, and Central

Region	%Change in yield	Value change (mill.US$./yr)
North - Rainfed	**3**	**10,859**
Northeast - Rainfed	**30**	**434,236**
Central - Rainfed	**-7**	**(27,594)**
Central - Irrigated	**-7**	**(32,091)**

PRIVATE AND PUBLIC RESPONSES

- Farmer response
  - Production technology, breed varieties, planting schedule
  - Water management, soil management
  - Livestock and integrated farming
  - Off-farm employment
  - Farm group on local water management
  - Saving group
  - Rice bank
- Government support
  - Payment on loss, grace period on credit payment, credit on farm inputs, reduction on interest rate

FUTURE POLICY OPTIONS

- Network on CC R&D
- R&D on effective CC model
- Climate change projection and warning system
- R&D on varieties in tolerance on CC
- Records on CC for effective forecasting and precautionary approach
- For the farmers: bio-fuel, animal work, reducing plough, reducing deforestation and increasing replanting, increasing use of organic fertilizer, better water management, adapting cropping system

Thank you