

Climate Change and Agricultural Implications in Chinese Taipei

Ching-Cheng Chang

Research Fellow, The Institute of Economics, Academia Sinica

Presentation at The Pacific Food System Outlook

“WHERE CLIMATE CHANGE WILL TAKE THE REGION’S FOOD SYSTEM”

September 15-17, 2008

East-West Center, Honolulu, Hawaii

Outline

- Impact
- Response

Local Climate

- Influenced by the East Asian Monsoon
- **Temperature**
 - Variations are mild
 - 17-20°C in the winter
 - 30°C during the summer
- **Rainfall**
 - Summer- from thunderstorm and typhoon
 - Winter-shallow front or mountain slope lifting effects
 - Half of annual rainfall come from **typhoon**

Climate Change Impact

■ Temperature:

- 1.0-1.4°C increase in the past 100 years
- Higher than the global means of 0.74°C
- Daily difference decrease 1 °C
- **Precipitation:**
- Increasing intensity
- Increase in the Northeast
- Decrease during the dry season in the South

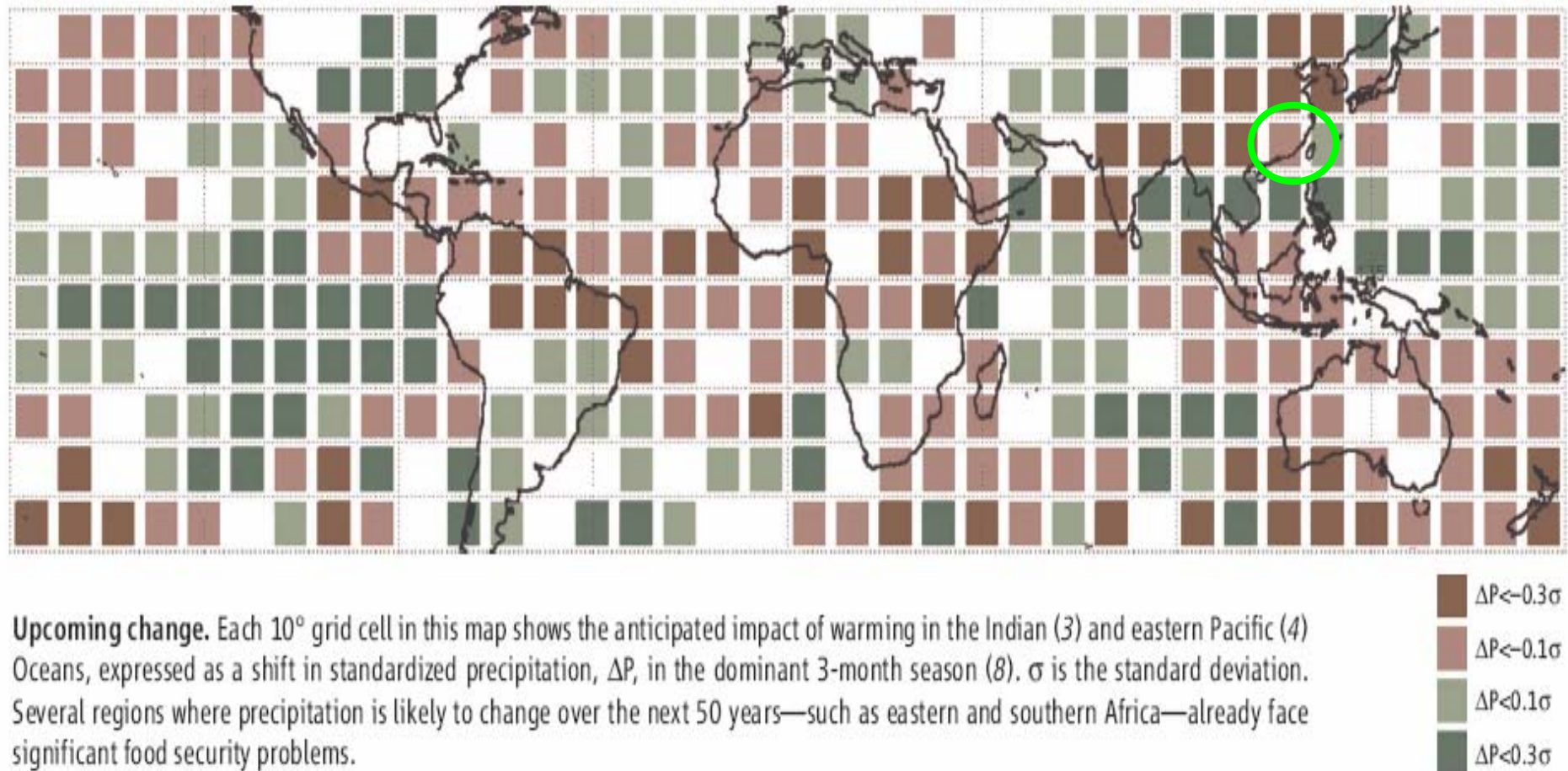
■ Sea Level Rise:

- Measured by tidal gauge
- Larger than the global mean
- Larger SLR can be explained by larger thermal expansion
- Non-Homog trends and patterns around Taiwan
- Vertical motion of land may play a role

■ Extreme Events

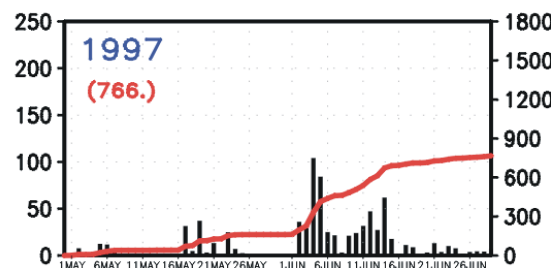
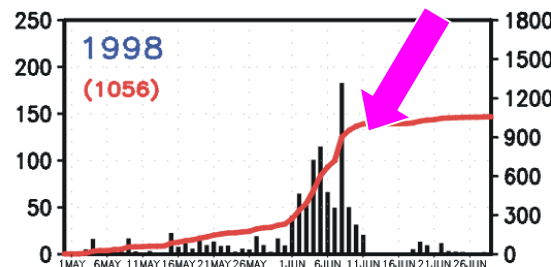
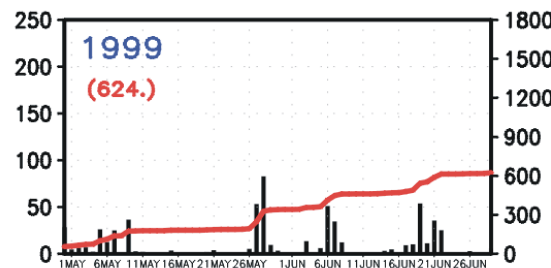
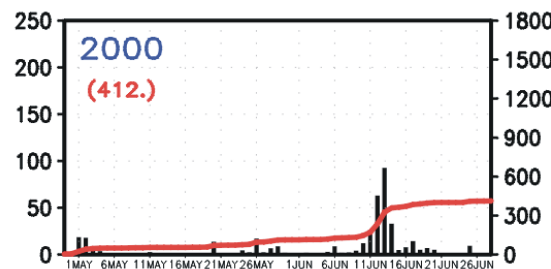
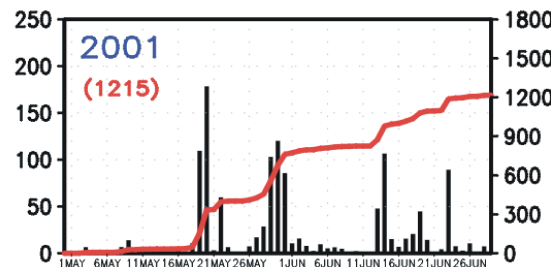
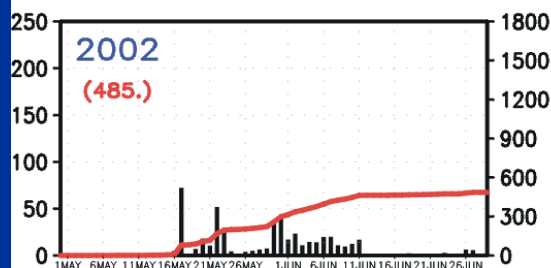
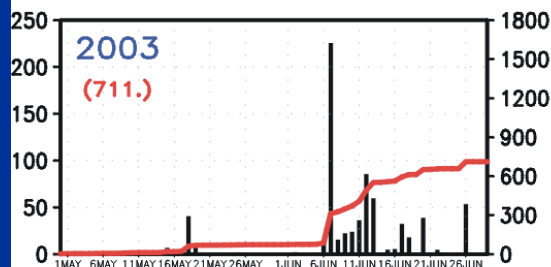
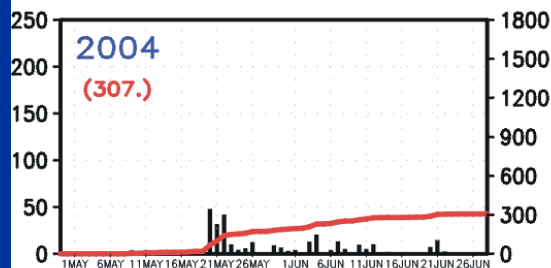
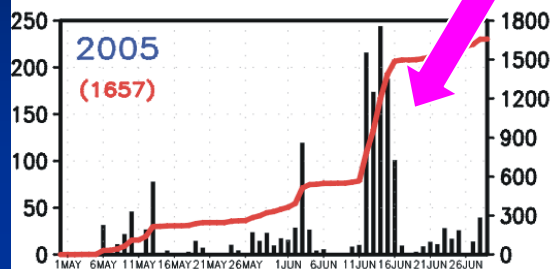
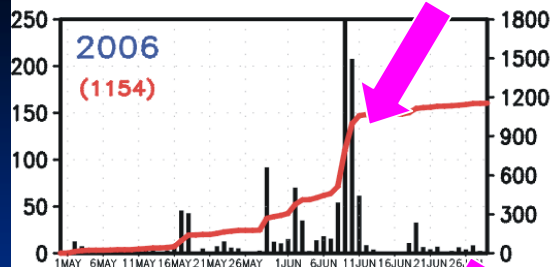
- **Reduced Sunshine Hours by 15%**
- **Humidity over 90% reduce by half**

Precipitation Forecast of the next 50 years- Indian and Pacific Ocean



Source : Brown and Funk, 2008. “Food Security Under Climate Change”, Science, No. 319, P.580-581.

May~Jun RAINFALL
auto-rain-gauge 120.2~120.8,22.4~23.6



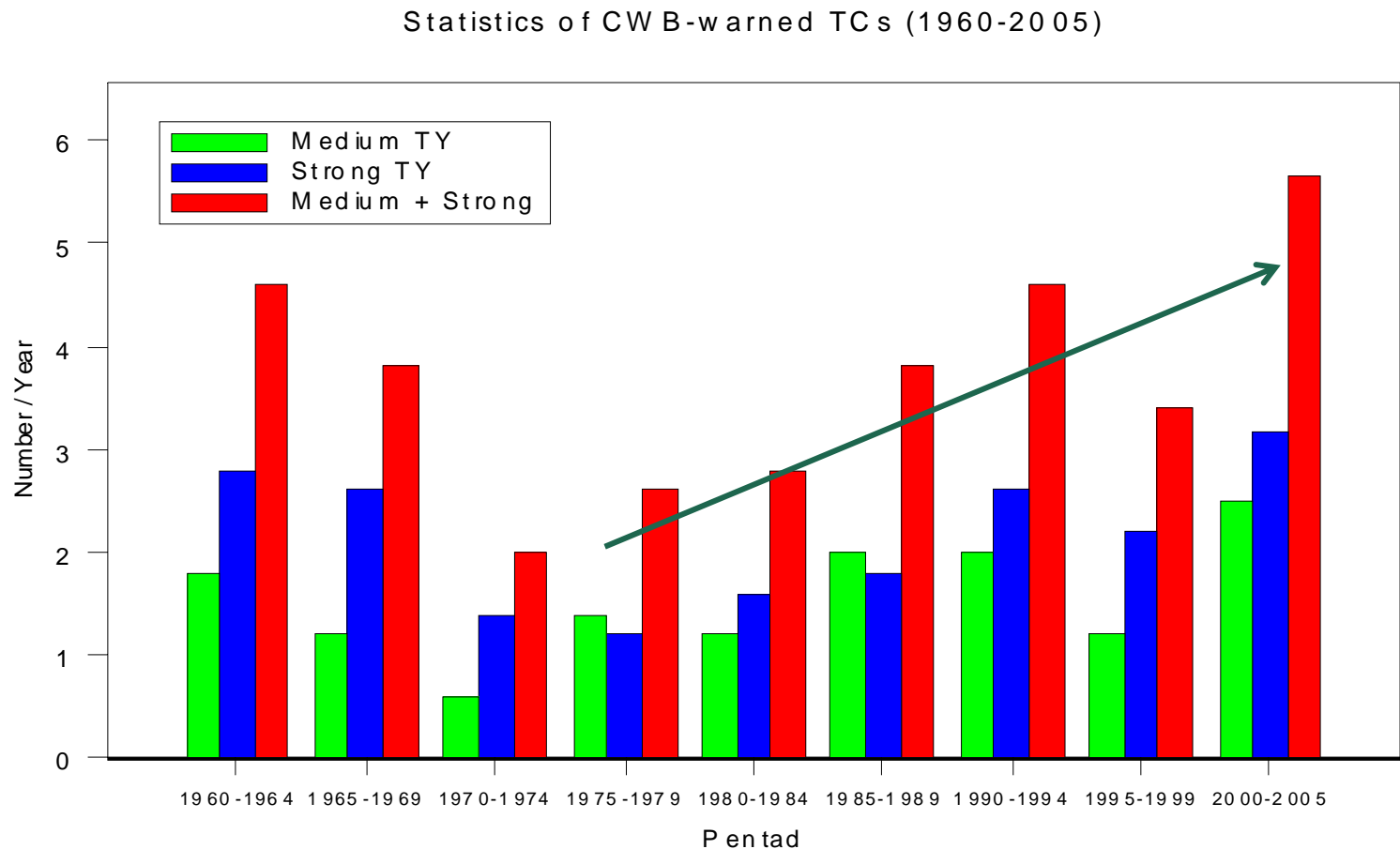
1997-2002

Two Record Breaking
Rainfall Events After
2000 :

- 2005 and 2006
- Mei-Yu season
- Western region

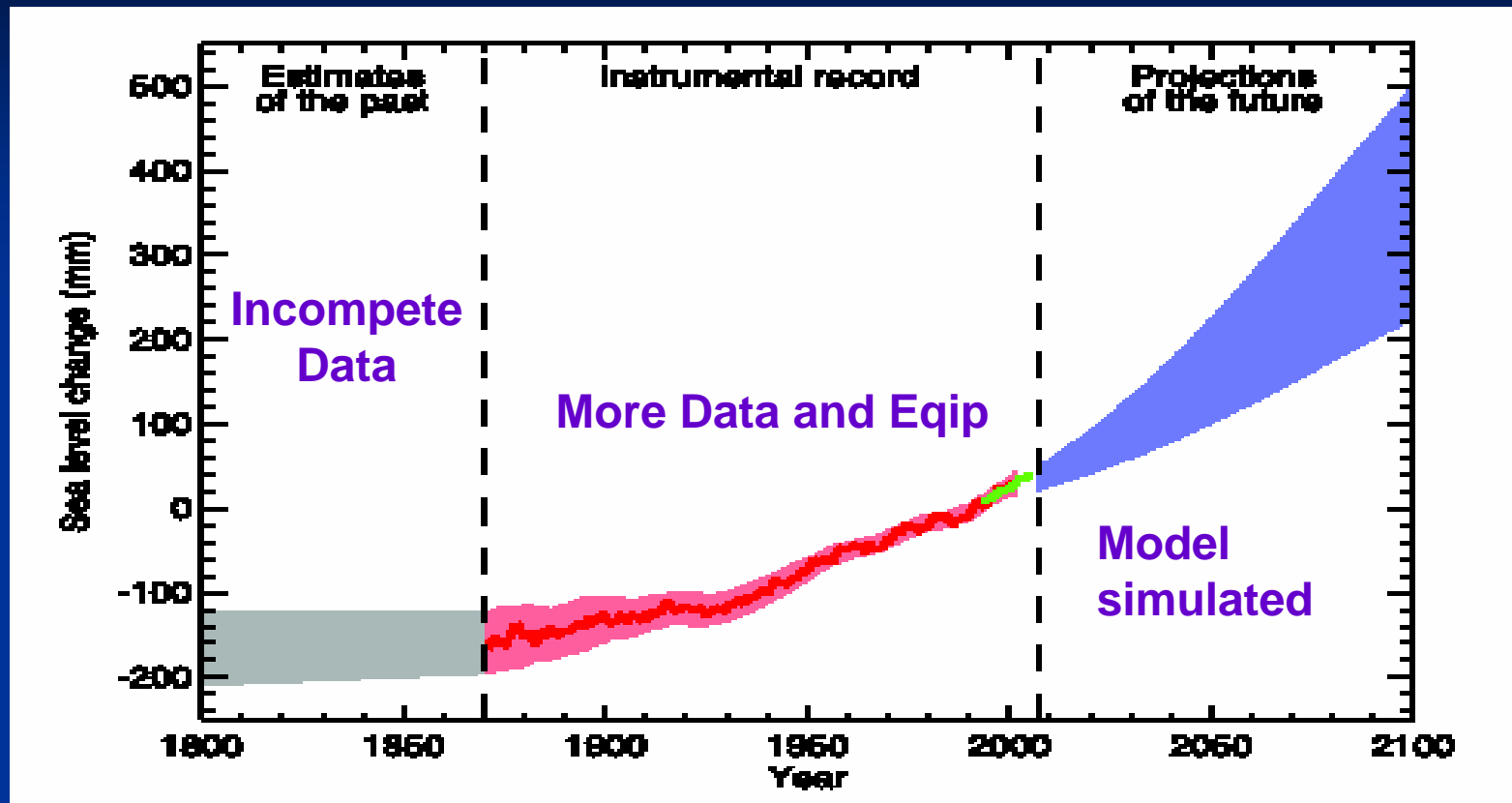
Source: Chou and Chen (2008)
‘Extreme Rainfall and Invading
Typhoon Event-Trend and
Identification Method’

The number of Mid-scale and Strong-scale Typhoon, 1960~2005



Source: Chou and Chen (2008) 'Extreme Rainfall and Invading Typhoon Event-Trend and Identification Method'

Sea Level Rise



Bindoff, N.L., J. Willebrand, V. Artale, A. Cazenave, J. Gregory, S. Gulev, K. Hanawa, C. Le Quéré, S. Levitus, Y. Nojiri, C.K. Shum, L.D. Talley and A. Unnikrishnan, 2007: Observations: Oceanic Climate Change and Sea Level. In: *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

Impact of Sea Level Rise

■ Global:

- 100 year: 0.17cm per year
- Recent 10 years: 0.30cm per year
- 2100 prediction (IPCC,2001): 1 meter

■ Taiwan

■ National Central Univ:

- **0.4% land loss** if 1 meter SLR

■ EPA :

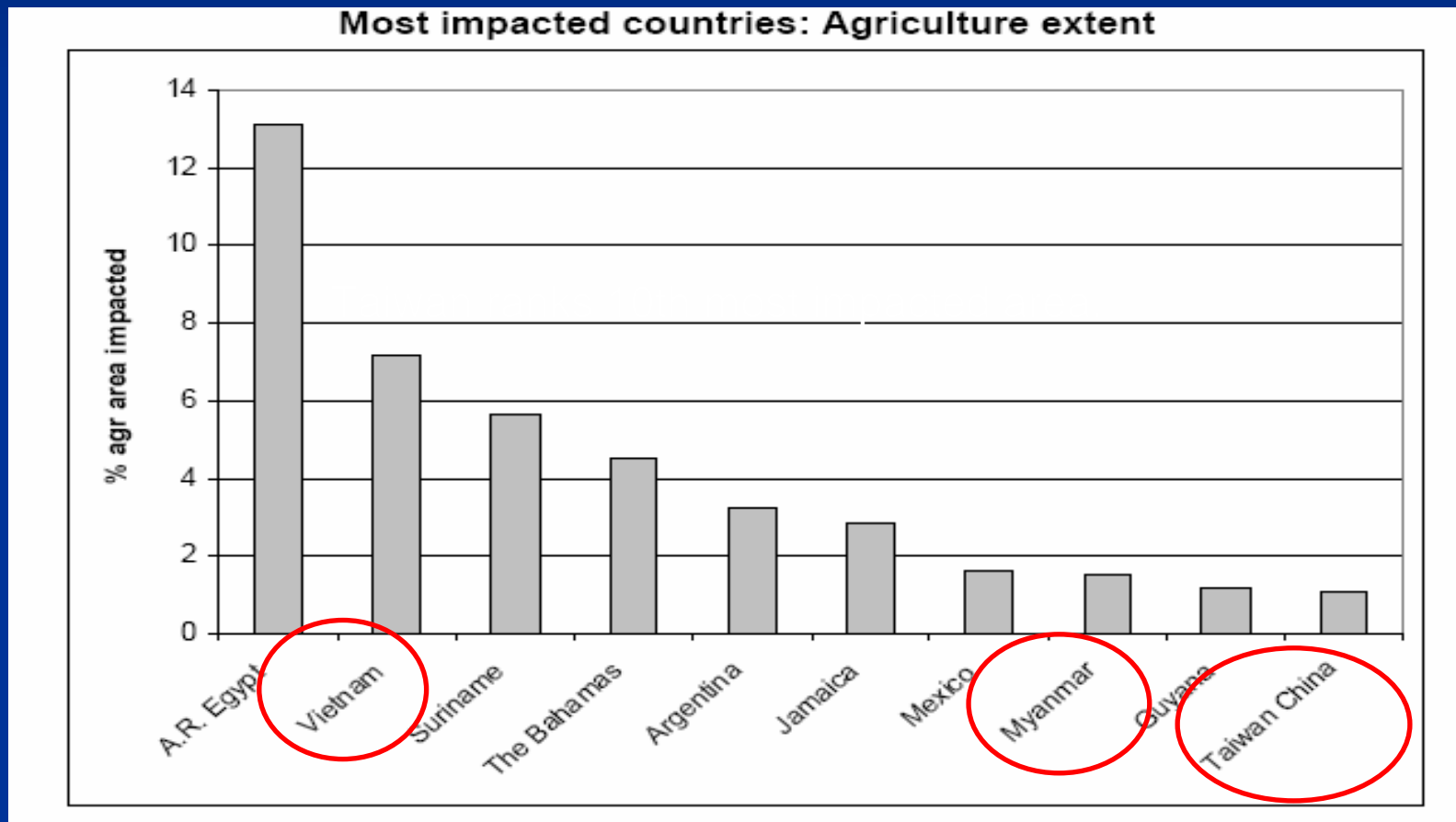
- **0.4% land loss** if 1 meter SLR
- 3.9% land in risk
- **8.2% population** affected

■ Not considering defense system

Agricultural Implications

WB Sea Level Rise study:

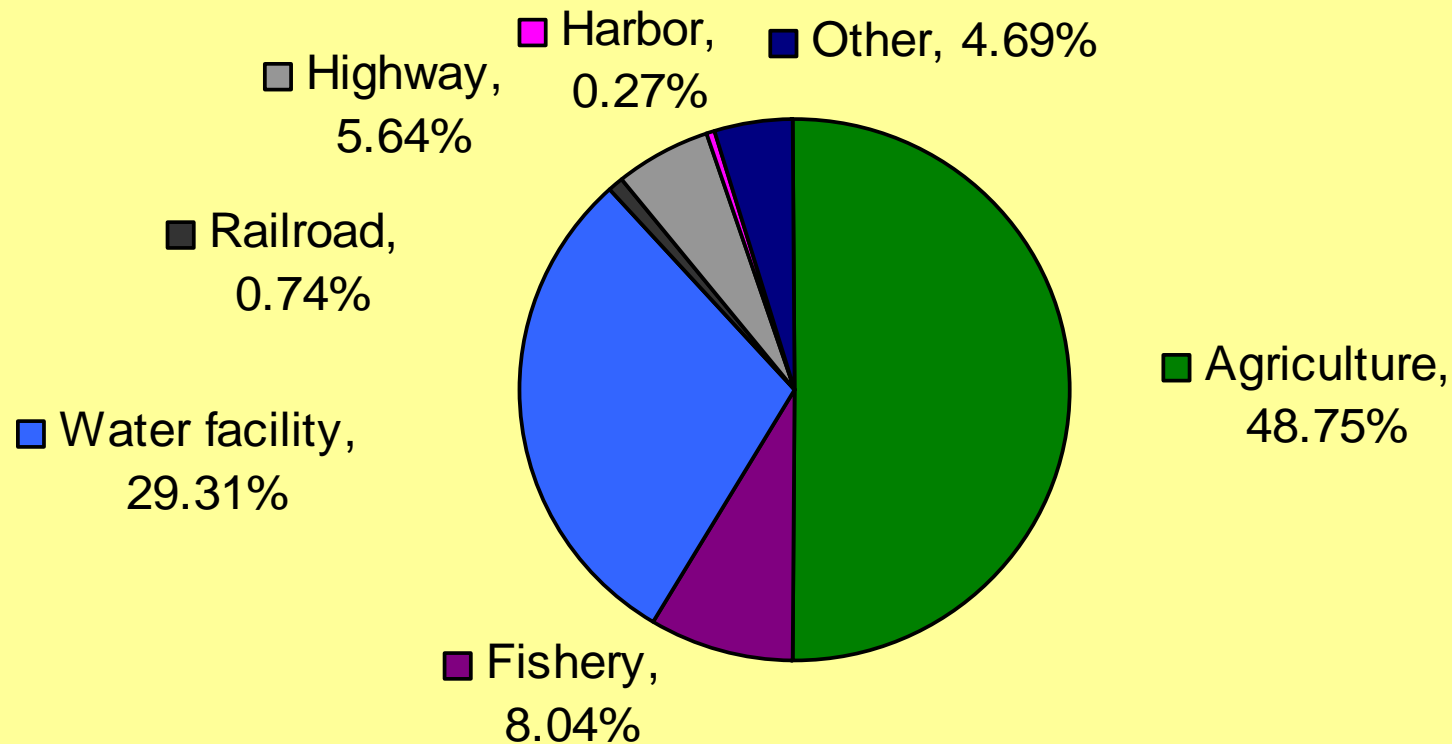
Taiwan ranks the 10th most impacted area.



Source: World Bank, 2007. The Impact of Sea Level Rise on Developing Countries: A Comparative Analysis. Washington DC: World Bank.

Natural Disaster Losses in Taiwan by Sector— 1985-2002 Total

Sector Breakdown of Total Loss of All Perils (1985-2002)



Source: Data compiled from the official statistics provided by the Central Weather Bureau

Weather-related Agricultural Losses

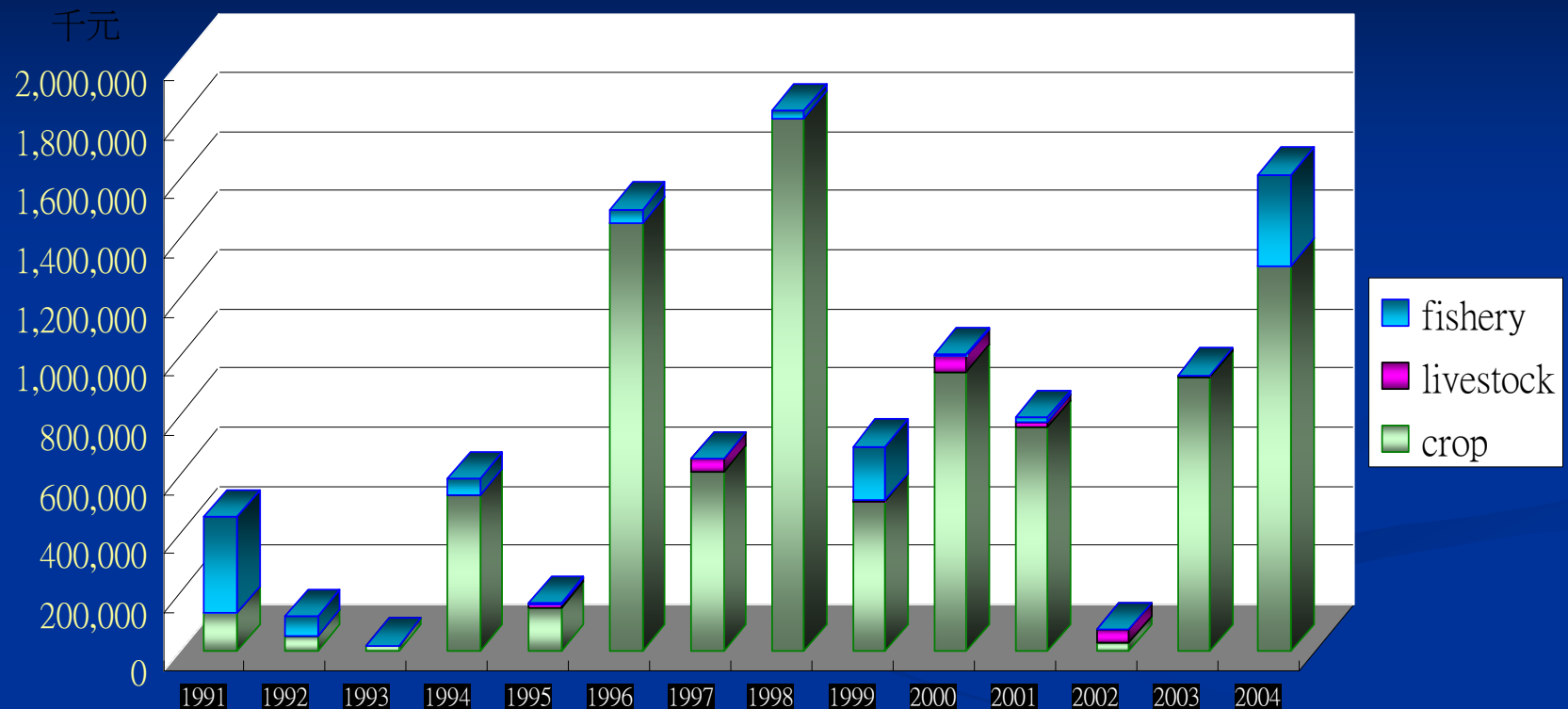
Severity % by Crop and Event Type

crop	Typhoon	Flood	Frost	Drought	Hail	Heatwave
RICE	22	20	26	10	41	
Field	39	26	10	70	54	
Fruits	25	33	22	18	44	8
Veget	27	30	25	13	41	39
Floral	40	35	21		29	33
Special	26	30	24	68	23	5

Source: Chen (2008), "The Impact of Climate Change on Taiwan's Agricultural Production", Paper presented at the Central Weather Bureau, Taipei, 2008.

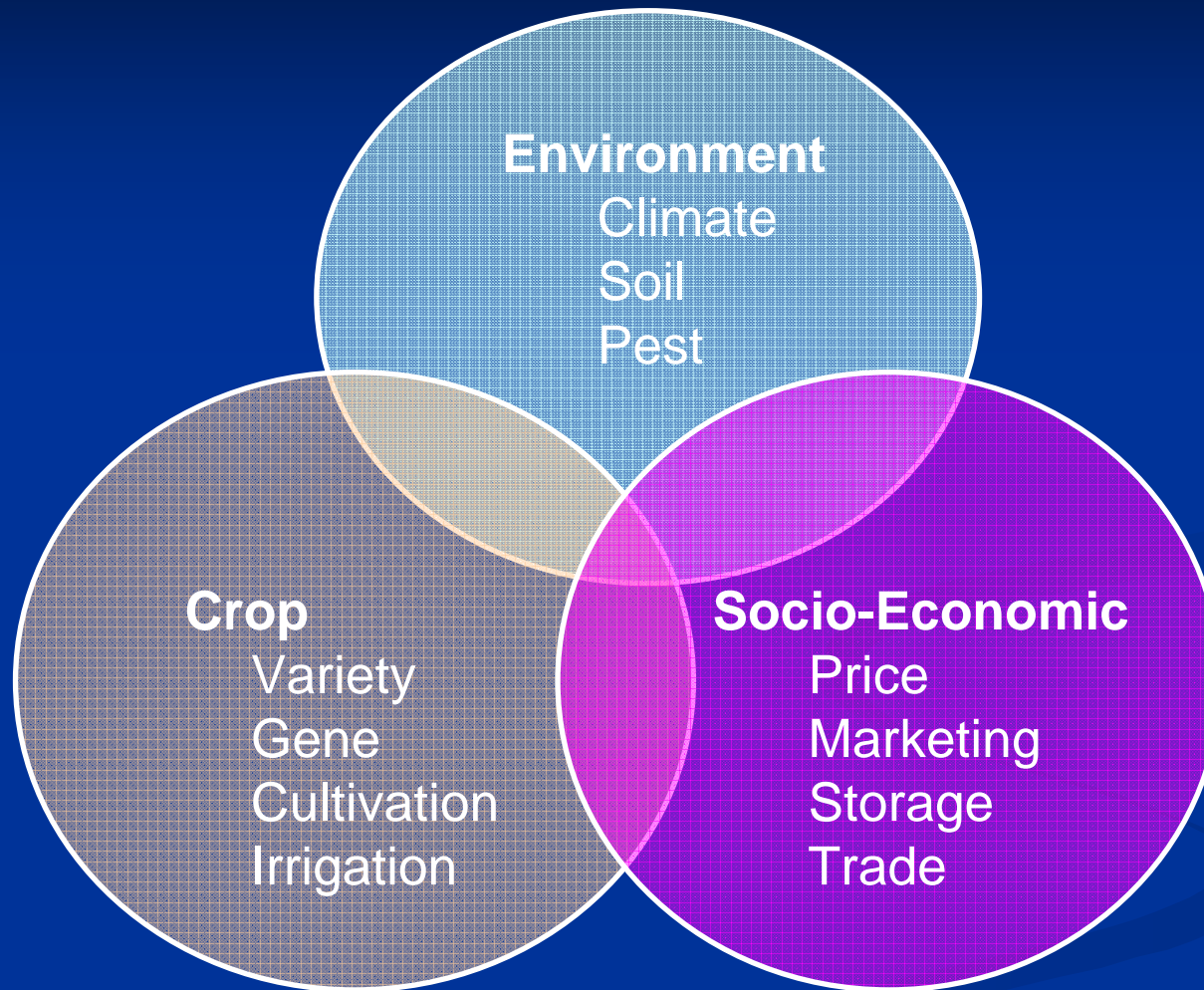
Government Relief on Agricultural/Fishery Disasters

1991-2004 農業/漁業災害救済金救助統計



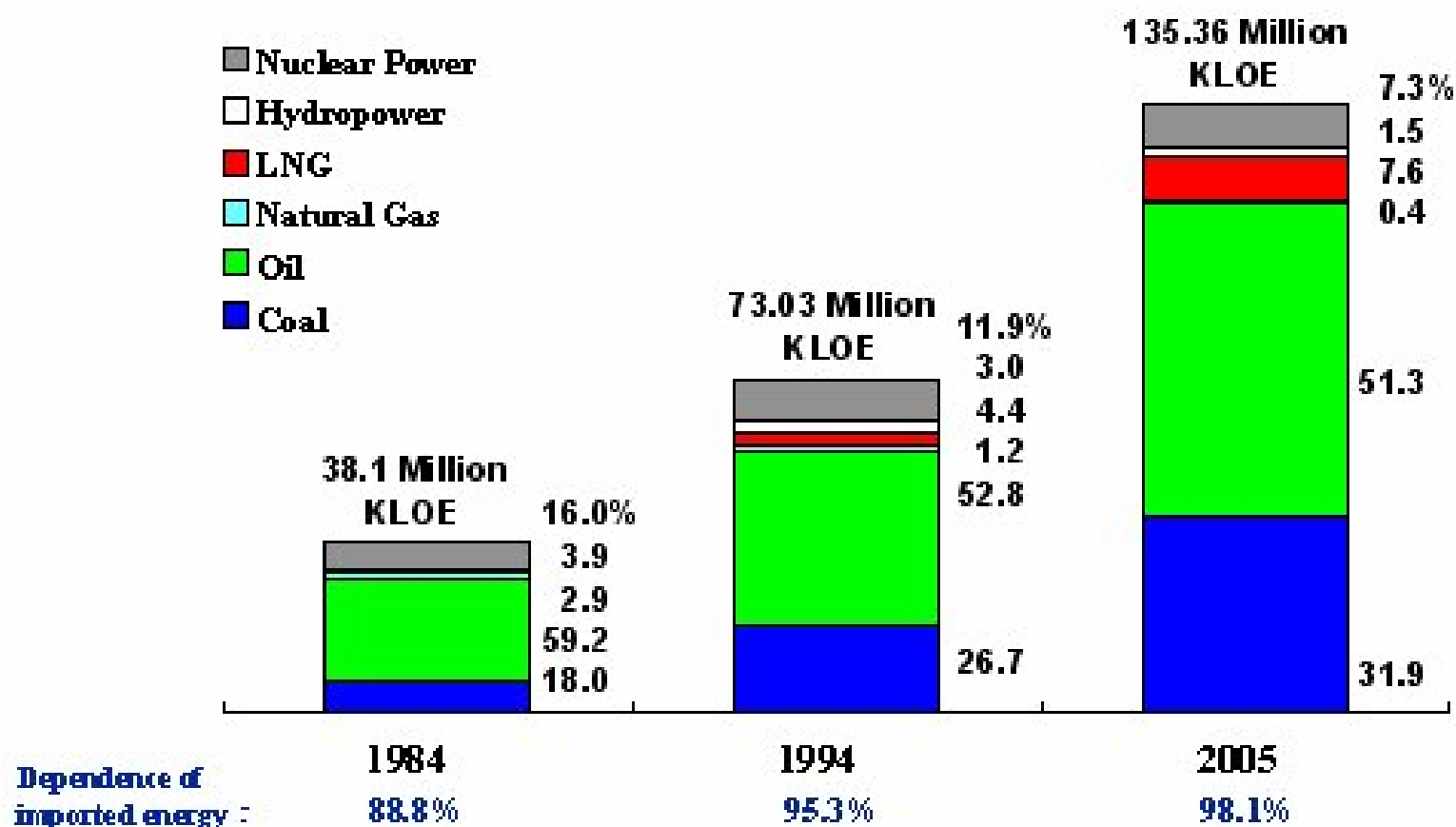
	Crop	Livestock	Fishery	Total
1991-2004 Total	9,208,829	180,870	1,038,937	10,428,636
Annual Avg	657,774	12,919	74,210	744,903
1991-1997	418,628	7,877	71,929	498,435
1998-2004	896,919	17,961	76,490	991,371

Policy Response



Agricultural Production System

Energy Supply Structure



Source: Taiwan's Energy Statistical Handbook 2005

Policy Response-Agriculture

- promoting organic fertilizer
- crop varieties
- GM crop: provide scientific validation and promote public education
- Biofuel feedstock:
 - The 1st bio-diesel manufacturing plant in ChiaYi
 - Taiwan Sugar: biomass ethanol production
 - Technology R&D
 - Rice straw
 - biomass from crop residues
 - Animal waste treatment
 - Algae

Policy Response-Energy

■ Renewable Energy Development Bill

- has been proposed by the Bureau of Energy in 2002
- revised in 2005,
- Now awaits for final approval by the Legislative Yuan.

■ Interim measures

- financial and tax incentives,
- equipment subsidy,
- premium power purchase agreement (ppa)
unilaterally enforced by the state-owned Taiwan Power Company
- projects supporting the development and promotion of renewable energy through the Energy Research and Development Special Fund and the Petroleum Fund.

Energy Policy Whitepaper (2006)

- Target for renewable energy
 - 10% of total installed capacity by 2010.
 - has become a common consensus in Taiwan
- How to achieve
 - promote non-carbon renewable energy,
 - expand the utilisation of low carbon (LNG) clean energy
 - adopt high efficiency power generating equipment,
 - promote co-generation system,
 - improve transmission line loss,
 - conserve energy and raise energy utilisation efficiency,
 - rationalize energy price,
 - facilitate an adjustment in industrial structure.

Policy Priority

- Reduce carbon dioxide emissions
 - high energy-consuming, highly polluting industries
- Scientific assessment
 - Extreme events on sectoral vulnerability
 - Bioenergy development strategies