

颱風路徑潛勢預報圖

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A Proposal for the Climate Change Adaptation Framework in Taiwan

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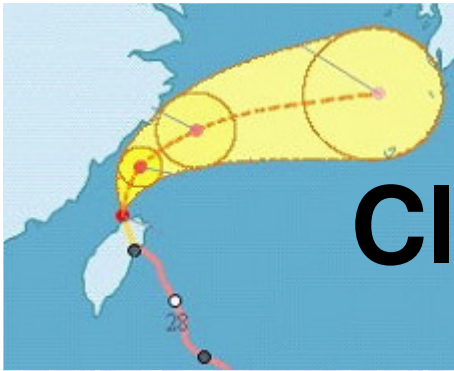
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Preface

- Global climate change has been observed, and the change trend and variability **might be very likely more significant** than that in twenty century.
- Climate change causes **impacts** directly or indirectly on all industries and sectors.
- Adaptation is aimed to **decrease climate vulnerability** and to **increase adaptation capacity**.
- Adapting to the climate change is to pursue **sustainable development**.

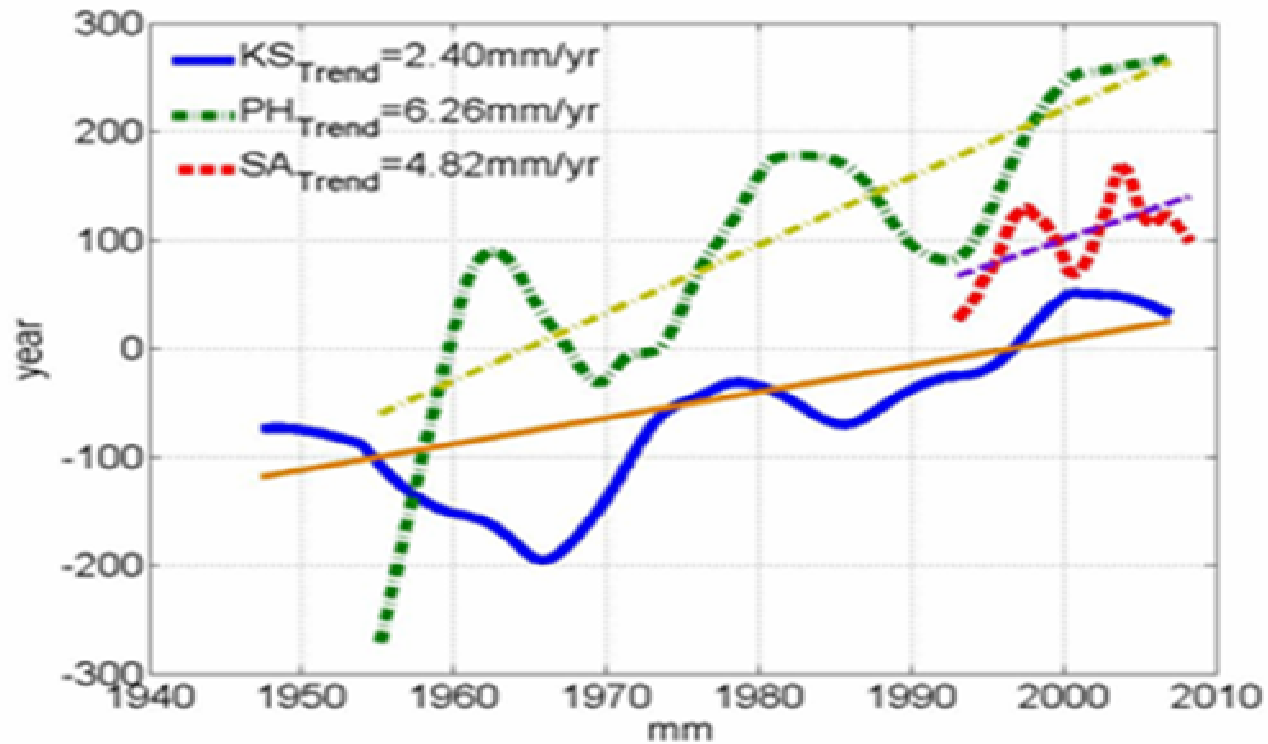


Climate Change in Taiwan

- **Temperature increases** significantly in the past 100 years, especially in **the northern Taiwan**. The frequency and lasting days of heat wave is increased obviously in the past 50 years.
- The **average precipitation** did not change obviously, but the days with rainfall less than 2 mm are almost disappeared . It leads to **high rainfall intensity** in single day. Thus, **the rainfall type** has significant changes in the past 100 years.
- The **typhoon number** is averaged **from 3.5 to 7** since 2000, and the middle strength of typhoon is increased.
- **Drought** in central, southern, and TaiDong becomes serious.
- The **sea level rising rate is 2.51 mm per year**.
- The rate of **land subsidence is up to 7.89 mm per year** in the southwest Taiwan.



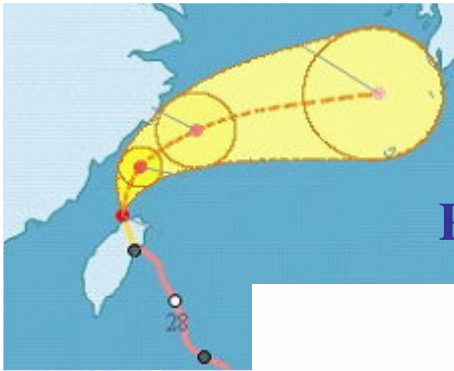
台灣近50年海平面上升趨勢



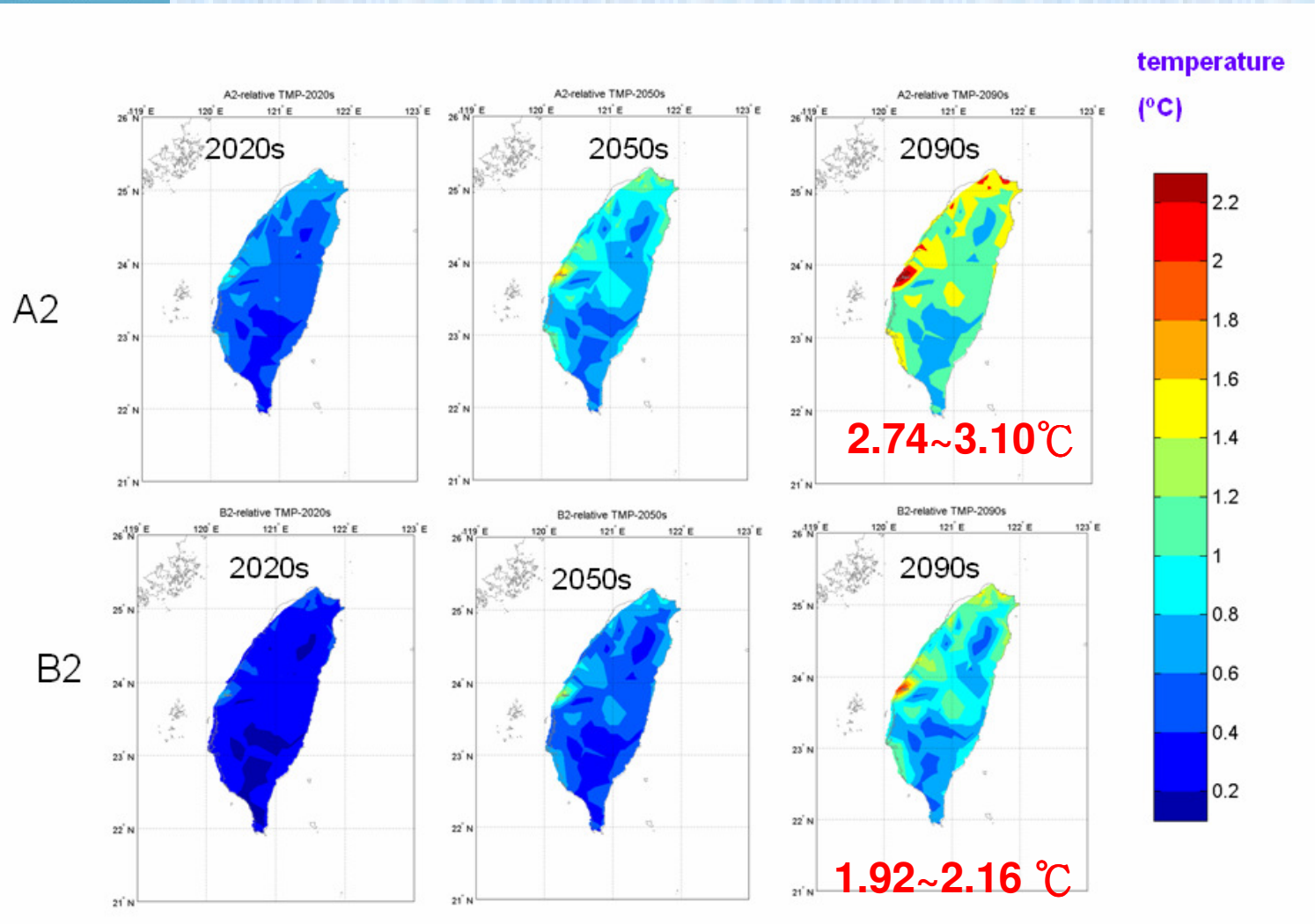
Sea level rising in the past 50 years:

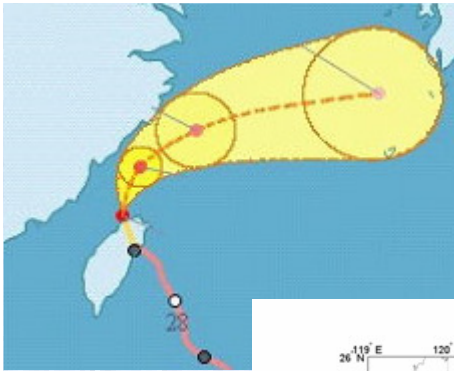
- The average rate: 2.51 mm per year
- In Kaohsiung: 2.4 mm per year
- In PenHu: 6.26 mm per year
- In the past fifteen years: 4.82 mm per year

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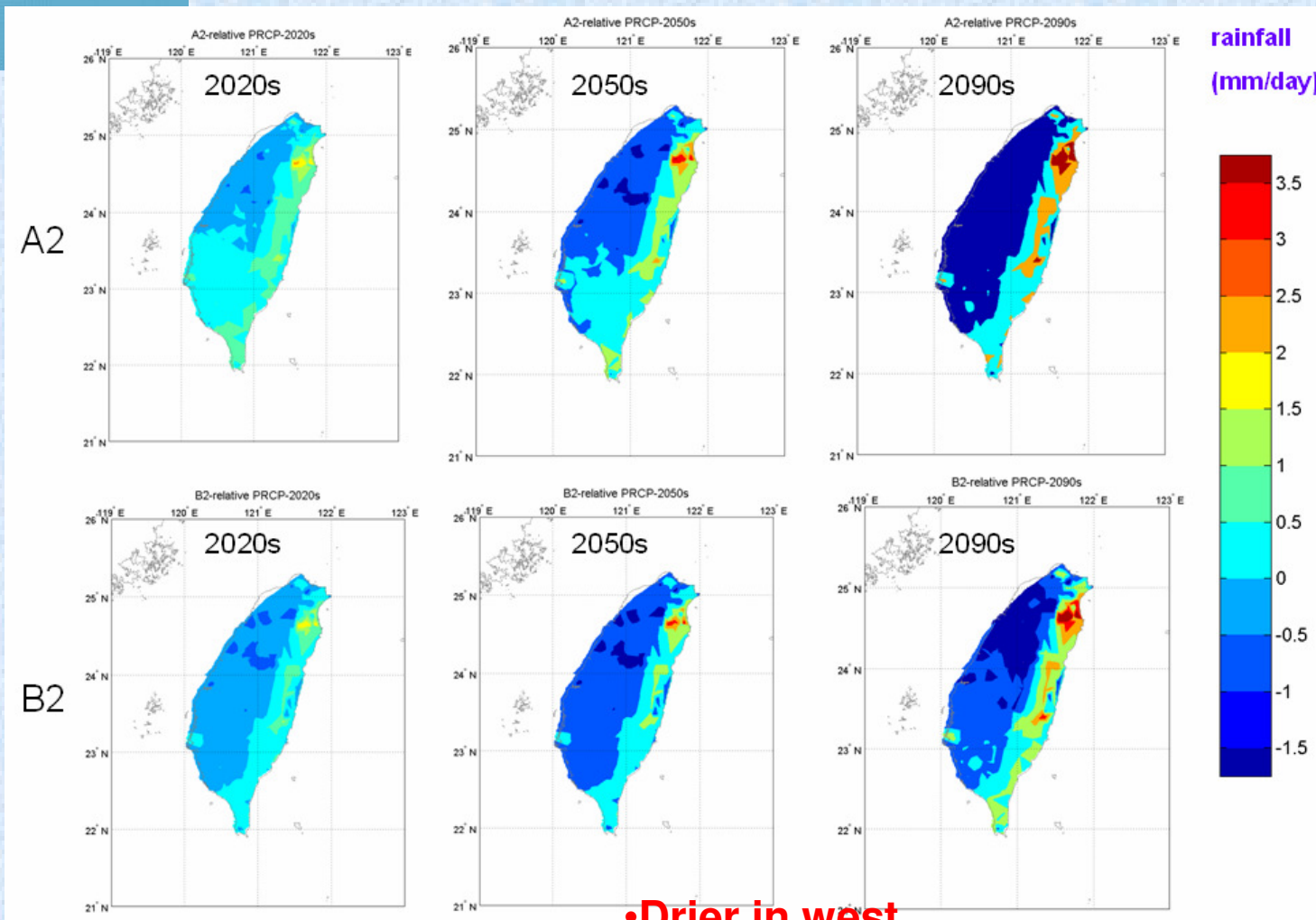


Projected temperature increment (compared with 1960-1990)

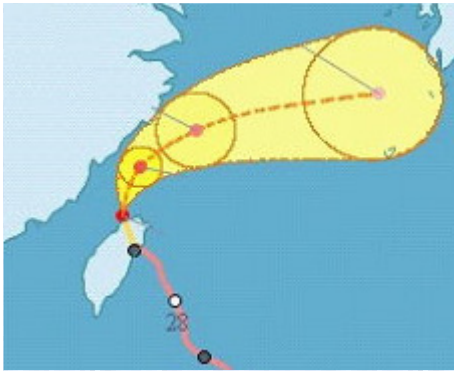




Projected precipitation change (compared with 1960-1990)

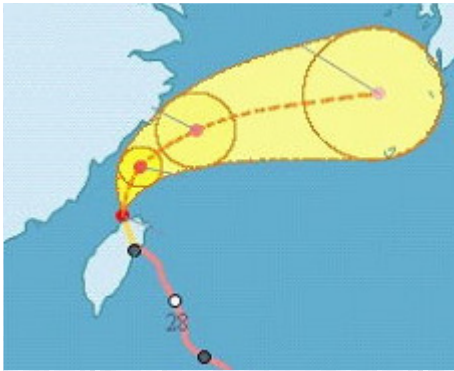


- Drier in west
- Wetter in east and northeast

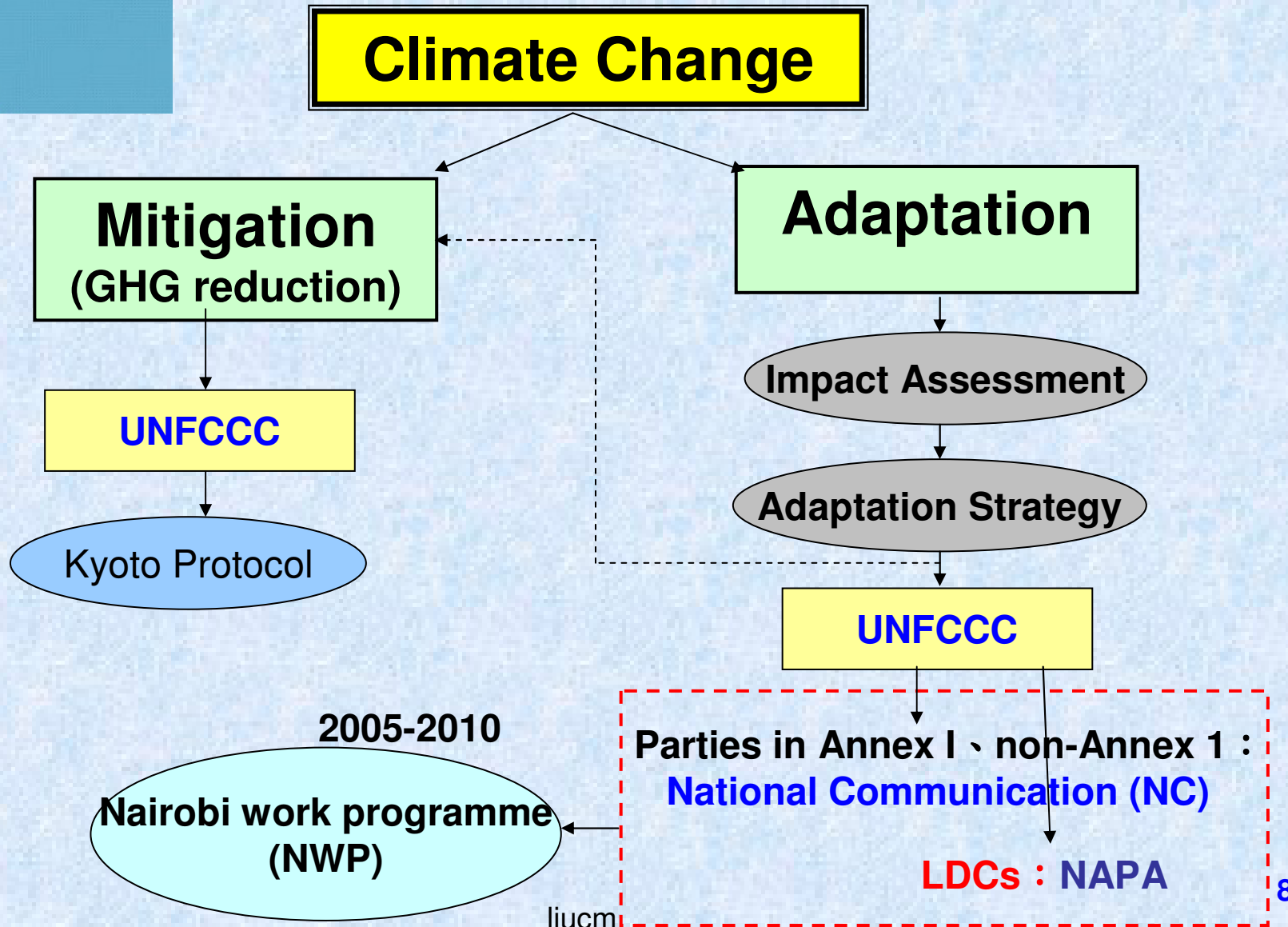


Other Climate Change Impacts in Taiwan

- **Agriculture** are impacted directly by increasing temperature. The yield of rice, corn, and wheat might be reduced 7% to 20% .
- Evidence showed **plant distribution** moved to higher latitude and the area of cypress and fir forest might be reduced.
- The **fishery** in west Pacific was influenced by the El Nino and La Nina. The shift of fish field results in fluctuation of harvest and market price.
- The changed distribution and habitat area of **amphibian, birds, coral, and Taiwan Landlocked Masu Salmon** have been observed and moved to higher altitude.
- Climate change will impact public health directly or indirectly, such as **chronic disease and infectious disease**.



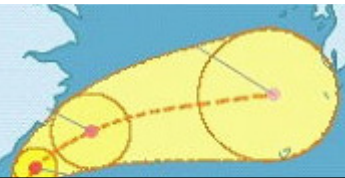
The responses of UN to climate change





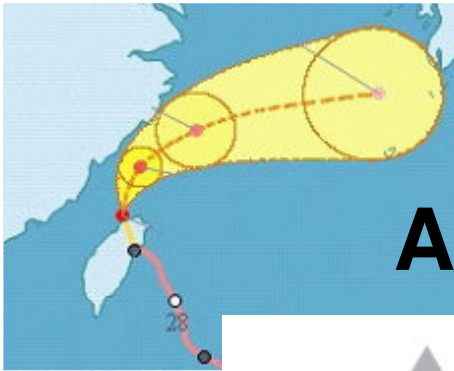
Nairobi Work Programme (NWP)

- **NWP is a 5 year programme (2005-2010) implemented by Parties, intergovernmental and non-governmental organizations, the private sector, communities and other stakeholders.**
- **Objectives:**
 - **To assist all Parties, in particular **developing countries**, including the least developed countries and small island developing States to **improve their understanding and assessment of impacts, vulnerability and adaptation to climate change****
 - **To **make informed decisions on practical adaptation actions and measures** to respond to climate change on a sound scientific, technical and socio-economic basis, taking into account current and future climate change and variability.**

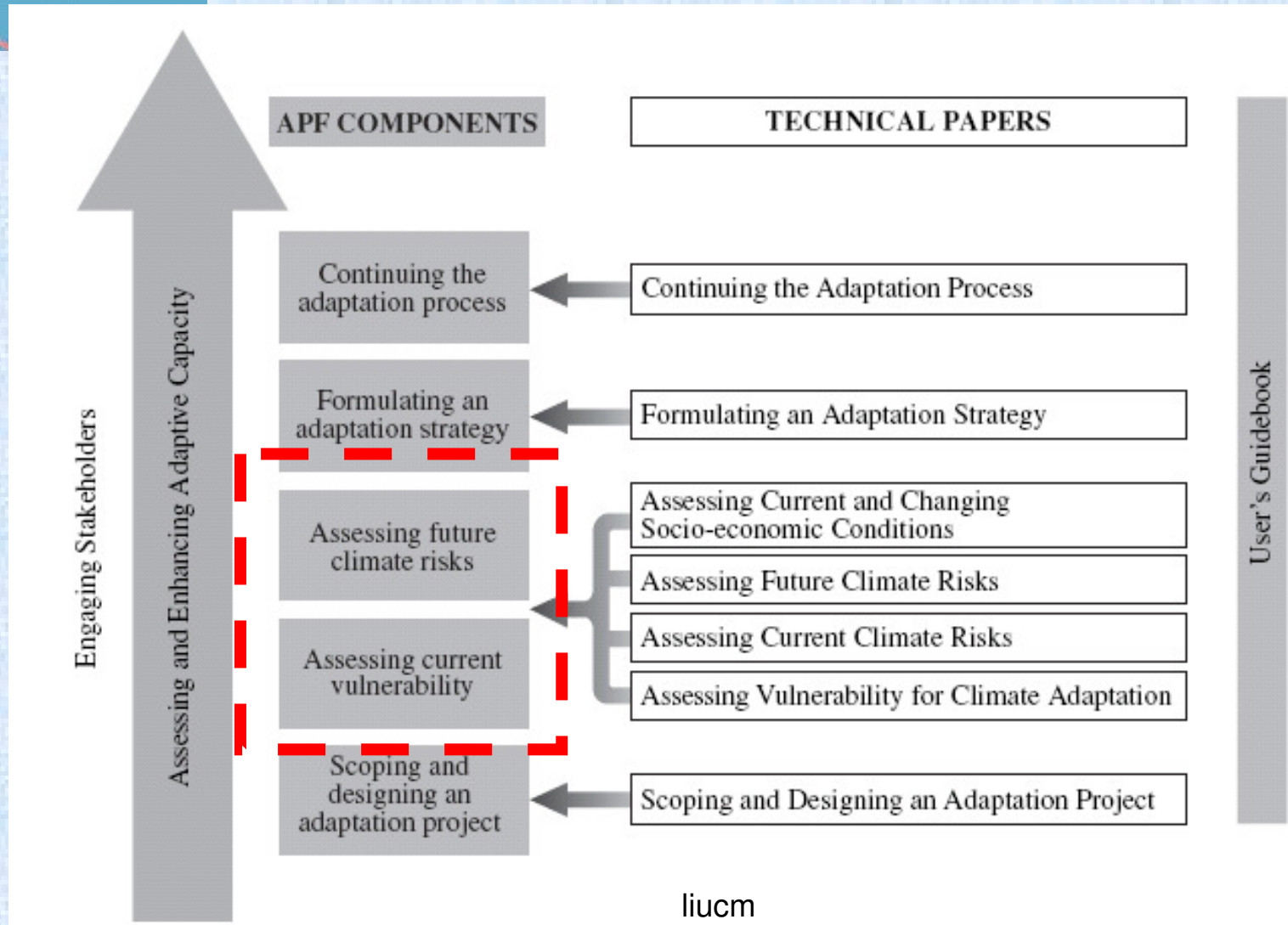


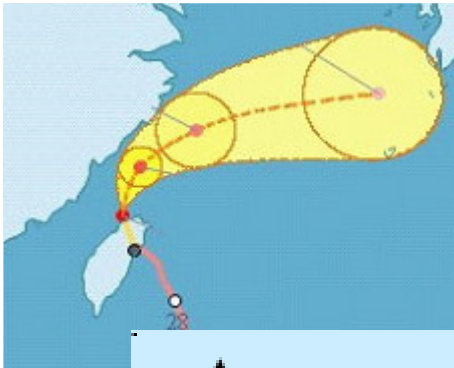
Areas of Work in NWP

areas	Descriptions
Methods and tools	Developing and disseminating methodologies and tools for impact and vulnerability assessments and adaptation planning.
Data and observations	Improving collection, management, exchange, access to and use of observational data and other relevant information on current and historical climate variability and change.
Climate modelling, scenarios and downscaling	Promoting the development of, access to, and use of information and data on projected climate change.
Climate related risks and extreme events	Promoting understanding of impacts and vulnerability, emphasising current and future climate variability and extreme events, and the implications for sustainable development.
Socio-economic information	Improving knowledge of the socio-economic aspects of climate change and promoting the integration of socio-economic information into impact and vulnerability assessments.
Adaptation planning and practices	Collecting, analysing and disseminating information on past and current practical adaptation actions and measures, including projects, short- and long-term strategies, and local and indigenous knowledge. This will be done through facilitating communication and cooperation between stakeholders.
Research	Promoting research on adaptation options.
Technologies for adaptation	Promoting the development and diffusion of technologies, know-how, and practices for adaptation, addressing identified adaptation priorities and building on lessons earned from current adaptation projects and strategies.
Economic diversification	Promoting understanding and the development and dissemination of ways to increase economic resilience and decrease reliance on vulnerable economic sectors.

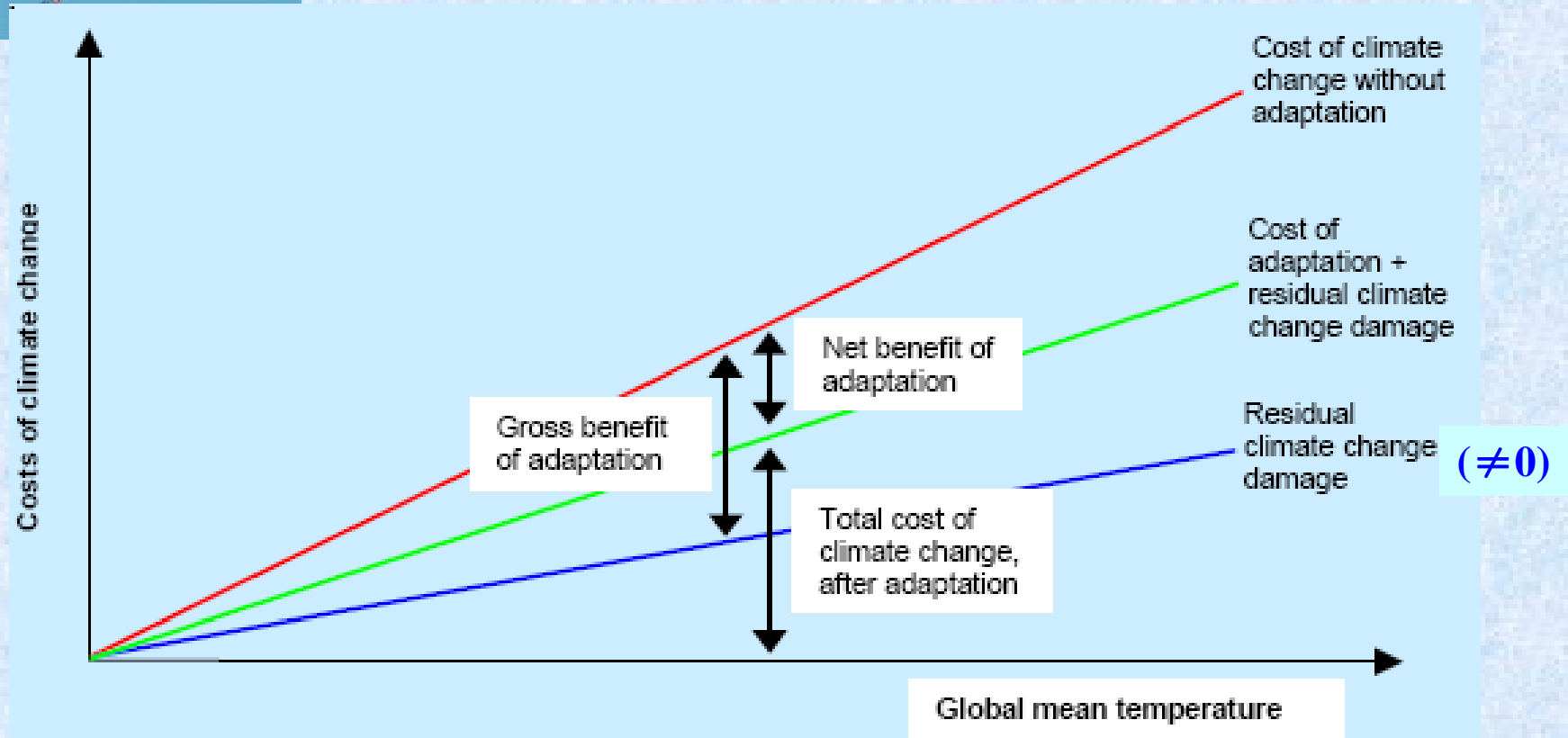


UNDP: Adaptation Policy Frameworks (APF)



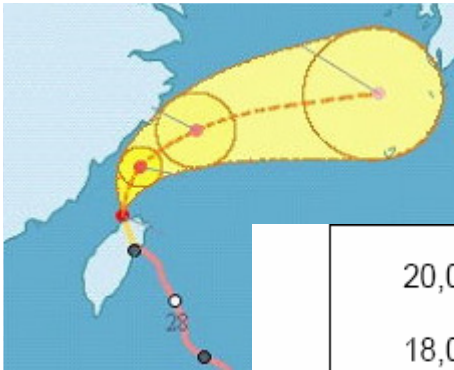


Adaptation cost

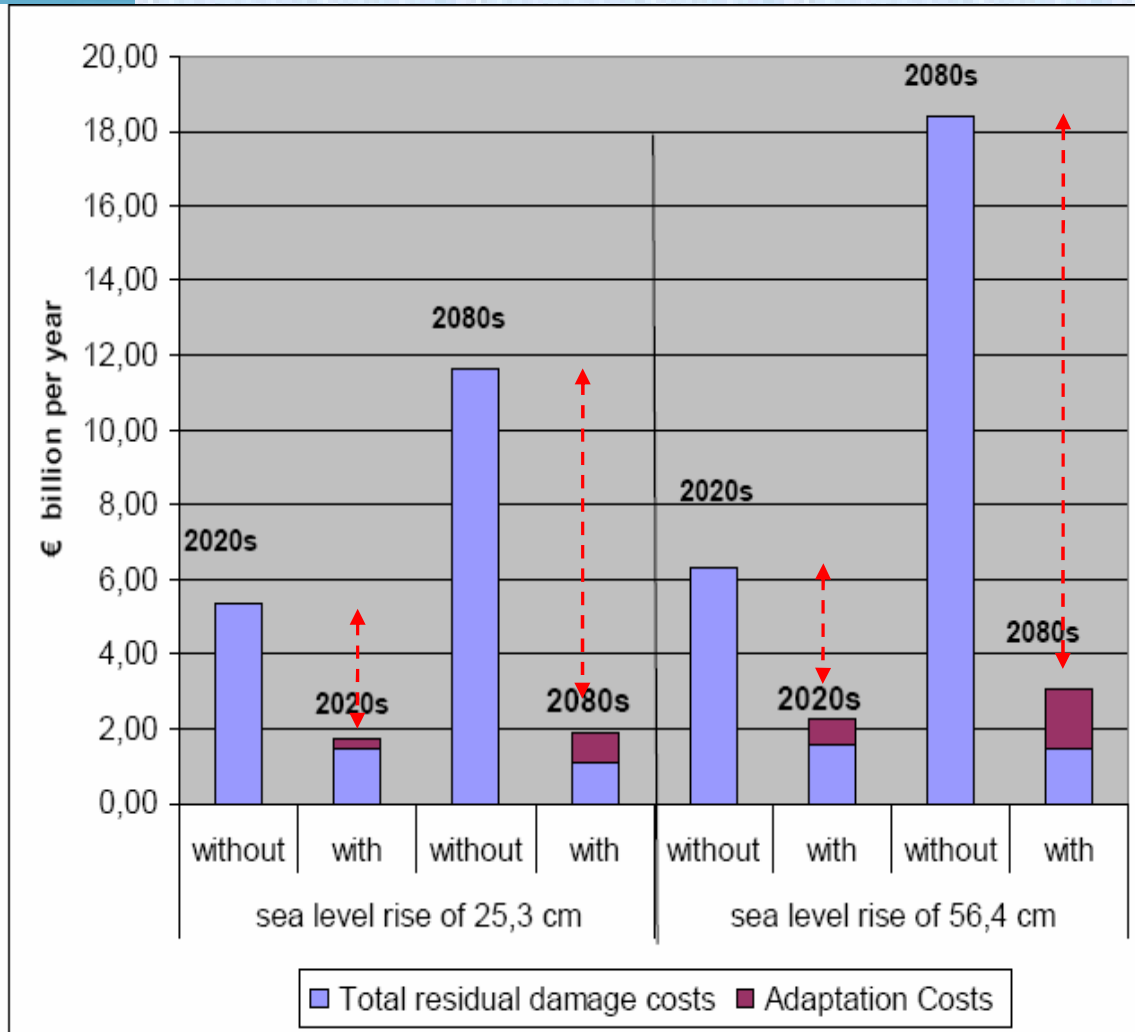


1. Hazard costs are certain.
2. Adaptation is to control the cost level in advance.
3. More early adaptation, more beneficial.

(from Stern review, 2006)



Damage cost prediction for sea level rising: with/without adaptation



**Net benefit of
adaptation**



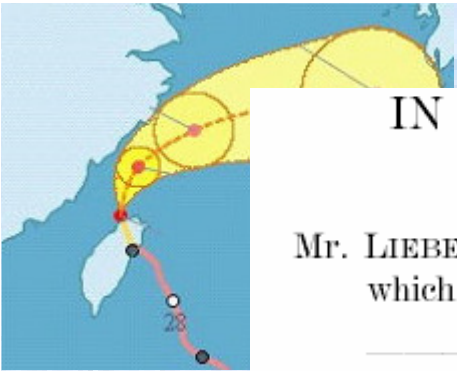
Global experiences on climate adaptation

- **Developed countries**
 - **EU:** 2007 「Green Paper」.
 - **Canada:** 2007 National climate change adaptation framework.
 - **Australia:** 2007 「National Climate Change Adaptation Framework」 and the establishment of 「Climate Change Research Center」
 - **Netherlands:** 2006 Nationaal Programma Adaptatie (ARK)
 - **UK:** 2006 「UK Climate Change Programme」 ; 2007 Climate Change Bill



Global experiences on climate adaptation

- **Developing countries**
 - **China:** 2007 「China's National Climate Change Programme」
 - **India:** 2008 「National Action Plan on Climate Change」 and 「Advisory Council on Climate Change」
- **Least Developed Countries (LDCs) and Small Island Developing States (SIDS)**
 - National Adaptation Programme of Action (NAPA)
 - Adaptation Fund



IN THE SENATE OF THE UNITED STATES

Mr. LIEBERMAN (for himself and Mr. WARNER) introduced the following bill;
which was read twice and referred to the Committee on

**Lieberman-Warner Bill – the
America’s Climate Security Act**

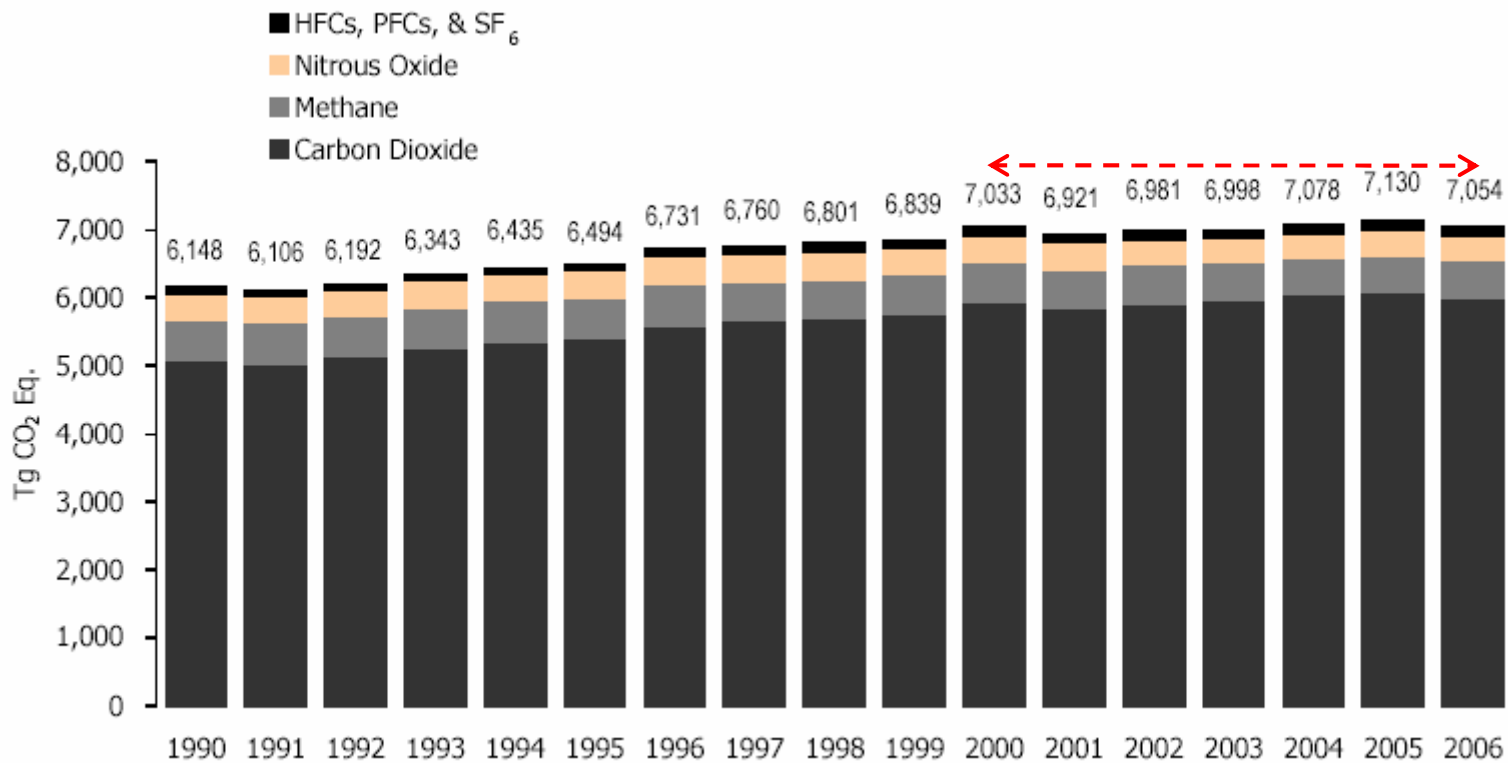
A BILL

To direct the Administrator of the Environmental Protection Agency to establish a program to decrease emissions of greenhouse gases, and for other purposes.

1 *Be it enacted by the Senate and House of Representa-*
2 *tives of the United States of America in Congress assembled,*

3 **SECTION 1. SHORT TITLE; TABLE OF CONTENTS.**

4 (a) SHORT TITLE.—This Act may be cited as the
5 “America’s Climate Security Act of 2007”.



zero growth

cutting carbon from most sources to 2005 levels by 2012 and then 70% below 2005 levels by 2050.

It will be 65% below 1990 levels (EU: 60 – 80%)

2,139 Tg CO₂ Eq.

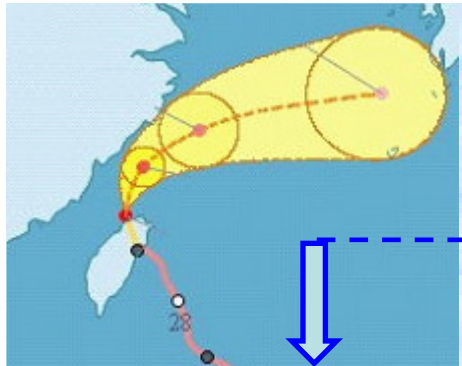
(2050)

= [2005] x 30%

= [2000] x 30%

= [1990] x 35%

Climate Security Act



Climate change adaptation

- Impact quantification assessment
- adaptation implement

Adaptation Fund

Disadvantaged minority welfare

Minority Fund

GHG emission reduction

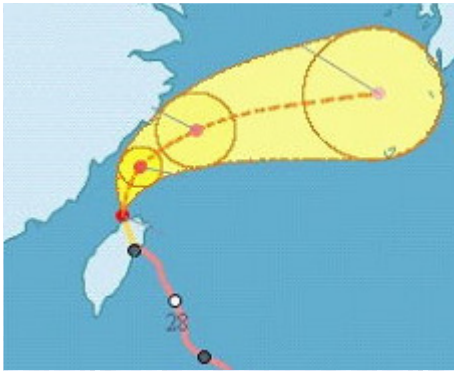
Carbon tax
Total quantity control

Inventory, reduction, emission trade, etc.

effects

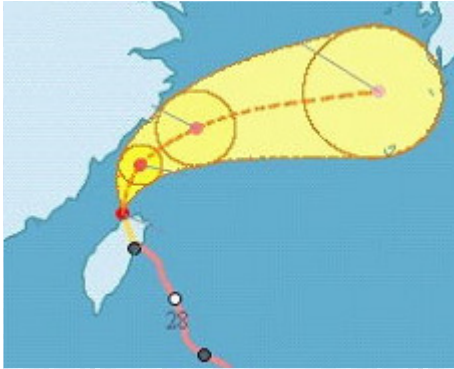
Disasters

Climate Change Security Fund



The current cognitions in Taiwan:

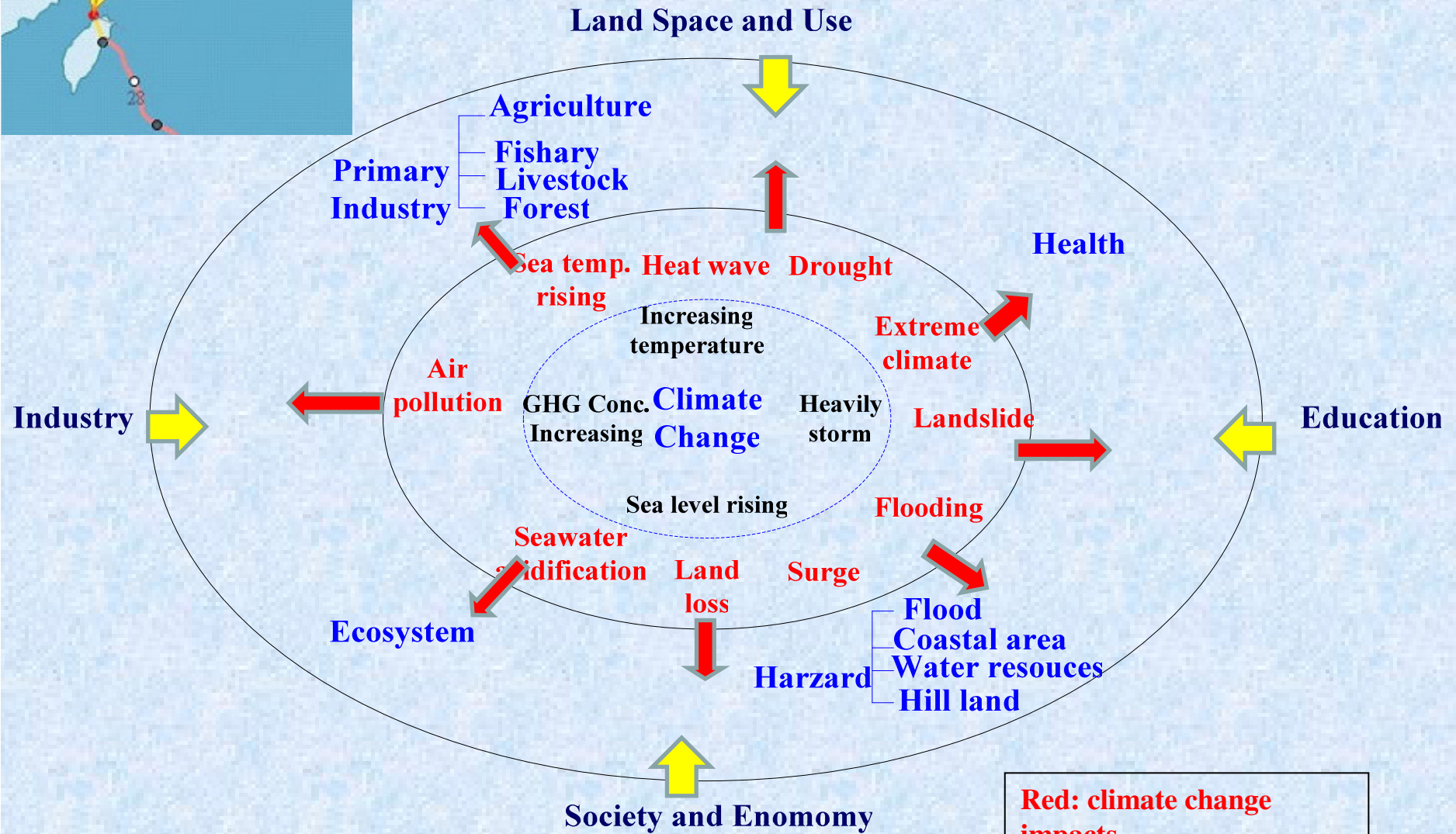
1. **Perceiving** the possibility of occurrence of record-break rainfall and climate change hazard.
2. **Agreeing** that climate is ongoing changing.
3. **Not tolerate** accidental hazards happened.
4. **Expecting** the government can control the flooding problems once and for all.
5. **Not know** how to adjust climate change and the associated uncertainty into **engineering design** and **constructions**.
6. **Non-engineering measures** are preferable, but are not able to handle with in short-term.



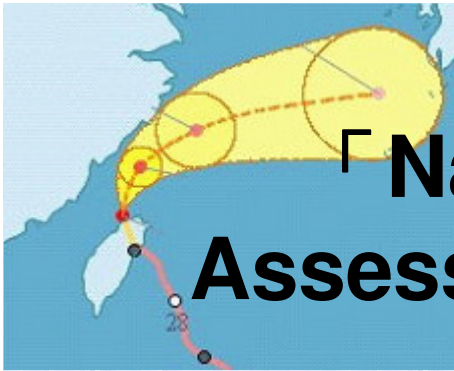
Unlike cognitions, the facts are:

1. **Natural disasters cannot be avoided**, but the damage can be reduced, such as typhoons.
2. The **right expectation** for government is to recover infrastructure back to normal states as soon as possible.
3. Climate change will cause negative impacts on water resources, primary industries, health, ecosystem, and socioeconomy. **A comprehensive assessment** on inter-sectors is needed.
4. Not only negative impacts, but also **positive opportunities** might be brought by climate change.

A general concept



Red: climate change impacts
Blue: fifteen adaptation action plans



「 National Climate Change Impact Assessment and Adaptation Strategy in Taiwan 」

- **Three objectives**
- **Five strategies**
- **Fifteen sectoral action plans (draft)**

The Framework

Objectives

Ecosystem conservation and sustainable land use

Reduction of negative climate change impacts

Take chance of positive impacts

Strategies

Organization adapt

Education adapt

Legislation adapt

Industry adapt

Land use adapt

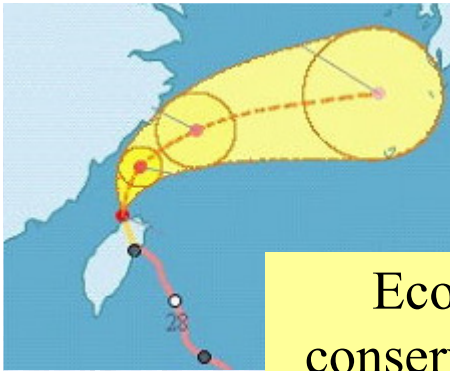
Action Plans

Specific sector plans:

climate research, flooding, landslide, water resources, coastal and low-lying area, ecosystem, agriculture, fishery, forest, livestock industry, and health.

Cross-sectoral plans:

land spatial management, socioeconomic development, education, and industry adaptation.

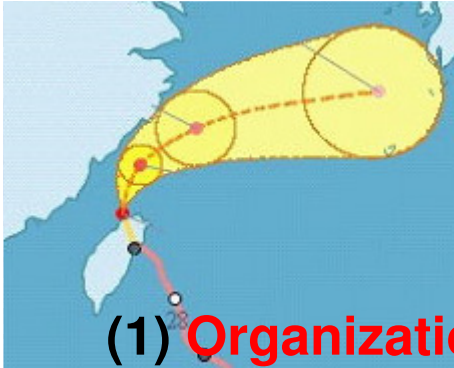




Objectives

The **three objectives** of this framework are:

- (1) to conserve the **ecological environment** and ensure the sustainable **land development**;
- (2) to **mitigate hazard impacts** on people's live and properties; and
- (3) to utilize the **business opportunity** of climate change and promote new industrial revolution.



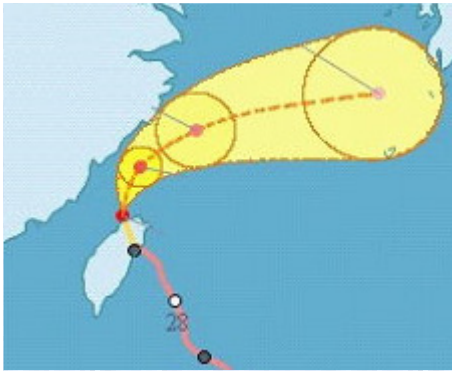
Strategies

- (1) **Organization.** It is necessary to establish a new agency with specific responsibility on coordinating and supervising the sectoral adaptation actions.
- (2) **Education.** The knowledge and cognition of climate change should be strengthened and the public consensus needs to be formed.
- (3) **Legislation.** Climate change should be taken into consideration in the rearrangement of governmental framework and amendatory of legislations.
- (4) **Industry.** Seeking the positive effects of climate change and developing new industrial revolution with combination of government and private business.
- (5) **Land.** The land spatial management should be considered into climate change adaptation strategies. Integrated national land plan and sustainable land use policy are suggested.



Guidelines for sectoral action plans

- **Key points** : need to comprise considerations of **land spatial and industrial management**
- Expend the **five major aspects** of strategies in individual sectors
- **Principles** :
 - Subdivide to **specific setoral plans** and **cross-sectoral plans**
 - **Bottom-up: from climate change impacts to adaptation action plans**
 - **Top-down: the cross-sectoral considerations are enclosed into specific sectoral plans.**



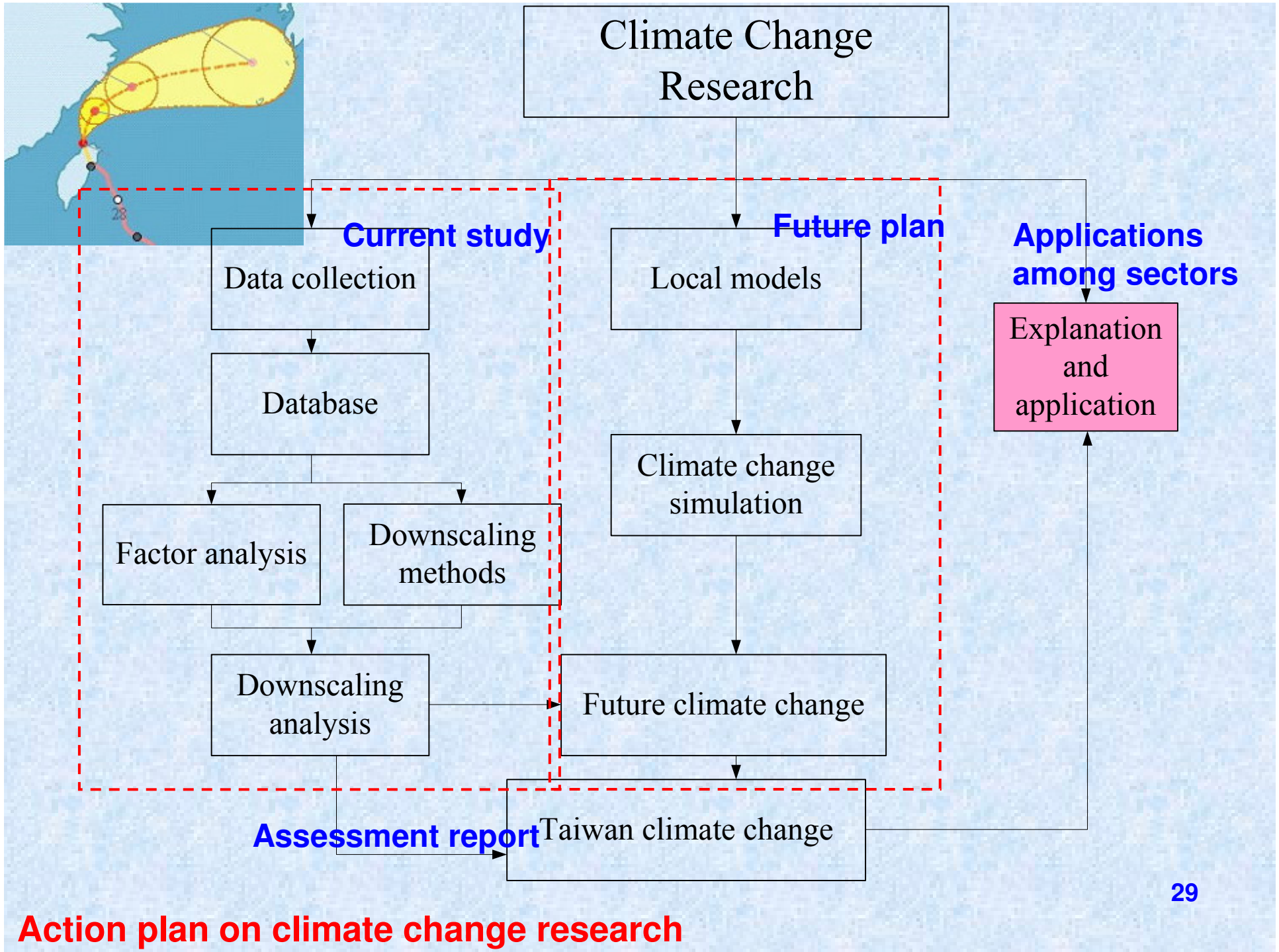
Development of sectoral action plans

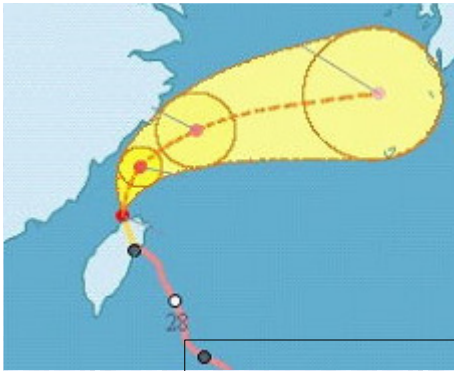
- Formulated by discussions, debates, and communications among **academics, professionals, and governmental officials.**
- The current projects are **draft.**
- The contents of all action plans should be **finalized** by administration agency.



The contents of sectoral action plans

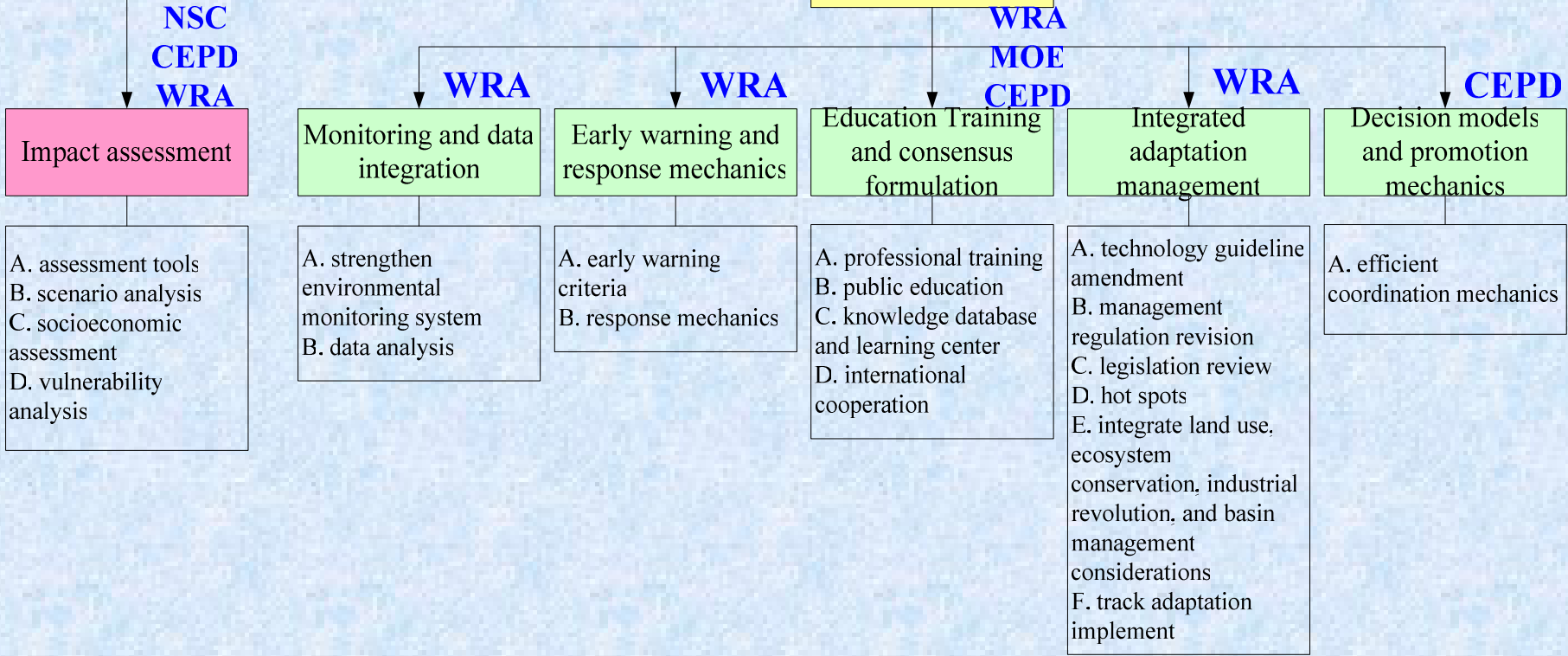
- Focus on strengthening **adaptation capacity**.
- The major contents are various adaptation strategies with **considerations** of:
 - **no-regret strategy** prior to complete and detailed impact assessment and vulnerability analysis in near future.
 - **land spatial management, industry revolution (excluded energy industry), early warning and response mechanics, and education.**
 - Adaptation execution is charged by **sectoral administration agency**, and impact assessment is by **National Science Council**.

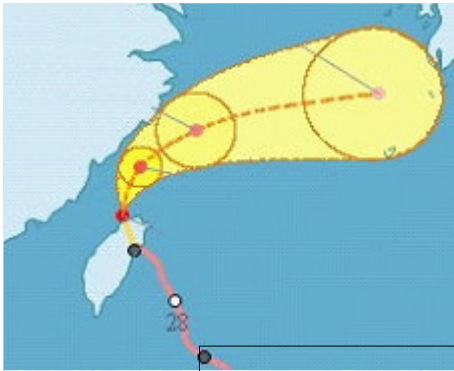




Urban Flooding Control

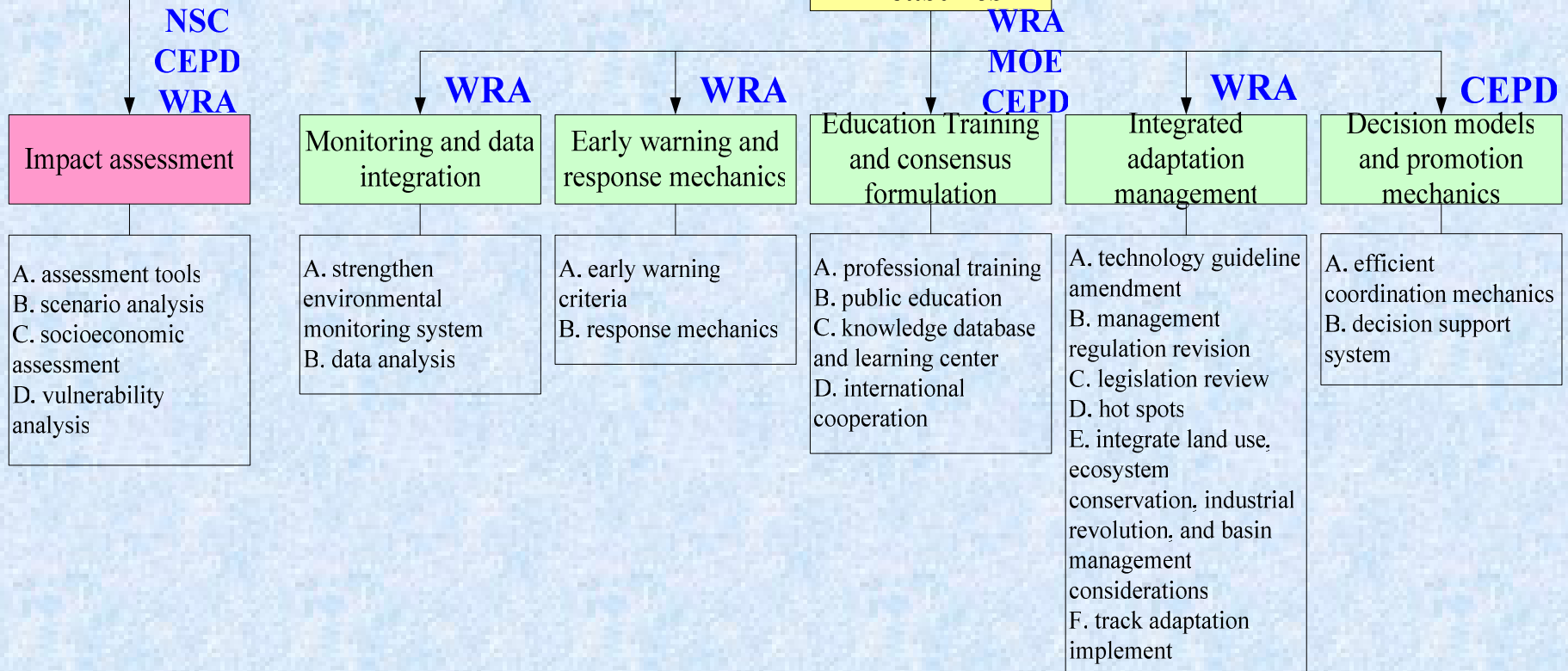
Adaptation measures

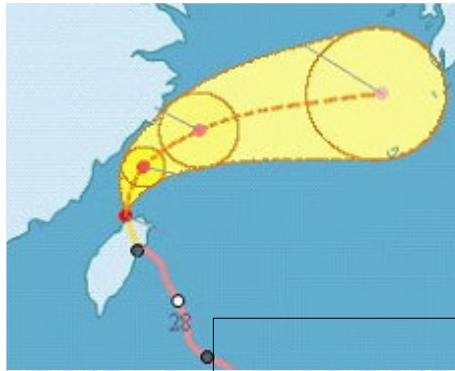




Water Resources

Adaptation measures





Coastal and low-lying area

Adaptation measures

CEPD
WRA
IDB
MOTC

Impact assessment

- Vulnerability analysis and impact assessment for:
- A. coastal and low-lying area
 - B. coastal city
 - C. off-shore island
 - D. coastal industrial parks
 - E. harbor
 - F. dike
 - G. coastal transportation

CWB

Monitoring and data integration

- A. strengthen environmental monitoring system
- B. data analysis

WRA

Early warning and response mechanics

- A. early warning criteria
- B. response mechanics

WRA
MOE
CEPD

Education Training and consensus formulation

- A. professional training
- B. public education
- C. knowledge database and learning center
- D. international cooperation

MOI
WRA
IDB
CEPD

Integrated adaptation management

- A. natural buffers
- B. dike construction review and improvement
- C. coastal industrial parks management
- D. off-shore island management
- E. flooding defense
- F. early warning system
- G. flooding area control
- H. hydraulic construction design revision
- I. hot spots
- J. track adaptation implement

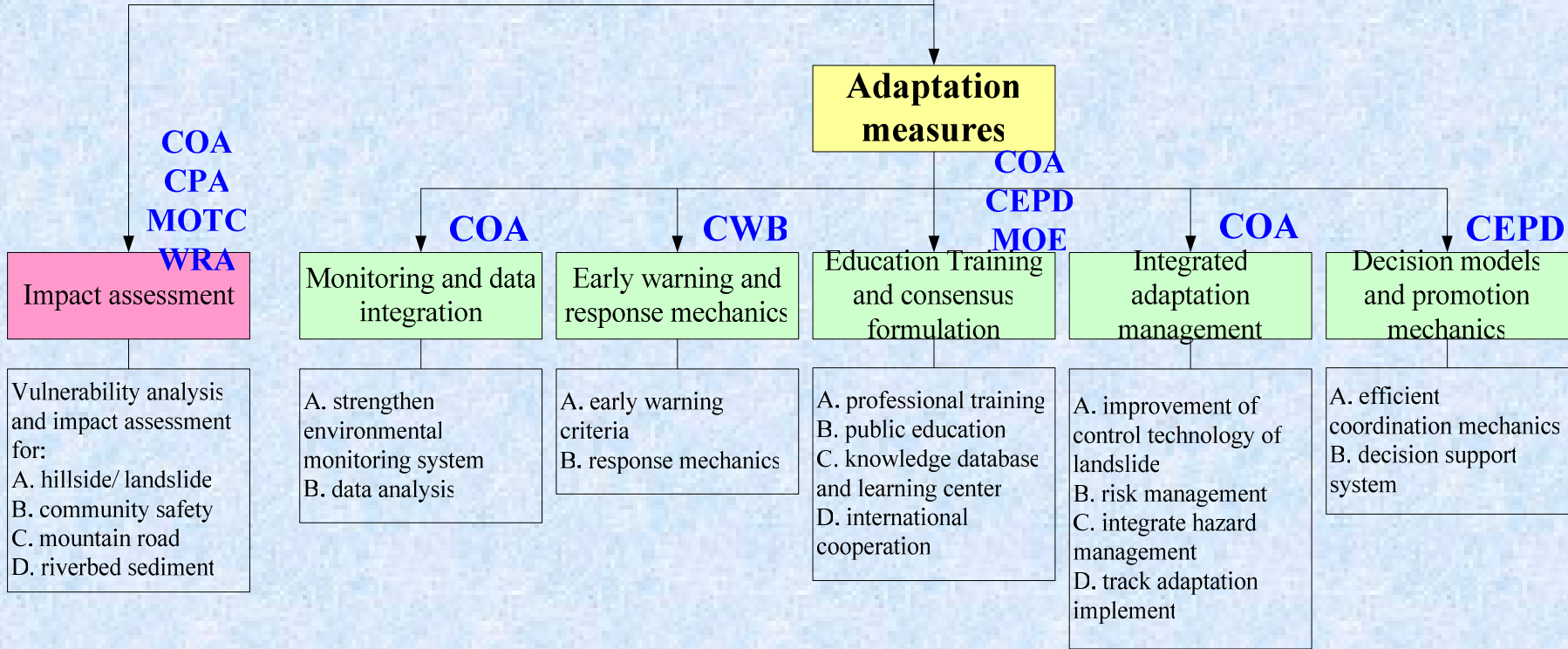
CEPD

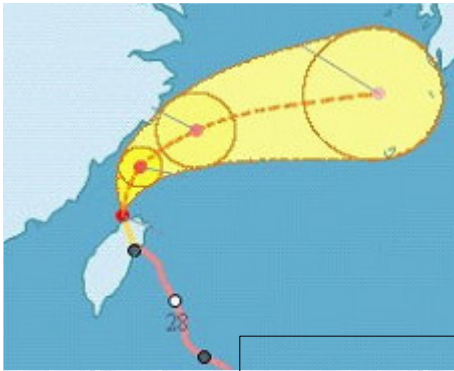
Decision models and promotion mechanics

- A. efficient coordination mechanics
- B. decision support system



Landslide Control





Ecosystem conservation

Adaptation

NSC

Impact assessment

Terrestrial ecosystem
Aquatic ecosystem

- A. phenology
- B. distribution
- C. abundance
- D. species
- E. landscape

MOI
MOEA
COA

1. ecological habitat conservation and protection

- A. protective area activity control
- B. coastal habitat conservation
- C. afforestation

MOI

2. natural protective area review

- A. adjust current boundaries
- B. set up new protective area
- C. review regulations and governances
- D. legislation amendment

COA

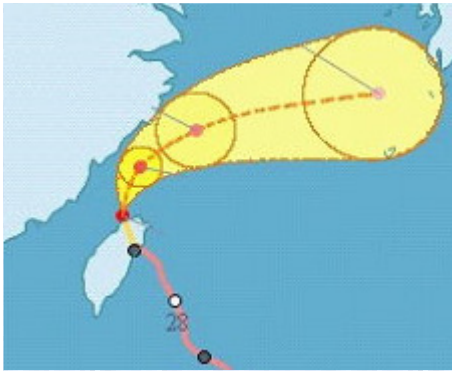
3. monitoring, prediction, and early warning of biodiversity

- A. regular monitoring and analysis for biodiversity
- B. build up indicators
- C. develop eco-prediction model
- D. early-warning system
- E. education

MOEA

4. bio-industry adaptation

- A. ecosystem service
- B. folklore creature
- C. gene conservation and application
- D. international cooperation



Food security and agriculture

COA

Adaptation

NSC

Impact assessment

- A. impact on food yield
- B. vulnerability analysis
- C. international trade impact

1. Stable agricultural yield

- A. breeding and cultivation
- B. efficient use of agricultural lands
- C. efficient water use
- D. shelters from extreme weather
- E. economic feasibility assessment
- F. education
- G. international cooperation

2. Agricultural land management

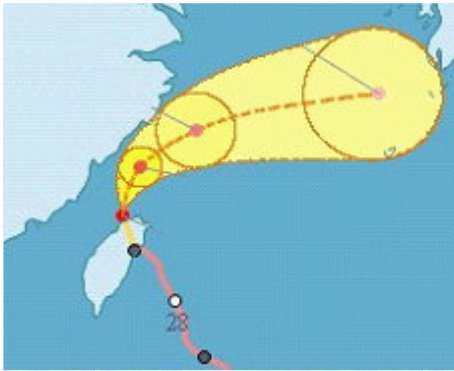
- A. review policy of agriculture abolishment and plant forest
- B. legislation amendment

3. Early warning system

- A. monitoring on agriculture cultivation
- B. yield prediction
- C. early warning system

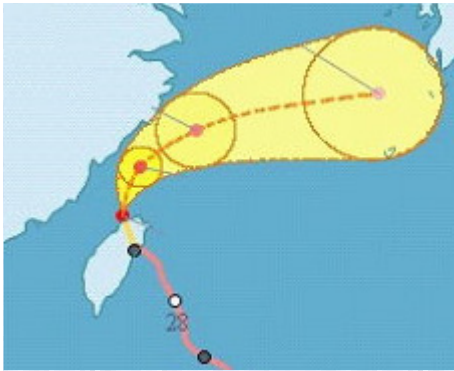
4. Industrial adjustment

- A. carbon-reduced agriculture
- B. bio-energy policy



Same concept applied to

- Action plan on fishery
- Action plan on livestock industry
- Action plan on forestry



Public health

DOH

Adaptation

NSC

Impact assessment

- A. extreme weather event
- B. chronic disease
- C. infective disease
- D. food poison
- E. air pollution

1. National climate change and public health action plans

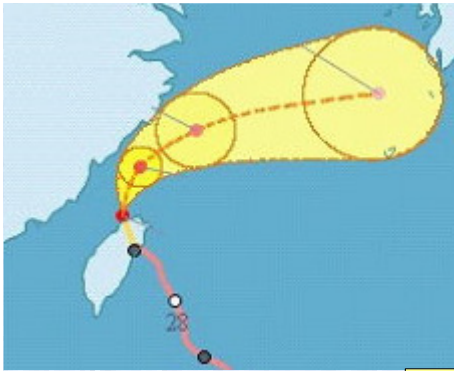
- A. vulnerability indicators establishment
- B. response mechanism

2. Early warning system

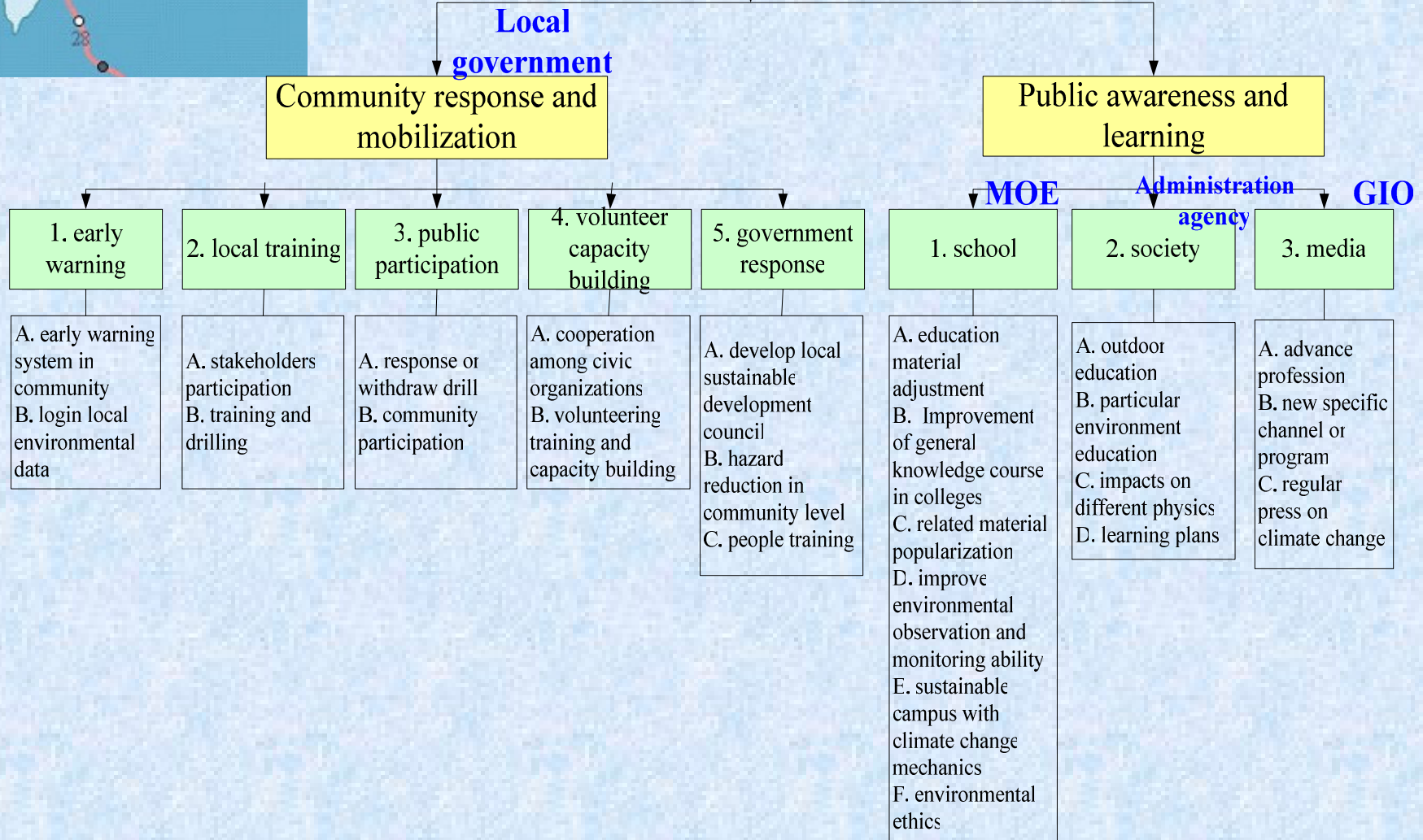
- A. monitoring system
- B. early warning system
- C. micro-environmental database

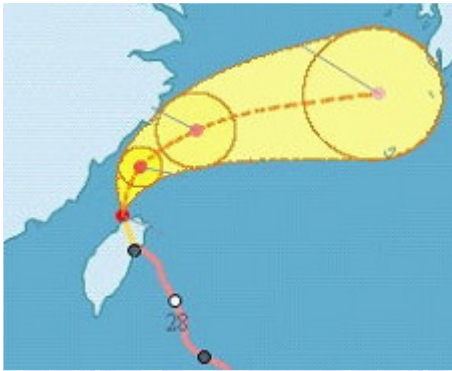
3. Education and international cooperation

- A. participate international organization
- B. international network establishment
- C. education



Education and Training





Society and Economy

CEPD

Adaptation

NSC

Impact assessment

- A. Integrated assessment
- B. vulnerability analysis
- C. environmental impact assessment
- D. optimization programming and evaluation

1. response mechanism

- A. adaptation and action plans
- B. legislation review and amendment
- C. Green industry development
- D. energy industry adaptation

2. early warning indicators

- A. settlement change and response
- B. information integration
- C. cost-benefit analysis

3. low-carbon society

- A. local sustainable development plans
- B. green campus promotion

Industrial revolution

Each administration agency

Legislation

Impact assessment

Legislation amendment

policy

New industrial development

Future scenario

- National industrial development policy review
- Related regulation amendment
- Industrial development consultant

Impact assessment

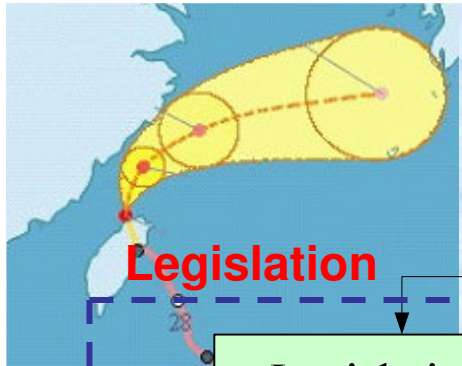
Land spatial and use management

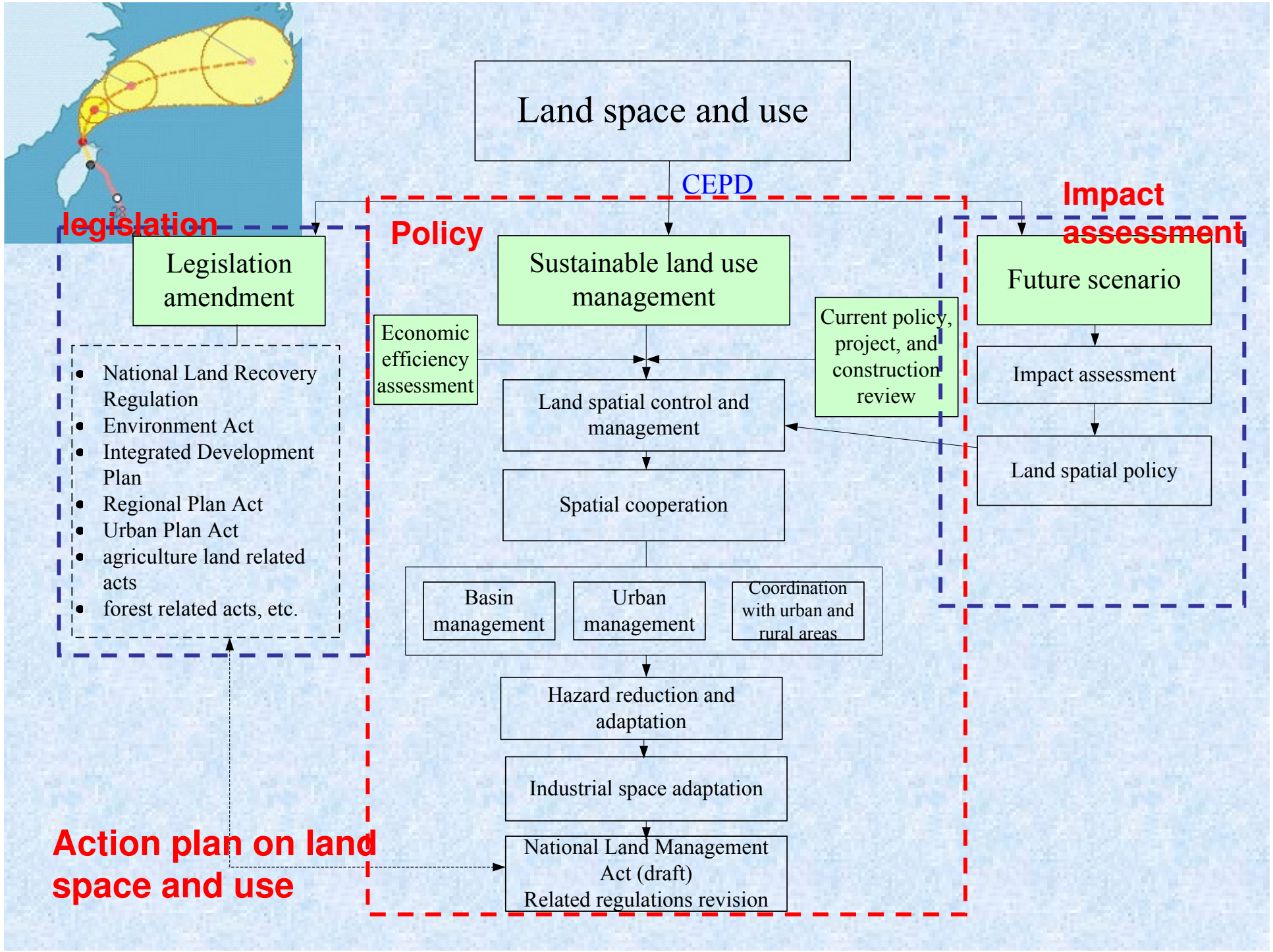
International trend

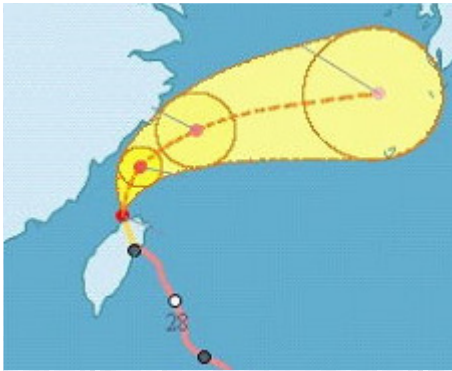
New industrial development with climate change (excluded energy)

Action plan on industrial revolution

- Diversified water resources
- Water-saving
- Low-carbon cultivation
- Low-carbon livestock
- Bio-technology
- Afforestation
- Epidemic prevention
- Low-carbon society

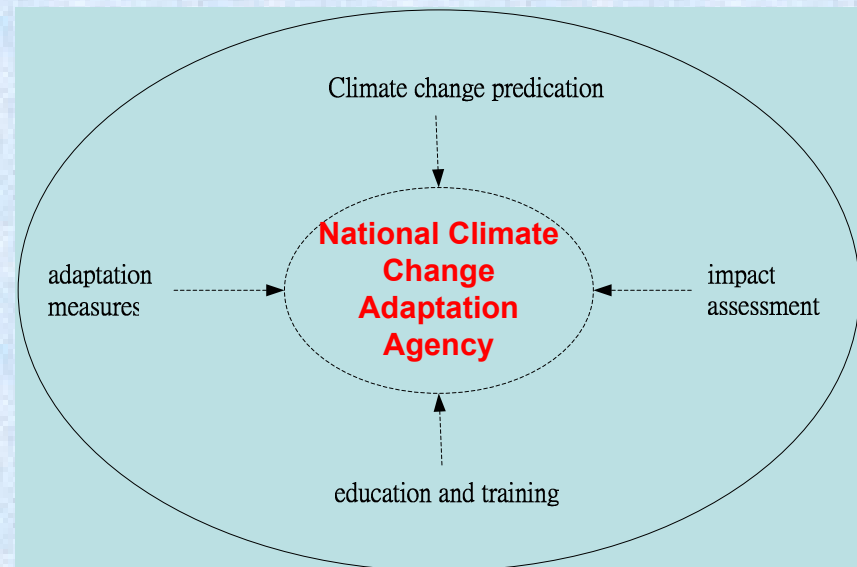






Cross-sectoral leading group

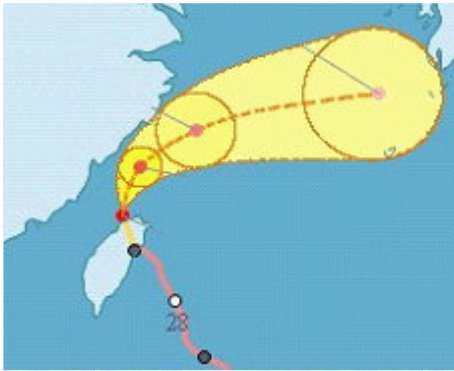
- Should **cross-sectoral leading group** be established for coordination and supervision of the national framework.
 - Short-term: 『**Climate Change Office**』 is recommended to be set under the **Council for Economic Planning and Development (CEPD)**.
 - Long-term:
Expanding the office ability and establishing 『National Climate Change Adaptation Agency』 .





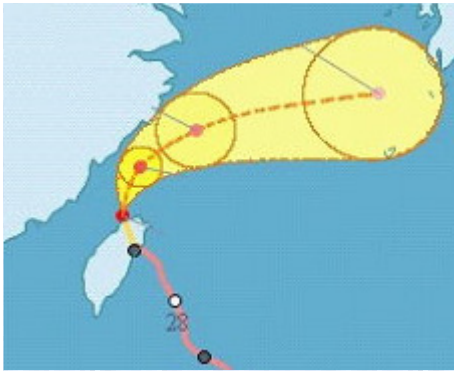
Conclusions

- Based on evidences of climate change and impacts, **proper adaptation strategies are needed** to sustain the future development of human system.
- A proposal for **national climate change adaptation framework** is addressed to facilitate adaptation capacity building in **Taiwan**.
- The proposed **action plans** should be finalized after debates with government. **(some has been done!)**



When it shall be fulfilled ?

1. until the promise from **central government** (**six-year pioneer plan of 10 billion NTD**)
2. until the practical actions launched by **each administration agency**
3. until **GHG Reduction Act** becomes **Climate Security Act** with pursuing **sustainability**
4. until **climate change impact** being considered into any decision-making



Thanks