中技社97年度秋季環境與能源國際研討會

國際間氣候變遷風險評估工具之發展現況

申永順

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內 容

- 氣候變遷風險
- 脆弱性與調適工作之計畫循環
- 氣候變遷風險分析工具
- 案例工具展示
- 結論與建議

為何需要氣候變遷風險分析工具?

- 異常氣候變遷事件之強度與頻率加劇，對於基礎建設、經濟等面向之衝擊甚大，必須積極面對。
- 在氣候變遷劇烈的現在，傳統的基礎設施設理念計以無法符合目前之要求
- 人類需要更深入、範圍更大、更具系統性的風險管理方式，以有效因應。

典型的異常氣候變遷事件所引起之衝擊 - 1/3

強風

Source : SANEF

December 1999:
Storm in France: winds from 160 to 200 km/h

森林火災

Summer 2003:
Forest fire close to A8 motorway (South of France)

Source : ASF/ Escota

(GERICI, 2007)

典型的異常氣候變遷事件所引起之衝擊 - 2/3

暴雨及洪水

8 July 2001:
A1 motorway flooded (North of France), following very local strong storms

Source : SANEF

Bulgaria洪水

(GERICI, 2007)

典型的異常氣候變遷事件所引起之衝擊 - 3/3

颶風造成橋樑破壞

US 90 - St. Louis, Mississippi

颶風造成道路損壞

Many part of Interstate 10 (**New Orleans**, Louisiana) were underwater.
Some ramps were used to support emergency operations

(GERICI, 2007)

Adaptation case studies

1. **Mali:** rice and potato production
2. **South Africa:** municipal water sources
3. **Honduras:** coastal zone development
4. **Thailand:** fisheries, rice production
5. **Madagascar**: protected areas identification and management
6. **Angola**: Okavango River Basin Management
7. **Coastal Hazards**: building resilience to multiple hazards

(USAID, 2008)

Key Countries and Focus Areas

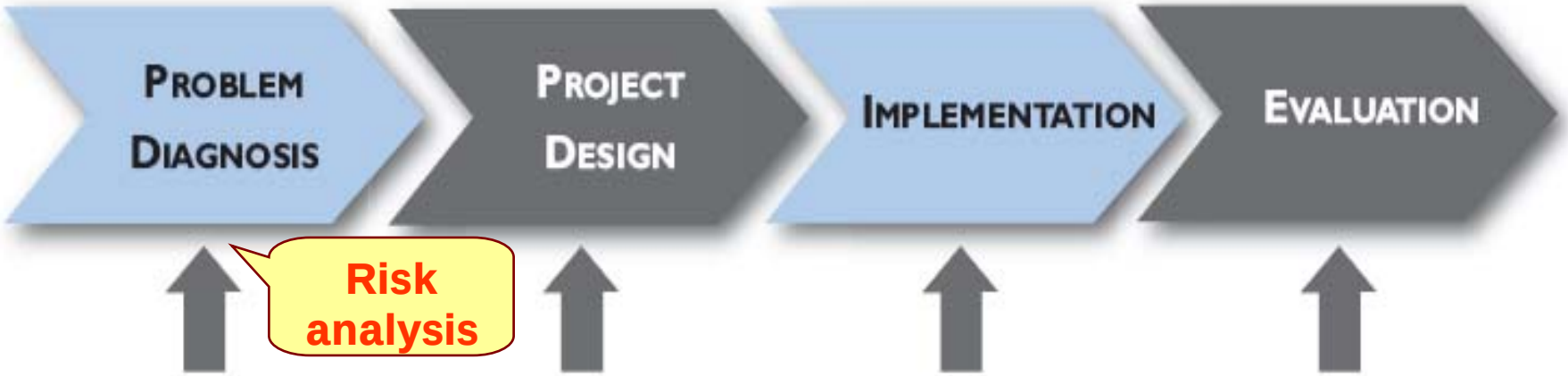
Climate Change Projects in over 40 Countries and Regions

Four Focus Areas:

- **Adapting to Climate Variability and Change**
- Climate Change Science for Decision Making
- Energy and Mitigation Technology
- Land Use and Forestry

(USAID, 2008)

脆弱性與調適工作之計畫循環



Step 1: Screen for Vulnerability

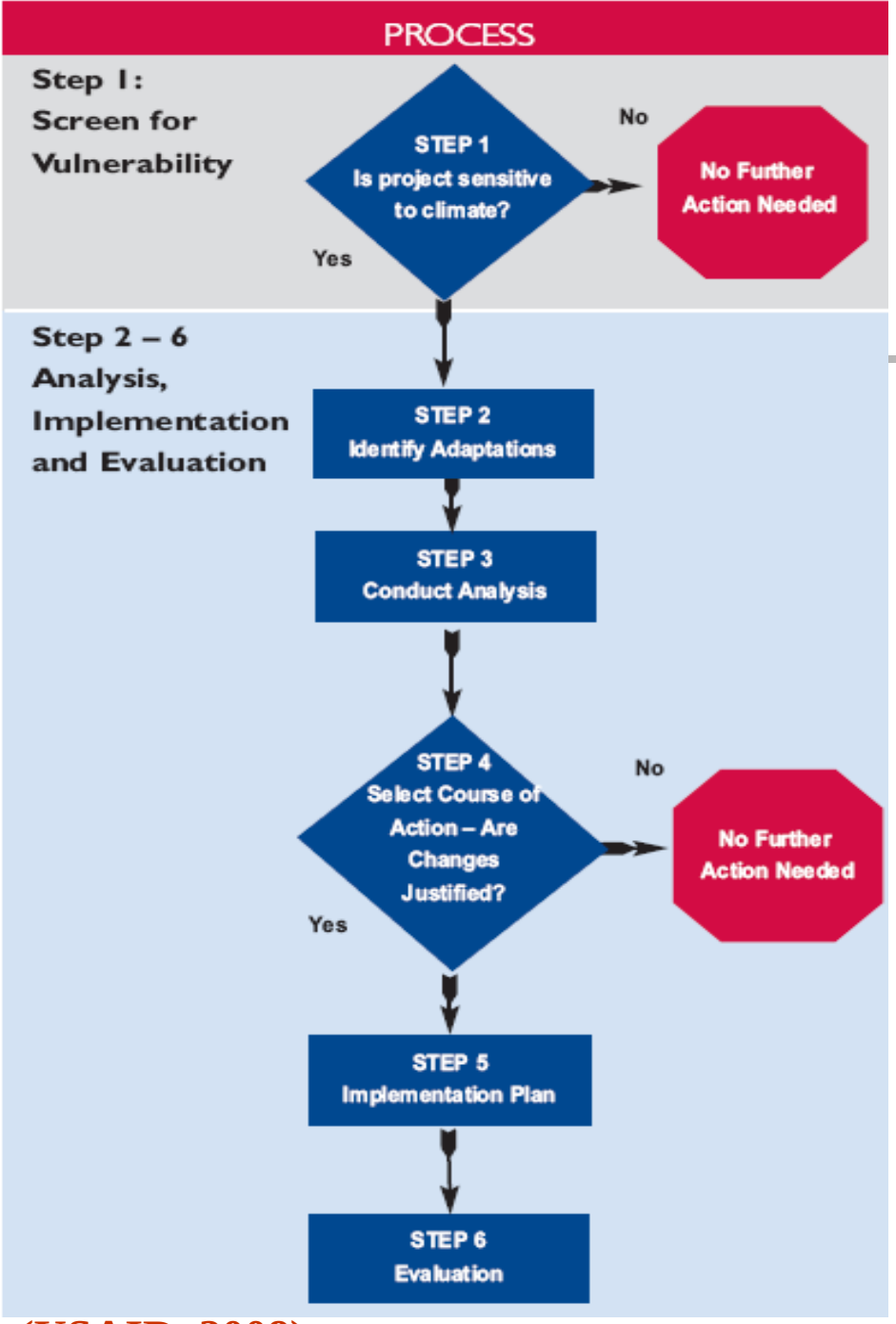
Step 2: Identify Adaptations
Step 3: Conduct Analysis
Step 4: Select Course of Action

Step 5: Implement Adaptations

Step 6: Evaluate Adaptations

Thai residents walk on a flooded street in the Chon Buri province, about 81km (50 miles) east of Bangkok, September 14, 2005. The weather bureau warned that the depression from the east coast of Vietnam could cause flooding in some areas of Thailand. REUTERS/Sukree Sukplang SS/mk.

Source: Adapting to climate variability and change -- a guidance manual for development planning, USAID (2007)



DEFINITIONS

Step 1 – Screen for Vulnerability Vulnerability Screening is a preliminary assessment of whether climate variability or change could compromise the integrity, effectiveness, or longevity of a project within the planning horizon for the project.

Step 2 – Identify adaptations Work with stakeholders to identify alternative designs or management practices that may enable them to better cope with climate variability and change. The emphasis should be on finding measures that increase resilience to climate change, but still make sense under the current climate.

Step 3 – Conduct analysis Examine the consequences of climate variability and change as well as the effectiveness, costs, and feasibility of adaptations that can reduce vulnerability to climate variability and change.

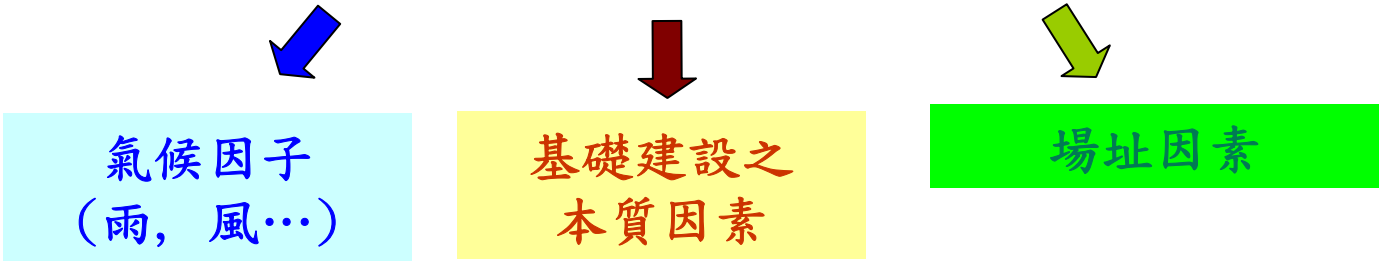
Step 4 – Select course of action Meet with stakeholders to review results of the analysis. Determine if changes in a current project design are required or if a proposed project should feature new adaptations.

Step 5 – Implement adaptations Prepare an implementation plan identifying next steps, responsible staff and organizations, timeline, and resource needs required to incorporate the climate change adaptations into the project.

Step 6 – Evaluate adaptations Evaluate the implementation of adaptations and their effectiveness. Since many adaptations may be due to infrequent, extreme events or long-term climate change, it may be difficult to evaluate effectiveness in a relatively short time period following implementation. But, at a minimum, an evaluation can be done to see if the adaptations were put in place and whether there were problems or excessive costs associated with them.

(USAID, 2008)

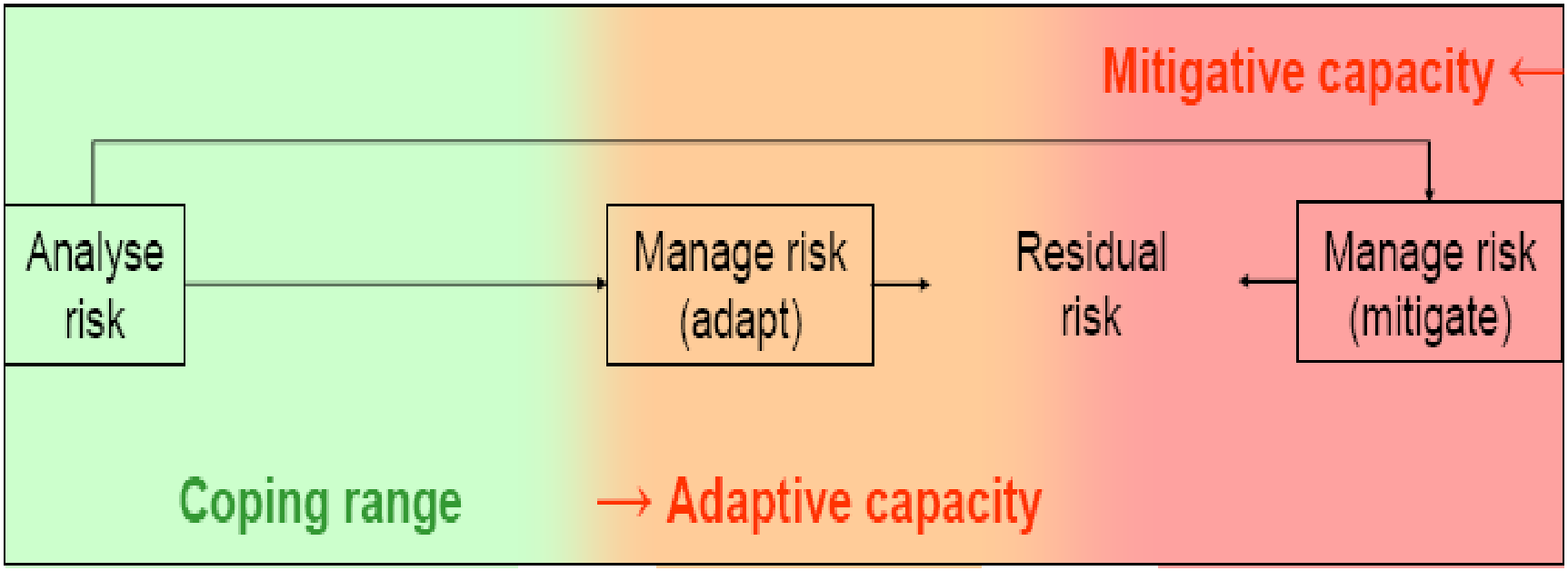
風險因子之系統化鑑別



- 評估基礎建設之敏感性
- 決定其風險程度與臨界恕限值
- 建立持續判斷氣候數據變化之能力
- 累積與永續議題相關方法與工具之網路知識與經驗

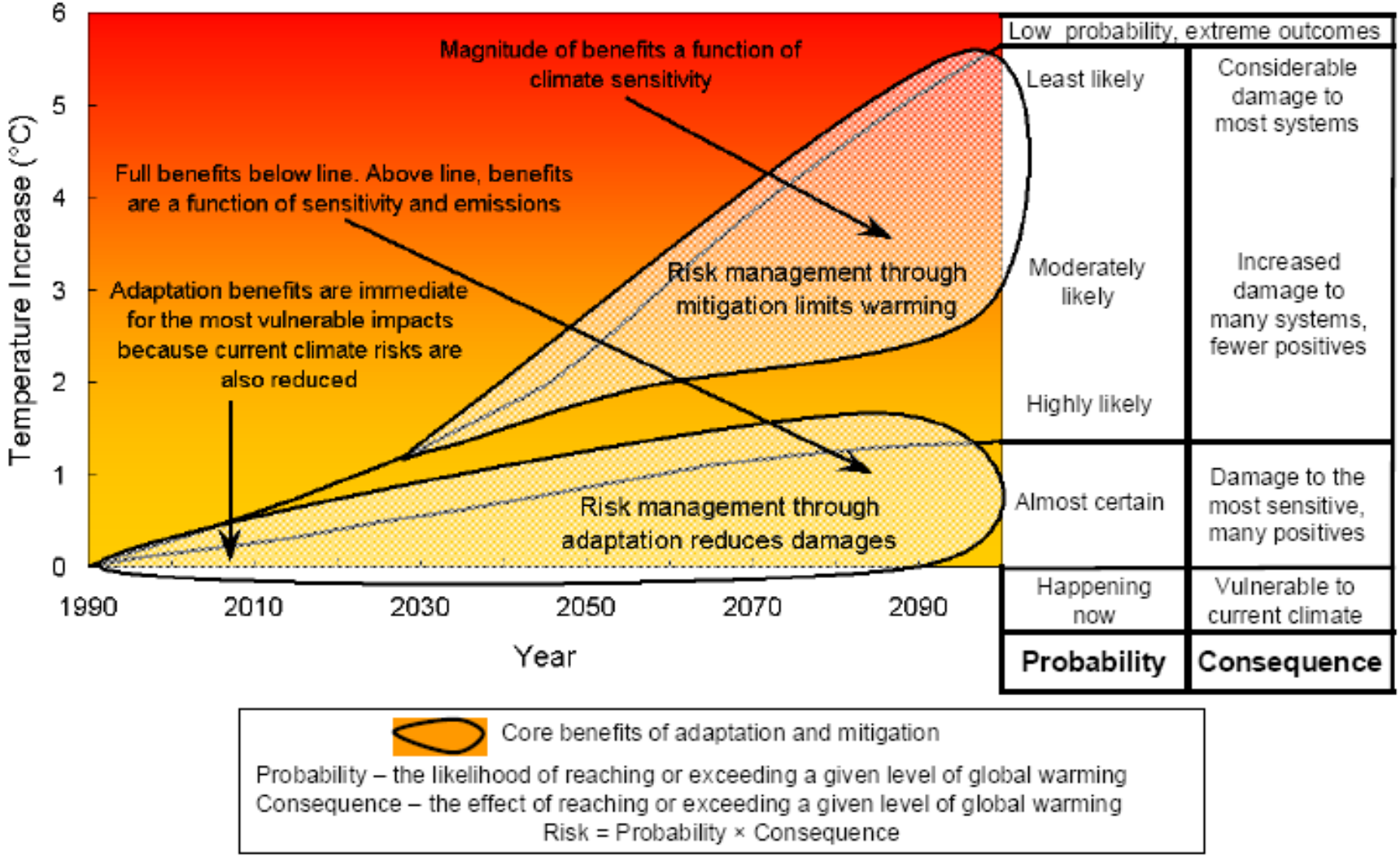
(GERICI, 2007)

減緩與調適二者間之互補關連性



(Jones and Preston, 2006)

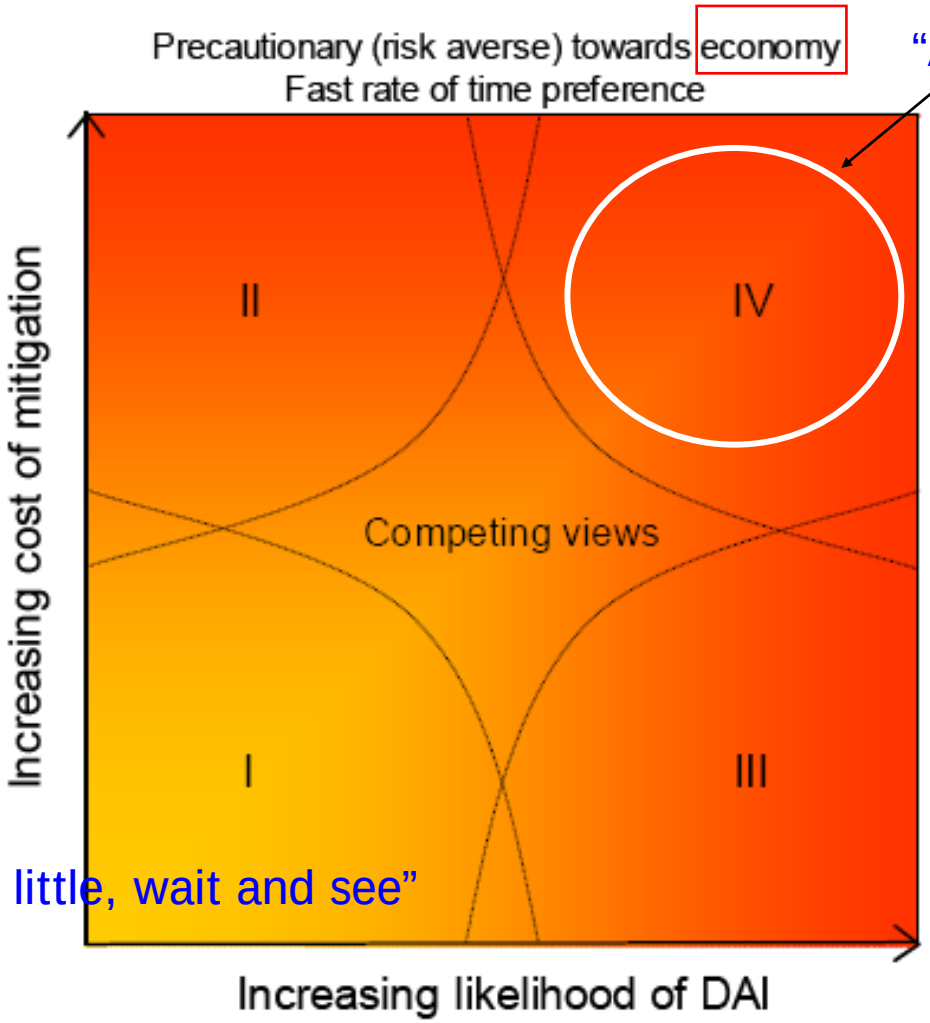
氣候變遷風險之架構



- 調適策略應用於氣候變化相對較低之情境(機率大而衝擊小者)
- 減緩策略應用於氣候變化相對較高之情境(機率小而衝擊大者)

(Jones and Preston, 2006)

減緩成本與人為危害干擾(DAI)矩陣中四項可能之管理策略



Strategy I
- Wait and see on everything
- Reduce uncertainty through experience
- Reactive adaptation (min loss/max benefits)
- Modest mitigation – known low cost options

Strategy II
- Wait and see on climate and impacts
- Research economic, tech uncertainty
- Reactive adaptation (min loss/max benefits)
- Efforts to reduce mitigation costs

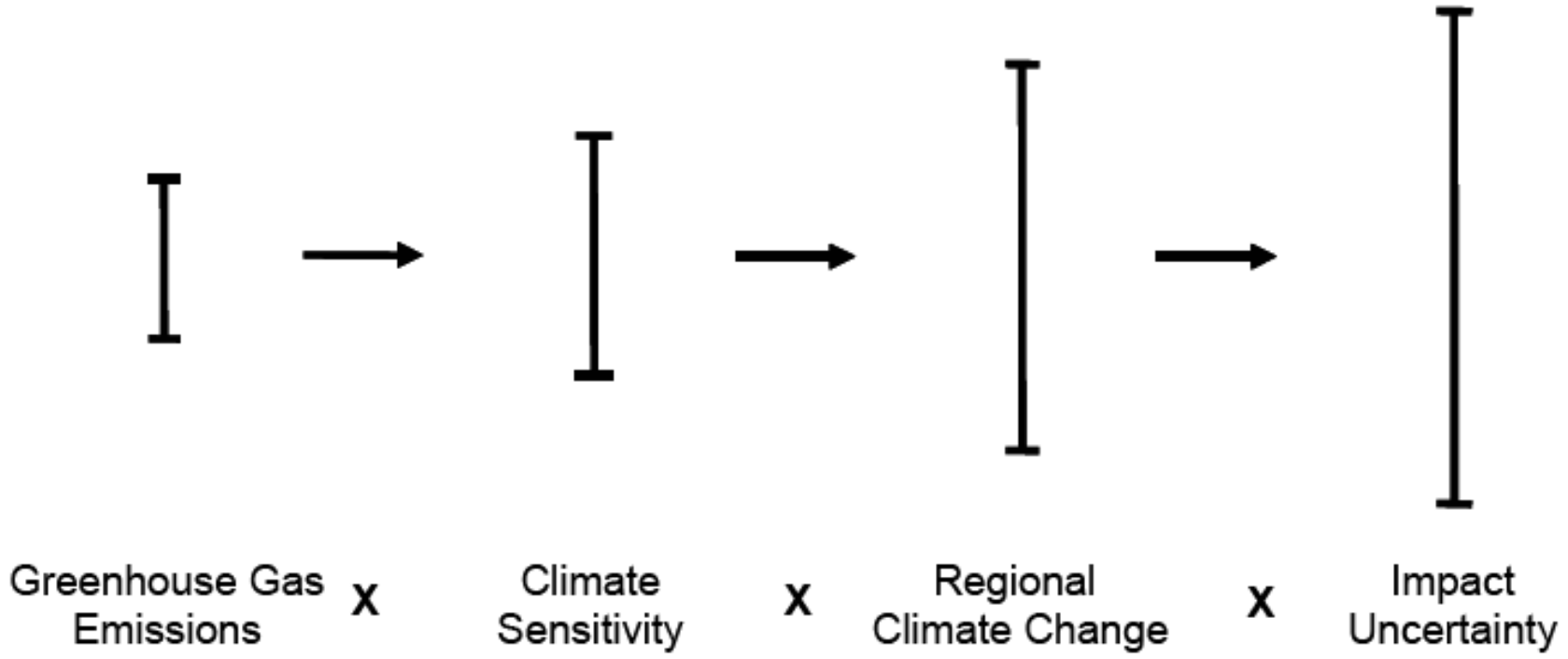
Strategy III
- Act early to stabilise
- Research climate & impact uncertainty
- Anticipatory adaptation
- Strong mitigation – develop low cost options

Strategy IV
- Act on everything
- Research everything
- Anticipatory adaptation and cost reduction
- Anticipatory mitigation and cost reduction

凝於高度不確定性，欲進行風險與成本量化仍有很高的難度

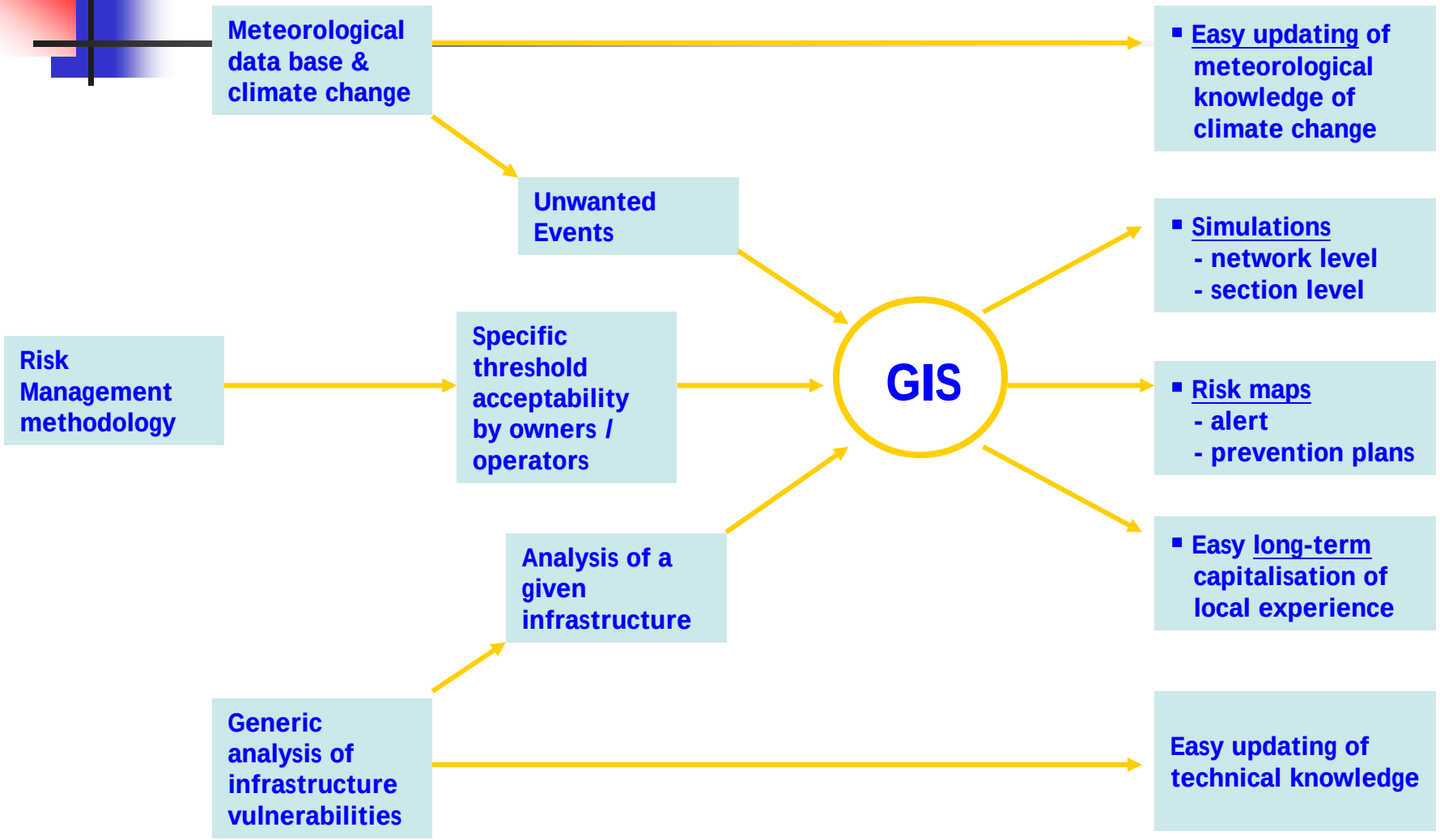
DAI: dangerous anthropogenic interference (Jones and Preston, 2006)

氣候變遷分析中不確定性衍生之示意圖



(Jones and Preston, 2006)

氣候變遷風險管理與工具之架構
-- 以GERICI為例



(GERICI, 2007)

脆弱性與調適計畫之調適作為選項

	HONDURAS	MALI	SOUTH AFRICA	THAILAND
Infrastructure	• Construction of groins, sea walls, breakwaters, dams, drainage systems • Sand pumping, river dredging, lining of river channel • Improved design and higher levees • Installation of collectors, storm gates and pumps	• Construction of water gate • Development of food storage facilities • Install rock lines to capture runoff	• Recycling – urban • Reuse – mining • Build dam • Expand well fields	• Water resource development • Construction of weirs
Capacity Building	• Improve environmental education • Build staff capacity and infrastructure to implement flood warning system	• Build knowledge and capacity to understand agricultural production stressors • Build capacity in weather forecasting	• Drought/risk management • Hydro-climatic network/monitoring	• Build knowledge and capacity in adaptation • Encourage conservation • Strengthen commodity value chains and find new markets
Policy	• Design and implement zoning regulations and building codes • Limit deforestation • Adoption of local policy and ordinance initiatives	• Facilitate access to credit	• Intersectoral reallocation • Reallocation of reservoir yield • Water conservation and demand management (including metering and price structure) • Conjunctive use	• Compensation for flood damages • Regulations to control unsustainable fishery practice • Develop resource management plans at the community level

Source: (USAID, 2007)

選擇調適方式之準則矩陣

PILOT STUDY	Effectiveness	Cost	Feasibility	Social/Cultural Feasibility	Assistance Requirements	Adequacy for Current Climate	Speed of Implementation	Consistency with State Policy
La Ceiba, Honduras	√	√					√	
Zignasso, Mali	√	√	√		√	√		
Polokwane, South Africa	√	√	√	√			√	
Songkram River, Thailand			√	√				√

- Analyze options for robustness under current and future conditions
- Can use projections or historical data
- Compare with performance of "base" project

Source: Adapting to climate variability and change -- a guidance manual for development planning, USAID (2007)

有關調適規劃之建議網路資源

UK Climate Impact Program (UKCIP): UKCIP provides tools and data to support climate change risk assessments and develop adaptation strategies. The program offers climate change and socio-economic scenarios, a framework for making decisions in the face of climate risk and uncertainty, and a methodology for costing the impacts of climate change. Although specific to the United Kingdom, UKCIP's tools and databases of climate change adaptation case studies and adaptation options are relevant and useful for the U.S. http://www.ukcip.org.uk/

USAID: Through their Global Climate Change Program, USAID helps developing countries and countries in transition address climate-related concerns. In 2007, USAID published a guidance manual for development planning, *Adapting to Climate Variability and Change*. This manual provides guidance on how to assess vulnerability to climate variability and change, as well as how to design or adapt projects so that they are more resilient to a range of climatic conditions. Specific cases on water, flood, and agricultural management impacts and adaptation options are included. http://www.usaid.gov/our_work/environment/climate/docs/reports/cc_vamanual.pdf

Eldis—Community-Based Adaptation Exchange Program: Eldis is a global services organization specializing in adaptation services in high-risk countries. It offers a database of donors, implementing agencies, academia, and policy organizations involved in adaptation. http://www.cba-exchange.org

ICLEI Local Governments for Sustainability: ICLEI is a global services organization specializing in both mitigation and adaptation support to local governments in the U.S. and globally. Through their Sustainable Cities program, ICLEI works with local governments to build resiliency to climate impacts. http://www.iclei.org

Queensland Climate Change Center of Excellence (QCCCE): Based in Australia, the QCCCE is a new unit within the state's Office of Climate Change, providing policy advice, information, and scientific data on climate change and impacts. ClimateSmart Adaptation 2007-12 (put title in italics) is the government's action plan to increase resilience to climate change impacts in key sectors including: water planning, agriculture, emergency services, human health, tourism, finance, and insurance. http://www.climatechange.qld.gov.au/

(Pew Center, 2007)

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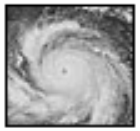
USAID
FROM THE AMERICAN PEOPLE

Pakistan Earthquake - USAID is providing humanitarian assistance for the people of Pakistan in response to the recent earthquake.



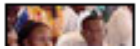
Hurricane Season 2008 - USAID is assisting Haiti and other nations affected by a series of destructive tropical storms and hurricanes this year.

Global Food Crisis - USAID is responding to the global food insecurity caused by the rapid spike in food prices

Georgia Response - USAID is providing emergency assistance for the people of Georgia in response to the current crisis situation.

World AIDS Day - USAID has funded almost $6 billion since inception of its HIV/AIDS program in 1986, more than any other public or private organization.

The Global Development Commons is a call to the international development community to improve collaboration through innovative technologies



Public-Private Partnerships - Mobilizing

SEARCH

GO

Advanced Search...

COUNTRY LOCATOR

Afghanistan GO

USAID provides economic and humanitarian assistance in more than 100 countries to provide a better future for all.

USAID KEYWORD

GO

Browse USAID Keyword List »

IN THE NEWS ...

- 11/10/08: USAID Hosts Leadership Meetings for Syrian and Palestinian Americans
- 11/07/08: USAID Receives "Green Status" under the President's Management Agenda
- 11/07/08: USAID Responds Immediately to Haitian School Collapse
- 11/07/08: USAID Commits to Smooth Transition
- 11/06/08: USAID Airlifts Shelter Materials to Pakistan Quake Victims
- 11/06/08: USAID and Oikocredit Announce $36.2 Million Guarantee for Microenterprise Activities

氣候變遷風險分析工具

iisd International Institute for Sustainable Development / Institut international du développement durable

THE WORLD BANK

IDS Institute of Development Studies

Sharing Climate Adaptation Tools:
Improving decision-making for development
Geneva Workshop, 11-12 April 2007

Do not wait; the time will never be "just right."
Start where you stand, and work with whatever tools you may have at your command, and better tools will be found as you go along.
Napoleon Hill



氣候調適工具之分類

1. 資訊產生、資料庫及平台
2. 以電腦為基礎之決策工具
3. 調適/風險管理程序

氣候調適工具之分類

-- 1.資訊產生、資料庫及平台

- 資訊產生與資料庫工具可提供不同利害相關者所需之氣候變遷與脆弱性資訊。
- 這些資訊大多為公開且跨領域與尺度，其雖非作為決策工具，但可作為後續風險管理與調適管理程序之所需。
- 此類別包括從全球循環模擬(Global Circulation Modellling, GCM) (如: PRECIS)，至脆弱性與調適數據 (如: NAPA Platform)之評估。

氣候調適工具之分類
-- 1.資訊產生、資料庫及平台

Tools	More information
PRECIS - Providing Regional Climates for Impacts Studies - UK Met Office Hadley Centre	http://precis.metoffice.com/
Vulnerability mapping and impact assessment – ILRI, TERI, ACTS, CIAT	http://www.dfid.gov.uk/research/mapping-climate.pdf
SERVIR Climate Change Mapping Tool - USAID, NASA, CATHALAC, IAGT	http://www.servir.net/
Statistical DownScaling Model (SDSM) – Environment Agency, UK	www.sdsm.org.uk
Climate Analysis Indicators Tool - WRI	http://cait.wri.org/
NAPA Platform - UNITAR	www.napa-pana.org
Climate envelopes/adaptation risk screening platform (CIEAR) - SEI	www.sei.se/oxford/
Other information generation/database tools: OFDA/CRED International Disasters Database (EM-DAT)	

氣候調適工具之分類
-- 1.資訊產生、資料庫及平台

Tool	*Audience*	*Screening level*	*Spatial scale*	*Training time*	*Application time*	*Main data type*	*Economic analysis*
1.a) PRECIS (UK Met Office)	all	Input tool	multi-scale	varying	varying	Quantitative	No
1.b) Vulnerability assessment (ILRI et al)	donors	policy	national	unknown	2-6 months	Quant.	not at present
1.c). SERVIR (USAID, NASA)	all	various	local, regional	none	<1 month	Quant	No
1.d). SDSM (Environment Agency)	gov't, donors, other	project	multi-scale	half-day	<1 month	Quant	No
1.e). CAIT (WRI)	all	programme	national	none	<1 month	Quant	No
1.f). NAPA Platform (UNITAR)	gov't, donors, NGOs	project, programme	multi-scale	none	NA	NA	No
1.g). CIEAR (SEI)	all	various	multi-scale	varying	varying	quant	Yes in future

氣候調適工具之分類
-- 1.資訊產生、資料庫及平台

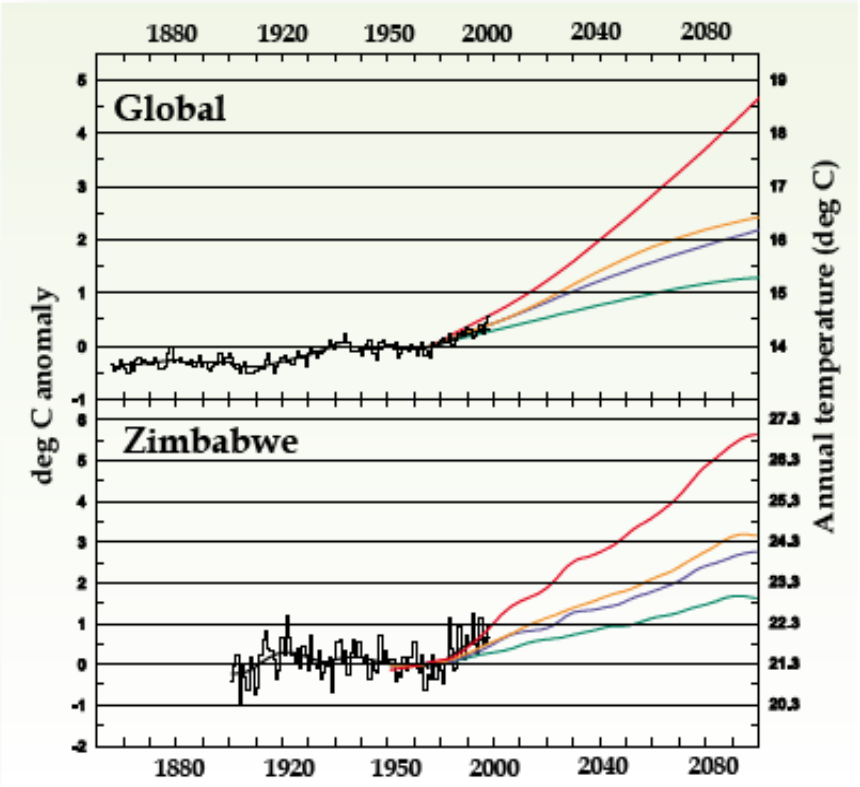
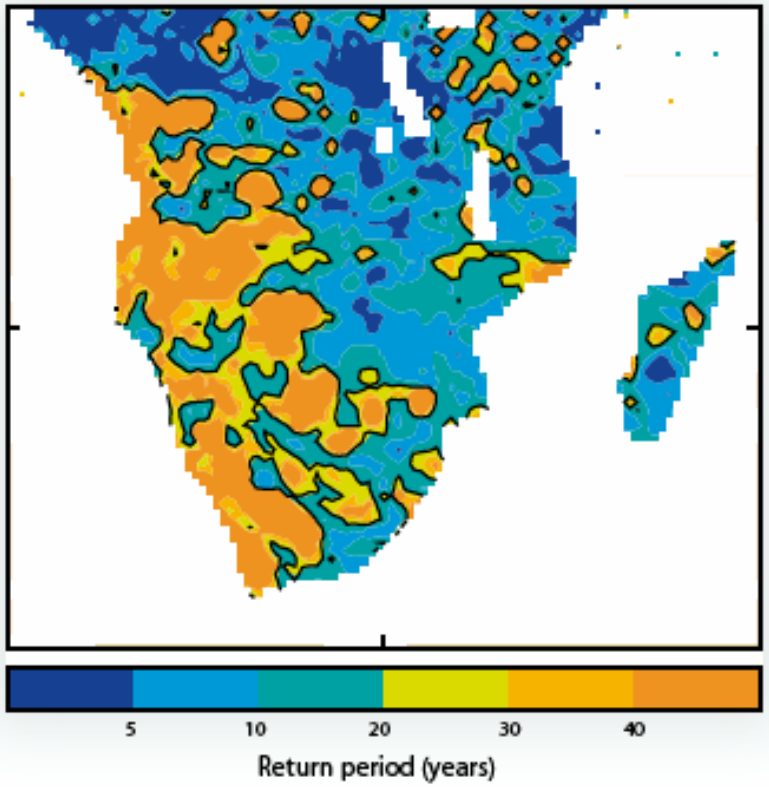


Figure 2: An example of a "simple" climate scenario for communicating to a general audience with limited knowledge of climate change. Shown in this diagram are the observed and model-simulated annual temperature changes to 2100 under four emissions scenarios (represented by the coloured solid lines) globally and for Zimbabwe. The change was simulated by a simple climate model with a medium climate sensitivity (2.5° C) and calculated in relation to the 1961-1990 average. Such scenario information is of particular interest to farmers and nature conservation practitioners alike (adapted from Hulme and Sheard, 1999).



Source: (USAID, 2007)

Figure 3: An example of "sophisticated" climate scenarios. Shown here are the summer rainfall return periods for the 2080s with relation to present-day, one-in-20-year events over Southern Africa, under the IPCC SRES A2 emissions scenario, as simulated by the UK Hadley Centre regional climate model, PRECIS. Values under 20 imply the present-day extreme precipitation event will be more frequent in the future, and vice versa (adapted from Jones *et al.*, 2004).

氣候調適工具之分類
-- 1.資訊產生、資料庫及平台

Scorecard
Climate change

Argentina
South America

Argentina
South America

Summary – Argentina	Score	Category	Rank
CO_2 Energy Emissions Index	3.59	High	57/166
CO_2 Land Use Emissions Index	3.41	High	23/163
Unsustainable Energy Index	5.35	Medium	102/134
Climate Change Vulnerability Index	6.61	Medium	133/168

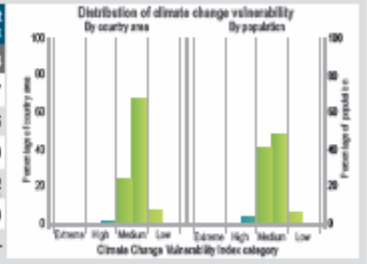
0 = highest risk, 10 = lowest risk

CO_2 from energy use	Country	Regional average
CO_2 Energy Emissions Index	3.59	4.78
Total CO_2 emissions ($MtCO_2$) 2005*	146.6	72.0
CO_2 emissions per capita (tCO_2) 2005*	3.71	2.49
Cumulative CO_2 emissions ($MtCO_2$) 1955-2005*	4,816	1,982
Average annual change in CO_2 emissions (%) 1990-2005	+3.1	+4.6
Carbon intensity of growth (tCO_2 per '000$ GDP) 2005	0.47	0.91
Carbon intensity of industry (tCO_2 per '000$ industrial GDP) 2005	0.31	5.14

CO_2 from land use change	Country	Regional average
CO_2 Land Use Emissions Index	3.41	3.96
Total CO_2 emissions from forest biomass ($MtCO_2$/yr) 1990-2005*	121.6	143.7
CO_2 emissions from forest biomass per capita (tCO_2/yr) 1990-2005*	3.18	6.83
Cumulative CO_2 emissions from land use change ($MtCO_2$) 1950-2000*	2,448.1	7,602.8
Total change in forest area (thousand km^2) 1990-2005	-22.4	-53.9
Average annual change in forest area (%) 1990-2005	-0.4	0.0
Carbon stocks in forest biomass (Mt Carbon) 2005	2,411	10,638

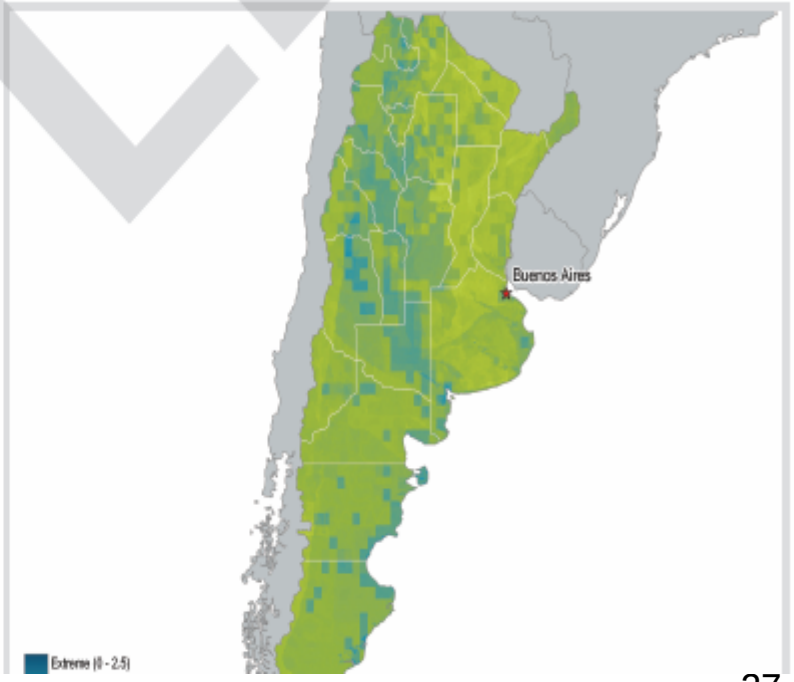
Unsustainable energy	Country	Regional average
Unsustainable Energy Index	6.86	6.16
GDP per unit of energy use (2000 PPP$ per kgoe) 2005*	7.73	6.57
CO_2 per unit of energy use (tCO_2 per toe) 2005*	2.30	2.12
Share of energy supply: hydro, solar, wind and geothermal (%) 2005*	4.6	14.7
Total primary energy supply (Mtoe) 2005	63.7	35.9
Total energy consumption per capita (kgoe) 2005	1,666	1,169

Climate change vulnerability	Country mean	Lowest risk	Highest risk
Climate Change Vulnerability Index*	6.61	8.28	8.64
Economy	5.50	8.09	3.27
Natural resources and ecosystems	7.74	8.75	3.05
Poverty, development and health	8.23	8.67	7.89
Agriculture	5.54	9.06	2.72
Population, settlement and infrastructure	5.73	8.18	0.19
Institutions, governance and social capital	5.32	-	-



* For values of specific locations or regions: climate@maplecroft.com

0 = highest risk, 10 = lowest risk



http://www.maplecroft.com/CC_Scorecard_Argentina_sample.pdf

氣候調適工具之分類
-- 1.資訊產生、資料庫及平台

weADAPT
Collaborating on Climate Adaptation

The Climate Change Explorer Tool (CCE)

Facilitating an advanced understanding of long-term climate forecasts for

The Climate Change Explorer (CCE) is a tool that aims to facilitate the gathering of climatological information and its application to adaptation strategies and actions. The CCE packages data access routines with guidance and customized analytical and visualization procedures. It is designed to simplify the tasks associated with the extraction, query and analysis of climate information, thereby enabling users to address issues of uncertainty when devising policies and strategies, and also when implementing actions.

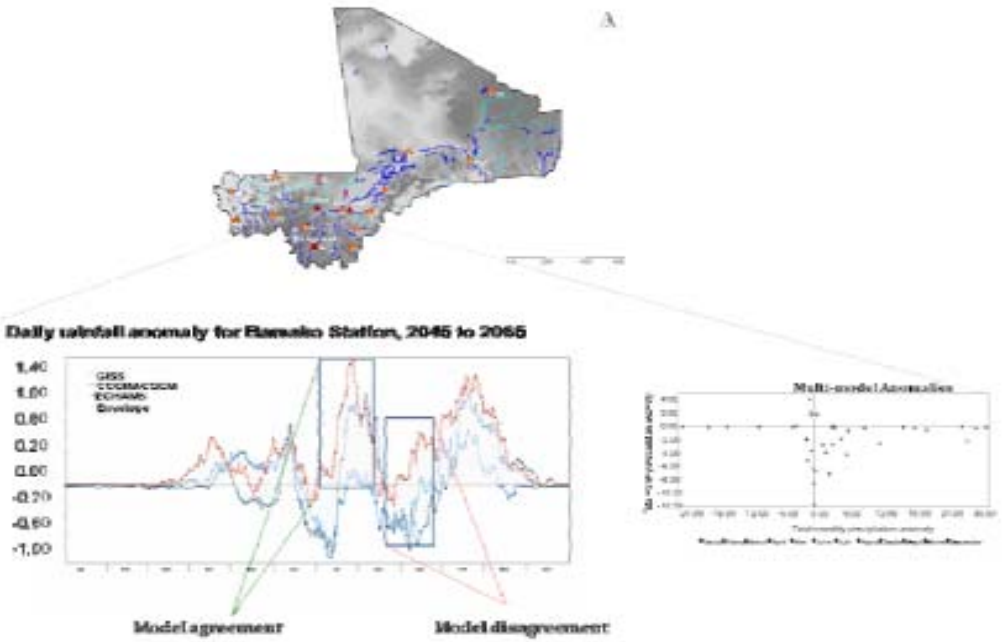


Figure 1: Example Output from the Climate Change Explorer in Mali.

Source: www.weADAPT.org.

The PRECIS Regional Climate Modelling System

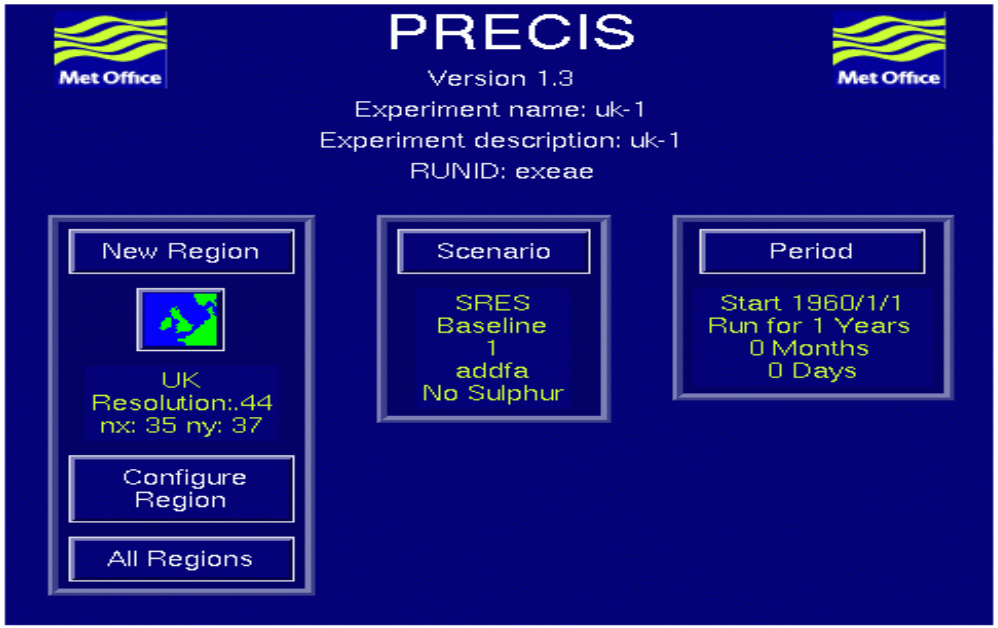
PRECIS is a powerful tool for creating climate scenarios

Welcome to the PRECIS website!

PRECIS stands for "Providing REgional Climates for Impacts Studies."

Developed at the Hadley Centre at the UK Met Office, PRECIS is a regional climate modelling system designed to run on a Linux based PC. PRECIS can be easily applied to any area of the globe to generate detailed climate change projections.

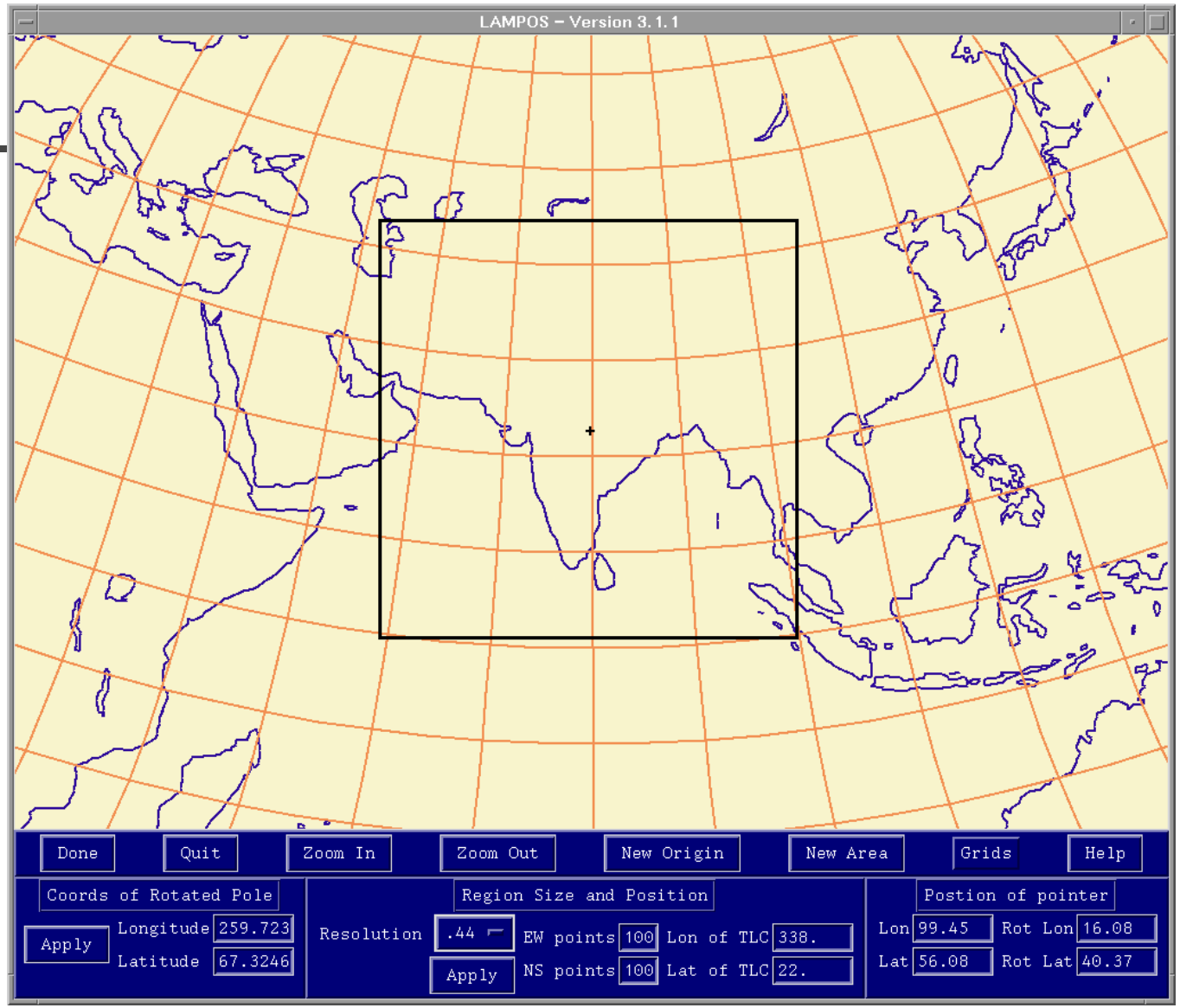
- **What is PRECIS?**
  Find out more about the PRECIS system and hardware requirements; download PRECIS publications
- **How can I get PRECIS?**
  The PRECIS dissemination strategy
- **The PRECIS user page**
  Documentation, FAQs, request lateral boundary conditions, technical support
- **PRECIS worldwide**
  Institutes which are running or have run PRECIS
- **Analysis / Validation**
  Datasets for validation, pattern scaling technique
- **PRECIS Workshops**
  General information about PRECIS workshops, summary of past international & UK based workshops
- **Useful Links**
  Links to news reports, publications and workplans from institutes using PRECIS



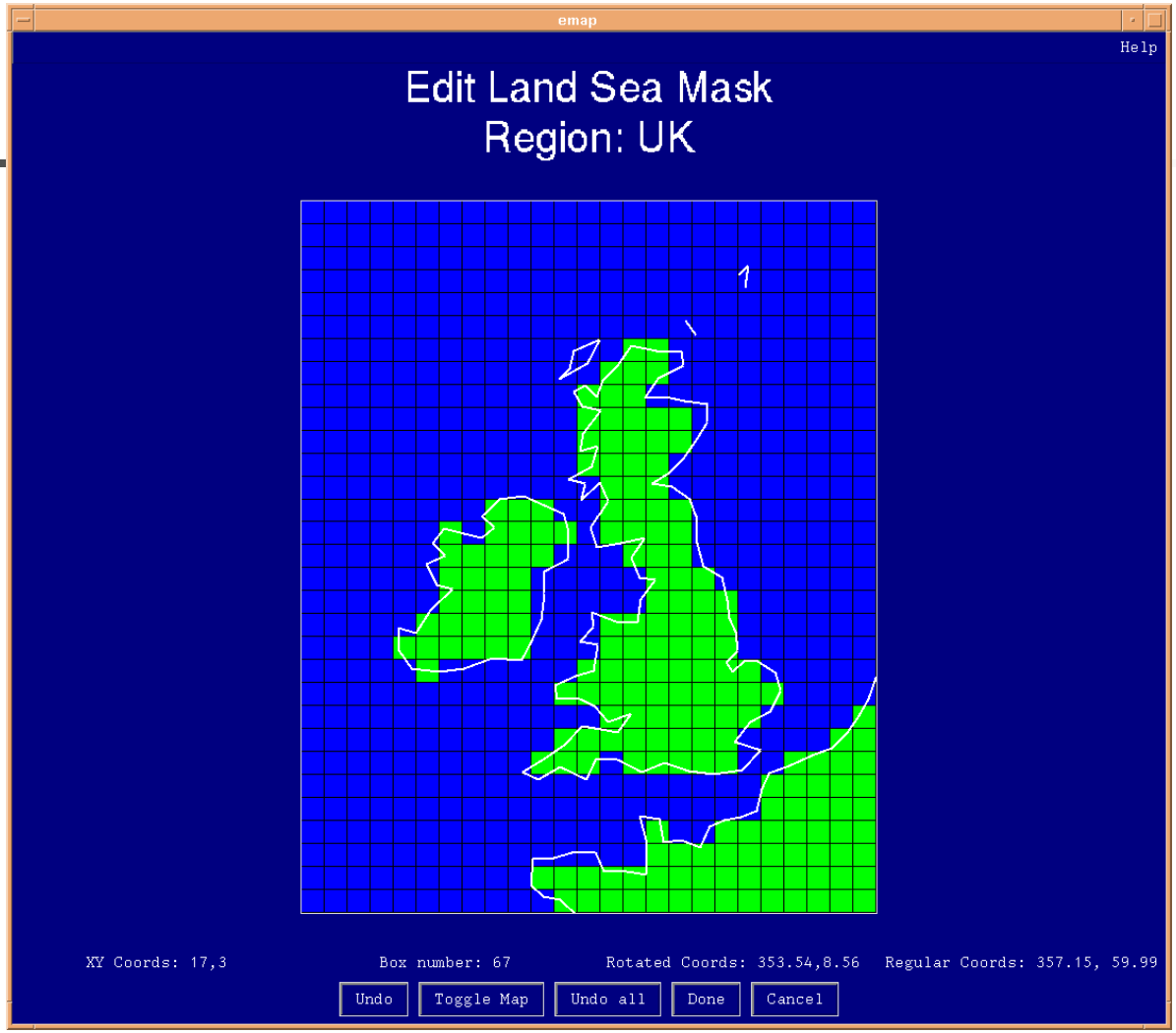
PRECIS -- 提供區域性氣候變遷之衝擊研究所需的情境模擬與分析

- 高解析度之氣候模擬系統
- 可應用於全球任何區域
- 典型場域尺度 **5000 x 5000km**
- 可於個人電腦操作，易於條件設定與情境模擬
- 目的在於提供國家層級之脆弱性與調適研究所需之資訊
- 適用之國家可藉此工具建立國家自身氣候變遷之情境

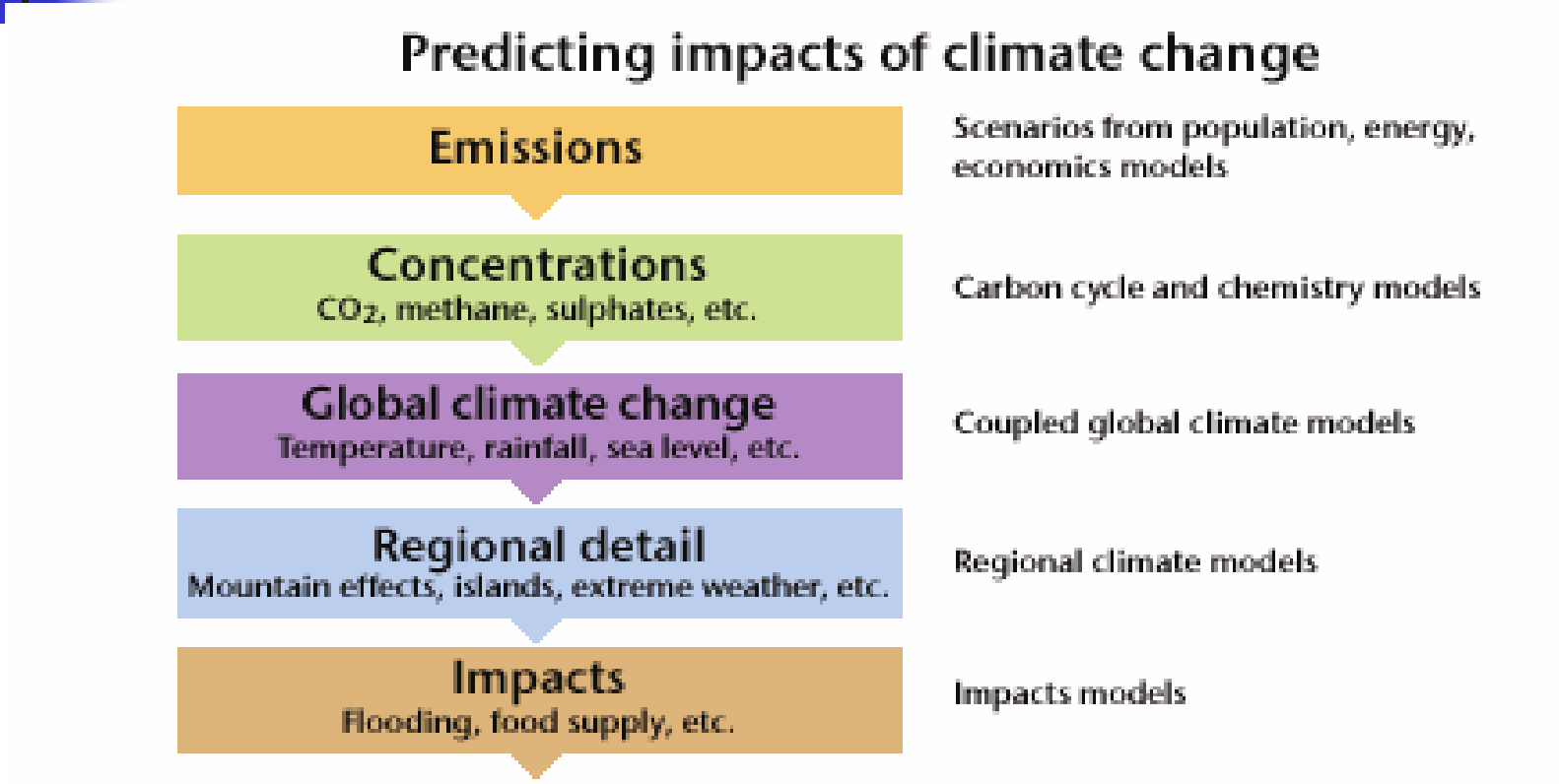
Setting up a PRECIS domain



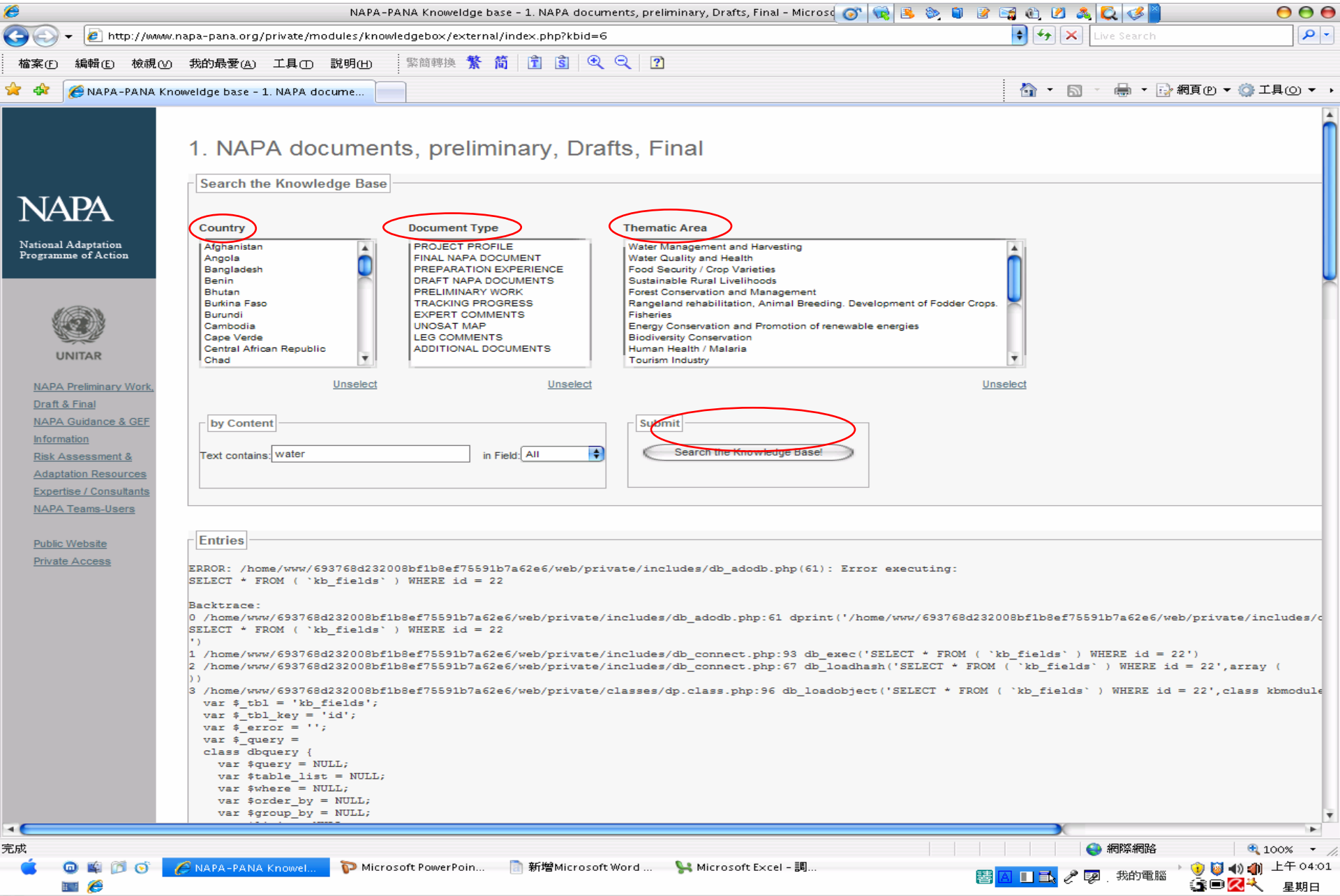
Editing the land-sea mask



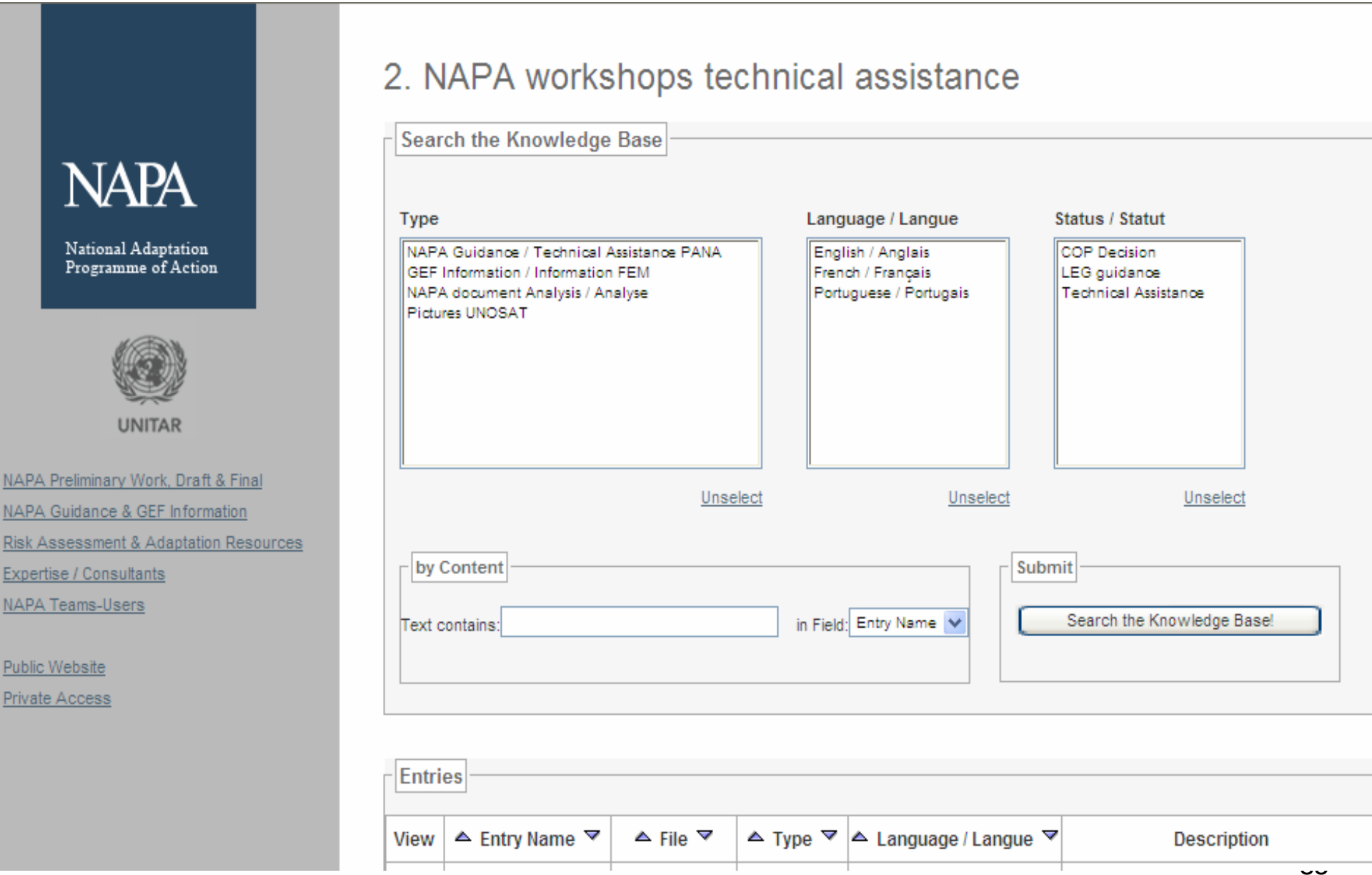
PRECIS -- 提供區域性氣候變遷之衝擊研究所需的情境模擬與分析



氣候調適工具之分類-- 1.資訊產生、資料庫及平台

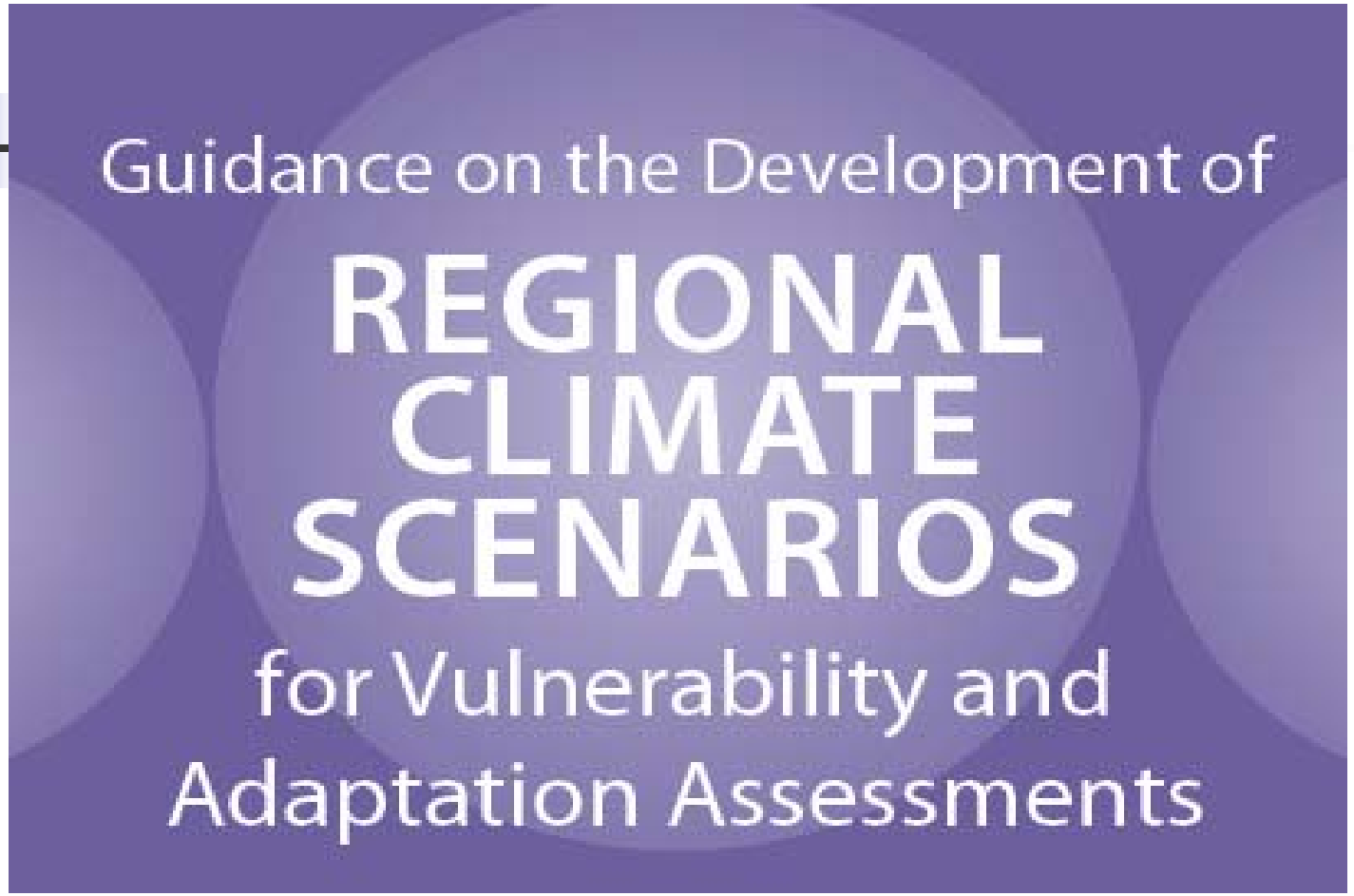


氣候調適工具之分類-- 1.資訊產生、資料庫及平台



http://www.napa-pana.org/private/modules/knowledgebox/external/index.php?kbid=8

氣候調適工具之分類-- 1.資訊產生、資料庫及平台



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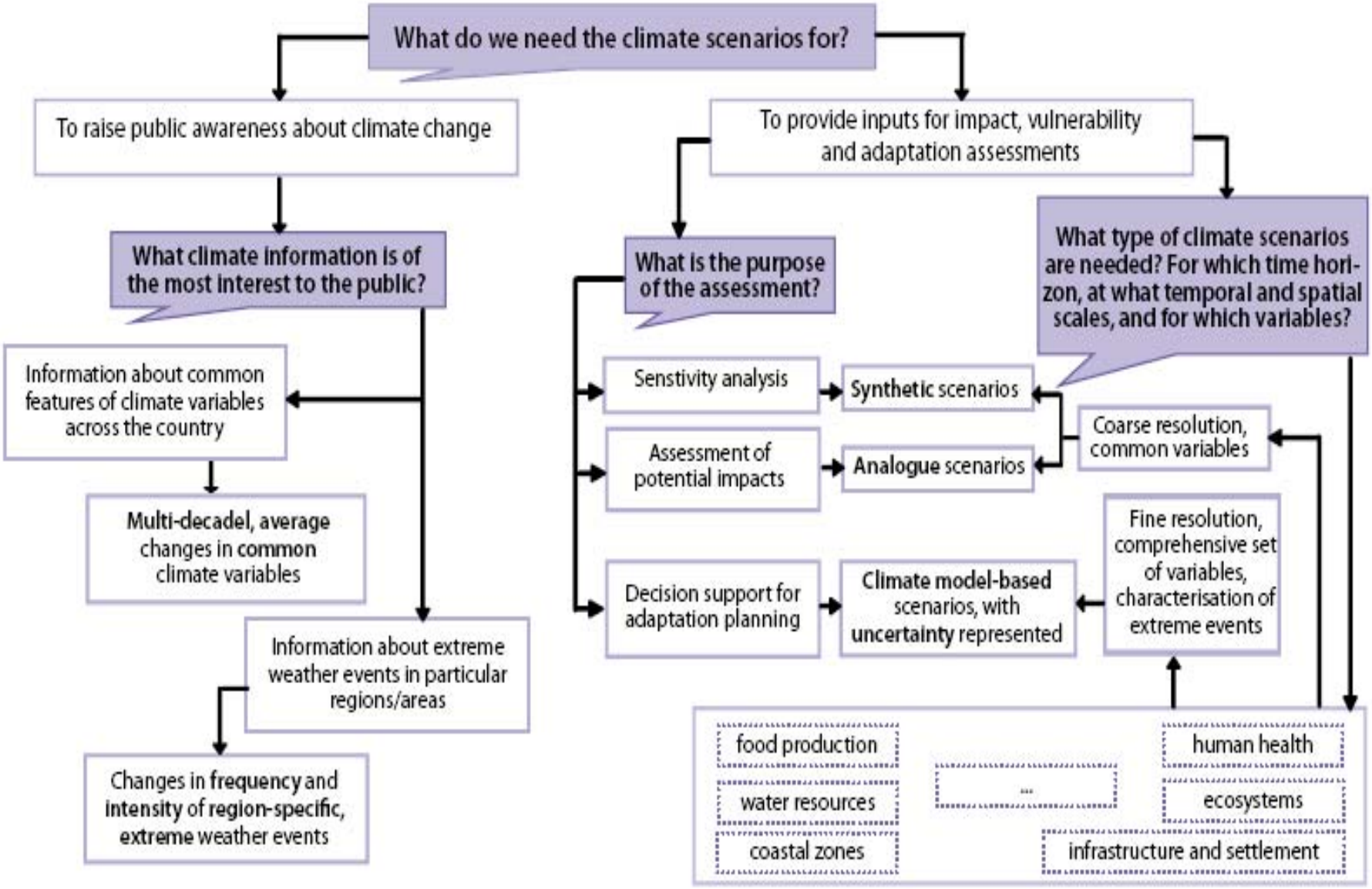
國家通訊中鑑別氣候情境需求之架構



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Climate Change Impact, Adaptation and Vulnerability (CCIAV) 之評估與其對氣候情境數據之評估與要求事項

- **UNFCCC** coming into force
- IPCC 1st and 2nd Assessment Reports

CCIAV assessments	Questions of investigation	Assessment frameworks	Climate scenario needs
First generation	Does climate change matter?	Sensitivity analysis	Synthetic scenarios
Second generation	What are the likely impacts of climate change?	Impact assessment	Analogue or climate model-based scenarios
Third generation	How to manage climate change-induced risk?	Risk management framework	Model-based projections with uncertainties quantified

- **Second** National Communications from NAI Parties
- IPCC 4th Assessment Report

- **Initial** National Communications from NAI Parties
- IPCC 2nd and 3rd Assessment Reports

CCIAV: climate change impact, adaptation and vulnerability

http://www.napa-pana.org/private/modules/knowledgebox/external/index.php?kbid=8

氣候調適工具之分類
-- 2. 以電腦為基礎之決策工具

- 以電腦為基礎之決策工具主要在協助使用者，基於計畫或方案之投入資訊，鑑別氣候相關風險與調適選項。
- 這些典型的工具包括社會脆弱資訊，協助使用者建立優先順序，以及包括經濟分析之決策程序。
- 這些工具可整合不同形式的數據，以及來自不同利害相關者所投入的資料。
- 如CRiSTAL軟體即在於進行計畫層級之決策，而 SEI平台則可應用於各類尺度之情境。
- 這些模式的優點在於可使方案的執行者，便利地隨手瀏覽平台訊，而不須向過去特別倚賴專家的建議。

氣候調適工具之分類
-- 2. 以電腦為基礎之決策工具

工具	更多資訊
CRiSTAL – IISD, IUCN, SEI, Intercooperation	**www.iisd.org/security/es/resilience/climate_phase2.asp**
ADAPT - World Bank	**www.worldbank.org/climatechange**
Adaptation Wizard – UK Climate Impacts Programme (UKCIP)	**http://www.ukcip.org.uk/resources/tools/adapt.asp**
Country Database – UNDP-GEF	**Database restricted to users of UNDP intranet.**

氣候調適工具之分類
-- 2. 以電腦為基礎之決策工具

Tool	*Audience*	*Screening level*	*Spatial scale*	*Training time*	*Application time*	*Main data type*	*Economic analysis*
2.a).CRiSTAL (IISD/ IUCN/SEI/Intercooperation)	all	project	local, regional	1 hour	<1 month	Qualitative	not at present
2.b). ADAPT (World Bank)	all	project	local, regional	none	<1 month	Qual	No
2.c). Adaptation Wizard (UKCIP)	all	various	multi-scale	none	<1 month	Quant and qual	Yes
2.d). UNDP Country database	Country offices	Project	National	20 minutes	<1 month	Quant and qual	No

氣候調適工具之分類-- 2. 以電腦為基礎之決策工具

Q53 fx

A B C D E F G H I J K L M N O

CRiSTAL 3.1 Community-based Risk Screening Tool: Adaptation and Livelihoods

Livelihoods and Climate Change

In its Fourth Assessment Report, the Intergovernmental Panel on Climate Change (IPCC) concluded that the globally averaged surface temperatures increased 0.74 ± 0.2°C between 1906 and 2005. This trend is expected to persist, with a 1.8 to 4°C warming predicted for the current century. (1) Warming will vary by region and be accompanied by significant changes in local precipitation, sea level rise and changes in the frequency and intensity of some extreme events. Yet these impacts will not be distributed or felt uniformly, as those "with the least resources have the least capacity to adapt and are the most vulnerable." (2)

Juergen Blaser, Intercooperation

Climate change will thus impact natural and human systems to alter the productivity, diversity and functions of many ecosystems and livelihoods around the world. For poor natural resource-dependent communities, climate change may compound existing vulnerabilities. Settlement on marginal or unstable lands already heightens exposure to climate hazards. Heavy dependence on ecosystem services places their welfare at the mercy of environmental conditions. As the availability and quality of natural resources decline, so does the security of their livelihoods. Limited resources and capacities for responding to stresses such as floods and droughts constrain their ability to meet basic needs and move out of poverty.

With climate change impacts already being observed, there is an urgent need for adaptive response measures. For the poor, this must start with actions that reduce current vulnerabilities and increase adaptive capacity so they can face the longer-

CRiSTAL 3.1

Livelihoods and Climate Change

How does CRiSTAL help you do this?

IISD, IUCN, SEI-US and Intercooperation have developed CRiSTAL (Community-based Risk Screening Tool - Adaptation & Livelihoods), a decision-support tool that helps communities, project planners and managers to:

- Systematically understand the links between local livelihoods and climate;
- Assess a project's impact on livelihood resources vulnerable to climate risk and important to coping;
- Devise adjustments that improve a project's impact on livelihood resources central to adaptive capacity

To do this, CRiSTAL is divided into two modules:

1. Module 1: Synthesizing information on climate and livelihoods
2. Module 2: Planning and managing projects for climate adaptation

The first module is designed to help you collect and organize information on the climate and livelihood context of the project area. The second module will then use this information to help you analyze how a project affects local vulnerability and adaptive capacity, providing a basis for devising project adjustments that foster adaptation to climate change. Module 1 must be completed in order to use Module 2.

Microsoft Excel - iisd-cristal.xls

氣候調適工具之分類-- 2. 以電腦為基礎之決策工具

CRiSTAL • IISD, IUCN, SEI, Intercooperation

What are the climate-related hazards, impacts and coping strategies in your project area?

Enter the main climate-related hazards that affect your project area, their associated impacts, and the primary coping strategy for each impact. To view definitions of "hazard", "impact" and "coping strategy", place your cursor over the word. To see examples of hazards, impacts and coping strategies, place your cursor over the associated text box.

If the answer to either "Is the strategy working" or "Is the strategy sustainable" is no, enter an alternative coping strategy.

Hazard 1:

	Impact →	Coping strategy	Is the strategy working?	Is the strategy sustainable?	Alternate coping strategy	Notes
1:			yes	yes		
2:			yes	yes		
3:			yes	yes		

Hazard 2:

	Impact →	Coping strategy	Is the strategy working?	Is the strategy sustainable?	Alternate coping strategy	Notes
1:			yes	yes		
2:			yes	yes		

工具展示

Q53 fx

A B C D E F G H I J K L M N O

CRiSTAL 3.1

Community-based Risk Screening Tool: Adaptation and Livelihoods

Livelihoods and Climate Change

In its Fourth Assessment Report, the Intergovernmental Panel on Climate Change (IPCC) concluded that the globally averaged surface temperatures increased 0.74 ± 0.2°C between 1906 and 2005. This trend is expected to persist, with a 1.8 to 4°C warming predicted for the current century. (1) Warming will vary by region and be accompanied by significant changes in local precipitation, sea level rise and changes in the frequency and intensity of some extreme events. Yet these impacts will not be distributed or felt uniformly, as those "with the least resources have the least capacity to adapt and are the most vulnerable." (2)

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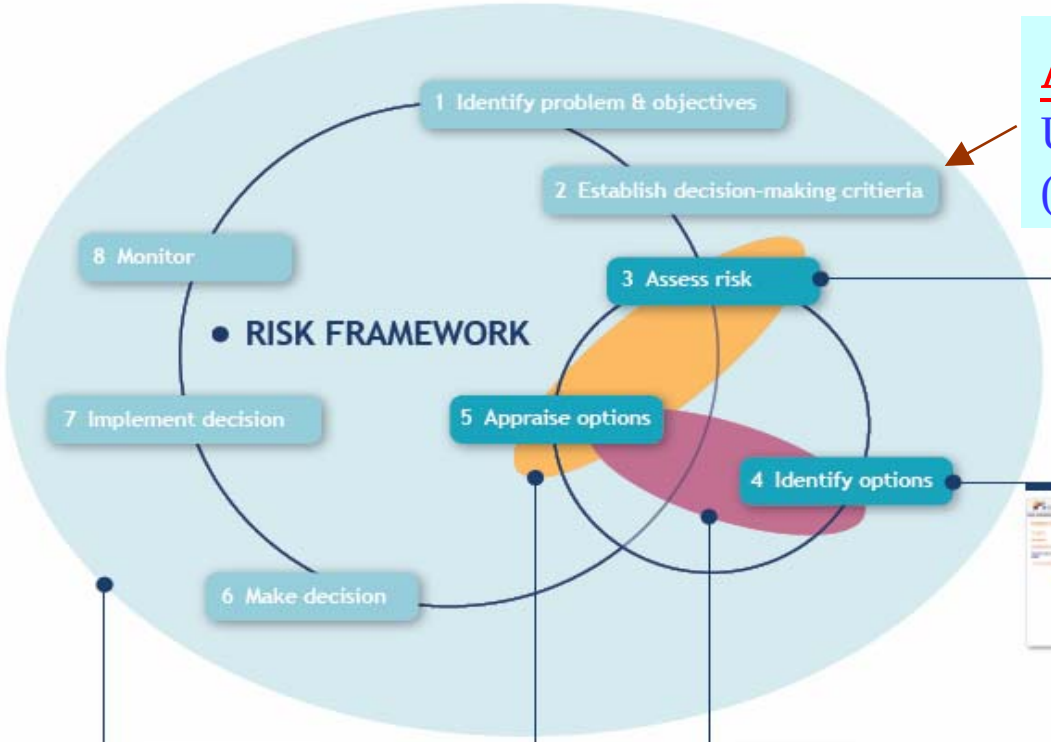
With climate change impacts already being observed, there is an urgent need for adaptive response measures. For the poor, this must start with actions that reduce current vulnerabilities and increase adaptive capacity so they can face the longer-

氣候調適工具之分類-- 2. 以電腦為基礎之決策工具



Adaptation Wizard

UK Climate Impacts Programme (UKCIP)

Adaptation Actions

UKCIP08 Climate scenarios

UKCIP02 Climate scenarios

Socio-economic scenarios

BACLIAT

LCLIP

Nottingham Declaration Action Pack

Identifying adaptation options

Adaptation Wizard

Costings

氣候調適工具之分類–
3. 調適/風險管理程序

- 調適/風險管理程序包括已被特定國際組織發展之工具，目的在篩選計畫/方案，及(或)制定政策之優先順序。
- 過去這些程序必須倚賴執行者所信賴的外部氣候變遷專業機構之專家，其傾向於倚賴更多定性的氣候科學資訊之資訊投入。
- 在可適用時，這些工具會將經濟分析整合於其中。
- 整體而言，此類工具所花費的時間較以電腦為基礎之決策工具為長，但決策通常會更加完整，以利於後續災害風險之降低與調適決策之選擇。

氣候調適工具之分類–
3. 調適/風險管理程序

工具	更多資訊
Climate quick scans - DGIS, The Netherlands	**www.nlcap.net**
Preparedness for Climate Change - Red Cross/Red Crescent	**www.climatecentre.org**
Climate Change Adaptation Guidance Manual - USAID	***www.ids.ac.uk/climatechange***
Opportunities and Risks of Climate Change and Disasters (ORCHID) - IDS	**www.ids.ac.uk/climatechange**
Integration of climate risks into country programming - UNDP	**UNDP Intranet only**
Other paper-based/process tools:	**http://www.proventionconsortium.org/?pageid=32&projectid=1**

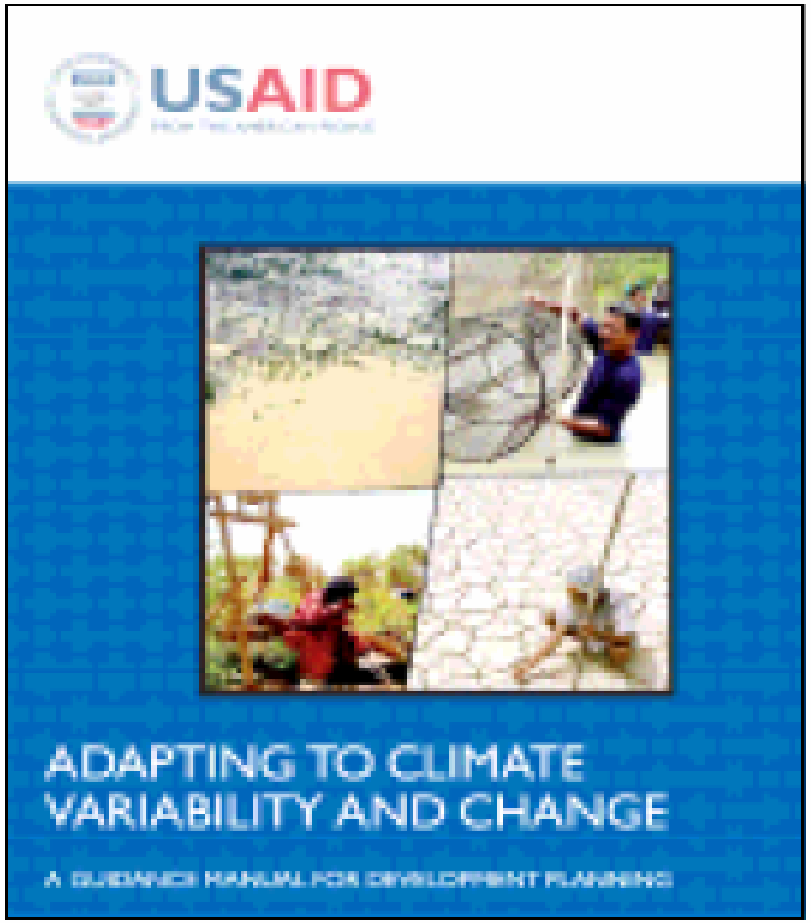
氣候調適工具之分類–
3. 調適/風險管理程序

Tool	*Audience*	*Screening level*	*Spatial scale*	*Training time*	*Application time*	*Main data type*	*Economic analysis*
3.a). Climate quick scans (DGIS)	donors	project, programme	multi-scale	none	<1 month	Qual	No
3.b). Preparedness for Climate Change (Red Cross/Crescent)	NGOs	programme, policy	National	none	> 6 months	Qual	No
3.c). Climate Change Adaptation Guidance Manual (USAID)	donors	policy, project	local, regional	-	2-6 months	Quant and qual	not at present
3.d). ORCHID (IDS/DFID)	donors, NGOs	programme	regional, national	none	2-6 months	Qual	Yes
3.e.) CCA/UNDAF Guidance (UNDP)	Country offices	programme	National	none	>6 months	Qual	No

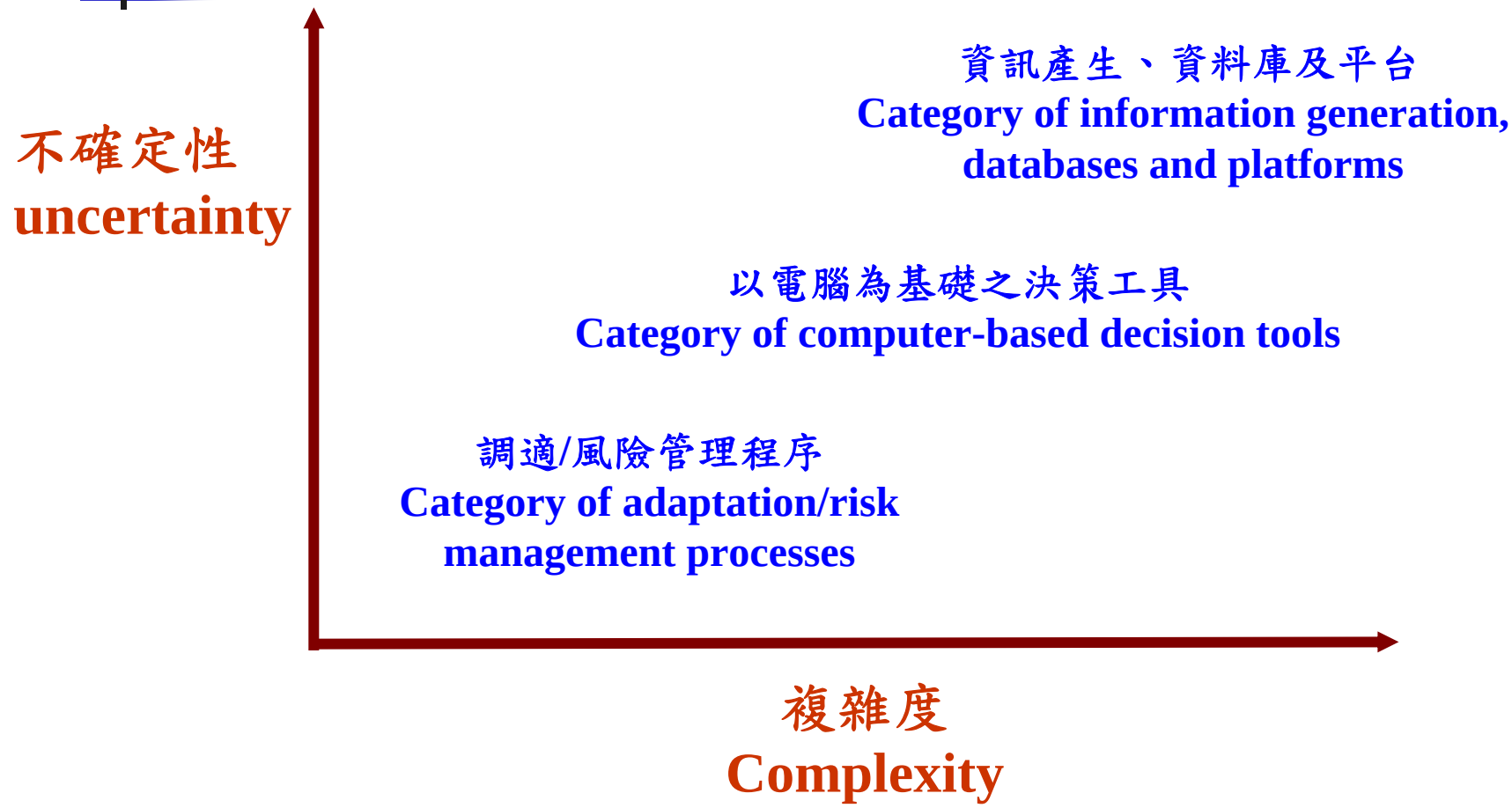
Adapting to Climate Variability and Change

USAID Adaptation Goals:

- Educate project planners:
  - Provide climate change information for non-experts
- Increase resilience of projects
  - Identify opportunities for adaptation
- Improve planning processes
  - Incorporate adaptation into project planning
- Approach
  - Adaptation Guidance Manual
  - Tools

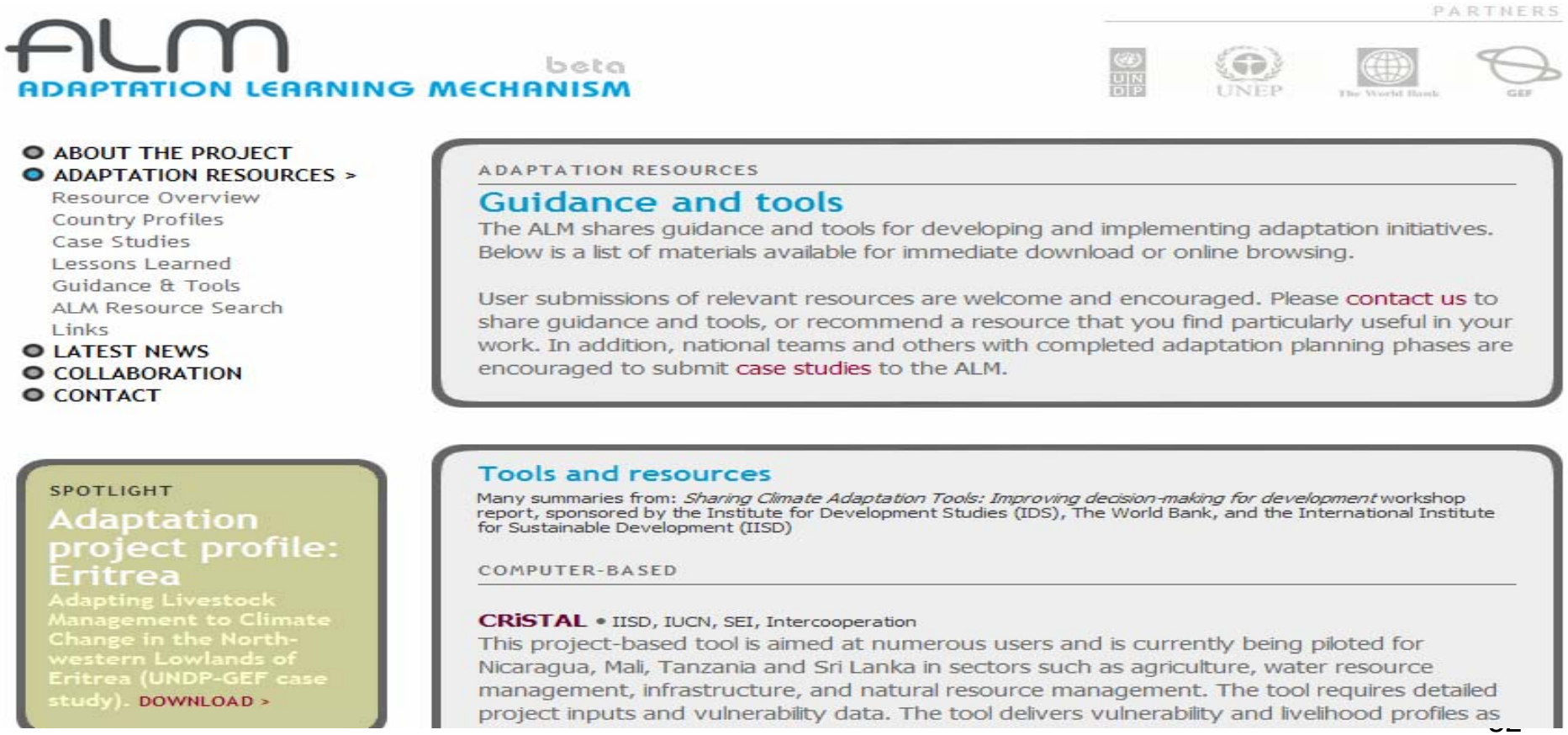


不同調適工具之分析
Analysis of various categories of adaptation tools



氣候調適工具之資源網站

- Adaptation Learning Mechanism (ALM): one of the most famous website
  http://www.adaptationlearning.net/resources/tools.php



我國相關研發成果

- 國科會國家災害防救科技中心
  - 主要功能：包括「研發推動」、「技術支援」及「落實應用」，協助擬訂有效的防救災對策，提昇社會整體抗災能力、改善環境、強化國土保安。
  - 歷年防災國家型科技計畫成果
- 各學術與大學研究機構之個別性研究
- 天然災害模擬工具已有初步建置，主要針對特定環境衝擊議題(如滂災等)進行評估

結論與建議

- 過去人類社會基礎建設的設計原則，必須隨著氣候變遷與衝擊之加劇而須改變。即過去以事件為基礎(如10年防雨、100年防洪基準等)，如今使變得不適用且危險。氣候穩定的假設已經是錯誤的。

- 以風險分析為導向之管理模式的需求十分迫切，有關基礎建設在不同氣候條件水準下之成本敏感性，是良好決策之必要資訊。

- 適當的資訊網路與知識累積極為關鍵，與新的、重大的氣候衝擊事件相關的資訊，必須在國際間有效建立與傳遞，以防止災害再度發生。

- 台灣政府與相關學術研究機構，可積極開發或引進國際間已發展且成效良好之氣候調適與風險評估工具，以評估我國在地性之氣候衝擊類別與大小，及制定適用於我國之調適決策。

謝謝聆聽

敬請指教