

氣候變遷調適方案之建構與思考原則

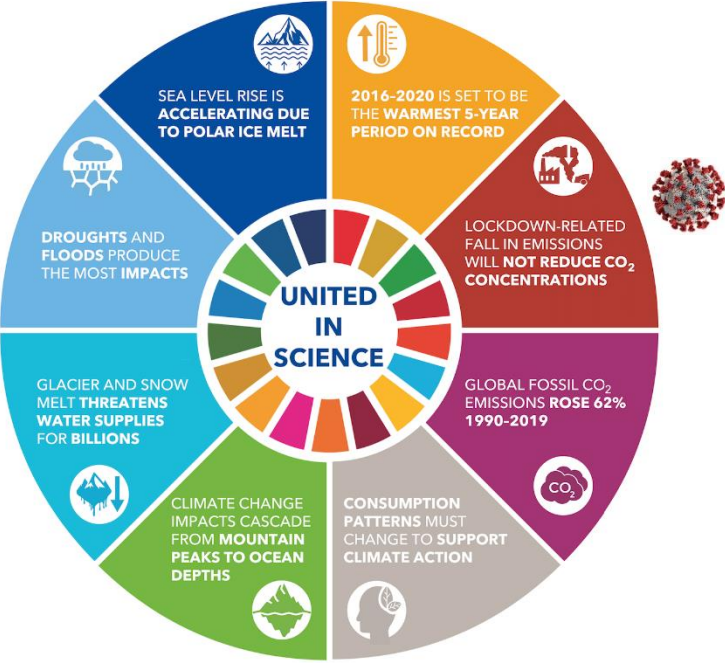
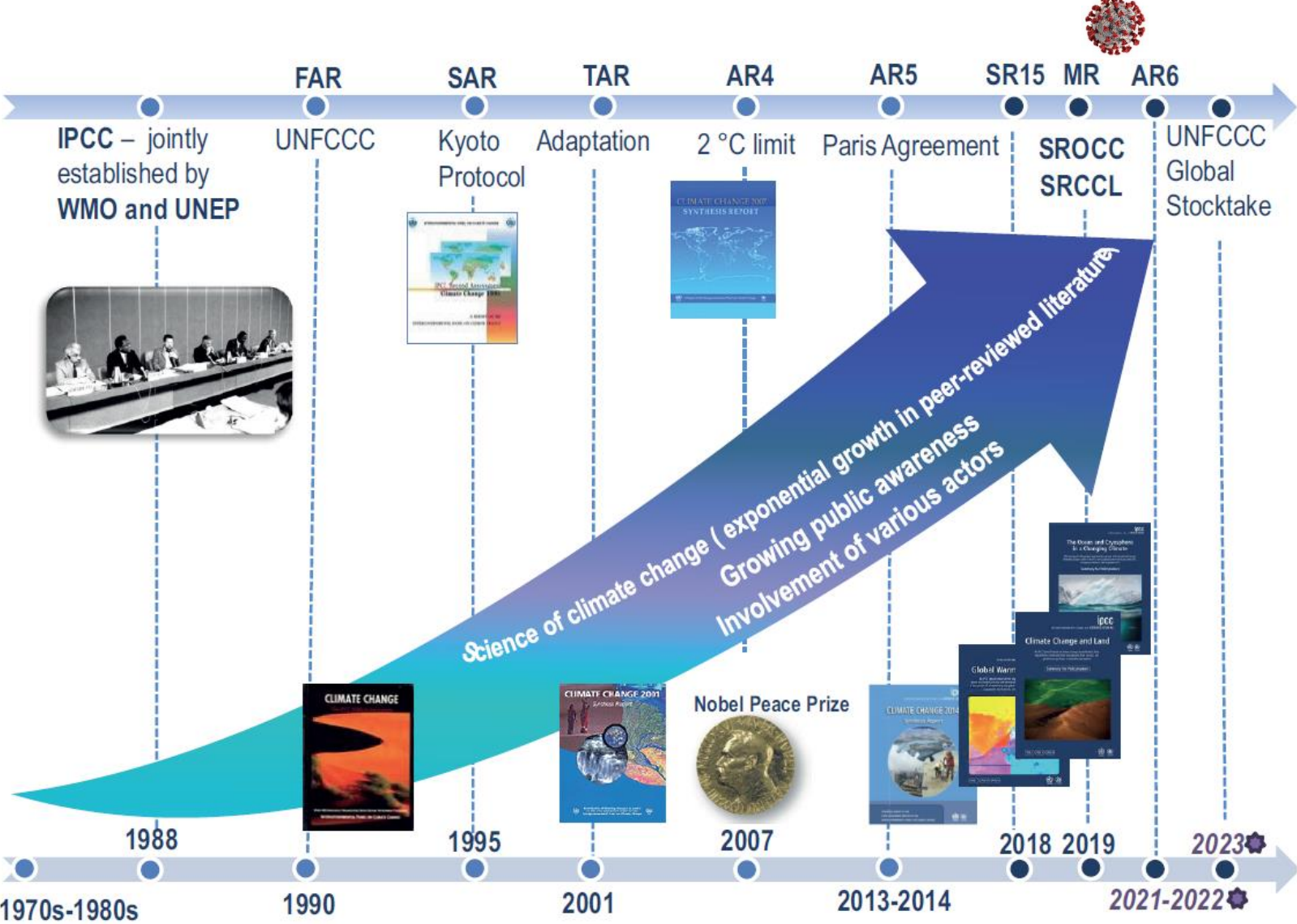
國際架構與國內經驗



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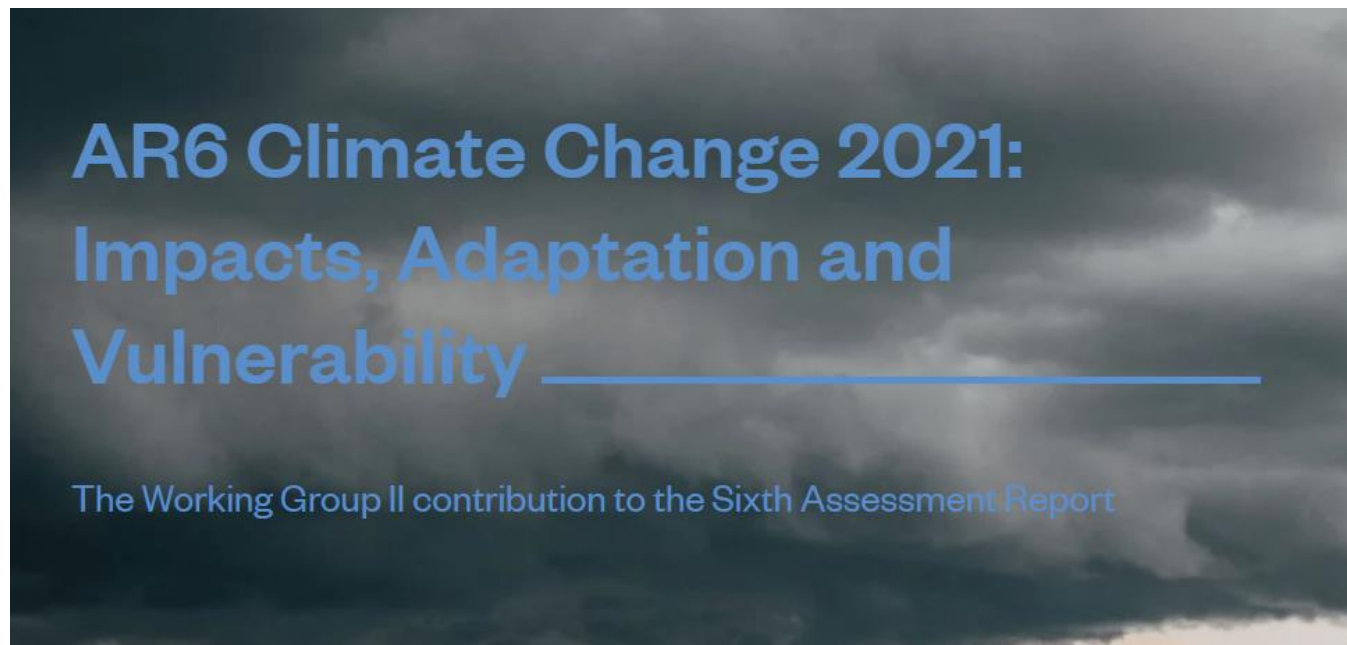
1988→現在→未來

氣候報告的演變與前景



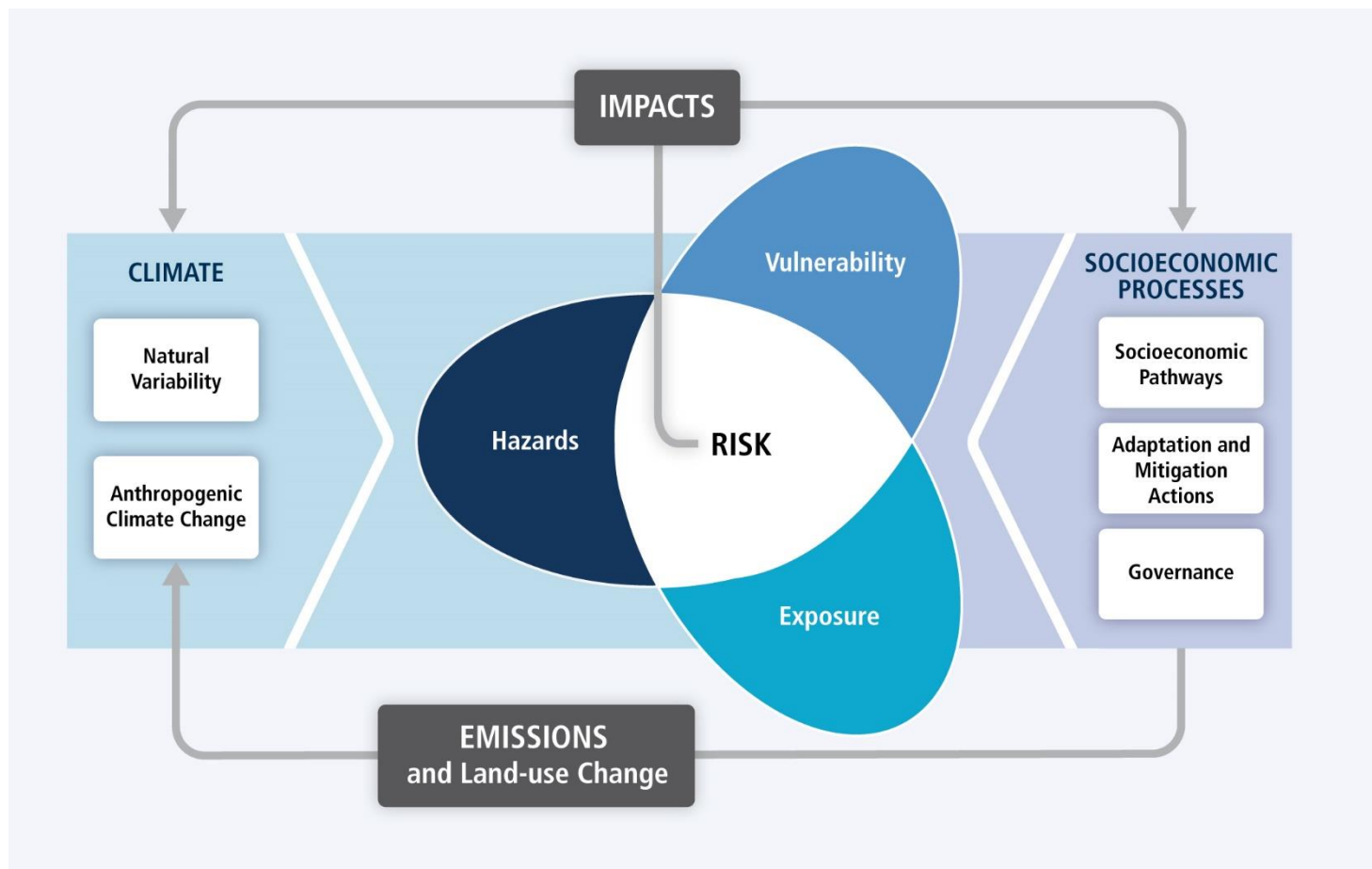
氣候變遷調適的基本思維邏輯

◆ 衝擊、調適與脆弱度



氣候變遷風險與調適之核心概念

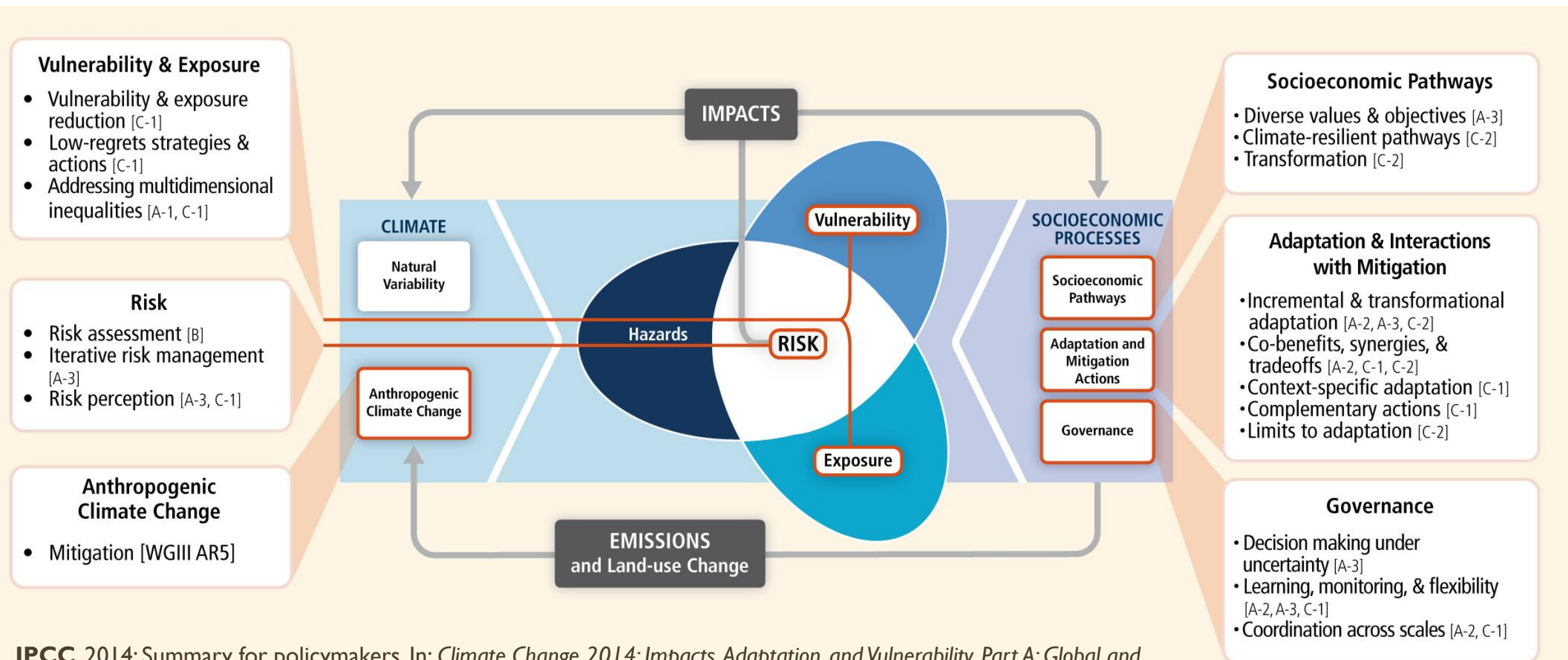
風險 = f (危害、脆弱度、暴露度)



IPCC, 2014: Summary for policymakers. In: *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*

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氣候變遷調適的公共性與私有性可能組合

		Beneficiaries	
Providers		Private	Public
	Private	e.g. buying sand bags to limit home flood damage	e.g. urban flood risk reduction via intentional rural flooding
	Public	e.g. grants for house insulation to reduce cold / heat stress	e.g. global climate models; “Em-dat” hazards database

Fig. 1. Domains of adaptation.



Tompkins, E. L., & Eakin, H. (2012). Managing private and public adaptation to climate change. *Global environmental change*, 22(1), 3-11.

氣候變遷調適的定義/意義

◆解析歐盟對於氣候變遷調適的定義

□歐盟認為：Adaptation means **anticipating** the adverse effects of climate change and **taking appropriate action** to prevent or minimise the damage they can cause, or **taking advantage of opportunities** that may arise

□核心概念：

氣候變遷造成其他許多情勢的變化（氣候的變化衍生的其他各方面的變化）

$\int_{t_i}^{t_f} \Delta f(x_i) dt$: 從 t_i 到 t_f 這段時間，隨著氣候變遷導致的 $f(x)$ 的累積衝擊

$\Delta Action = f(\int_{t_i}^{t_f} \Delta f(x_i) dt)$ $\Delta Action$: 採取的行動的變化

- 氣候變遷→氣候變遷造成的損害
- 氣候變遷→氣候變遷可能衍生的機會

□關鍵邏輯

- 預期氣候變遷造成的損害→採取適當行動→預防或最小化損害
- 瞭解氣候變遷可能衍生的機會→利用機會→最大化機會帶來的效益

歐盟公共服務的觀點

氣候變遷調適計畫的議題

◆ 歐盟於2009年發布國家氣候變遷調適(NAP)指引，然而諸多會員國並未遵循指引擬定完整的氣候變遷調適計畫

◆ 主要的問題包括

- 系統思考：仰賴專家與執行者的經驗意見，缺乏系統性的整體思考與規劃
- 財務配套：公共服務部門的預算並未隨著NAP編列，或有整體的規劃
- 損害預估：缺乏比較氣候損害與損失的資料(comparable disaster damage and loss data)
- 垂直整合：各層級氣候變遷調適計畫的銜接不良
- 多方參與：包括的權益相關者不夠完整全面

Table 1: Multiple levels of governance in the NAS by member state

Country	International	European	National	Regional	Local	Individual
Denmark		•	•	•	•	•
Finland		•	•			•
France	•	•	•	•	•	•
Germany	•	•	•	•	•	•
Netherlands		•	•	•	•	
Spain	•	•	•	•	•	
UK	•	•	•	•	•	•

歐盟國家氣候變遷調適計畫

各國包括的部門別

Table 2: Vulnerable sectors in national adaptation strategies

Vulnerable sector	DE	DK	ES	FI	FR	LV	NL	PT	SE	UK
Agriculture	•	•	•	•	•	•	•	•	•	•
Biodiversity	•	•	••	•	••	•	•	•	•	•
Energy	•	•	•	•	•	••		•	•	•
Finance	•	•	•	•	•	•	•	•		•
Forests	•	•	•	•	•	•	•	•	•	•
Health	•	•	•	•	••	•		•	•	•
Water management	•	•	••	•	••	•	••	•	•	•
Construction	•	•	•	•	•		•	•	•	•
Fisheries	•	•	•	•		•		•	•	•
Coastal areas	•	•	••			•	••	•	•	•
Tourism	•		•	•	•		•	•	•	•
Land use	•	•		•			••	•		•
Transport	•	•	•	•	•				•	•
Communication infra-structure	•	•	•						•	
Industry	•		•	•	•					•
Emergency services	•	•				•				
Mountains	•		•							

Source: BASE 2014, PEER (2009). Note: • sector is dealt with; •• identified as a key sector in the national strategy

歐盟國家氣候變遷調適計畫

各國財務議題：是否明訂財源？誰付錢？誰管控？

Table 3: Funding adaptation measures within multiple governance levels and sectors

Country	Does NAS refer to adaptation funding?	Who pays for the implementation?	Who controls the use of funds?
Denmark	Not specified	Public and private sectors coordinated by the government	Monitored by coordination forum
Finland	Not explicitly	All relevant actors through mainstreaming into existing policies	No separate funding
France	Defined without commitment	Government, stakeholders, professional federations	ONERC orientation council
Germany	Not specified	Not specified	Not specified
Netherlands	No reference to specific funding	Both public and private (PPP) at all levels	Cost-benefit analyses
Spain	Not specified	Not specified	Not specified
UK	Mentions funding for regional partnerships and research	Not specified	Not specified

Source: BASE (2014)

氣候變遷調適的財務 總體經濟的圖像

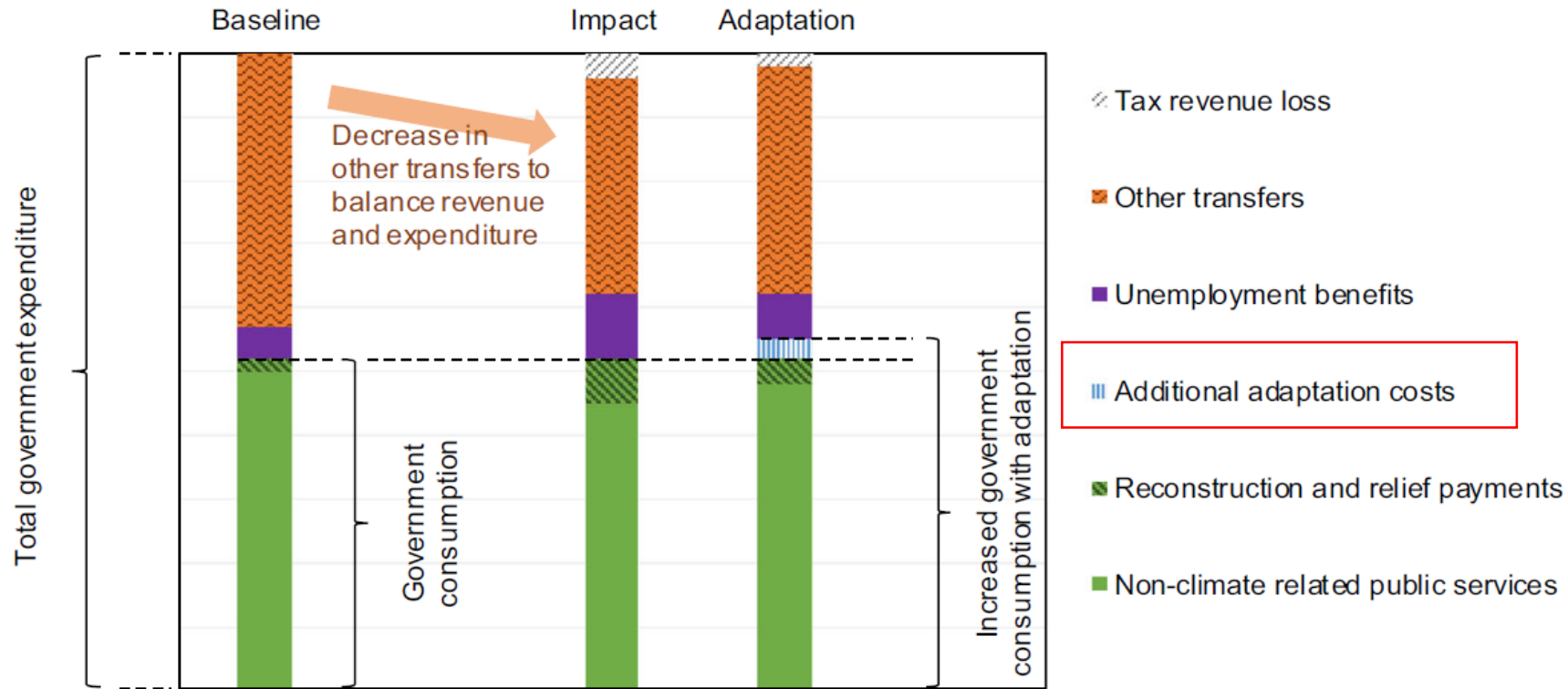


Fig. 1 Conceptual model of effects of climate change impacts and adaptation on government expenditures. Magnitudes of expenditure categories in the Baseline are set to reflect the EU-wide public expenditure structures (EUROSTAT 2018). The effects in the Impact and Adaptation scenarios are depicted exaggeratedly for illustrative purposes

英國司法部的氣候變遷調適計畫



Preparing for Climate Change: A Climate Change Adaptation Strategy

◆發行時間：2020年5月

◆主要內容要點

- 目的
- 範疇
- 驅動力
- 策略目標
- 治理方式
- 關鍵界定風險
- 報告方式
- 衍生資料
- 溝通與發行計畫
- 監測與評估
- 補充資料與行動方案

2020

英國司法部的氣候變遷調適計畫

□ 範疇：牽涉到的相關部門與權益相關者

- 地產管理
- 監獄管理者
- 法院與法庭管理者
- 設施管理提供者
- 商業夥伴
- 政策制訂者
- 特別關心氣候變遷的部門，譬如環境食物與鄉村部(DEFRA)、工商、能源與產業部(BEIS)
- 該部與從屬部門的簽約者
- 對聯合國和永續發展目標(SDGs)感興趣者

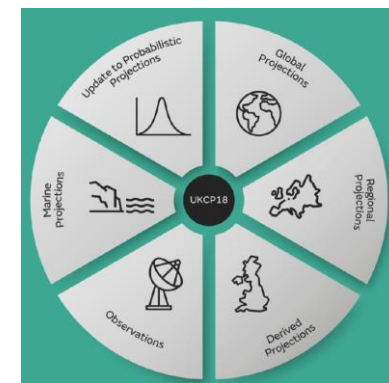
□ 驅動力：各種對於未來風險的預估

➢ UK Climate Projections 2018

By 2061:

- Summers will likely be drier by 16-42%, and hotter by 3.6°C-5°C
- Hot spells of over 30°C for more than 2 days are likely to occur around 4 times a year
- Winters will likely be wetter by 16-42%
- The intensity of rainfall over the year will likely be increased by 7.5%, significantly increasing the likelihood of flash floods

- IPCC報告的未來風險預估
- 巴黎協定的升溫小於2°C目標
- 聯合國永續發展目標(SDGs)
- Climate Change Act 2008 (英國氣候變遷法2008年版本) 於2019年通過的2050目標修正案



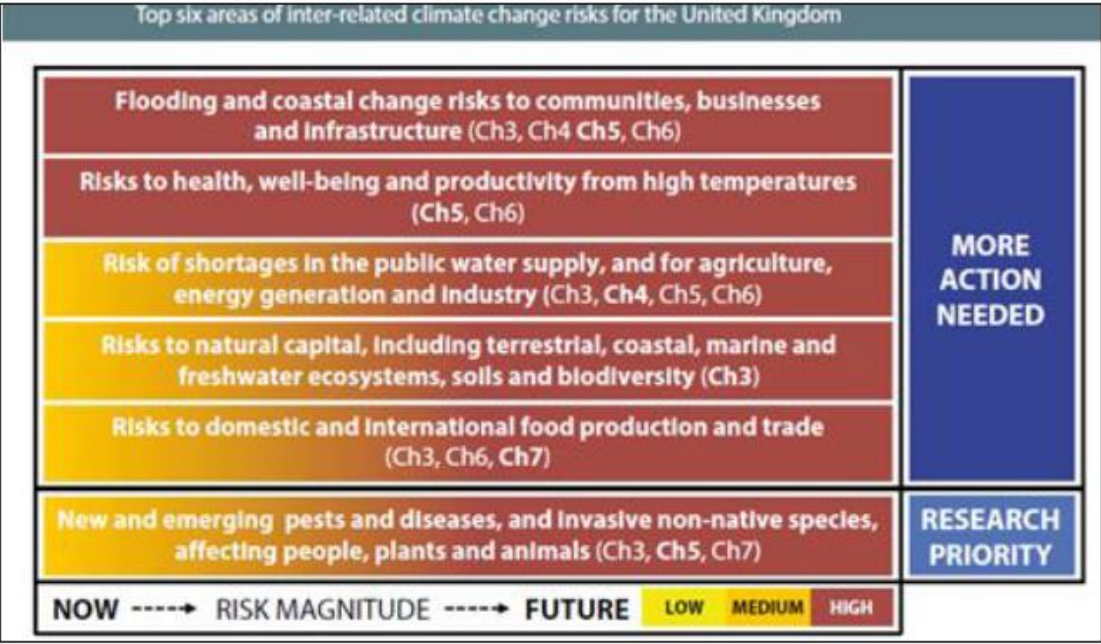
英國司法部的氣候變遷調適計畫

策略目標

- 司法部必須因應未來可能發生的氣候變遷
- 司法部必須為未來升溫2°C情境下其地產、政策、人員而計畫
- 司法部必須為未來可能升溫4°C情境下其地產、政策、人員而計畫

治理方式

- 接受政府的高階永續委員會(Senior Sustainability Board)管轄
- 在司法部中接受單一計畫管理委員會(Single Department Plan, SDP)管轄
- 財產管理主管每月依據綠色承諾提交報告給財務長
- 司法部的永續小組必須確定司法部運作朝向永續
- 接受DEFRA主導的環境25年計畫的管制
- 司法部是政府國內調適委員會(Government's Domestic Adaptation Board, DAB)的一員
- 在國家調適報告推動委員會(Adaptation Reporting Power, ARP)下，需要提出報告



英國司法部的氣候變遷調適計畫



□ 關鍵界定風險

- Extreme weather events such as flooding, storms and droughts (風暴、旱澇)
- Overheating in buildings (建築物過熱)
- Underheating in buildings (建築物過冷)
- Social or civil unrest in the UK (逃脫)
- Disruptions to transport and other critical infrastructure (交通與關鍵基礎設施脫序)
- Climate-related international human displacement (氣候相關之國際人口移動)
- Risks to natural capital, including terrestrial, coastal, marine and freshwater ecosystems, soils and biodiversity (自然資本風險)
- Risks to domestic and international food production and trade; new and emerging pests and diseases, and invasive non-native species, affecting people, plants and animals (國內與國際食物生產與貿易風險)
- Risks to public water supply (公共用水風險)

氣候變遷調適的必要治理措施

◆國家型立法

- 氣候變遷（調適）相關法律
- 氣候變遷調適施行細則或子法

◆國家型計畫

- 國家氣候變遷調適相關組織與長中短期計畫
- 國家氣候變遷調適計畫指引

◆地方型計畫

- 地方型組織與長中短期計畫
- 地方氣候變遷調適計畫指引



Adapting to Climate Change: A Guide for the Transportation Industry

Tiffany Finley, Associate, Advisory Services
Ryan Schuchard, Manager, Climate and Energy



Prepared by
West Coast
Environmental Law



PREPARING FOR CLIMATE CHANGE

An Implementation Guide
for Local Governments
in British Columbia

監測與評量不同氣候變遷調適計畫的績效

◆ 關鍵指標

□ 脆弱度

- 關鍵氣候風險
- 非氣候因素
- 回應能力

□ 調適目標與標的

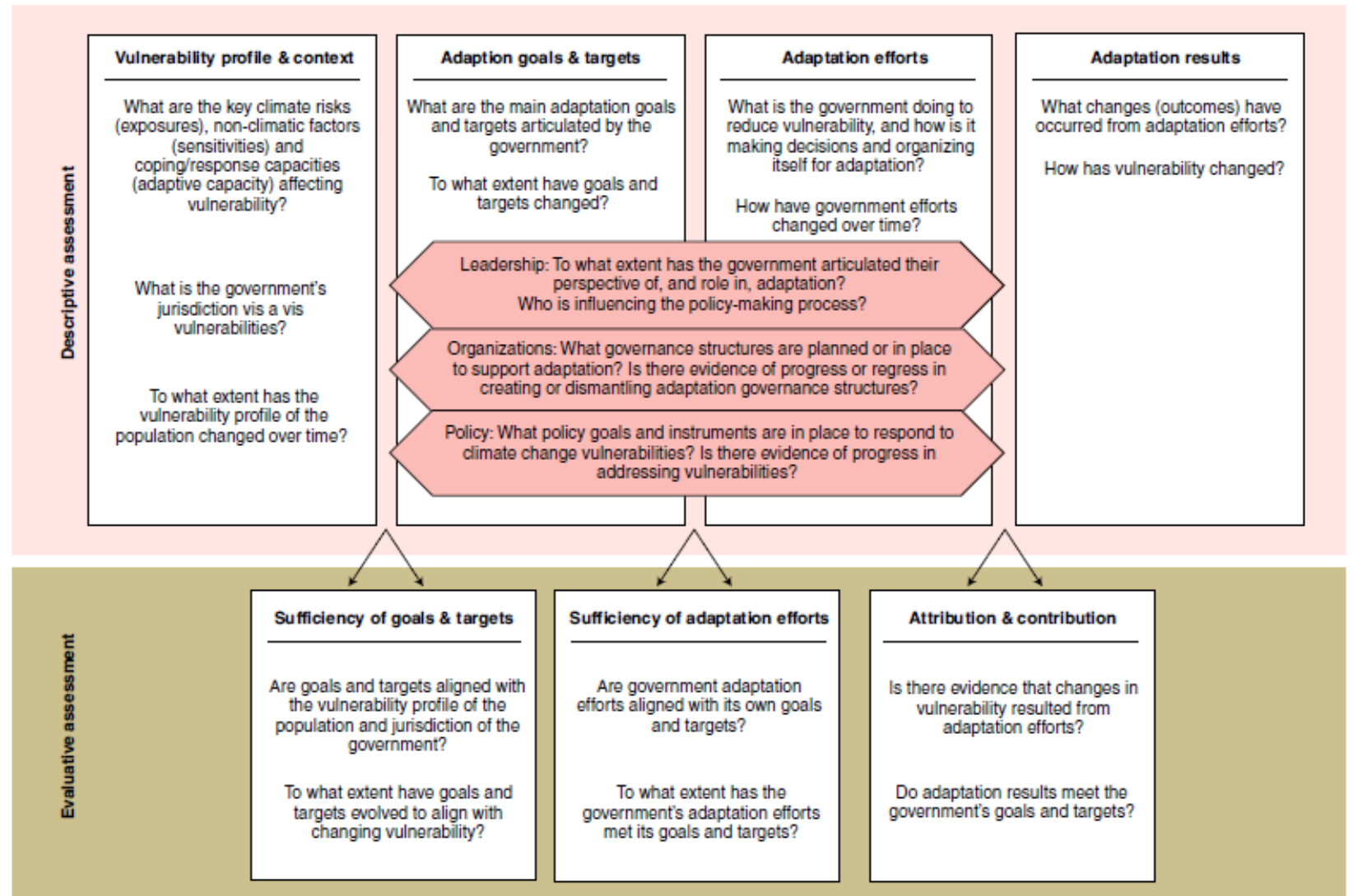
- 主要調適目標與標的
- 目標與標的修正程度

□ 調適的努力

- 降低脆弱度的作為與決策
- 如何隨時間修正

□ 調適的成果

- 因調適造成的改變
- 脆弱度如何改變了



地方層級的氣候變遷調適工具 三層級風險評估則工具

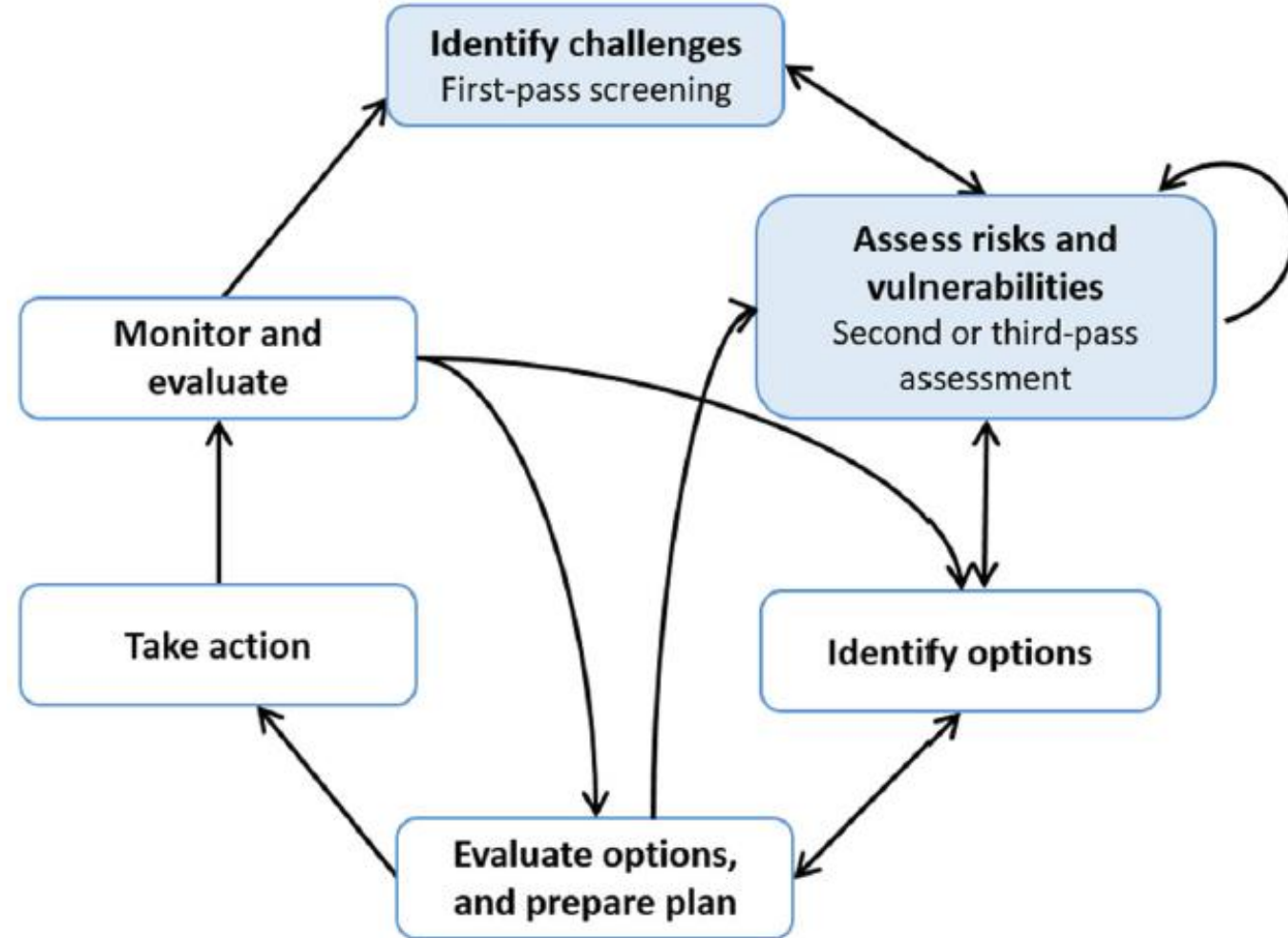
A three-tier risk assessment process for climate change adaptation at a local scale

◆CoastAdapt：依據若干氣候變遷調適指引設計的工具

- ❑ US Climate Resilience Toolkit
- ❑ European Climate Adaptation Platform
- ❑ Klimatolse for Germany
- ❑ Adaptation Wizard for the UK

◆三層級風險評估

- ❑ 第一次：簡易快速風險評估
- ❑ 第二次、第三次：依據ISO31000氣候決策與報告指引進行較為細緻的風險評估



歐盟國家提出的調適報告架構

◆ 整體

- 整體進展、調適策略、調適行動計畫

◆ 步驟A：準備調適的基礎

- 統籌結構、權益相關者在政策發展中的參與

◆ 步驟B：評估氣候變遷的風險與脆弱度

- 現在的氣候變遷狀況與未來預測

- 知識缺口、知識轉移

◆ 步驟C：界定調適方案

- 調適選項的界定、資金與資源的界定與配置

◆ 步驟D：執行調適行動

- 在規畫過程中將調適主流化、執行調適

◆ 步驟E：監測與評估調適行為

- 監測與報告、評估

Adaptation preparedness scoreboard:

Summary for United Kingdom

Disclaimer

Based on the scoreboard in Commission Staff Working Document SWD(2018)460 accompanying the evaluation of the EU's strategy for adaptation to climate change. For referencing this Commission analysis from June 2018, please use the full version in the SWD.

SUMMARY

Overall progress

Development of a national adaptation programme has been legally required in the UK since 2008, with responsibility shared between UK and devolved administrations. The first adaptation strategies became operational across the UK in 2010 (Wales), 2013 (England and UK issues) and 2014 (Northern Ireland and Scotland). A second round of adaptation programmes are under development, with the England and UK NAP expected in the second half of 2018). Reports indicate positive progress towards implementing adaptation actions, suggesting adequate funding resources are available.

Adaptation strategies

The first UK NAP¹ (concerning England and UK policy issues) was published in 2013; and programmes concerning the devolved administration were published in 2010 (Climate Change Strategy for Wales, which covers adaptation)² and 2014 (Northern Ireland Climate Change Adaptation Programme; Scottish Climate Change Adaptation Programme)³.⁴ Together, the programmes cover the complete territories of the UK. There is no further regional sub-division of UK governance before the level of cities or local authorities.

Adaptation action plans

The respective adaptation programmes specify the policies and actions to be implemented to meet adaptation objectives. These correspond to key sectors (e.g. buildings; infrastructure; communities; agriculture; natural environment; and business). Annual progress reports indicate that 51% of the 370 actions included in the UK NAP were complete in 2017 and 35% were on track for completion. Progress reported by the devolved administrations varies. Scotland reported that almost 100% of actions are on track for completion; progress in Northern Ireland and Wales is under review.

Step A: Preparing the ground for adaptation

¹ Her Majesty's Government, 2013, The National Adaptation Programme: Making the country resilient to a changing climate, paragraph 25. URL: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/209866/pb13942-nap-20130701.pdf

² Welsh Assembly Government, 2010, Climate Change Strategy for Wales. URL: <http://gov.wales/docs/desh/publications/101006ccstratfinalen.pdf>

³ Department of Agriculture, Environment and Rural Affairs (DAERA), 2014, Northern Ireland Climate Change Adaptation Programme (NICCAP). URL: <https://www.daera-ni.gov.uk/sites/default/files/publications/daera/Northern%20Ireland%20Climate%20Change%20Adaptation%20Programme.pdf>

⁴ Scottish Government, 2014, Climate Ready Scotland Scottish Climate Change Adaptation Programme. URL: <http://www.gov.scot/Publications/2014/05/4669>

我國氣候變遷調適計畫 自我評估與報告討論

◆填表單位、計畫名稱、計畫編號

1. 預期面臨之氣候風險☺
2. 氣候風險與可能造成衝擊的因果關係☺
3. 是否曾就危害或衝擊進行風險評估☹
 - ① 氣候情境之依據☹
4. 對應氣候危害之主要措施或方法☺
 - ① 風險管理之手段☹
 - ② 追蹤量化之改善標的或統計指標☹
 - ③ 完成目標的時間點或階段成果☹
 - ④ 能力建構或法規調適之標的☹
5. 規畫過程面臨的困難、挑戰或障礙☺
6. 行動計畫執行面臨的困難、挑戰或障礙☺
7. 預期解決風險之程度☹
8. 計畫機關與氣候變遷之關聯性☺

環保署國家氣候變遷調適 成果報告審查討論會議



國家氣候變遷調適行動方案
農業生產及生物多樣性領域執行成果

行政院農業委員會
109年9月24日

重要執行成果及效益

四、海洋環境監測(1/2)

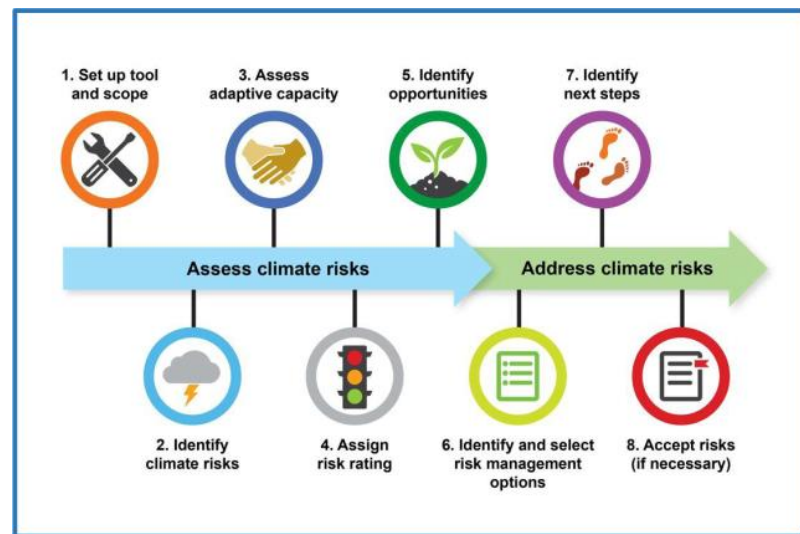
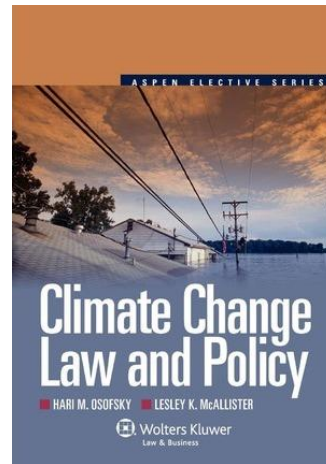
- (二) 溶氧量、鎘、鉛、汞、銅、鋅、氨氮等7項水質項目達成率為99.8%，甲、乙類海域環境水質監測站的pH值7.5-8.5之間的達成率，分別達100.0%及98.4%。
- (三) 19處漁港水體水質監測：以PH值、溶氧量、鉛、銅、汞、鋅、鎘等7鎘項目計算達成率，總達成率為97.5%，其中PH值達成率為97.4%、溶氧量達成率為84.9%，其他部分包括重金屬(鎘、銅、鉛、鋅與汞)等項目達成率均100.0%。



我國氣候變遷調適計畫面臨之議題

- ◆ **指引文件**：缺乏國家與地方層級的氣候變遷調適指引文件
- ◆ **未來預估**：國家公告與更新之未來氣候情境之應用與推廣
- ◆ **基本理解**：對於氣候變遷調適的理解有待一致化
- ◆ **關鍵步驟**：基本步驟的釐清與基本要素的界定
- ◆ **風險管理**：氣候脆弱度與風險的明確界定
- ◆ **財務機制**：經費來源與財務結構
- ◆ **監測評估**：監測與評估機制

CLIMATE CHANGE ADAPTATION GUIDELINES



評量氣候變遷調適的關鍵建議(3+2)

◆理解氣候變遷調適的本質

- 氣候變遷調適計畫需回應「因應氣候變遷的調適作為」(因應氣候變化的作為的變化)

◆必須進行風險評估

- 需進行風險評估與管理

◆與常規型計畫區隔

- 需與未考慮氣候變遷之原必要進行之計畫有明確的區隔

◆需有明確經費來源

- 需有明確的經費來源與財務計畫

◆連結國際趨勢和SDGs

- 需與永續發展目標(SDGs)連結

