



# 世界の「水」と「気候変動」の未来シナリオ Future Scenario on water and climate in the world



Apollo 17,  
Dec. 1973

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**UNEPフォーラム2019、2019年5月21日(火)、国連大学ウ・タント国際会議場、東京、日本  
UNEP Forum 2019, May 21, 2019, U Thant Hall, UNU, Tokyo, Japan**

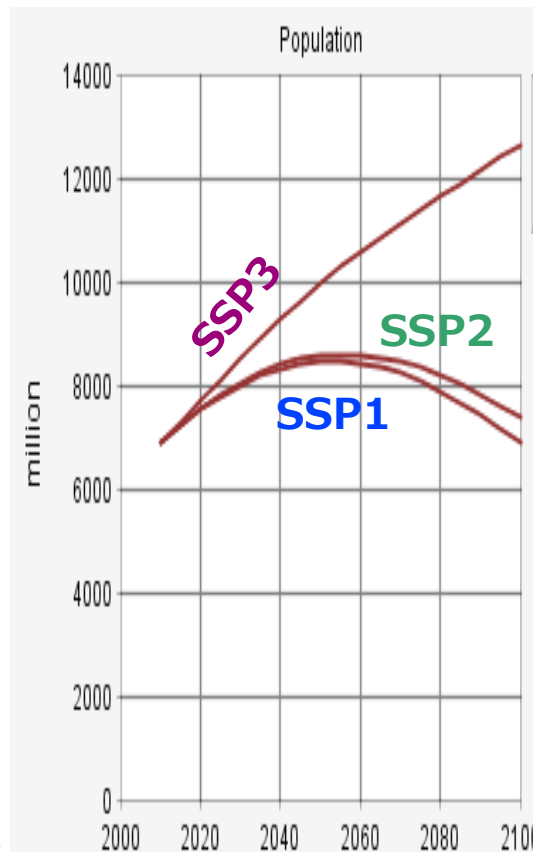
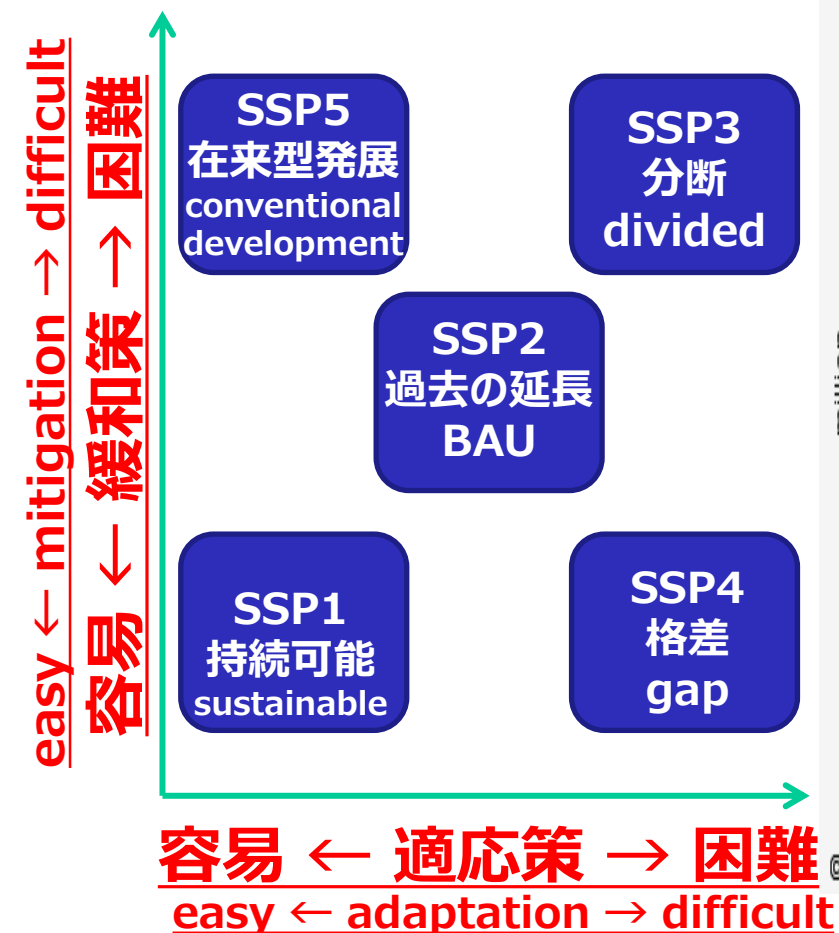


# 気候変動影響・対策の効果推計に必要な社会シナリオ

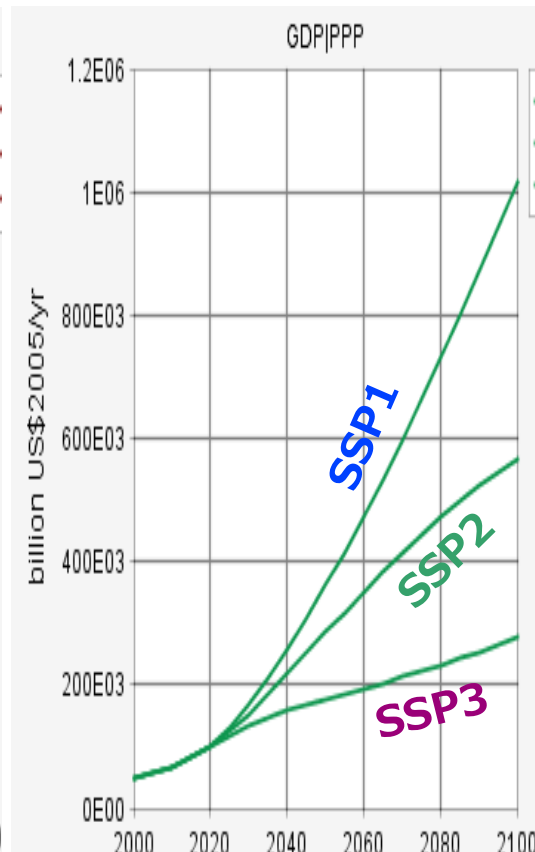
## social scenario to estimate impacts and effectiveness

人口や社会経済的發展度合い、技術の進歩と普及次第で気候変動影響や対策の効果は大きく異なる

Impacts of climate change and effectiveness of adaptation depend on social scenario



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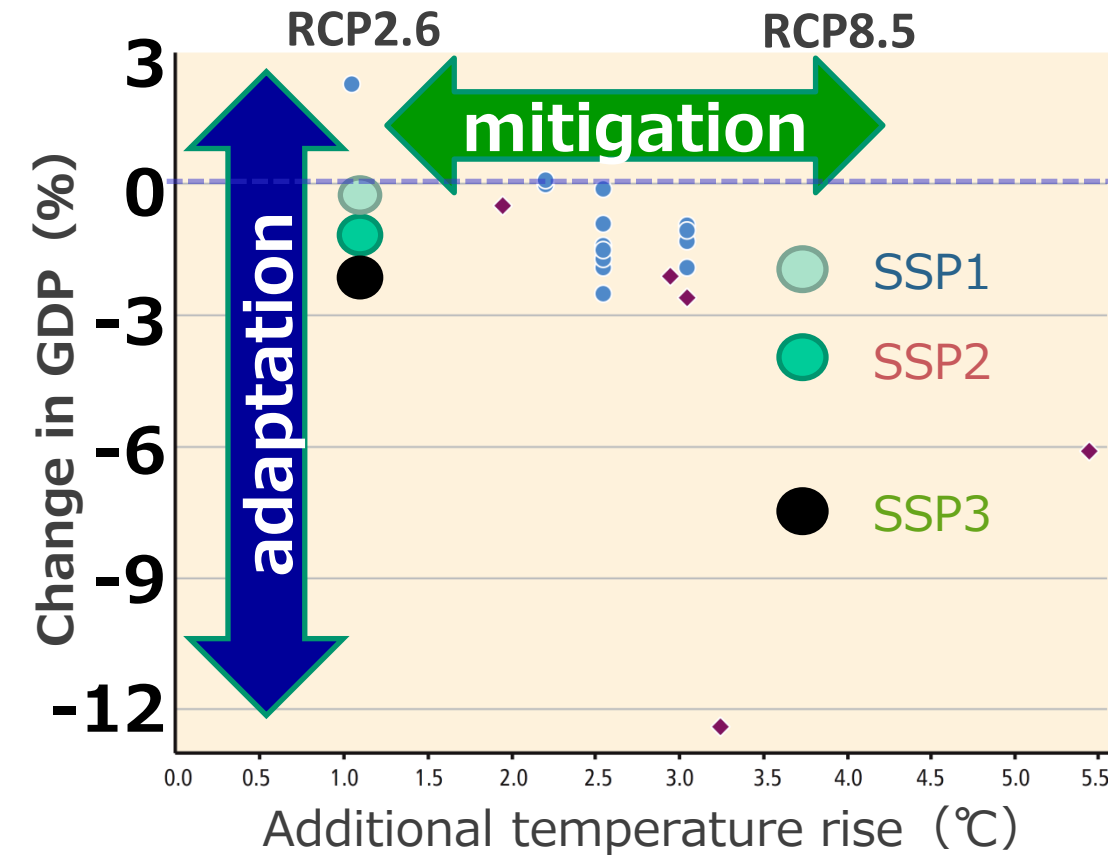


# Impacts and Adaptation

💧 **Around 2080 under RCP8.5-SSP3...**

- ❄️ **Global mean Temp: approx. +3.7 °C**
- ❄️ **Additional economic damage: 3.58 % GDP**
  - energy demand, labor, famine, food, hydro only.
- ❄️ **Flood damage ≐ +3.28% GDP ≐ +416 tril. ¥**
  - Adaptation cost ≐ +16 tril. Yen/y
- ❄️ **Yield decline of maize ≐ 16.8 tril. Yen/y**
  - Adaptation cost ≐ 19.5 tril. Yen/year
  - Food shortage ≐ 1.68 bill. ≐ 18% global population
    - ▣ price ↑, harvest and irrigated areas ↑, diet change, ...
- ❄️ **Potential coastal inundation ≐ 0.7 tril. Yen/y**
  - Adaptation cost ≐ 0.3 tril. Yen/y

# Temperature rise and economic damage



From "S-14" project:

- Energy demand, labor efficiency, famine, food production, hydro power are considered.
- Impacts for fluvial and coastal floods and ecosystems will be considered.

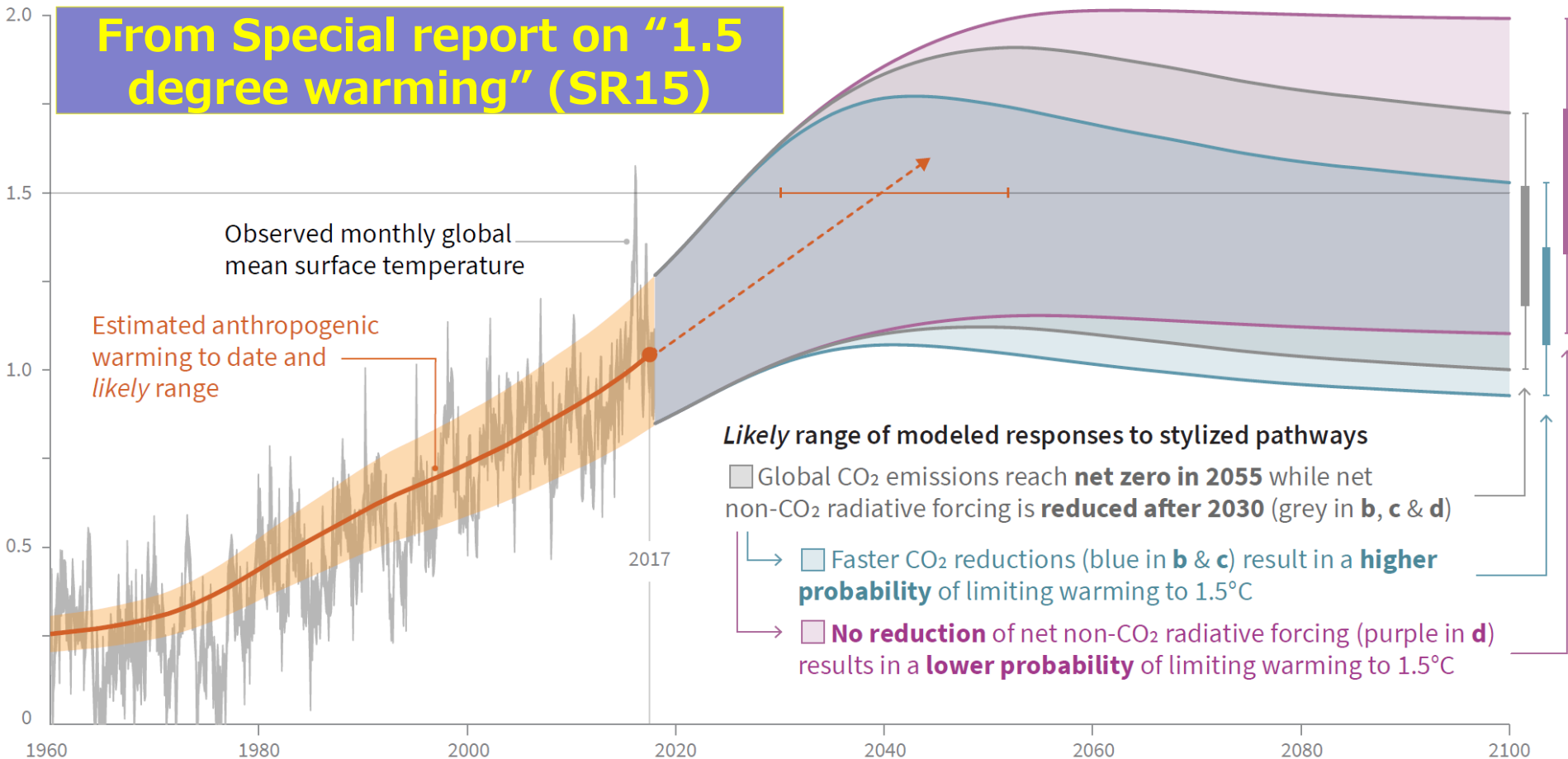
● Before AR4

◆ After AR4

- RCP8.5 should better be avoided but the difference between 2°C and 1.5°C targets was unclear.
- Socioeconomic pathway also matters a lot for climate change impacts on GDP.

# a) Observed global temperature change and modeled responses to stylized anthropogenic emission and forcing pathways

Global warming relative to 1850-1900 (°C)



**Human activities are estimated to have caused approximately 1.0°C of global warming above pre-industrial levels, with a likely range of 0.8°C to 1.2°C. Global warming is likely to reach 1.5°C between 2030 and 2052 if it continues to increase at the current rate. (high confidence)**

# Major messages from SR15

- 💧 An additional 0.5°C of warming compared to present is associated with further detectable changes including warming of extreme temperatures in many regions, increases in frequency, intensity, and/or amount of heavy precipitation in several regions, and an increase in intensity or frequency of droughts in some regions.
- 💧 At 1.5°C compared to 2°C:
  - ❄️ global mean sea level rise is projected to be around 0.1 m
  - ❄️ Lower risks of ocean acidification, decreases in ocean oxygen levels, health, livelihoods, food security, water supply, human security, and economic growth
  - ❄️ Most adaptation needs will be lower
  - ❄️ The avoided climate change impacts on sustainable development, eradication of poverty and reducing inequalities would be greater
- 💧 There are limits to adaptation and adaptive capacity for some human and natural systems at global warming of 1.5°C
- 💧 Under the Paris Agreement: global GHG emissions in 2030  
➔ 52–58 Gt CO<sub>2</sub>eq yr<sup>-1</sup> ➔  $\Delta T > 1.5^\circ\text{C}$ 
  - ❄️ ⇔ global CO<sub>2</sub> emissions start to decline well before 2030

# Social cost of 1 billion t of CO<sub>2</sub>

💧 1.3~2.0 mill.人・Y DALY  $\doteq$  0.34~0.52 bill.Yen

❄️ 1DALY  $\doteq$  2.60 mill. Yen

💧 1~3 EINES  $\doteq$  1.3~4 trill. Yen

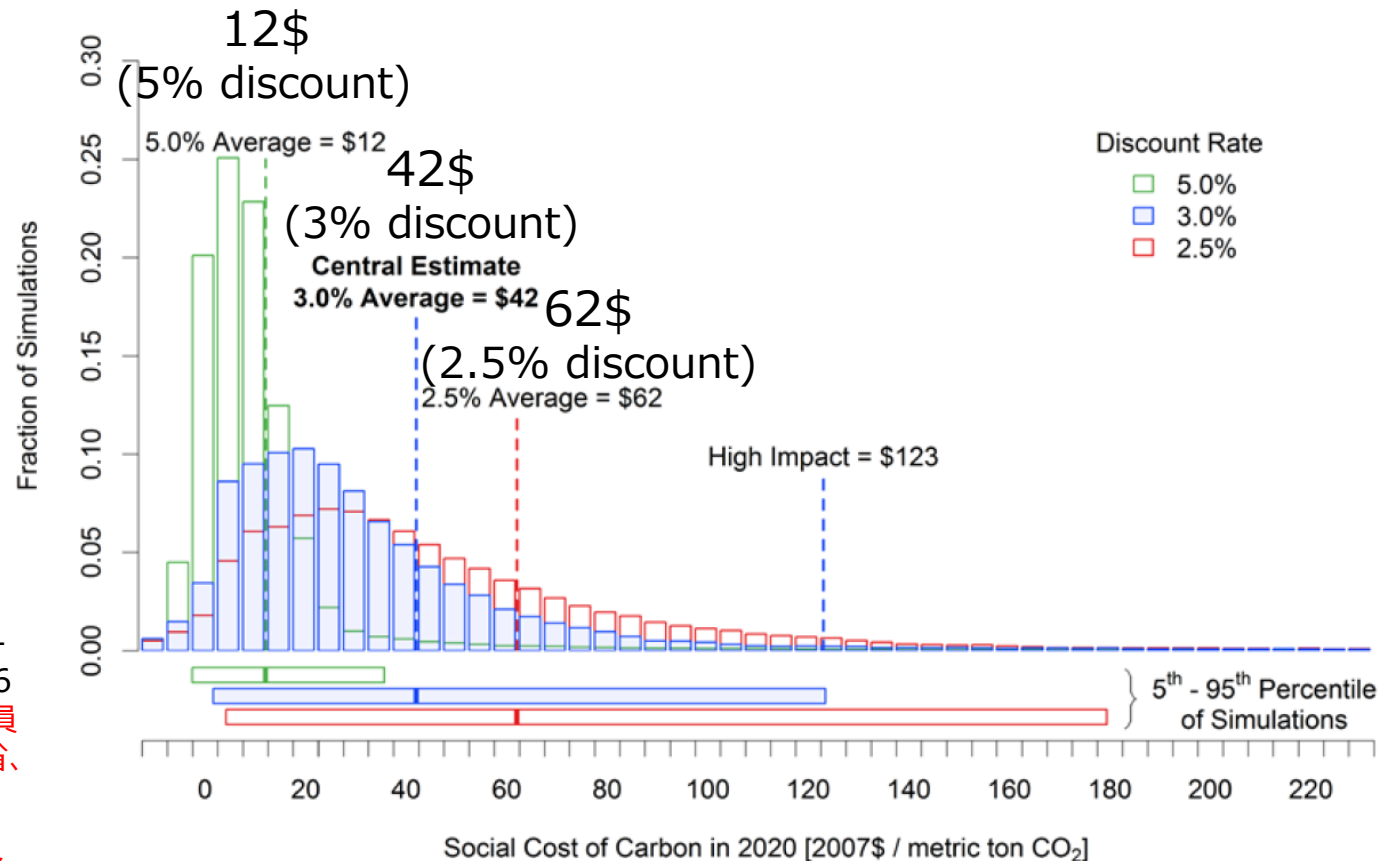
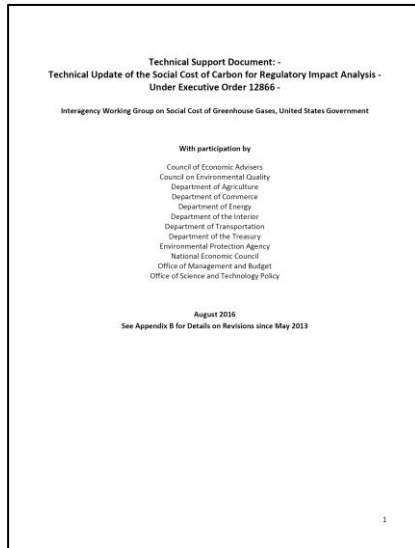
❄️ 1 EINES  $\doteq$  1.3 trill. Yen

💧 ➔ ~ 5~9 trill. Yen of global damage

	単位	CO <sub>2</sub>
DF Human Health	DALY/ton	$1.3 - 2.2 \times 10^{-3}$
DF Biodiversity	EINES/ton	$9.3 \times 10^{-10} - 3.0 \times 10^{-9}$
WF2 Human Health (global mean) (LIME3)	US\$/DALY	2.3E+4
WF2 Biodiversity (global mean) (LIME3)	US\$/EINES	1.1E+10
IF2 Global Mean	US\$/ton	40 - 84

Social cost of 1t CO<sub>2</sub>  $\doteq$  5K~10K Yen

# SCC in US under Obama Presidency



Technical Support Document  
– Technical Update of the  
Social Cost of Carbon for  
Regulatory Impact Analysis –  
Under Executive Order 12866  
合衆国政府、大統領経済諮問委員  
会、環境基準諮問委員会、農務省、  
商務省、エネルギー省、内務省、運  
輸省、財務省、環境保護庁、国家  
経済会議、行政予算管理局、科学  
技術政策室

- Based on 3 models (DICE, FUND, PAGE)
- 3 sets of discount rate with Monte Carlo method



# SCC in US under Trump Presidency (2017)

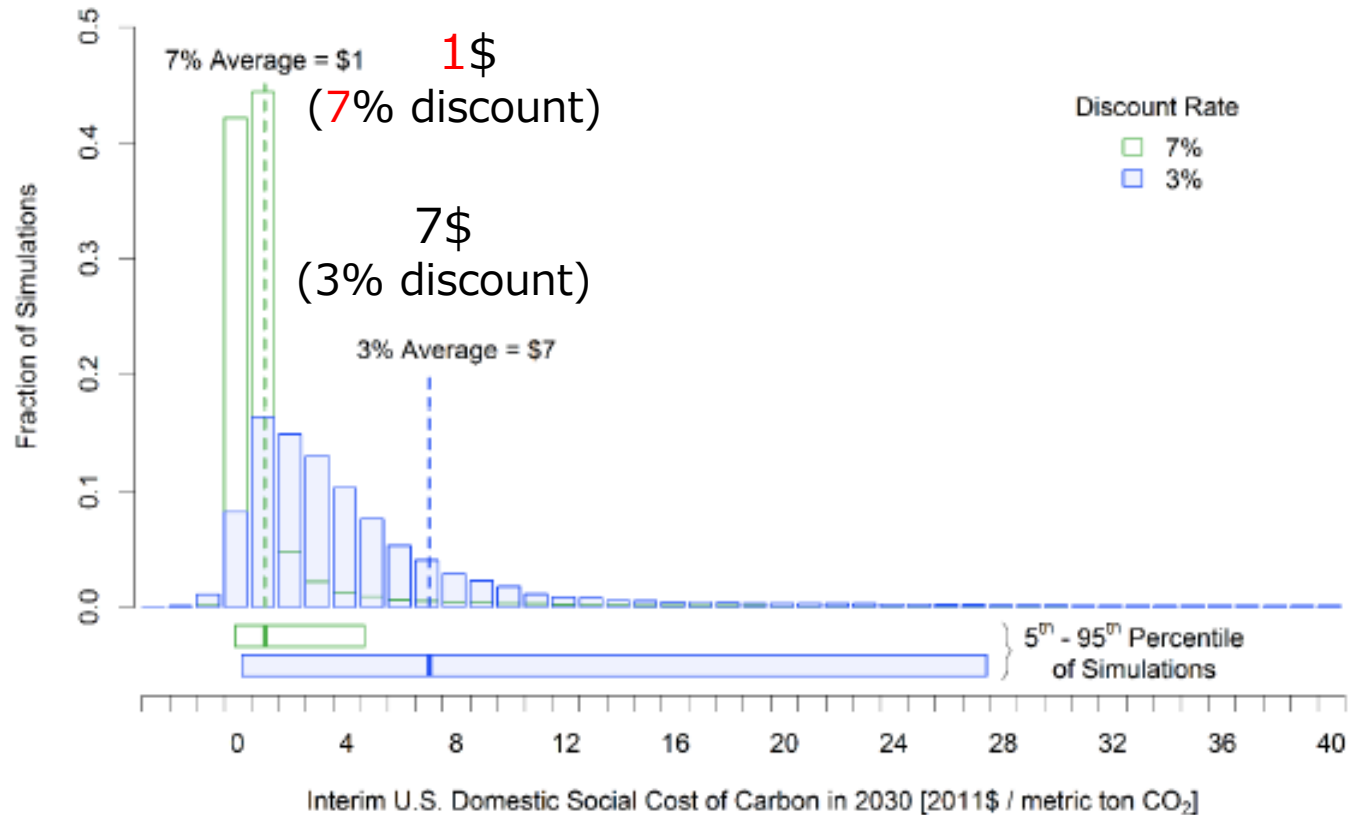
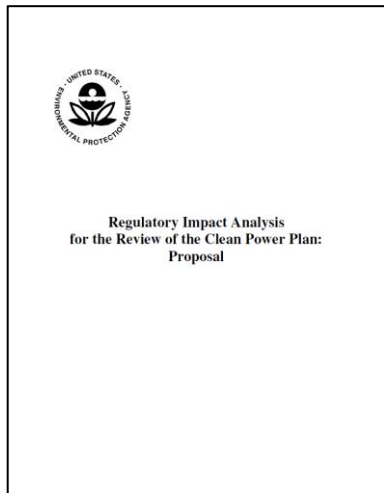
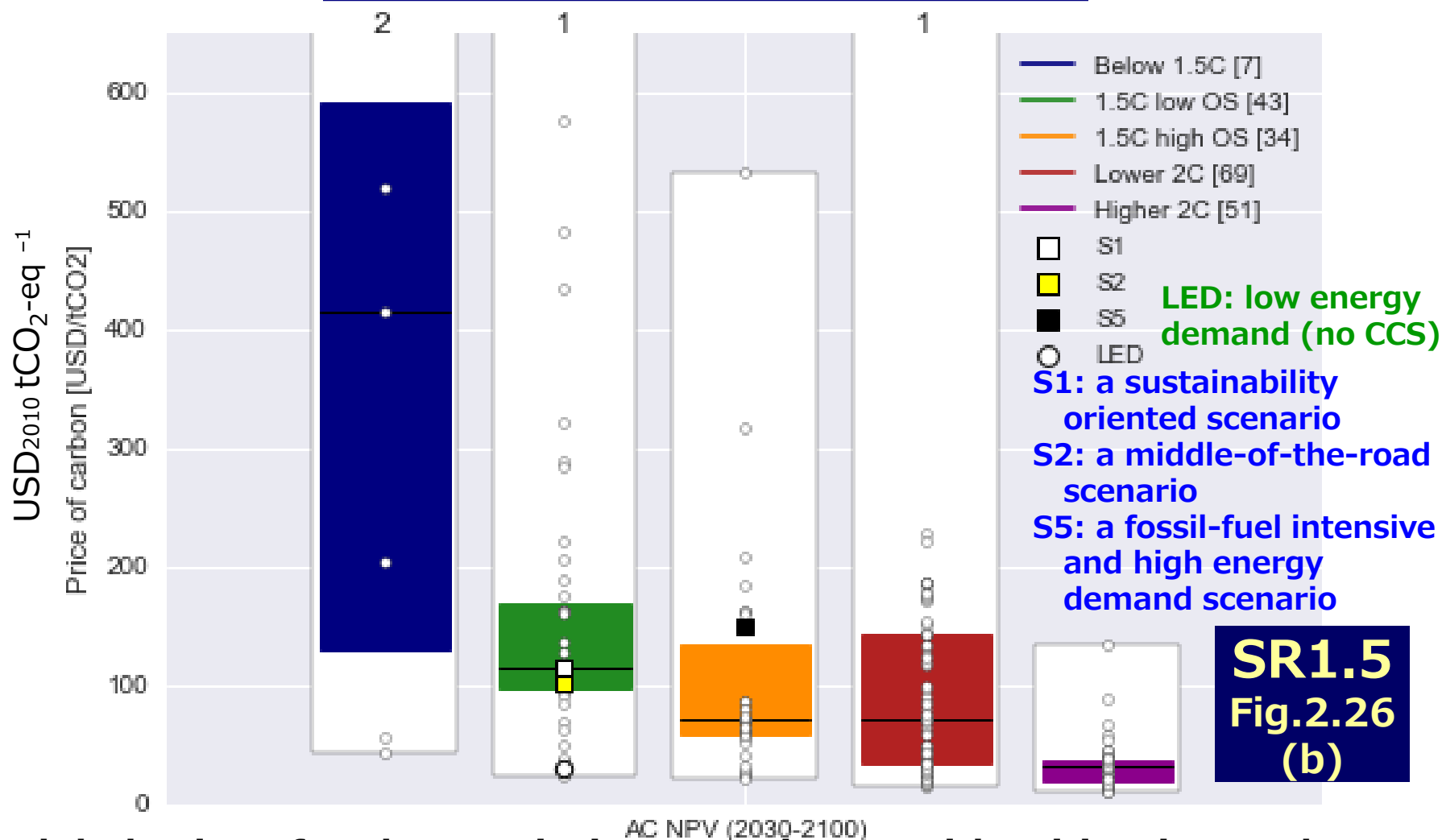


Figure C-1. Frequency Distribution of Interim Domestic SC-CO<sub>2</sub> Estimates for 2030 (in 2011\$ per metric ton CO<sub>2</sub>)

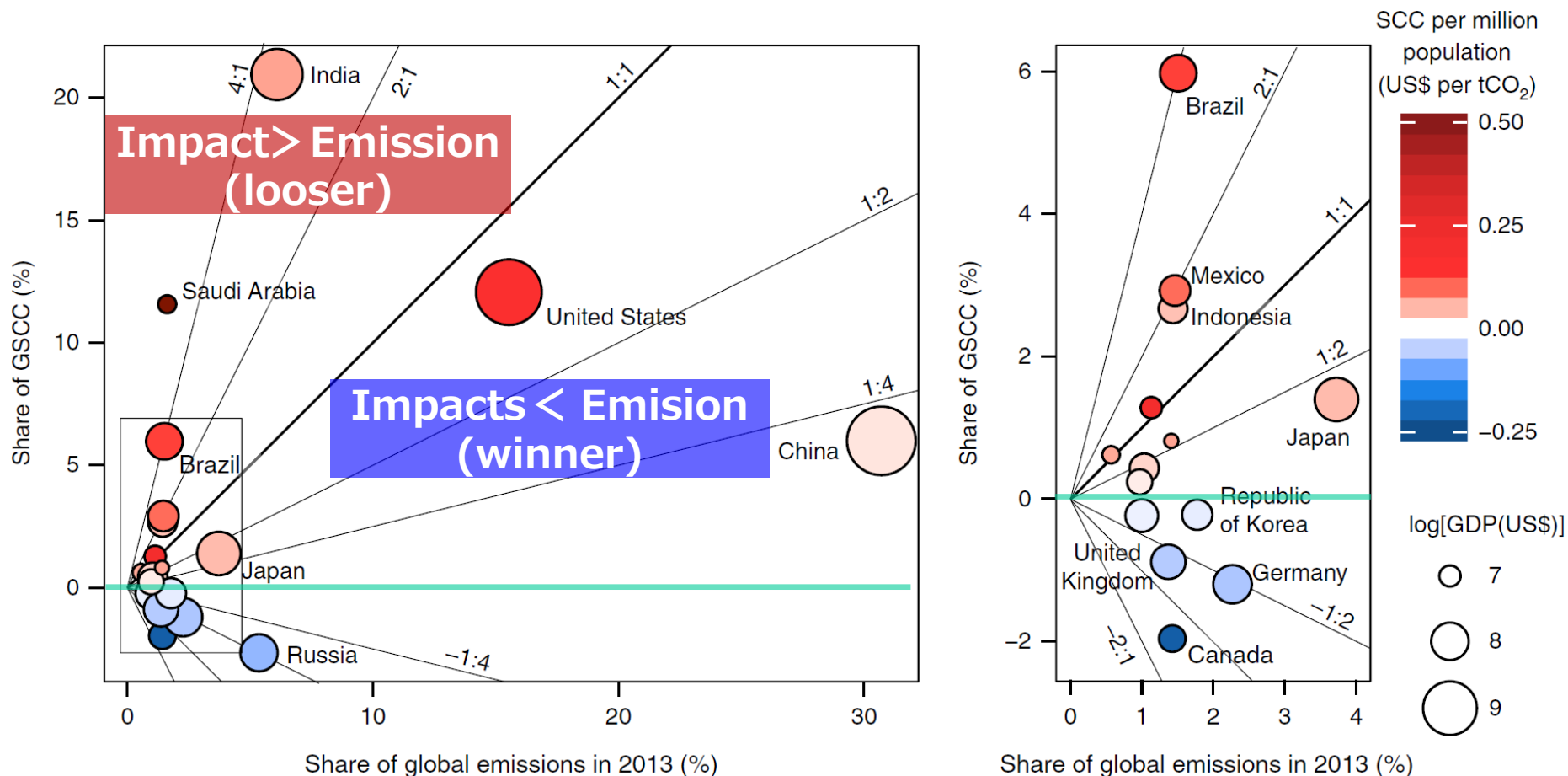
- 💧 Impacts within US only
- 💧 Higher discount rate (3~7%)

# Cost of mitigation

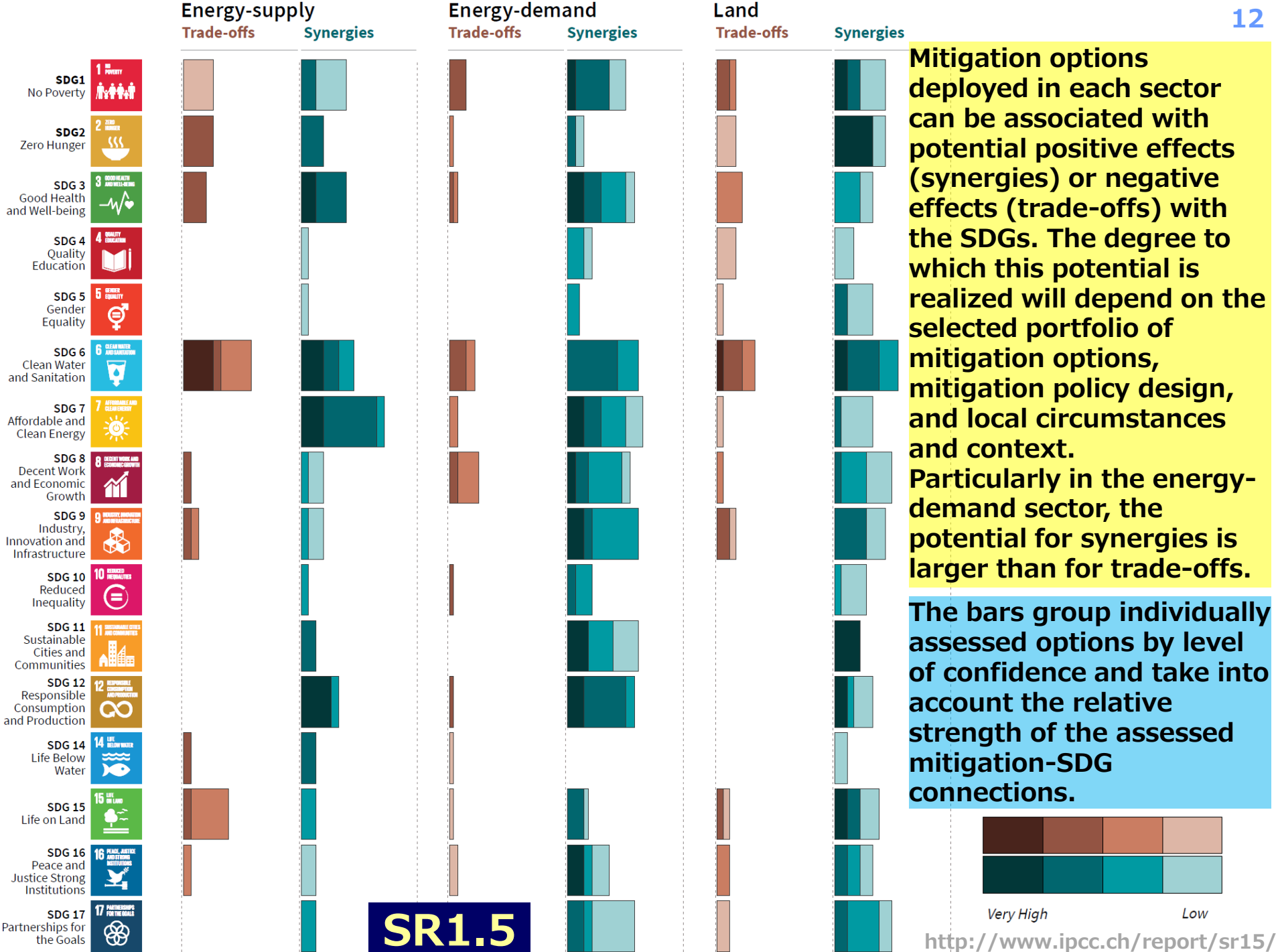


Global price of carbon emissions consistent with mitigation pathways. Average price of carbon (2030-2100) discounted at a 5% discount rate. AC: Annually compounded. NPV: Net present value. Median values in floating black line. The number of pathways included in boxplots is indicated in the legend. Number of pathways outside the figure range is noted at the top.

# Shares of CO<sub>2</sub> emission and global SCC



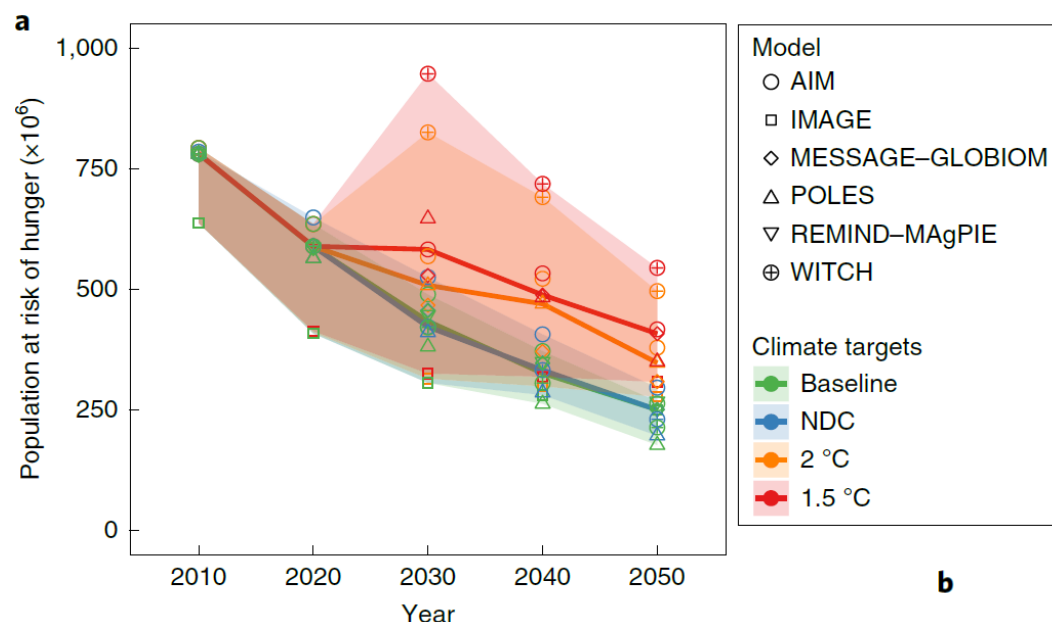
National SCC are with 2% discount rate with SSP2-RCP6.0. Colors are SCC/person, sizes reflect the *log*GDP. The box in the left panel indicates the bounds of the detail shown in the right panel.



# Climate change and SDGs

- 💧 **Mitigation options consistent with 1.5°C pathways are associated with multiple synergies and trade-offs across the SDGs.**
- 💧 **Adaptation options specific to national contexts will have benefits for SD and poverty reduction with warming of 1.5°C, although trade-offs are possible.**
- 💧 **Limiting the risks from global warming of 1.5°C implies system transitions that can be enabled by an increase of adaptation and mitigation investments, policy instruments, the acceleration of technological innovation and behaviour changes**
  - ❄️ **Education, information, and community approaches, including those that are informed by indigenous knowledge and local knowledge, can accelerate the wide scale behaviour changes consistent with adapting to and limiting global warming to 1.5°C**

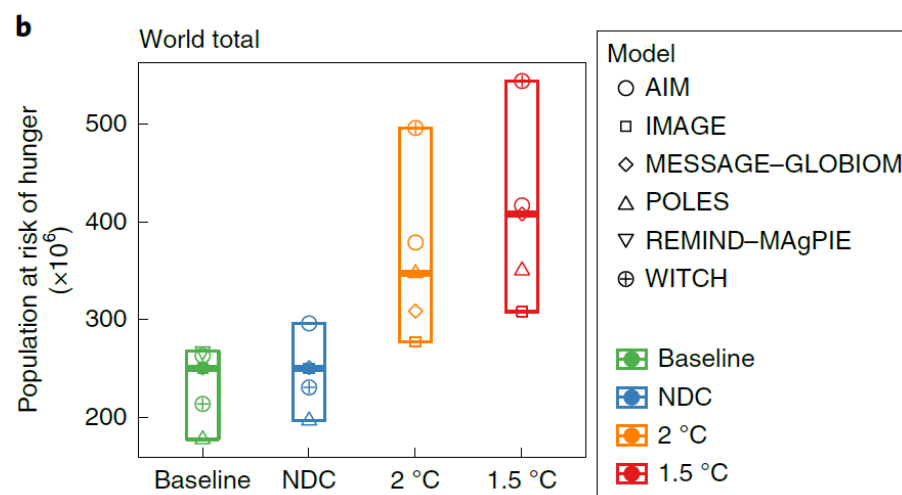
# Potential negative trade-offs between food security and climate mitigation



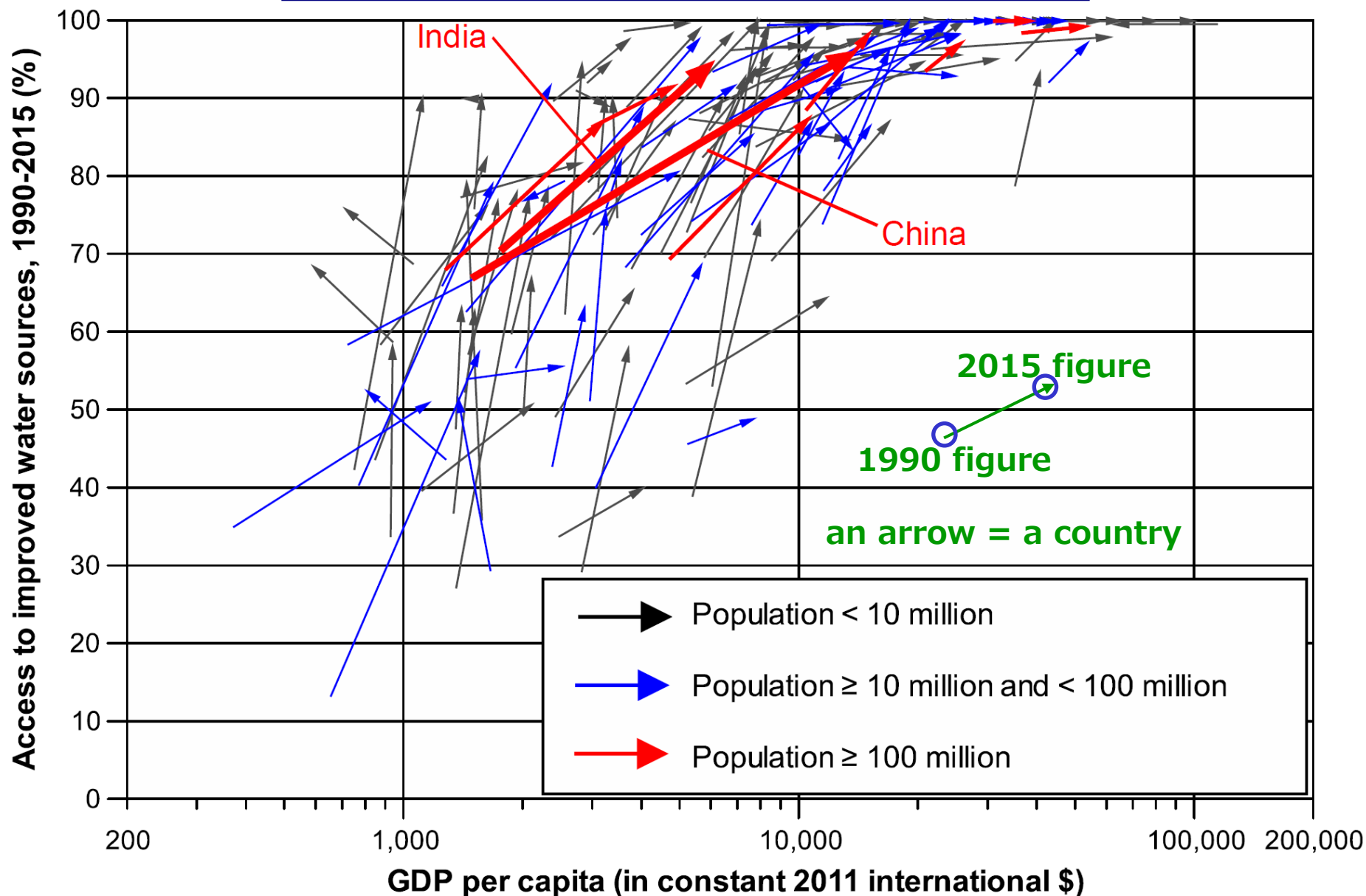
飢餓の危険性がある世界人口(百万人)。ベースライン、各国が定めた貢献(NDC)、2°C目標、1.5°C目標達成の緩和策を実現する社会経済シナリオに対応。

↓ Population at risk of hunger in 2050 under the various scenarios.

↑ The population at risk of hunger under the baseline and mitigation scenarios. The solid line indicates median value across the models and the shaded area represents upper and lower ranges of the model estimates for each scenario.



# GDP and Water Access



# Remarks

💧 **Transformative change is necessary to achieve SDGs and the 1.5°C target.**

❄️ **Side effect of radical change? 急激な変化の副作用は?**

❄️ **“change must proceed slowly”** (Wealth of Nations, Adam Smith; 国富論、アダム・スミス)

➤ **“man of humanity and benevolence” who uses reason and persuasion and “the man of system” who imposes his own “ideal plan of government” on others by force:**

❑ **The man of system is apt to be very wise in his own conceit; and is often so enamoured with the supposed beauty of his own ideal plan of government, that he cannot suffer the smallest deviation from any part of it.**

💧 **No one will be left behind (誰一人取り残さない)**

❄️ ⇔ **the greatest happiness of the greatest number (最大多数の最大幸福)**

❄️ **What is the ultimate goal? (究極の目標は?)**

❄️ **Well-being? Of what? (幸福度? 何の?)**