An Overview of ICA-RUS and Some Personal Views on Global Climate Risk Management

ICA-RUS/CCRP-PJ2 International Workshop

ICA-RUS
Integrated Climate Assessment - Risks, Uncertainties and Society

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Integrated Climate Assessment - Risks, Uncertainties and Society

- “Integrated Climate Assessment - Risks, Uncertainties and Society”
- Strategic project #10 (S-10), Environmental Research and Technology Development Fund, Ministry of the Environment
- FY 2012～2016
- Total budget ~300M JPY/yr (3M USD/yr)
- # of members=44+PDs

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Integrated Climate Assessment - Risks, Uncertainties and Society

Icarus in Greek myth

He would fall if he flies either too high or too low.
➡ "Risk Trade-Off"

Current Situation of Climate Change Issue

UNFCCC COP16, Cancun Accord :

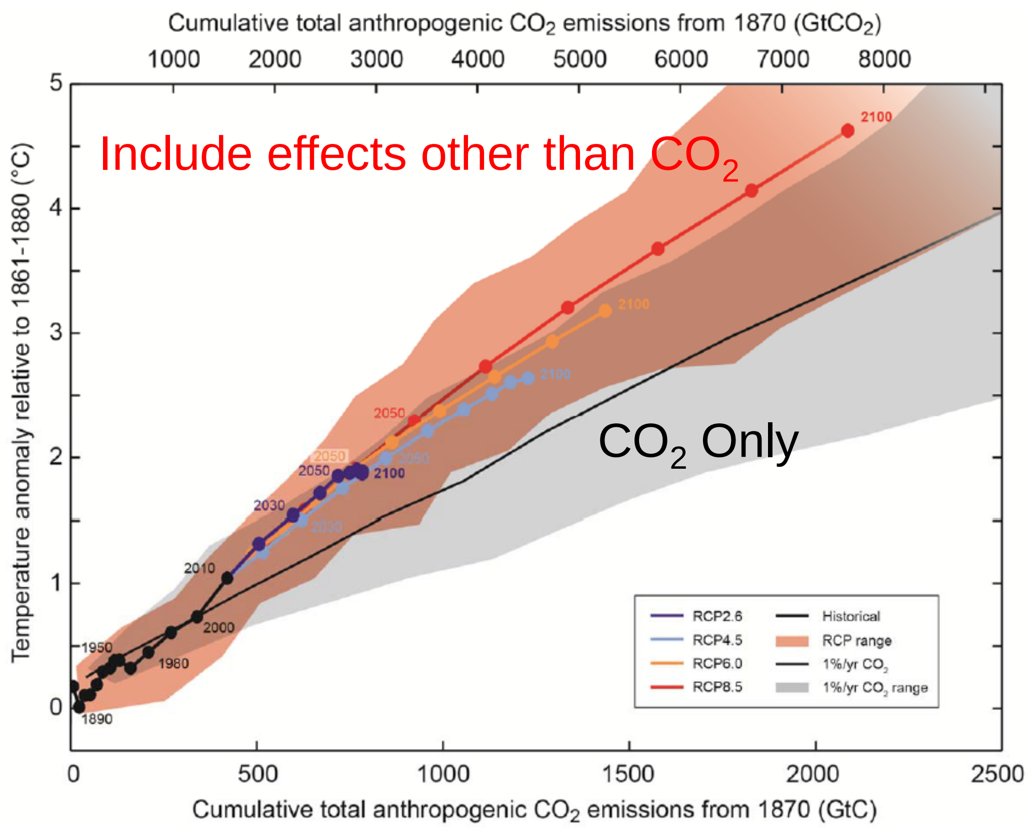
‘2 degree’ temperature target agreed

(‘1.5 degree’ also mentioned)

However, …

- Gap between ‘2 degree’ and bottom up targets from each country
- Decision of targets involves value judgment
- Scientific uncertainty between temperature and emission targets
- Linkages between climate policy and water/food security etc.

Global mean temperature rise is proportional to cumulative amount of CO_2 emissions →Limit of cumulative emissions is determined by limit of temperature rise



If we consider effects from emissions other than CO_2 and try to control the rise in global average temperature below 2℃ above preindustrial levels, upper limit amount of cumulative emissions are follows;

>33% → 900 GtC

>50% → 820 GtC

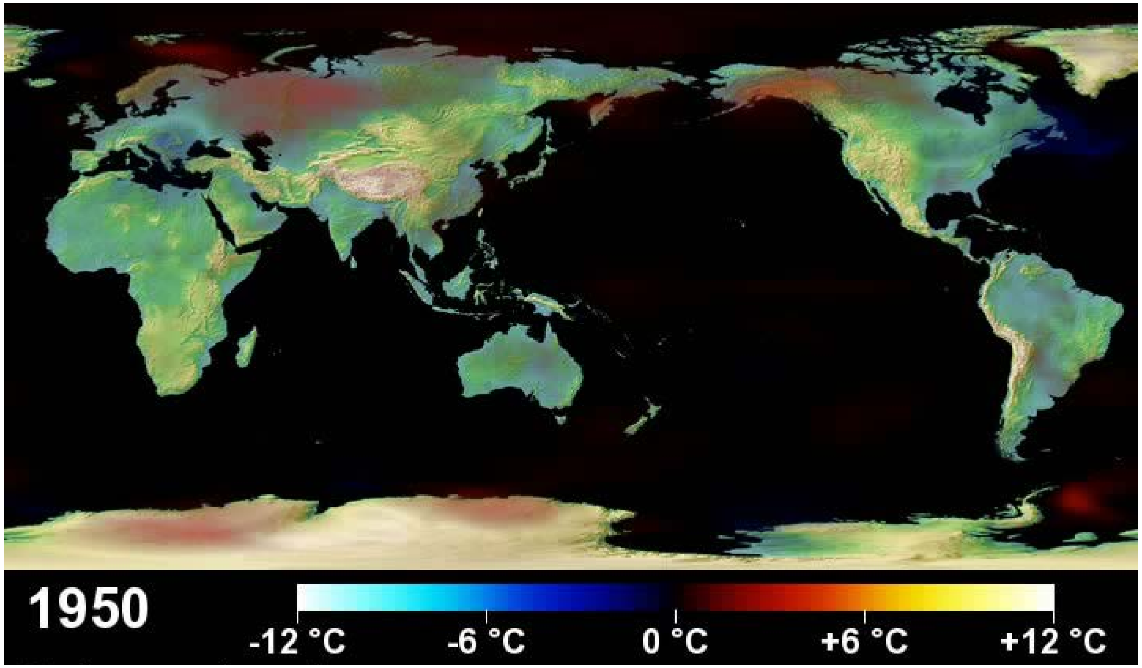
>66% → 790 GtC

About 515 GtC has already been emitted by 2011.

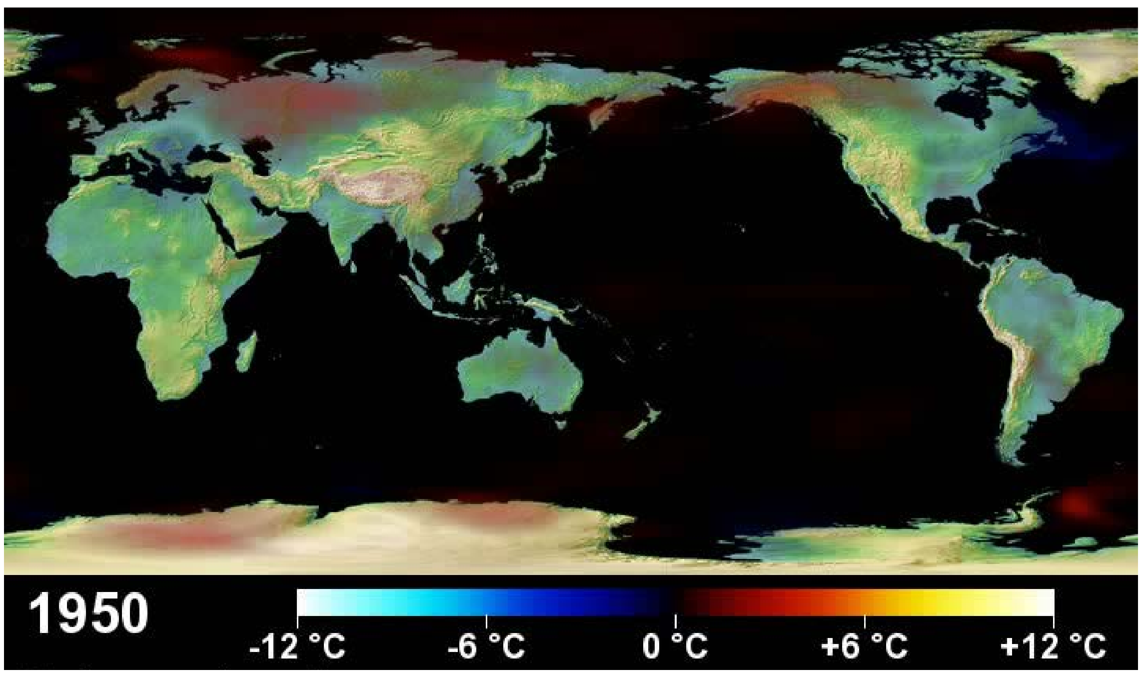
(IPCC WG1 AR5)

Simulation of Temperature Change

By MIROC5 Climate Model
(AORI/NIES/JAMSTEC/MEXT)

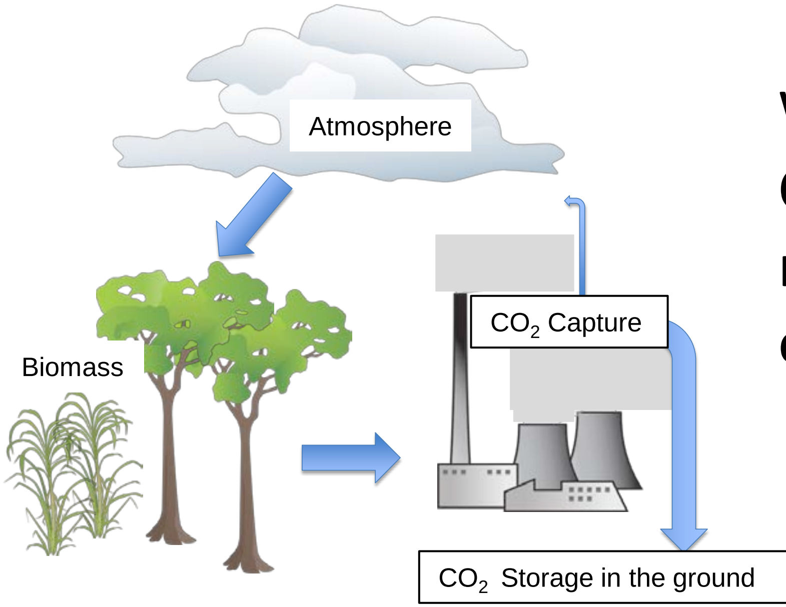


Scenario with no action
(RCP8.5)



Scenario to achieve
'below 2℃'
(RCP2.6)

Can we use Biomass CCS, 'the Trump'？



We need a technology to absorb CO_2 from atmosphere in order to reduce net anthropogenic emissions to almost zero.

→Biomass CCS

（CCS＝CO_2 Capture and Storage）

- Large scale cultivation of crops for fuel competes against production of food over the land.
- New land development accompanies carbon emission as well as destruction of ecosystem.
- Social acceptability of CCS itself is unknown in the first place.

“Grand Transformation” is needed?

“In terms of its scale and impact, the transformation towards sustainability is comparable with the two great revolutions which have crucially shaped world history: the Neolithic Revolution (the diffusion of arable farming and animal husbandry) and the Industrial Revolution (the transition from an agrarian to an industrial society).”

(WBGU Factsheet #4/2011)

But…, how seriously can we pursue it?

Comprehensive picture of climate-related risks

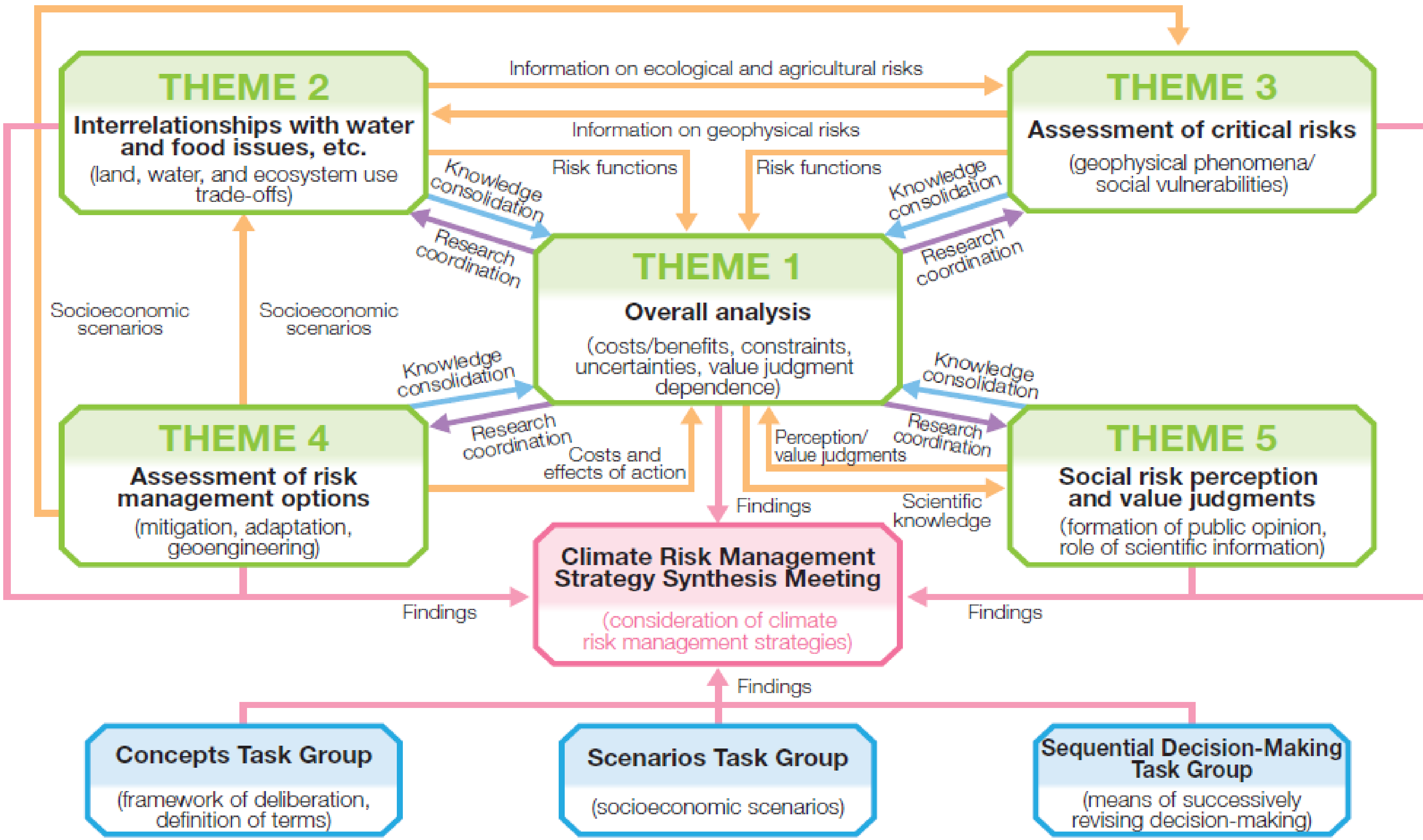
Adverse Impact of CC • Heat, flood, drought, sea level rise... • Risks on water, food, health, ecosystem… • Climate security? (refugee, conflict) • Large-scale discontinuities? • …	**Beneficial Impact of CC** • Health, agriculture, energy saving in cold regions • Northern Sea Route • …
Adverse effect of C policy • *Economic cost* • Technological risks (e.g., nuclear) • Bioenergy-food conflict • Risks due to radical socio-economic changes • …	**Benefit of C Policy** • *Mitigation of/adaptation to CC* • Energy saving • Energy security • Reduction of air pollution • Business opportunities • …

Risks/opportunities are different for different countries, regions, generations and other social attributes.

Risk Management Perspective

- Explicit consideration of uncertainties (‘Decision making under uncertainty’).
- Based on best available (comprehensive and unbiased) scientific information (‘Informed decision making’).
- Monitor future developments of circumstances, effect of the options taken and scientific findings. Revise framing of the problem and decisions according to their changes iteratively (‘Adaptive decision making’).
- Consider any event that could happen and any option that could be used (‘Thinking unthinkables’).
- Scientific rationality alone cannot derive the final decision (social judgment involved).

Structure of ICA-RUS



ICA-RUS

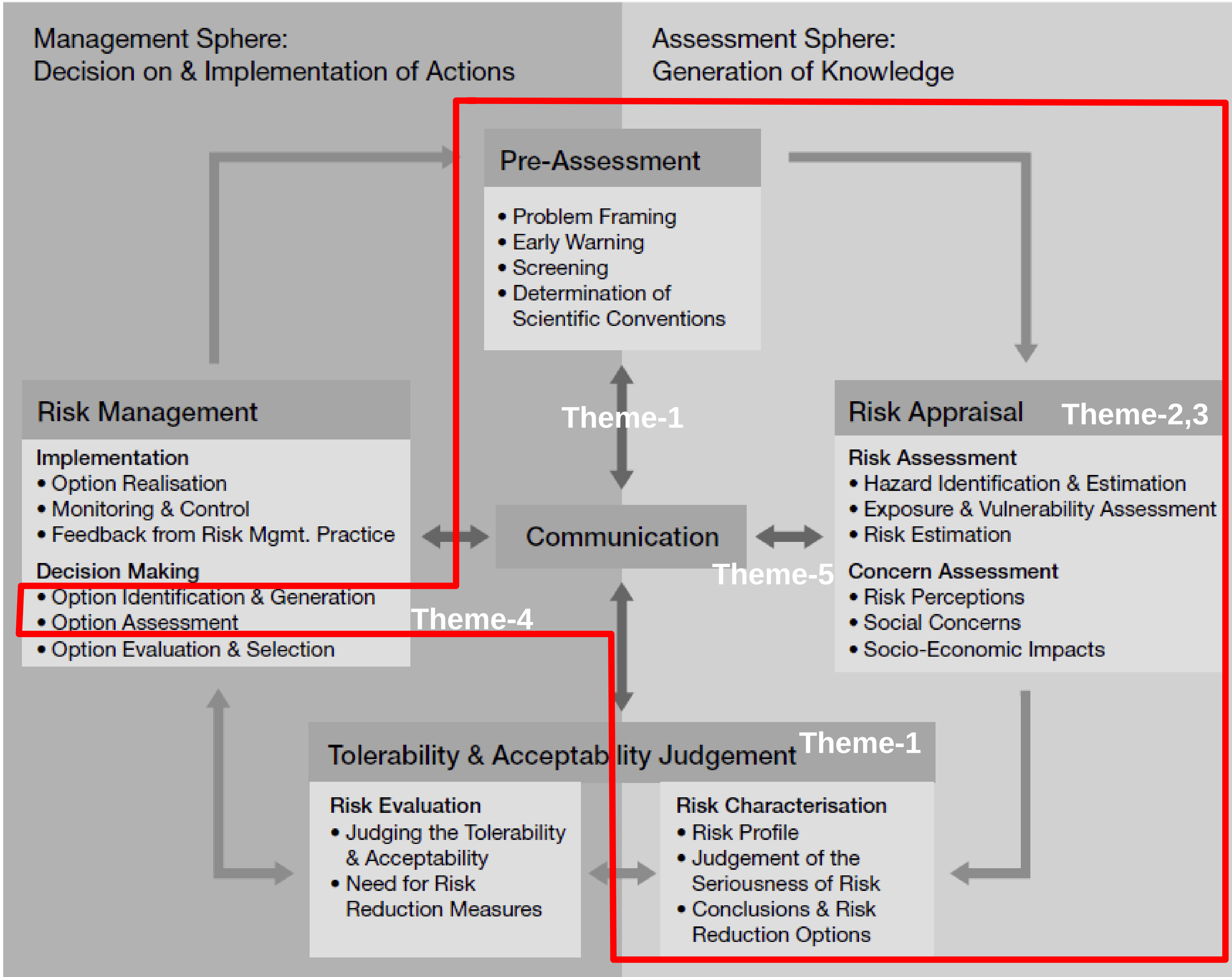
Integrated Climate Assessment - Risks, Uncertainties and Society

- Project Leader
  - Seita Emori (National Institute for Environmental Studies)
- Theme 1: Synthesis on global climate risk management strategies
  - Kiyoshi Takahashi (National Institute for Environmental Studies)
- Theme 2: Optimization of land, water and ecosystem uses for climate risk management
  - Yoshiki Yamagata (National Institute for Environmental Studies)
- Theme 3: Analysis of critical climate risks
  - Taikan Oki (University of Tokyo)
- Theme 4: Evaluation of climate risk management options under technological, social and economic uncertainties
  - Shunsuke Mori (Tokyo University of Science)
- Theme 5: Interactions between scientific and social rationalities in climate risk management
  - Yuko Fujigaki (University of Tokyo)

Target spatial/temporal scales

- Target spatial scale is ‘global’.
  - Decision making at the world level (‘humankind level’) is dealt with.
  - Spatial distribution of quantities on the globe will be explicitly analyzed especially in evaluation of climate risks and water/food problems.
- Target temporal scale is mainly ‘centennial’.
  - Decadal scale decision making to meet centennial scale target is well within the scope.
  - Risks occurring over millennial time scale (e.g., sea-level rise) that can affect the decision of centennial target are also dealt with.

Risk Governance Framework (IRGC, 2006)



Risk Inventory

- Related to the ‘risk (hazard) identification’ step of the risk governance framework, we have attempted to produce a comprehensive inventory of climate change risks (and opportunities).
- We have tried not to involve value judgment at this stage and tried to be inclusive.

First-level category	Second-level category	Third-level category	Specific examples of damage
Human life	Energy		Shortage of power station cooling water due to decline of river flow
			Electric power shortages due to damage to hydroelectric plants caused by flooding
			Destabilization of wind power generation due to changes in circulation fields
	Safety		Drowning due to storm surge flooding
			Drowning due to flooding
			Deaths by crushing caused by collapse of homes in landslides
	Health		Malnutrition due to food shortages
			Gastrointestinal diseases due to rise in air temperatures
			Heat-related deaths due to rise in air temperatures
	Economy and services		Flood damage to buildings
			Loss of buildings/houses destroyed or swept away by high tides
			Disruption of transport and community functions by snow
		Forestry	Changes in forest productivity and increased cost of adaptation
			Increased fire damage to planted forests
			Increased damage to planted forests caused by pests and disease
	Food	Food crops Cereals (rice, wheat, soybeans, maize, others) Livestock feed, vegetables, fruit, fruit trees, flowering plants, stem and root vegetables	Decline in cereal yields, production, and quality due to rise in air temperatures, droughts, flooding, etc.
			Change in land suitable for cultivation and growing periods due to rise in air temperatures and changed rainfall patterns, etc.
		Pasture, livestock production	Decline in pasture and livestock production due to rise in air temperatures, drought, flooding, etc.
			Decline in livestock production efficiency due to increase in pest and disease damage
		Wild fisheries, aquaculture	Change in marine yields due to changes in marine fish habitats
			Negative impact on shellfish production due to rise in sea levels in low-lying coastal regions
			Damage to fishery facilities due to extreme phenomena
		Food production in general	Destabilization of food production due to increased frequency of abnormal weather with climate changes
	Freshwater resources	Surface water, groundwater	Change in water-stressed population due to changes in river flow and water intake
			Decline in summer water resources due to melting of snow and ice
			Groundwater depletion in irrigated land in arid and semi-arid areas
		Water quality	Changes in quality of river water
			Changes in salination of groundwater in coastal areas due to sea-level rise
			Deterioration of water quality due to overgrowth of algae, etc. in rivers, wetlands, and reservoirs
Ecosystems and biodiversity		Northern forest	Reduction of soil organic matter and carbon emission due to melting of tundra
			Decrease/decline of tundra ecosystems due to northward movement of northern tree line
			Increase/intensification of forest fires due to drying
		Temperate forest	Increase in severe pest outbreaks due to rise in winter temperatures
			Damage to fauna and flora due to heat waves
			Loss of diversity due to increase in epidemics (chytridiales, etc.)
		Tropical forest	Decline and death of forests due to drying
			Intensification of windfalls and leaf litter due to tropical cyclone
		Grasslands, desert	The shrub invasion of grasslands and decline of biodiversity due to increase in atmospheric CO_2
			Increase in frequency and intensity of fires due to drying
			Increase in wind erosion of soil due to decline of plant cover through drying
		Low-lying land, shore regions	Submergence of low-lying marshland and mangrove forests due to sea level rise
		Uplands	Adverse impact of wintering of plants and animals due to decline of winter snow
		Inland water	Impact on ecosystems of changes in river flow and intake
			Impact on ecosystems of temperature rise and acidification of wetlands
		Oceans	Increase in volume of oxygen-deficient water due to decline of oxygen solubility
			Change in production and dissolution of calcium carbonate due to ocean acidification
			Change in marine biogeography due to rise in water temperature
		Fauna	Decline of migratory bird nesting grounds due to decline in marshlands
			Increase in animal heatstroke due to temperature rise
		Insects	Expansion of pest habitats due to temperature rise
			Increased frequency of major pest outbreaks due to temperature rise
			Decline of beneficial insects due to temperature rise
		Microorganisms	Change in soil microflora and impact on matter cycle due to environmental change
Geophysical systems (tipping elements)			Shrinkage of Greenland ice sheet
			Collapse of West Antarctic ice sheet
			Disappearance of Amazon rainforest

Option Inventory

- Related to the ‘option identification’ step, we have attempted to produce a set of comprehensive inventories for climate change policy options.
- Four separate inventories for mitigation (technological), socio-economic, adaptation and geo-engineering options.
- Risks and co-benefits induced by each option are also summarized.

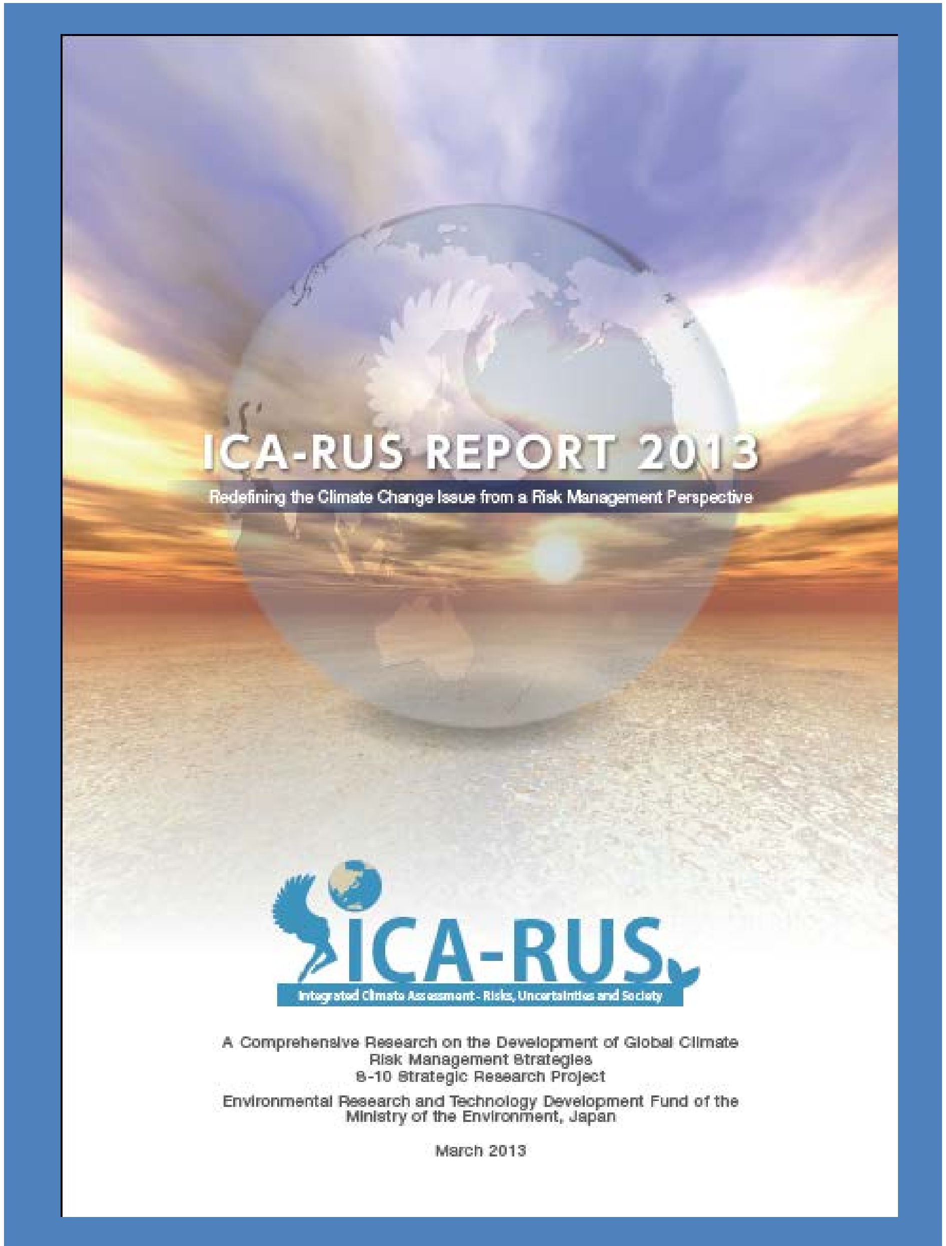
Technological mitigation options			Economic mitigation options	Regulatory institutional mitigation options	Opportunities for adoption	Co-benefits with sustainable development	Response risks	Constraints on wider adoption	Risks of obstacles	Entities subject to risks
First-level category	Second-level category	Third-level category								
Energy supply	Fuel conversion and power generation efficiency		Online electricity prices	Mandatory use of renewable energies	Creation of markets for new technologies	Improvement of environment (air pollution, etc.)	Increased GHG emissions due to use of unconventional fossil fuels	High investment risk	Price fluctuation risk	
	Energy-efficient supply		Reduction of subsidies for fossil fuels	Easing of environmental regulations			Energy security	Land use constraints	Competition with vested interests	
	Early CCS use		Subsidization of early demo units				Competition with food supply			
Transportation	Mode of transport (road, rail, etc.)		Subsidies, tax incentives	Fuel efficiency regulation	Instability of fossil fuel supply	Improvement of social infrastructure	Decline of effects due to income growth	Geographical conditions	Pricing risk	
	Land use and transport plans		Development of infrastructure							
										International, national,

What ICA-RUS will and won’t do

- ICA-RUS *won’t* propose a specific international framework of climate policy to be discussed under Durban Platform (to be agreed in 2015, put into effect in 2020).
- ICA-RUS *won’t* propose a specific long-term goal of climate policy which is intended to replace the ‘2 degree target’ under the review of long-term goals (2013-2015).

- ICA-RUS *will* try to reveal what decision making is implied by various proposals of such frameworks and goals and diagnose their (both scientific and social) rationalities from a risk management perspective.
- ICA-RUS *will* try to provide a set of alternatives and/or guidance regarding rational strategies for global climate risk management, based on which the society can discuss which strategy to take.

Annual report of ICA-RUS



Both English and Japanese versions available.

Policy debate on climate change

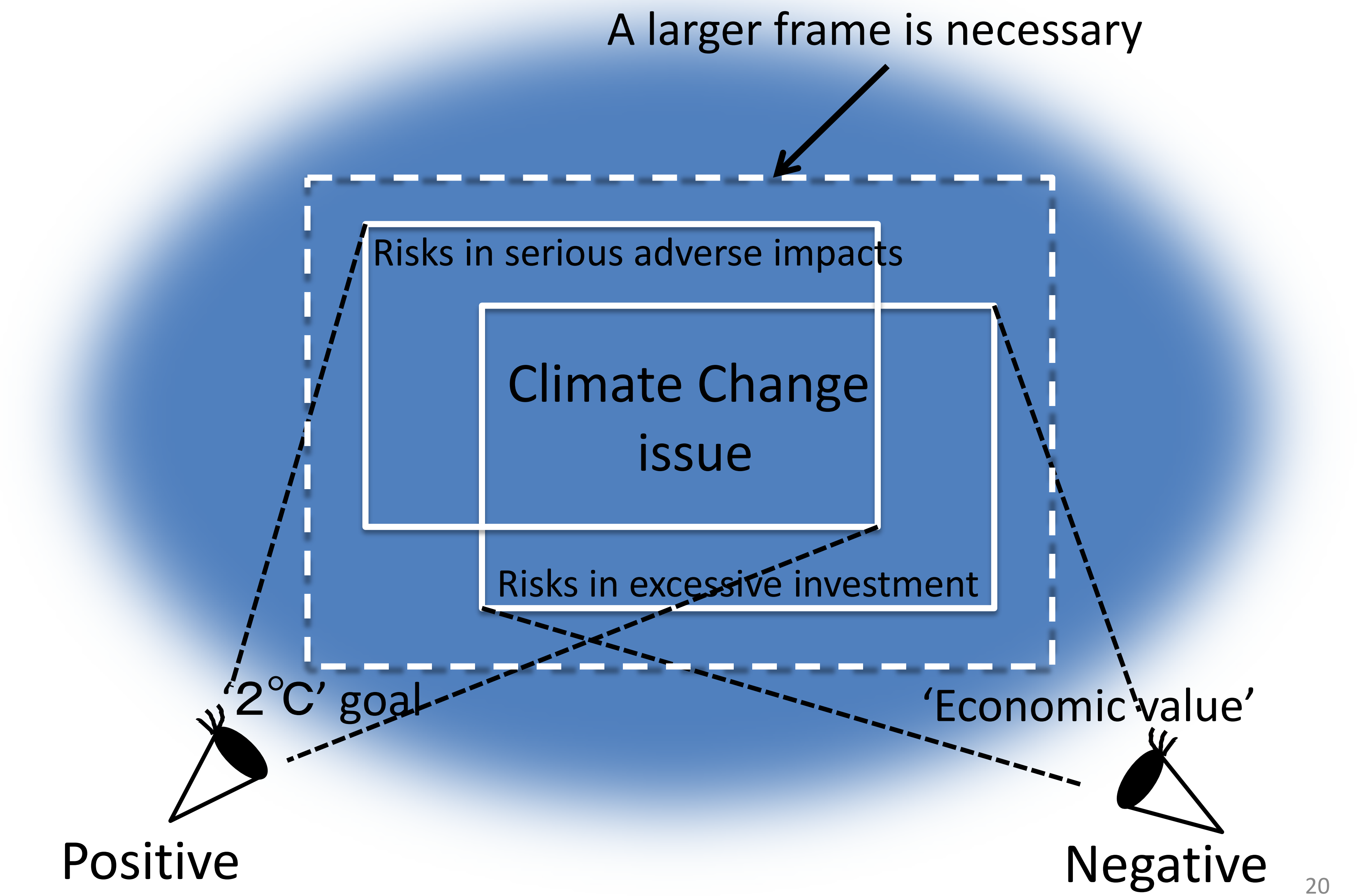
- Positive
  - We should aim for staying below ‘2℃’（1.5℃） for the sustainability of mankind.
  - We should ‘transform’ (drastically change) the way the world develops.

↑Sensitive to future climate change risks
（Insensitive to risks resulting from drastic actions?）

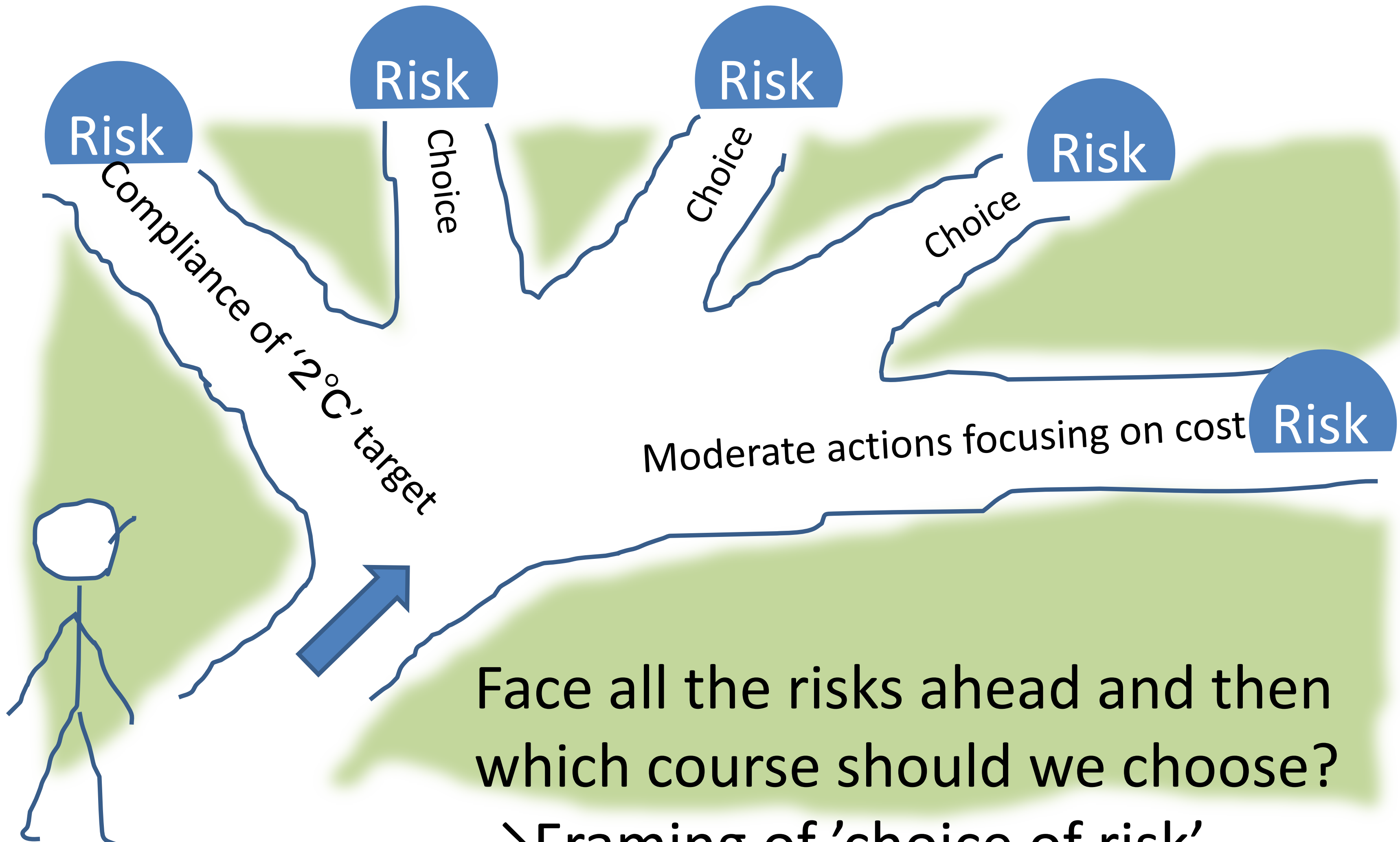
- Negative
  - It is already unrealistic to achieve such idealistic targets as ‘2℃’（1.5℃）.
  - It is irrational to invest only for climate change policy.

↑Sensitive to risks resulting from drastic actions
（Insensitive to future climate change risks?）

‘Gap’ in Framing



Whichever course we'd choose, there'll be risks



Face all the risks ahead and then which course should we choose?
→Framing of 'choice of risk'

This Workshop

- Exchange ideas and insights.
- Opportunity for interdisciplinary discussion.
  - Climate change impact assessment
  - Integrated assessment (incl. energy economics)
  - Uncertainty assessment
  - Water/food/energy nexus
  - Sociology/psychology on risk perception
- How to address the fundamental risk trade-off of the global climate change issue that mankind is faced with?