

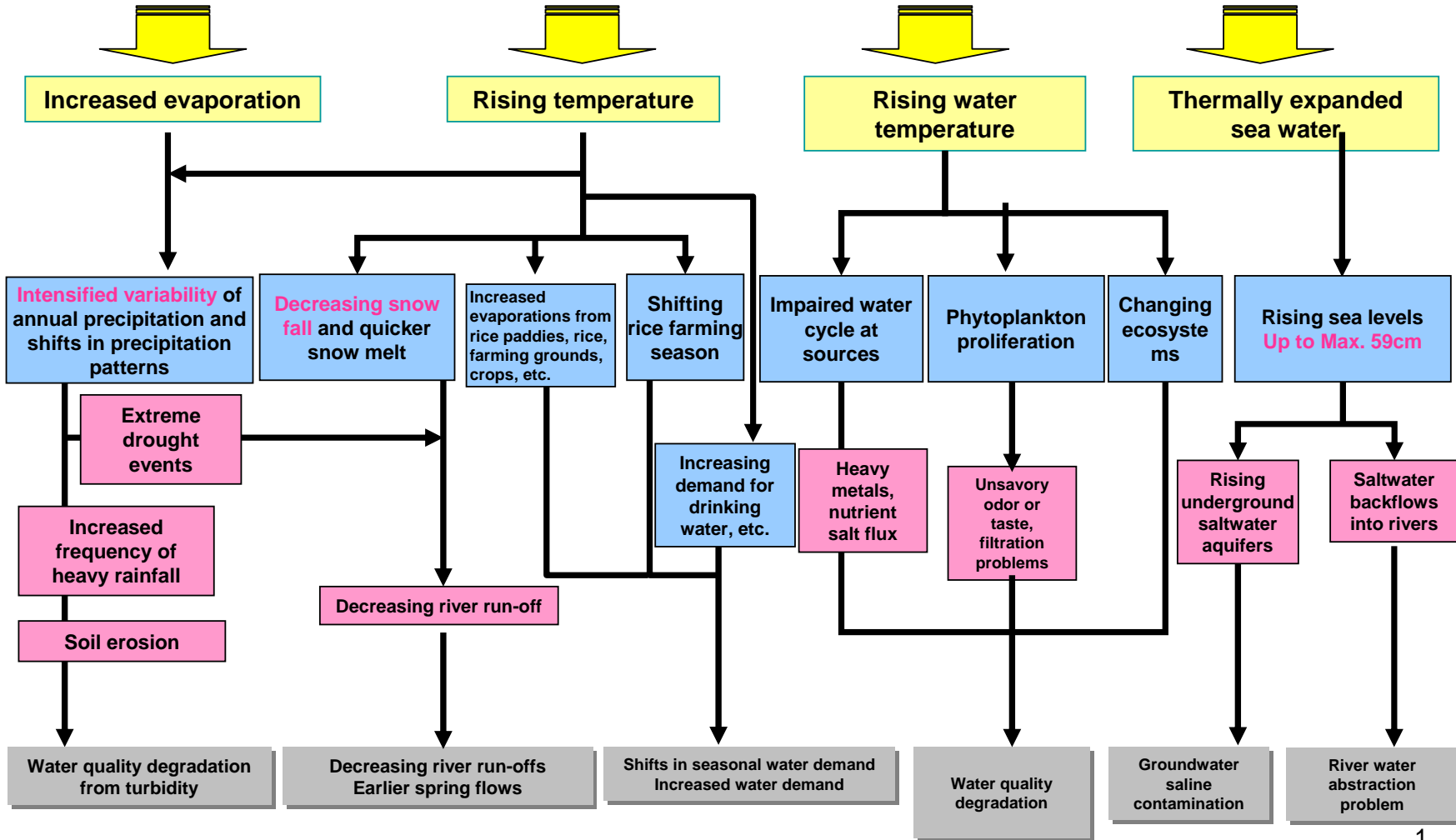
**“Integrated Water Resource Management  
addressing climate change and other risks”  
(Interim report)**

**Reference material**

Study Group on “Integrated Water Resource Management  
addressing climate change and other risks”

# Impacts of climate change (threats to water resources from global warming)

As a result of greenhouse gas emissions in bulk and their increased concentrations in the air amplifying heat absorption, temperatures have risen. This has also led to intensified precipitation variability and rising sea levels.

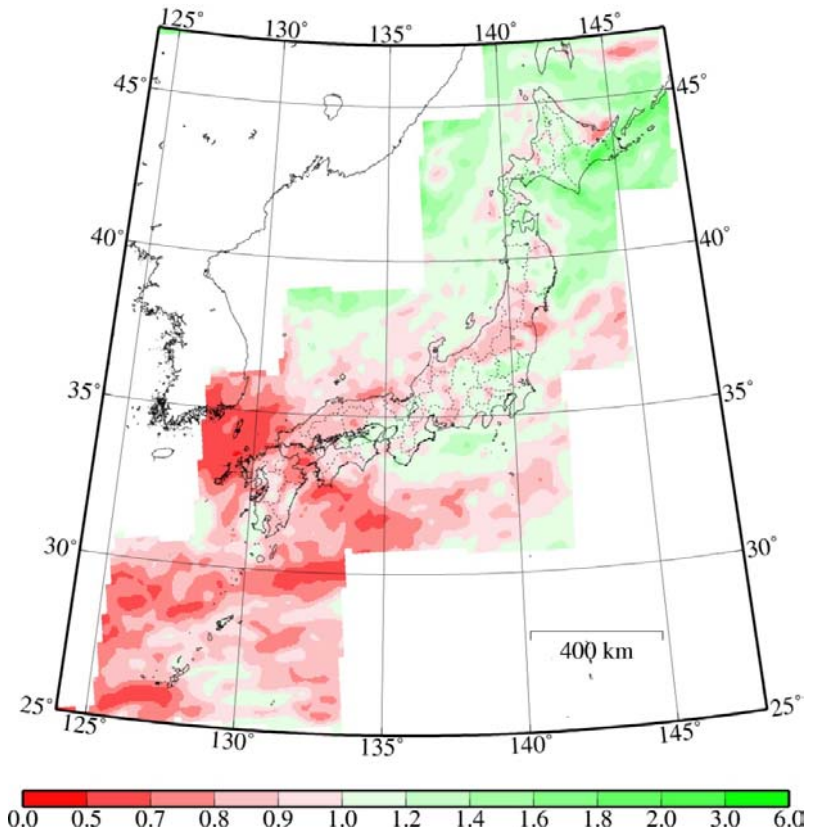
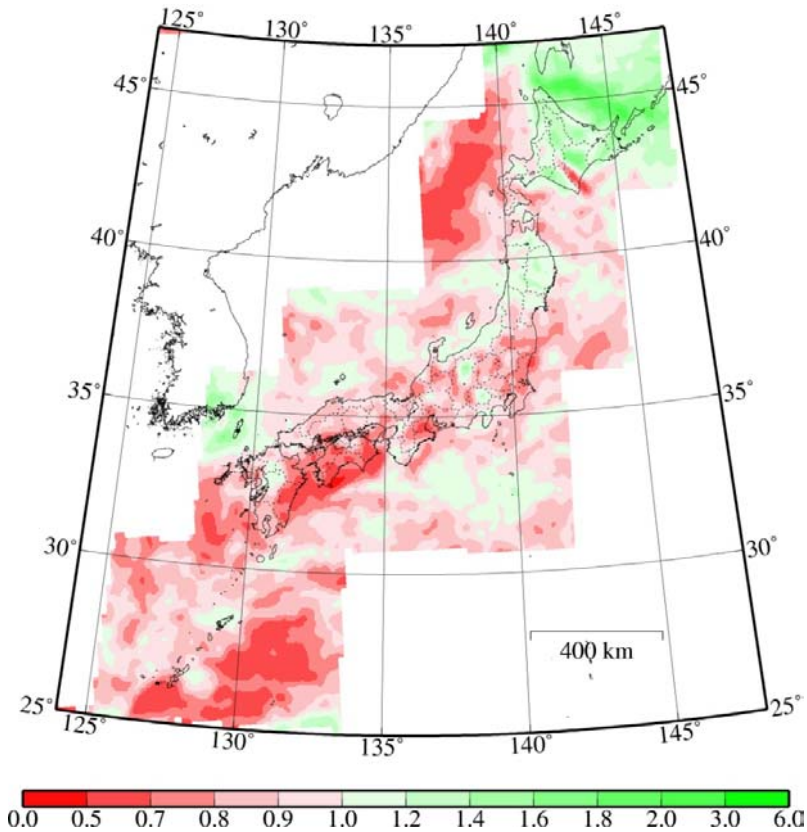


# Climate change prediction (Future changes in precipitation (RCM20: A2 Model))

To examine the second-lowest seasonal precipitation in two decades of 100 years hence, a decrease is expected in regions from east Japan through Kyushu in winter and in west Japan mainly in spring. Indicating increased scarcity risks where future natural climatic events are concerned.

## Winter

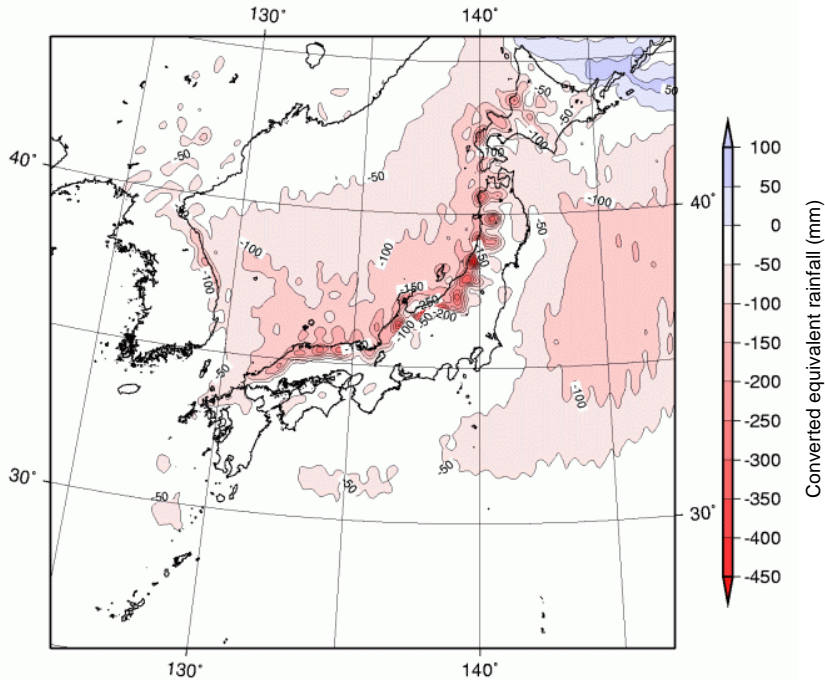
## Spring



\* Rate of change: Future seasonal precipitation / Present seasonal precipitation

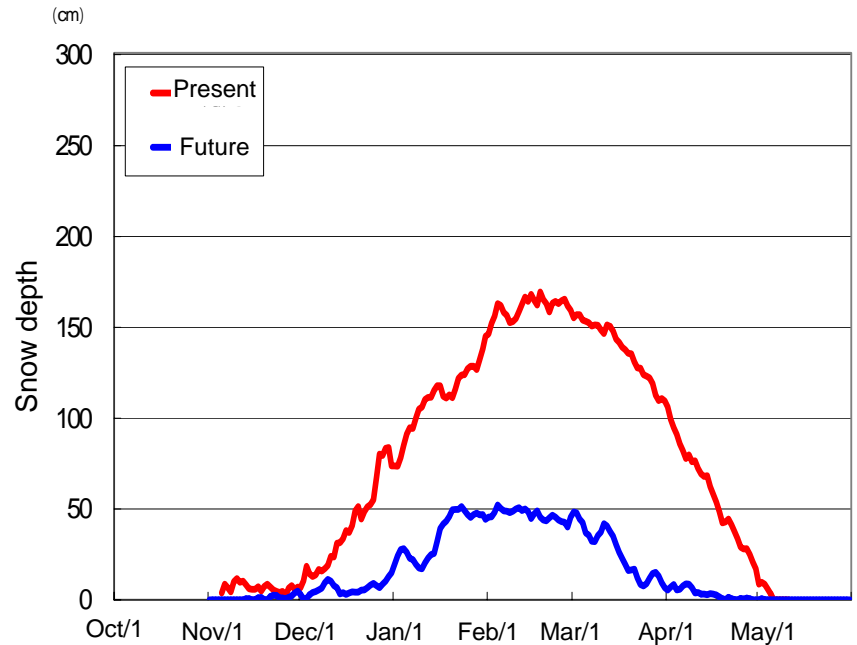
# Climate change prediction (snowfall)

- Snowfall will dramatically decrease in Japan Sea coast regions from Hokkaido to Sanin.
- In a 100 years' time, the upstream catchments of the Tone River will have considerably less snow depth.



**Changes in annual snowfall**  
 (Average of 2081 2100) (Average of 1981 2000)

(Source: Global warming projection vol. 6 (JMA))



Notes

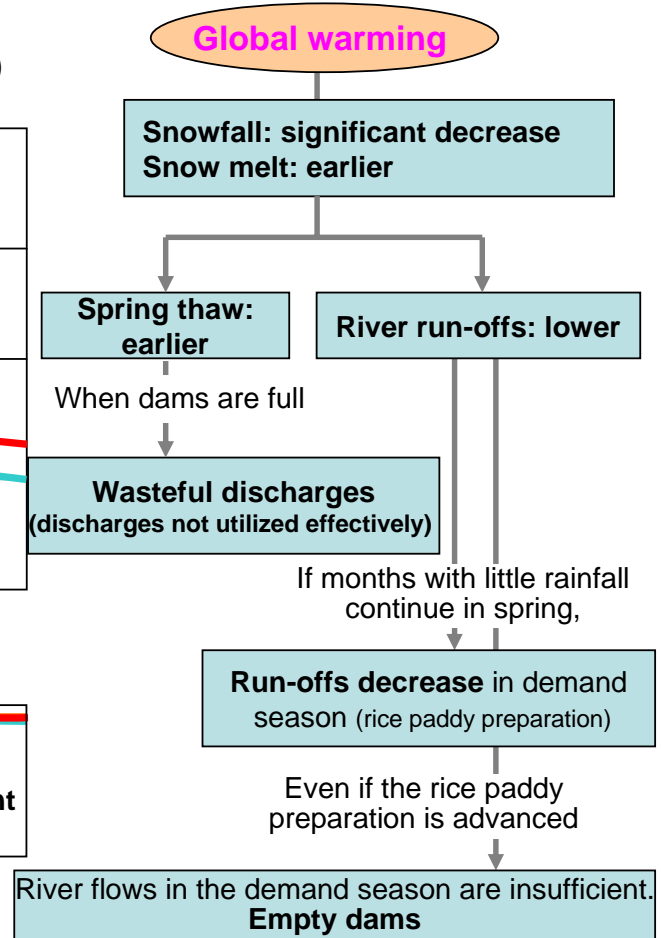
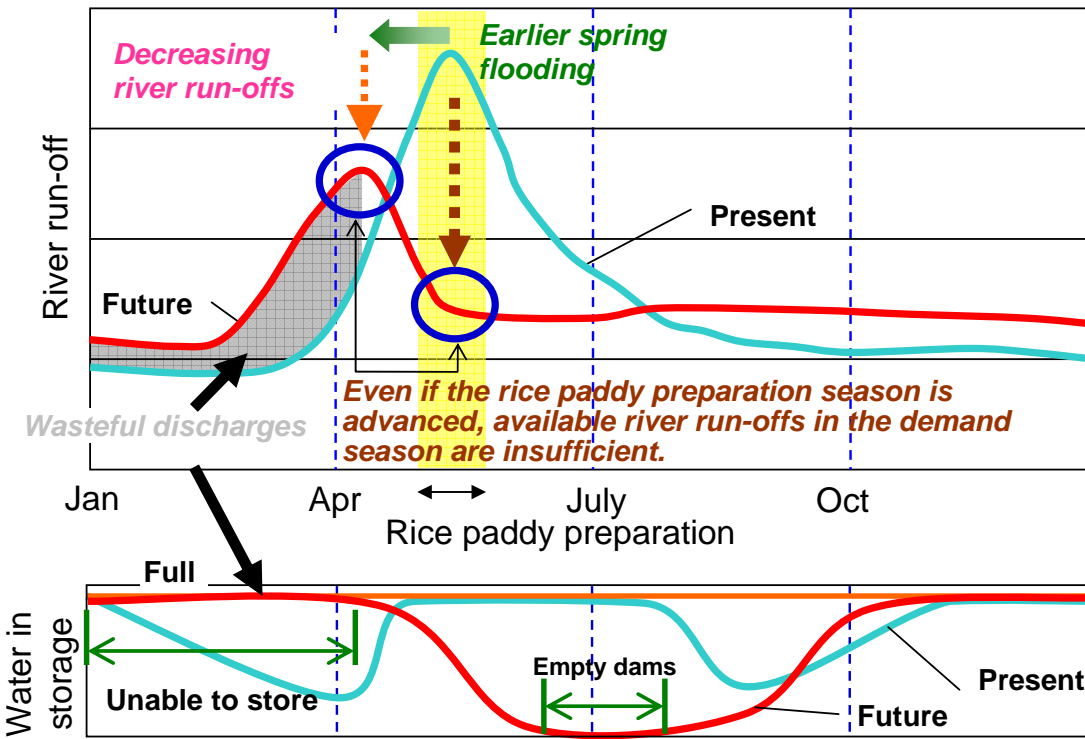
1. "Present" shows the averages of data for 1992 – 2006.
2. "Future" shows predictions (model: RCM20, A2) for approximately 100 years hence.
3. Computed by the Water Resource Department, MLIT

Snow depth changes expected 100 years hence (Fujiwara)

# Impacts of climate change (Schematized changes in river run-offs)

- Decreasing run-offs during the peak demand season such as rice paddy preparation
- Anticipated deviation from traditional water use patterns

## State of river run-offs after global warming (estimated)

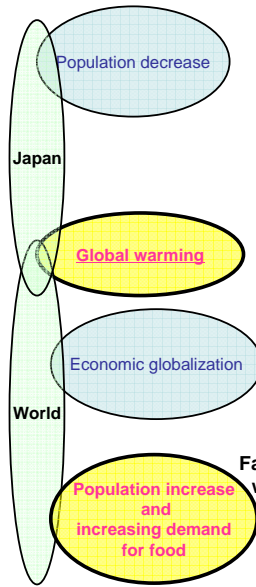


# Impacts on water demand from future social changes (rough estimate)

Basic idea employed in developing the scenario

- Speculating about factors relevant to social changes affecting water demand is extremely hard.
- Hence, an estimate is boldly made with key assumptions combining “Population decreases” (higher / medium level assumptions) and “Factors with grave impacts on major water uses” without considering drastic technology innovations.

Analysis of impacts of demand



**Household water**

Decreasing demand by population decrease (higher / medium level assumption)

Increased water use for better amenity of life?

Spread of water-saving apparatus (Water saving of about 20% based on 50% market permeation assumed.)

Spreading use of external service

Increasing population of immigrants from overseas

Future population (Compared to present)	50 years later		100 years later	
	Higher level	Medium level	Higher level	Medium level
Ishikari Riv	82%	75%	55%	40%
Tone Riv	84%	77%	53%	38%
Chikugo Riv	78%	72%	52%	38%
Whole country	77%	70%	48%	35%

Total water consumption (Lavatory, bathtub, kitchen, laundry)

Normal	Saving type
28.1m <sup>3</sup> /M	16.2m <sup>3</sup> /M ( 42%)

**Industrial water**

Economic growth projection (consumption volume 50 years hence is based on trends, volume 100 years hence is assumed as the same with 50 years hence)

Expansion of industries having an international edge

Shifts in user items

Further rationalization of water consumption (energy saving, R&D) (The water recovery rate is based on current trends; the figure 100 years hence is assumed to be the same as 50 years hence.)

Overseas shift of production bases and their return to Japan

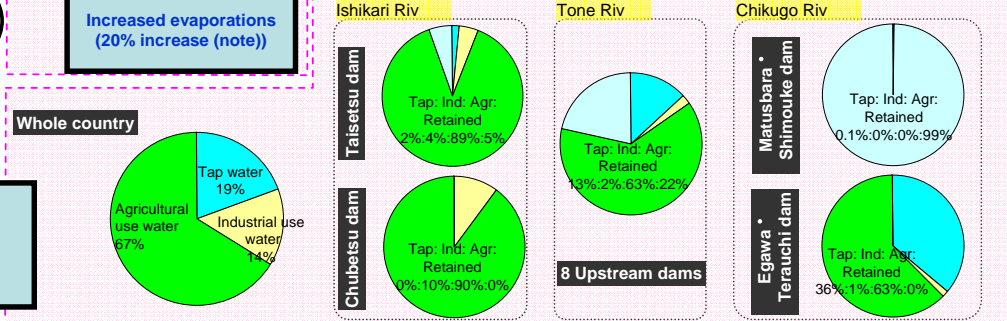
**Farming water**

Food self-sufficiency ratio improvement (Food productivity similar to the present level)

Increased demand for grain overseas

Changing dietary habits

Increased evaporations (20% increase (note))



**Legend**  
Factors for scenario development (Assumptions made in scenario development)

Future water consumption volume (Compared with present)		50 years hence		100 years hence	
		Higher level	Medium level	Higher level	Medium level
Household use	Ishikari Riv	About 65%	About 60%	About 44%	About 32%
	Tone Riv	About 67%	About 62%	About 42%	About 31%
	Chikugo Riv	About 62%	About 57%	About 41%	About 30%
	Whole country	About 60%	About 55%	About 40%	About 30%
Industrial use	Ishikari Riv	About 90% or so			
	Tone Riv				
	Chikugo Riv				
	Whole country				
Agricultural use	Ishikari Riv	Similar volume to the present level  (Only a 5% increase in consumption will be caused by evaporation increase of 20%, so future consumption levels are assumed to be similar to the present levels.)			
	Tone Riv				
	Chikugo Riv				
	Whole country				
Total	Ishikari Riv	About 99%	About 99%	About 98%	About 98%
	Tone Riv	About 94%	About 93%	About 89%	About 87%
	Chikugo Riv	About 96%	About 96%	About 94%	About 94%
	Whole country	About 91%	About 90%	About 87%	About 85%

(Note) "Prediction of changes caused by global warming in Kyushu's water resources for rice paddies," National Agriculture and Food Research Organization, 2006

# Evaluation of scarcity risks considering social changes and shifts in water use

**No. of days registering water scarcity (available dam storage volume is depleted without abstraction restrictions) estimated with social changes (population decrease) and shifts in water use (changing irrigation season, increased evaporation) taken into account (for 20 years)**

Irrigation period shifts (days) are based on computation considering temperature and optimum crop yield (\*)

River system name		Irrigation period pattern (No. of days by which abstraction is shifted for agricultural use water)	Present state	Higher level assumption		Medium level assumption	
				50 years hence	100 years hence	50 years hence	100 years hence
Ishikari Riv	Taisetsu dam	Advanced by 0-10 days	About 60 days	About 30 – 70 days	-	About 30 – 70 days	-
		Advanced by 0-20 days		-	About 20 – 100 days	-	About 20 – 90 days
	Chubetsu dam	Advanced by 0-10 days	About 30 days	About 130 – 180 days	-	About 130 – 180 days	-
		Advanced by 0-20 days		-	About 320 – 380 days	-	About 320 – 380 days
Tone Riv	8 upstream dams	Advanced by 0-40 days	About 30 days	About 100 – 110 days	About 10 – 50 days	About 90 – 100 days	About 10 – 40 days
		Deferred by 0-60 days		About 90 – 120 days	About 0 – 10 days	About 80 – 110 days	About 0 – 10 days
Chikugo Riv	Egawa / Terauchi dam	Advanced by 0-5 days	About 70 days	0 days	-	0 days	-
		Deferred by 0-30 days		About 0 days	-	About 0 days	-
		Advanced by 0-100 days		-	0 days	-	0 days
		Deferred by 0-40 days		-	About 0 – 20 days	-	0 days
	Matsubara / Shimouke dam	Advanced by 0-5 days	About 50 days	About 70 days	-	About 70 days	-
		Deferred by 0-30 days		About 70 – 80 days	-	About 80 days	-
		Advanced by 0-100 days		-	About 180 – 250 days	-	About 180 – 240 days
		Deferred by 0-40 days		-	About 220 – 260 days	-	About 210 – 260 days

Scarcity mitigated

Scarcity exacerbated

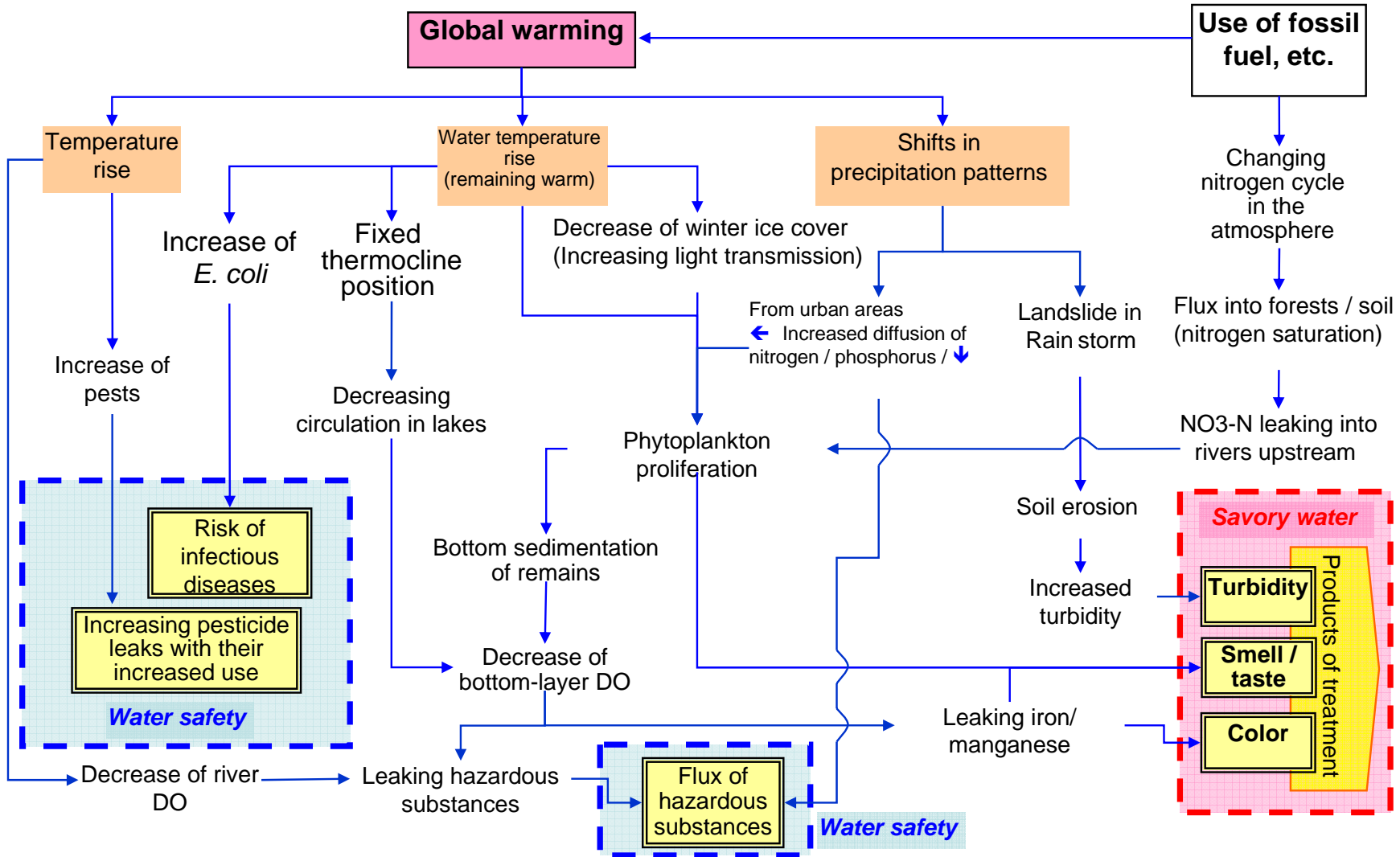
No. of days registering water scarcity (days registering empty dam) is a value for 20 years. (Present state: 1981 – 2000, 50 years hence: 2031 – 2050, 100 years hence: 2081 – 2100)

(Notes)

1. Calculation results obtained with the Center of Climate System Research, University of Tokyo (CCSR)'s high-resolution whole-globe atmosphere-ocean combined model (Computed by the Water Resources Dept. of MLIT with values predicted for Ishikari Riv, Tone Riv. and Chikugo Riv. 50 years / 100 years hence, (without considering abstraction restrictions)
2. The assumptions shown in Figure – 5 were taken into account as social changes.
3. Increased evaporation (20%): When agricultural use water abstractions increase by 5% as a result of increased evaporation

\* (Sources) (1). "Data on the recent state of climate variability and its impacts on agricultural crop growth" (MAFF, April 2002)  
 (2). "Changes in potential yield of rice paddies based on global warming prediction data" (Environment Resource Dept., National Institute for Agro-Environmental Sciences, 1998)  
 (3). "Unpublished data (2002), Hayashi, Ishigooka

# Impacts of Climate Change (Schematic of impacts on water quality)



(Note) Adapted by the Water Resource Dept. from "Global warming and Japan, third report: Environment prediction for nature and people" Hideo Harasawa, Shuzo Nishioka

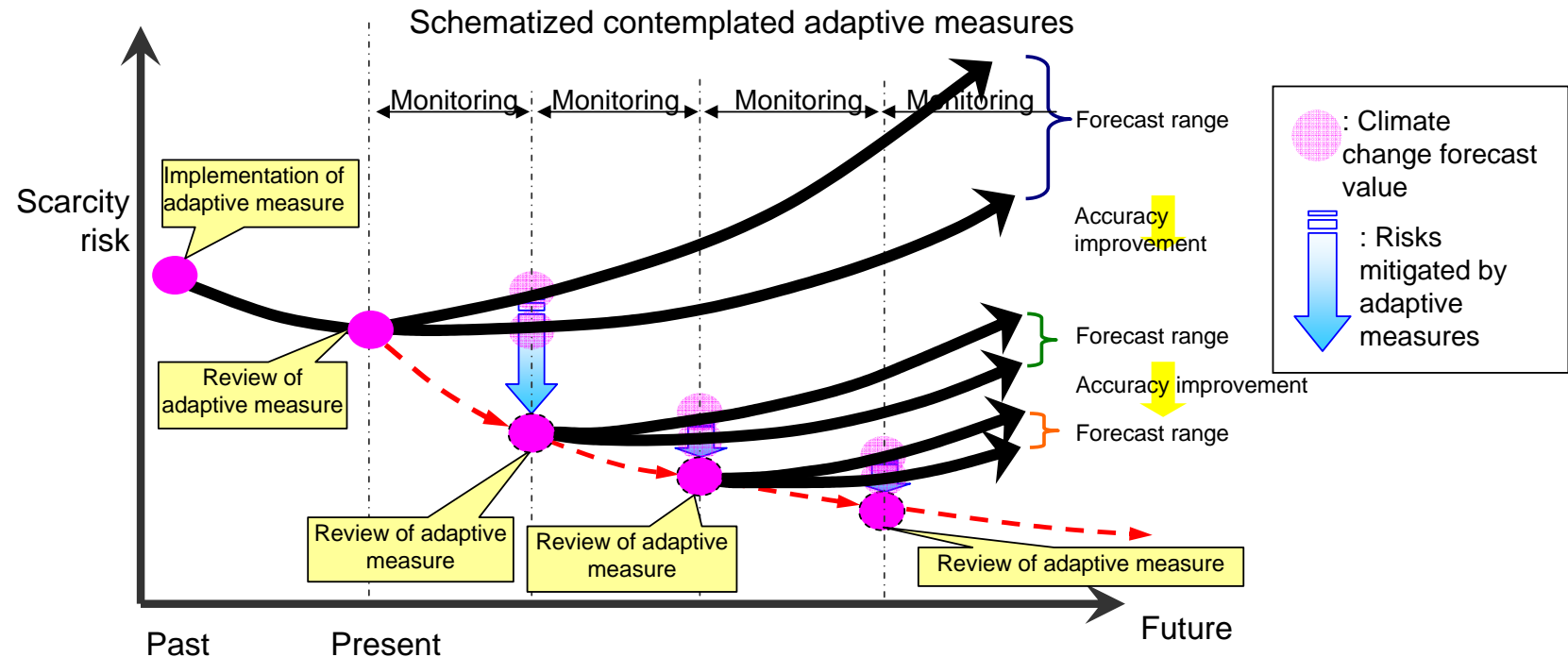
# How to handle new risk of climate change

## Basic idea

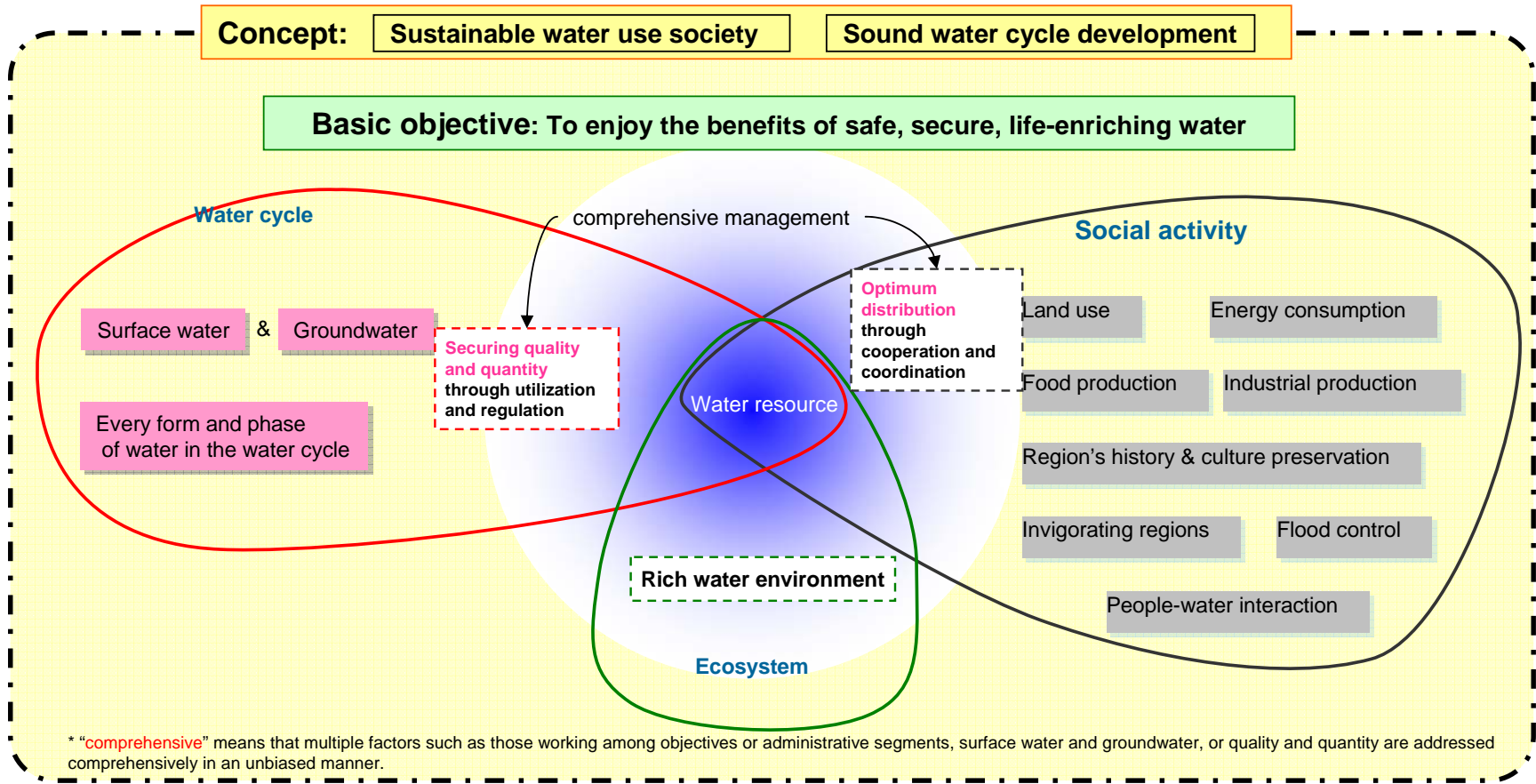
- Integrated water resource management to be promoted as an adaptation measure for future scarcity risks

## Basic point of view

- Adaptive measure  
Necessary adaptive measures are taken proactively for anticipated future changes in their early stages from a long-term strategic viewpoint.
- Building a society to use water effectively  
As the baseline of adaptive measures, a society in which people, water users, businesses, etc. use water carefully will be built. It will also contribute to mitigation measures.



# Integrated water resource management



## Integrated water resource management

**Concept:** To implement the management of the following to achieve the **basic objective** while paying attention to rich water environment for ecosystems

- ◆ Utilization and regulation to secure quantity and quality of water in a cycle as water resources for social activities
- ◆ Optimum water resource distribution through cooperation and coordination among the objectives of social activities

# Basic point of view for promoting Integrated water resource management

## Social needs

Effective utilization of water resources

Safe, savory water

## Changing natural / social conditions

Increasing risks in earthquake / casualties

How to handle new risk of climate change , etc.

Integrated water resource management  
 ~ Enjoyment of safe, secure, life-enriching water's benefits ~

## Basic point of view for promoting Integrated water resource management

### Management from an effective water resource utilization point of view

- Management from both supply and demand aspects
- Building a society to use water effectively on the demand side
- Maximum utilization of existing stock on the supply side
- Comprehensive surface water/groundwater management

### Quantity/quality comprehensive management

- Quantity/quality comprehensive management with more emphasis than before on the water quality that has significant impacts on human lives, health, water tastiness, people-water interaction, and the living base of creatures

### Management from a crisis management point of view

- To minimize impacts on people from such points of view as disaster control in an earthquake or casualties and security

### How to handle risk of climate change

- To take adaptive measures for emerging risks in their early stages by identifying them as primary threats

Quantity management

Quality management

Risk management

Quantity management