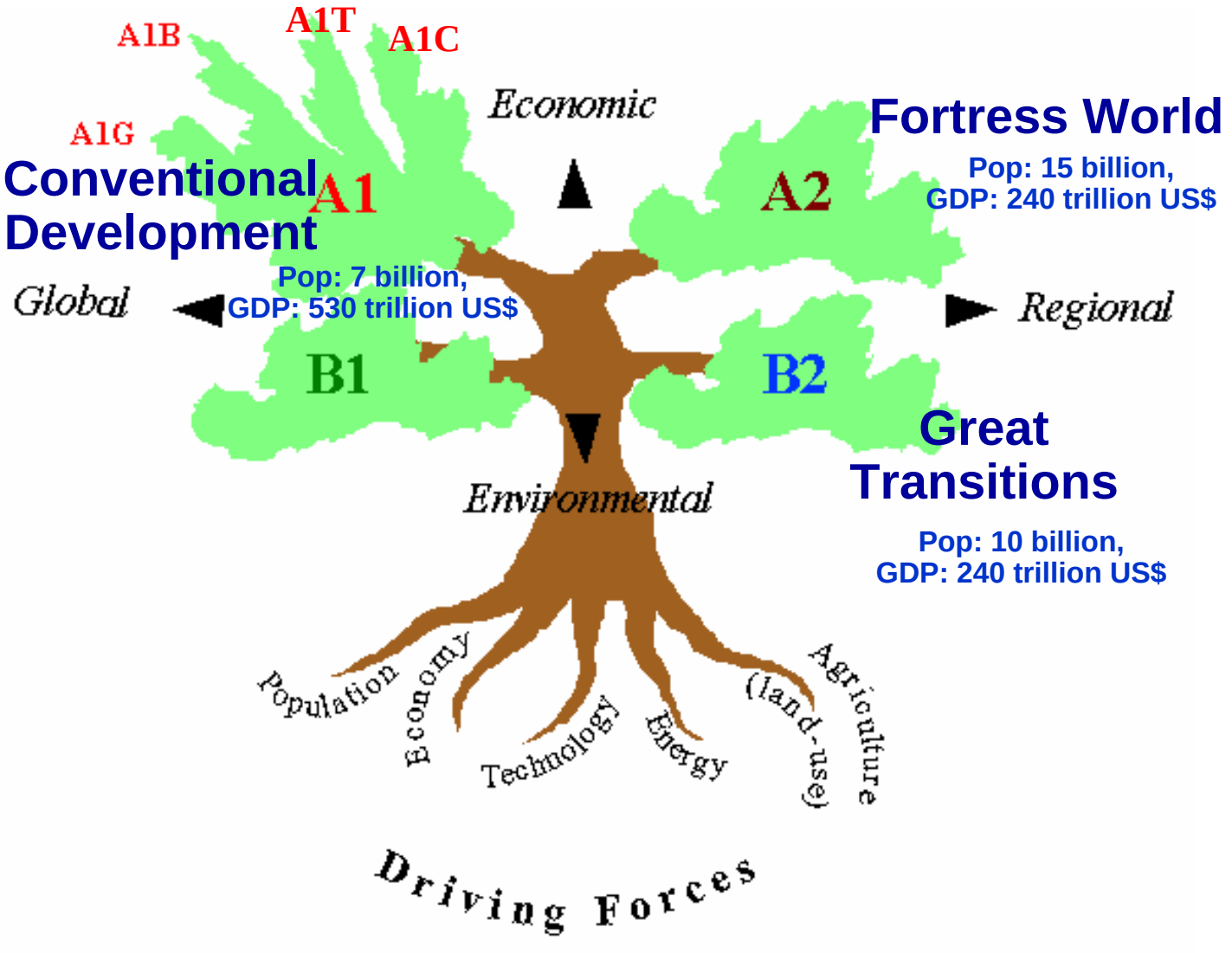
The 6th AIM International Workshop

27-28 March 2001, NIES Tsukuba, Japan

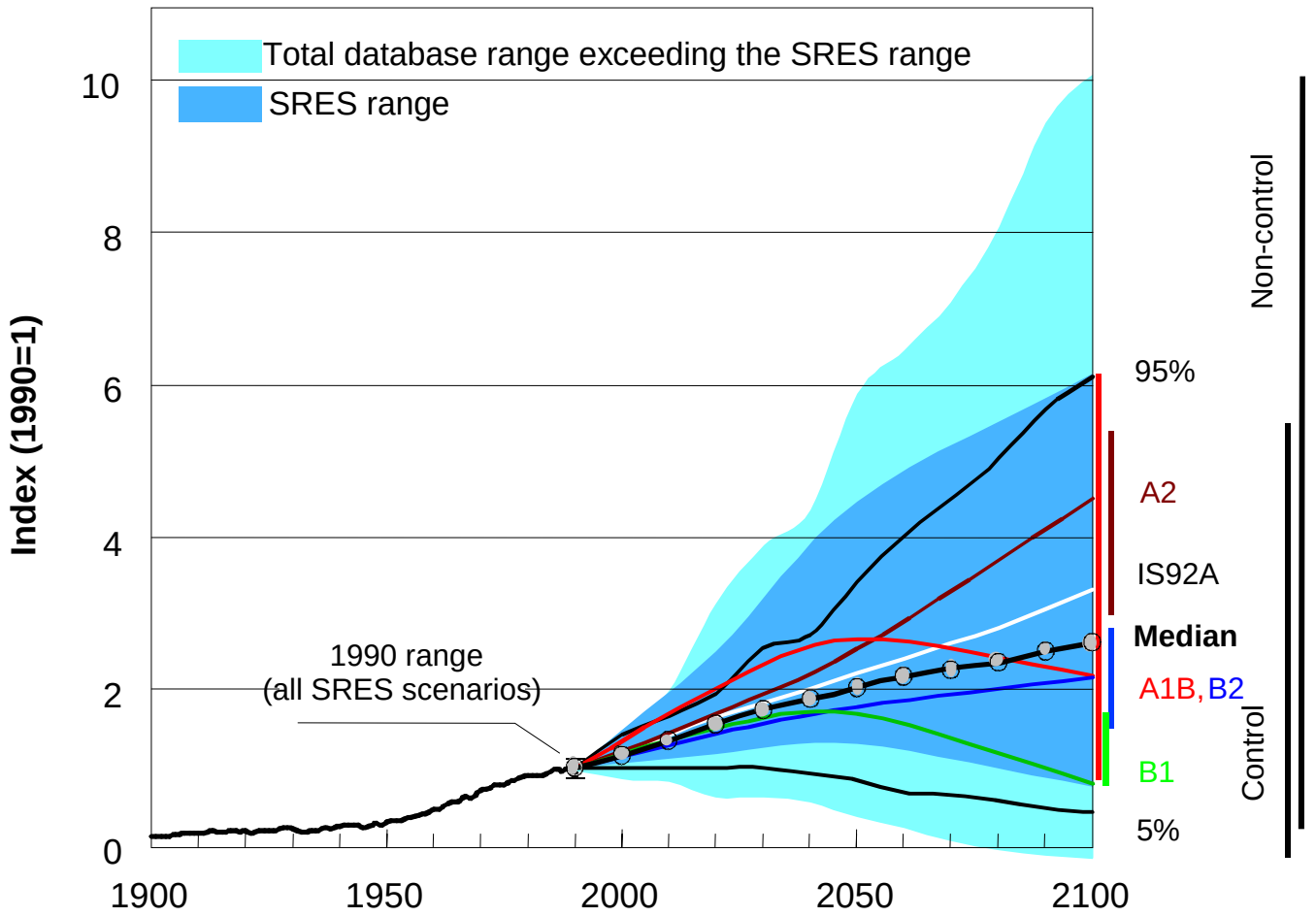
Overview of the AIM Project Progress

- FY 2000-

Mikiko Kainuma

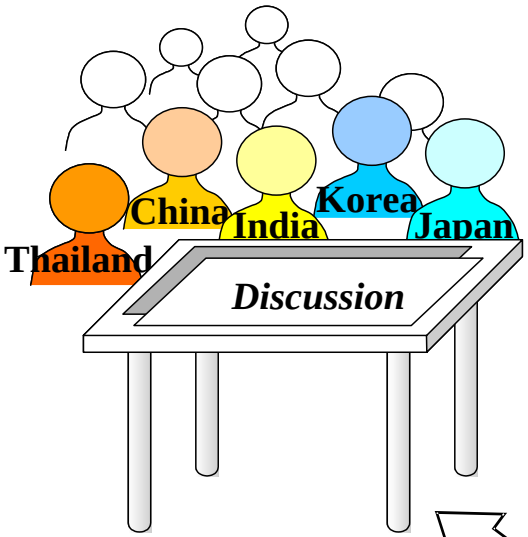


IPCC SRES Scenarios



Rage of CO2 emission projections

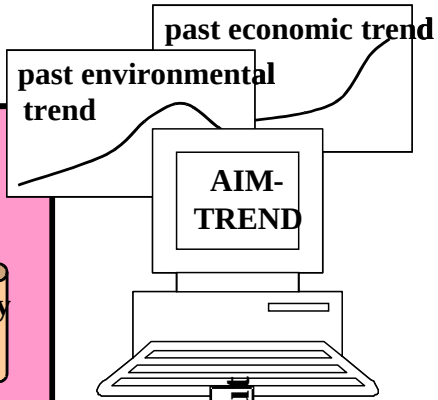
Scenario Generation & AIM-TREND



Input

- Renewable Energy
- Population Growth
- Economic Growth
- Energy Efficiency Improvement

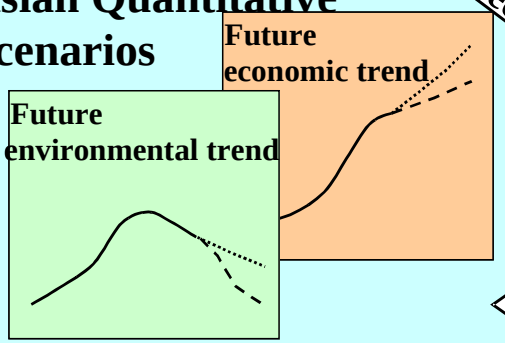
Narrative Scenarios



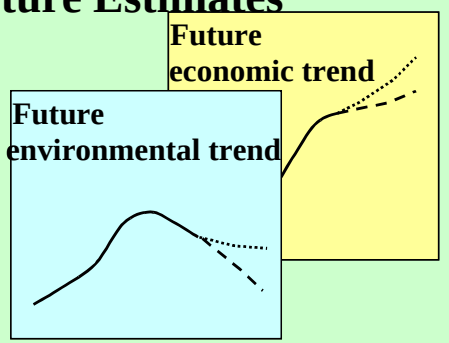
Output

Feedback

Asian Quantitative Scenarios

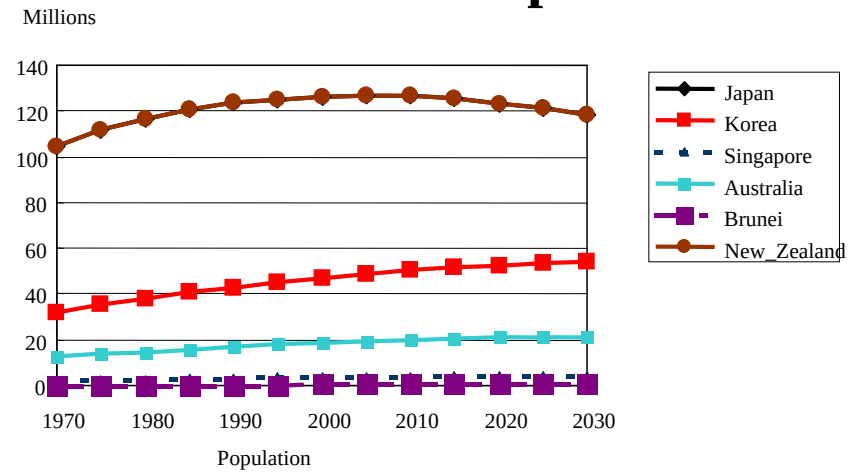


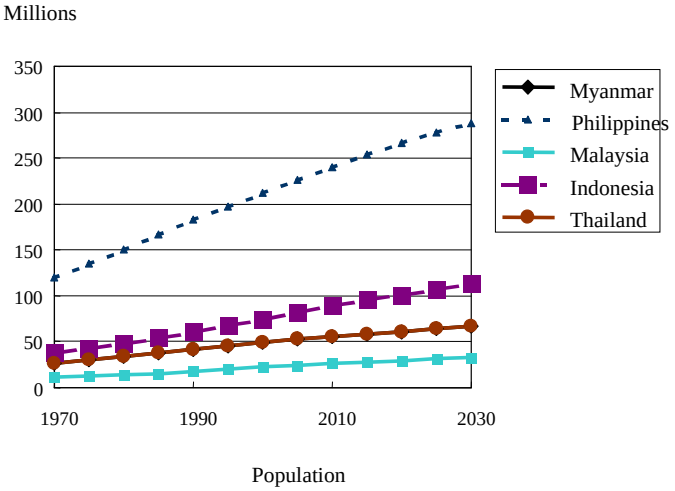
Future Estimates

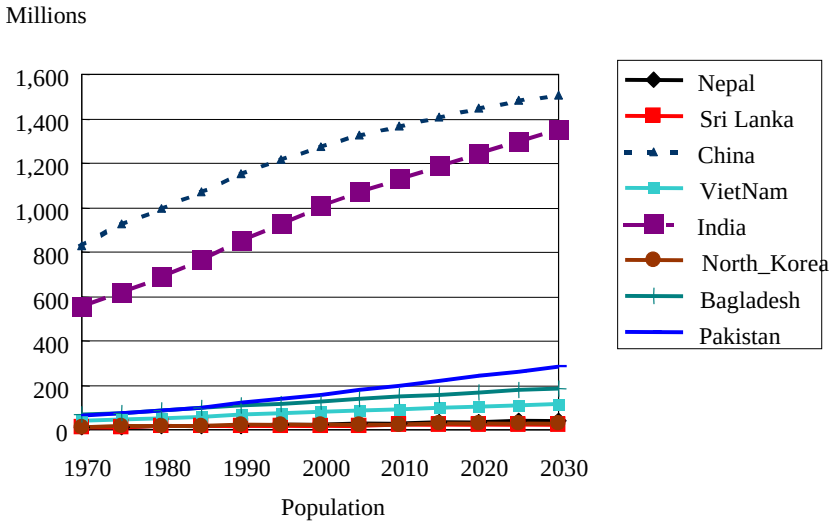


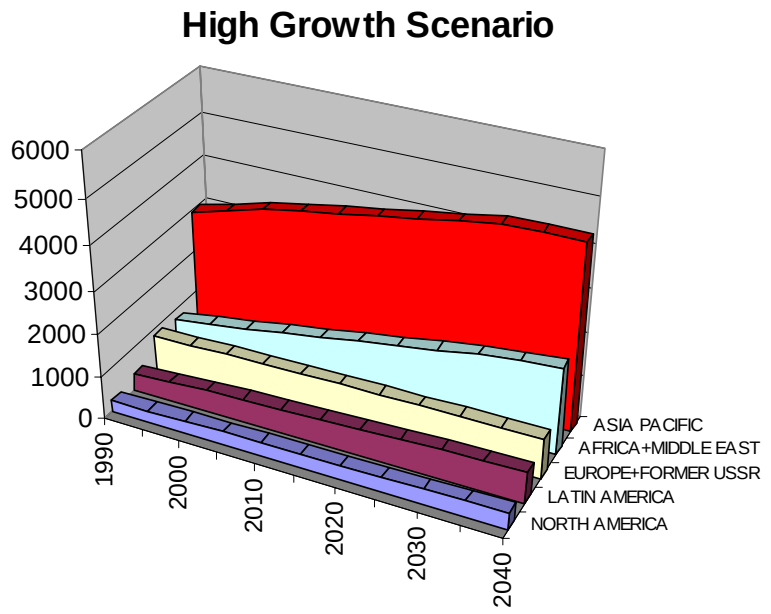
Basic Future Frameworks: Population and Economic Growth

Examples of Country Population

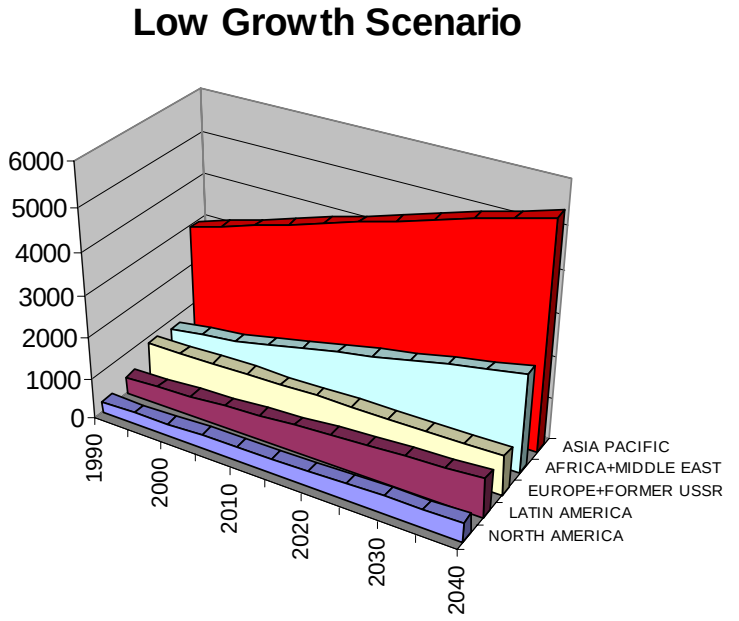








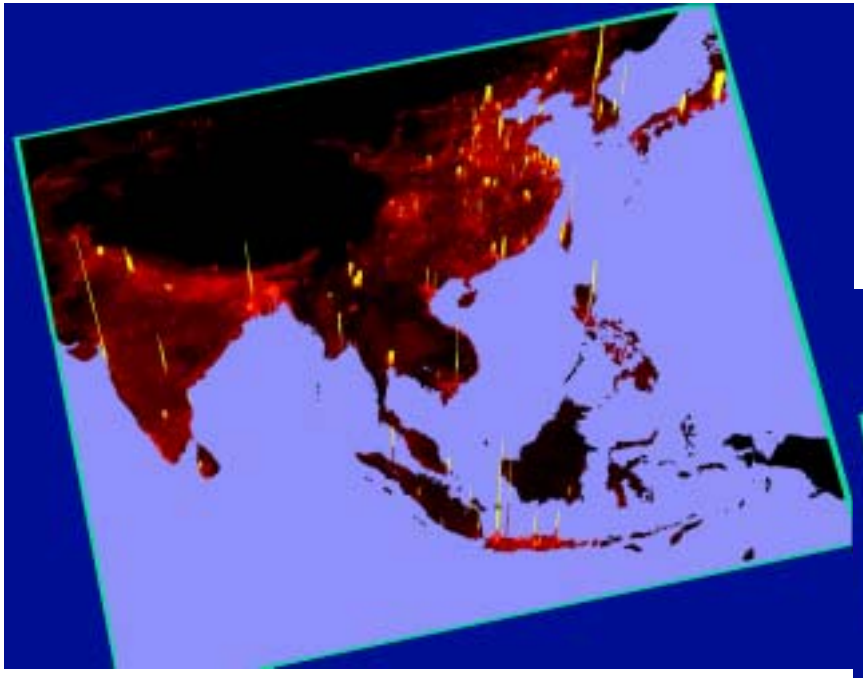
(a) Population projection under the Conventional Development Scenario



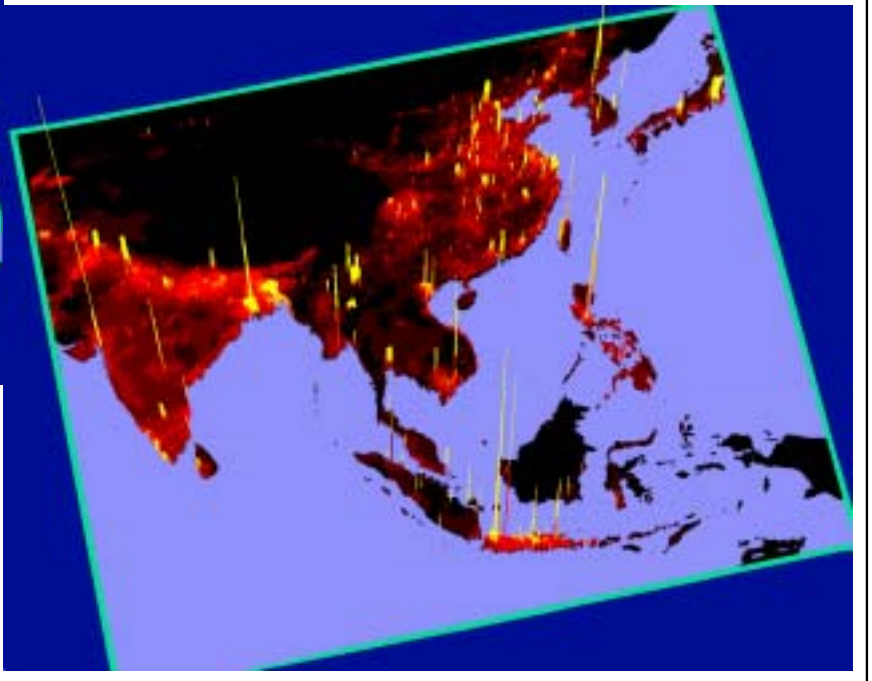
(b) Population projection under the Fortress World

Figure 1 Projection of population in the five regions

Urban Population Density, 1990 & 2050

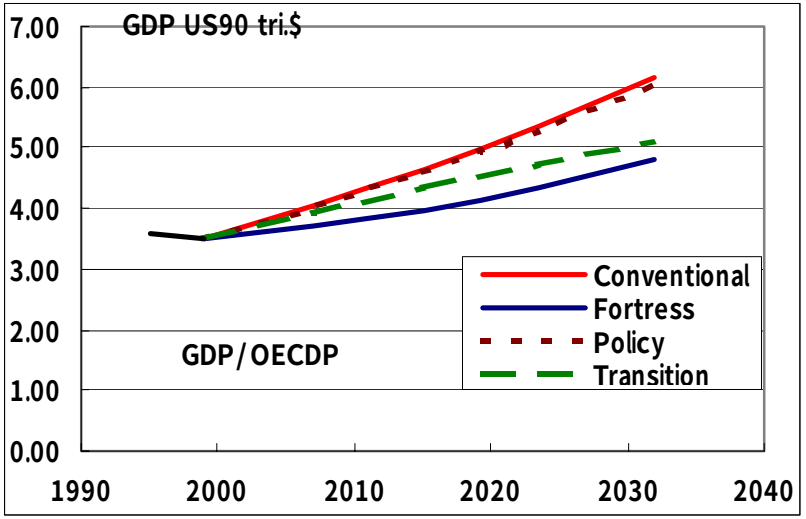


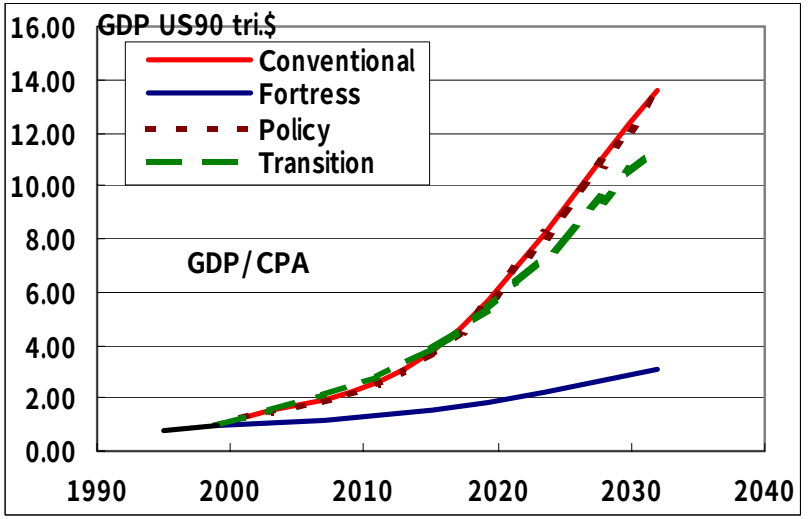
Population density in 1990

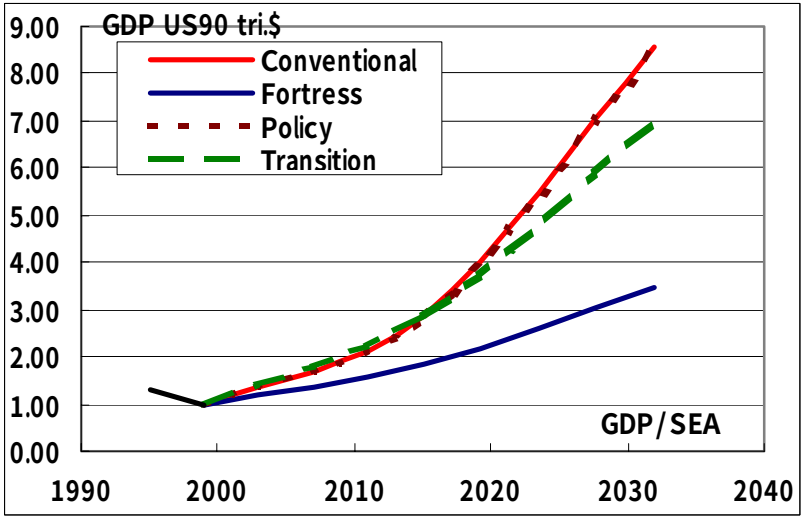


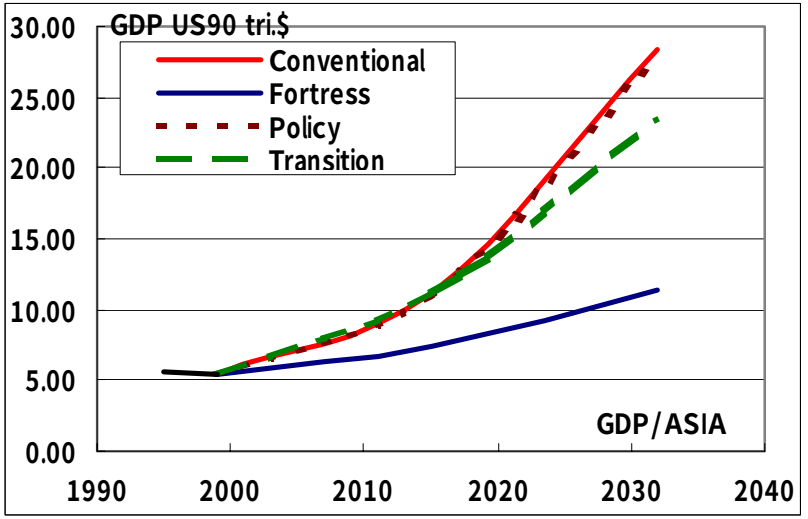
Population density in 2050

GDP


GDP US90 tri.$
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
1990
2000
2010
2020
2030
2040
Conventional
Fortress
Policy
Transition
GDP/OECDP


GDP US90 tri.$
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
1990
2000
2010
2020
2030
2040
Conventional
Fortress
Policy
Transition
GDP/CPA


GDP US90 tri.$
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
1990
2000
2010
2020
2030
2040
Conventional
Fortress
Policy
Transition
GDP/SEA


GDP US90 tri.$
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25.00
20.00
15.00
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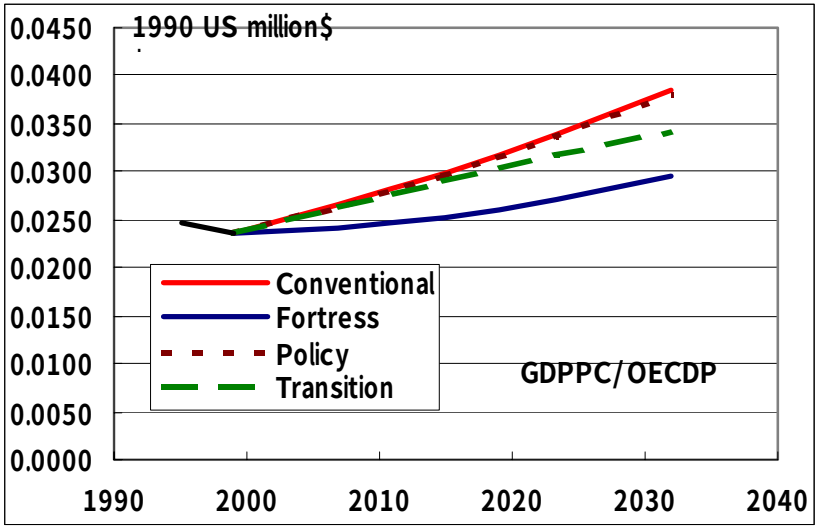
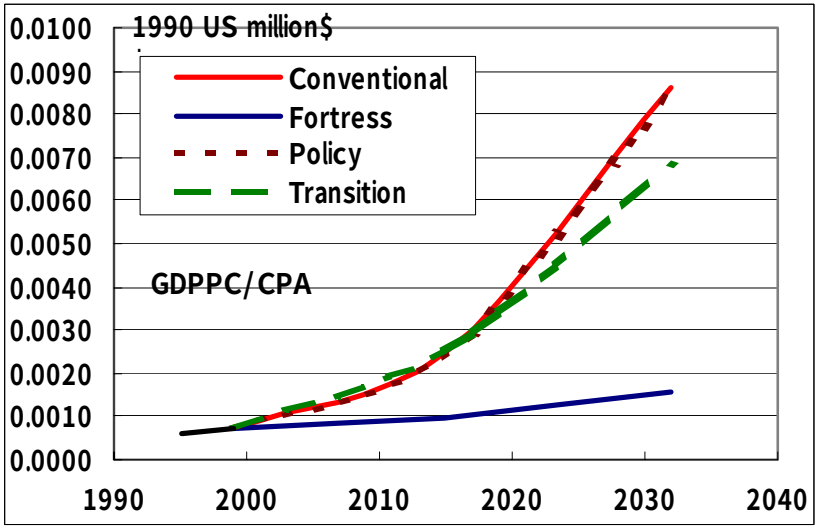
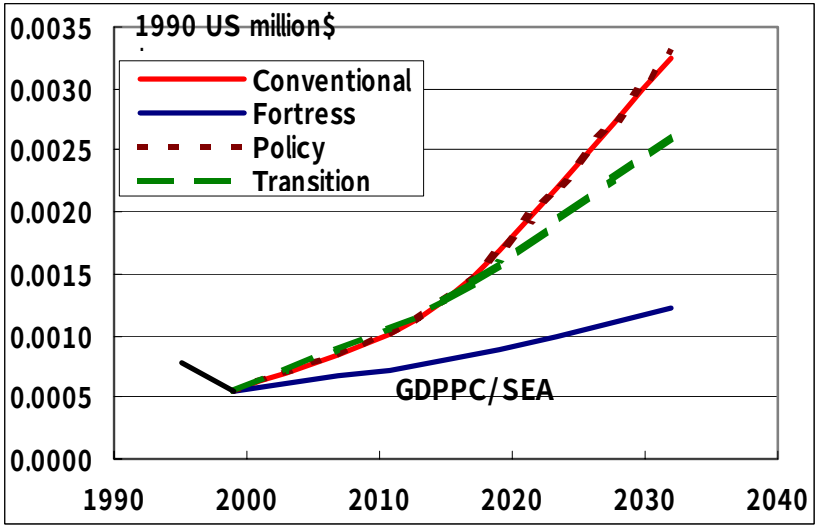
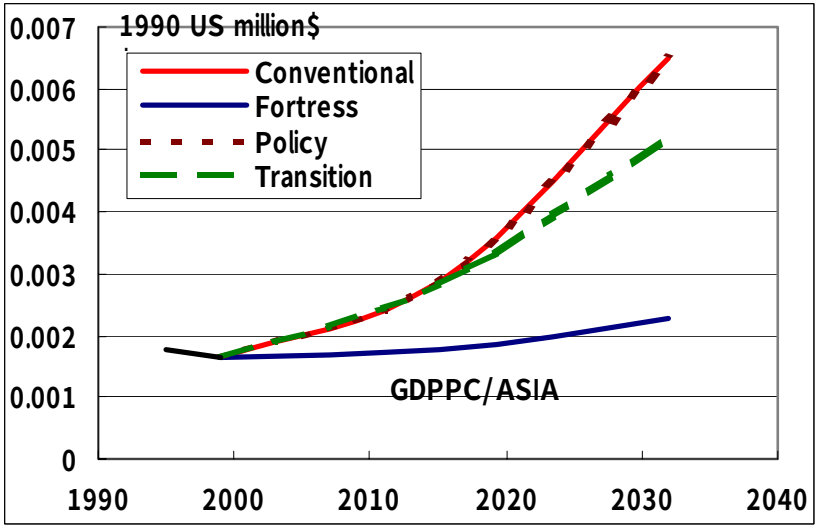
5.00
0.00
1990
2000
2010
2020
2030
2040
Conventional
Fortress
Policy
Transition
GDP/ASIA

per capita GDP









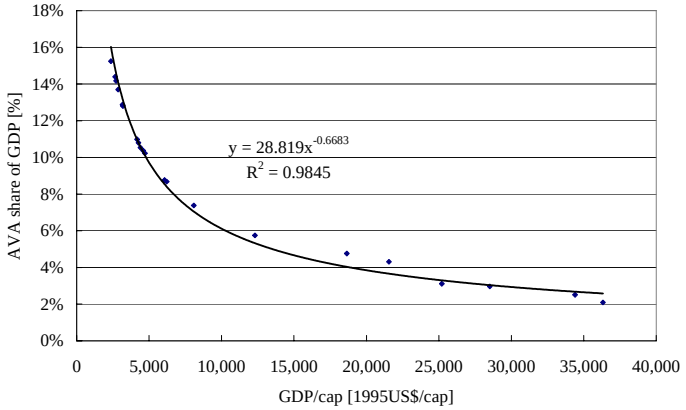


Figure 3 Relationship between AVA (Agricultural Valud Added) share and GDP per capita in OECD-Pacific countries

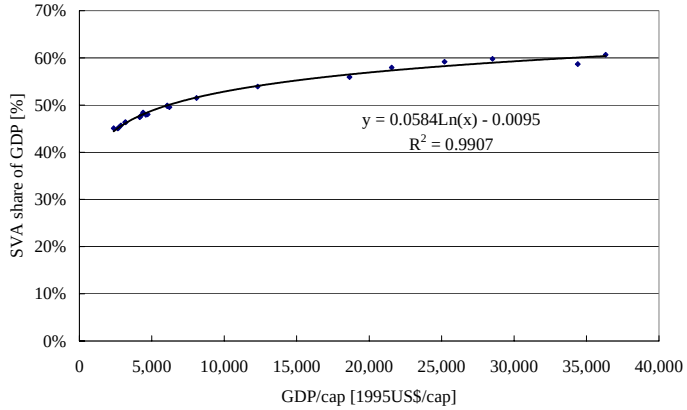


Figure 4 Relationship between SVA (Service Value Added) share and GDP per capita in OECD-Pacific countries

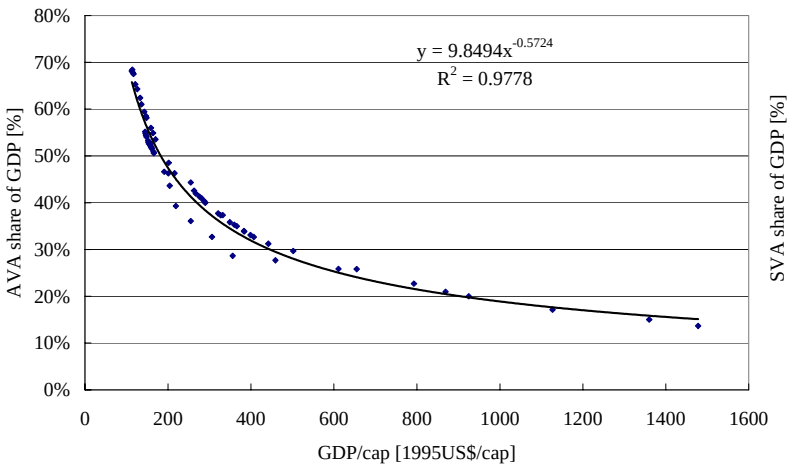


Figure 5 Relationship between AVA (Agricultural Valud Added) share and GDP per capita in Central Planned Asia and South East Asia

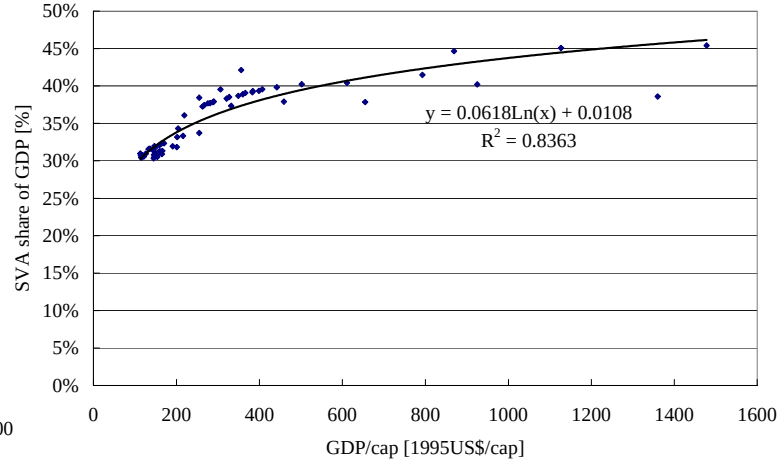
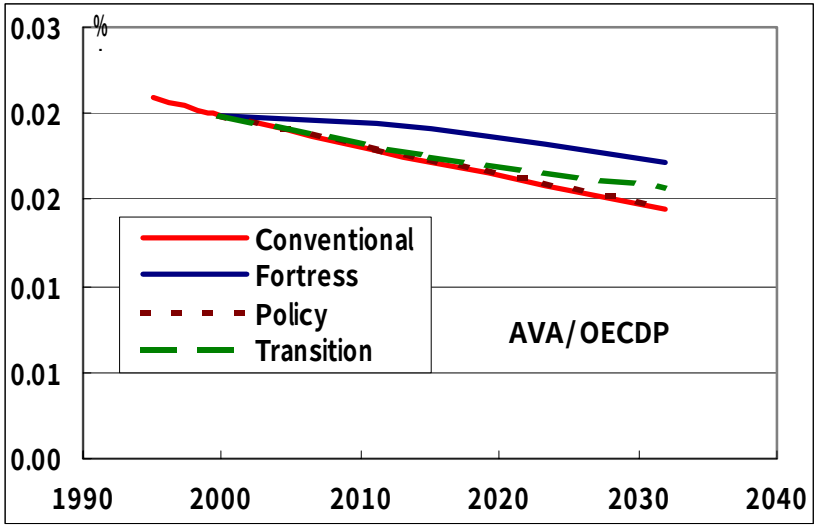
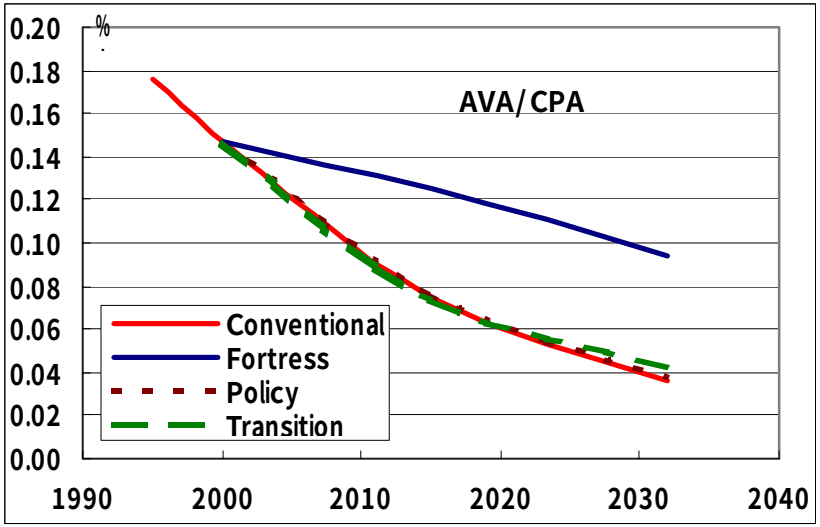
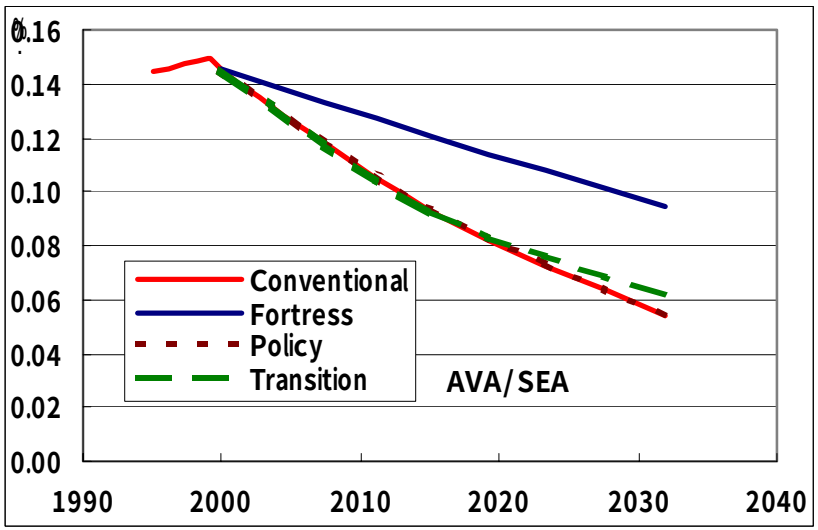


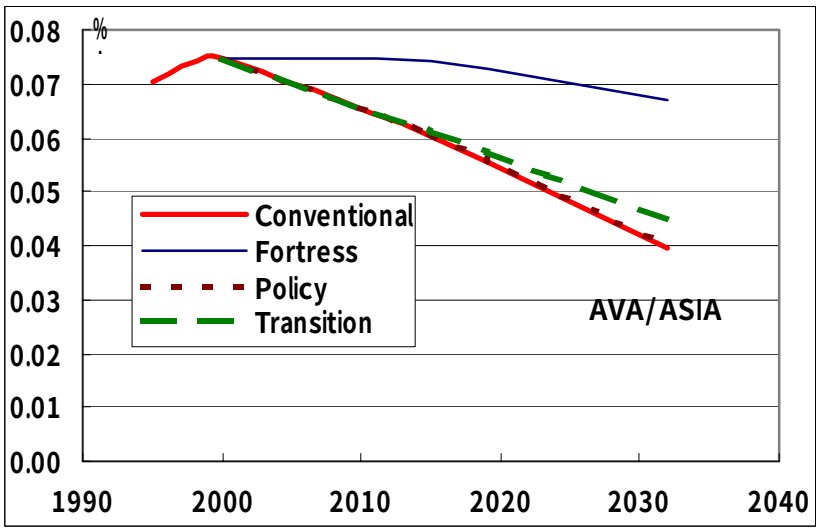
Figure 6 Relationship between SVA (Service Value Added) share and GDP per capita in Central Planned Asia and South East Asia

Value added/ agriculture

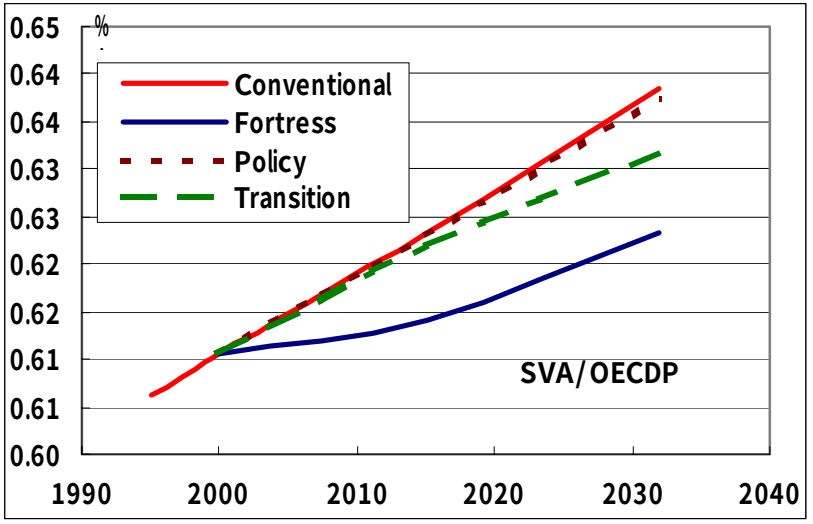


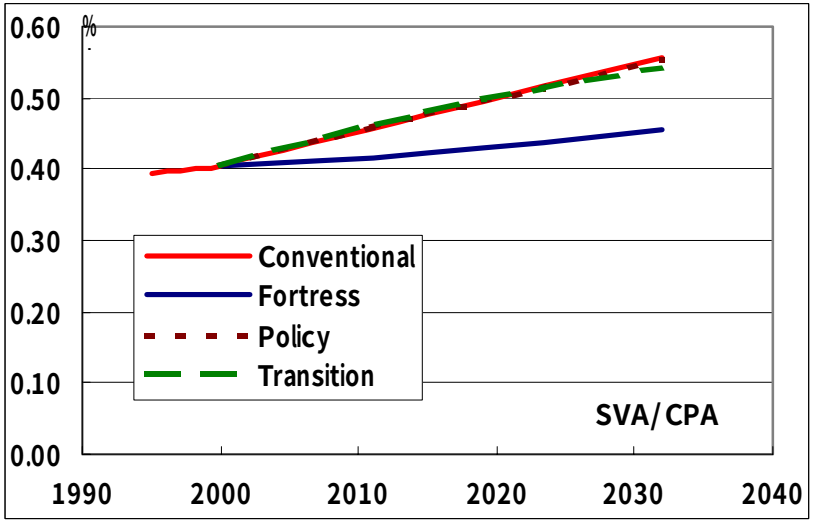


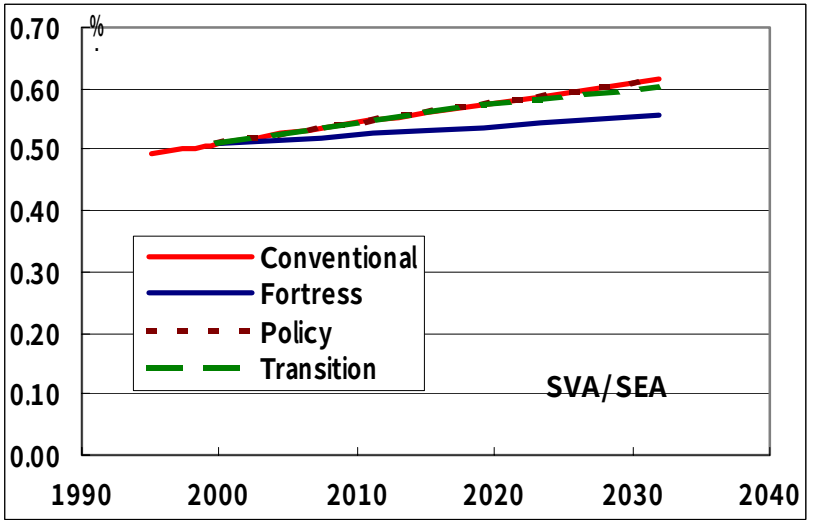


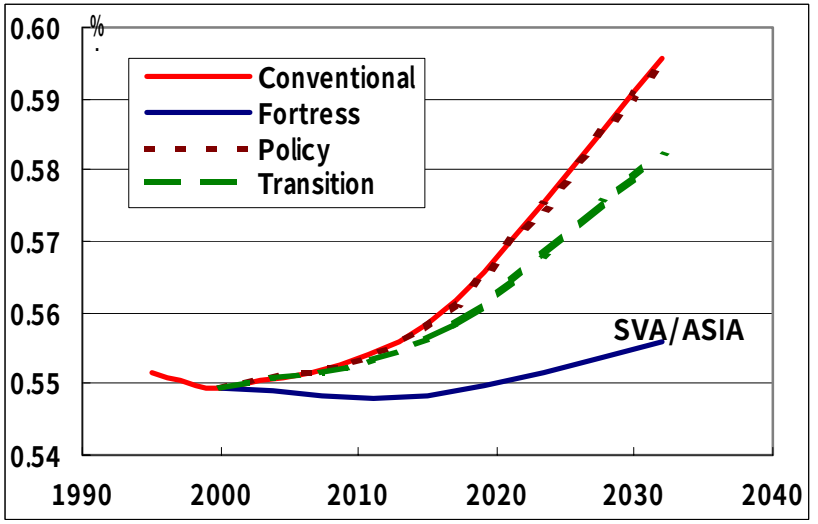


Value added/ service



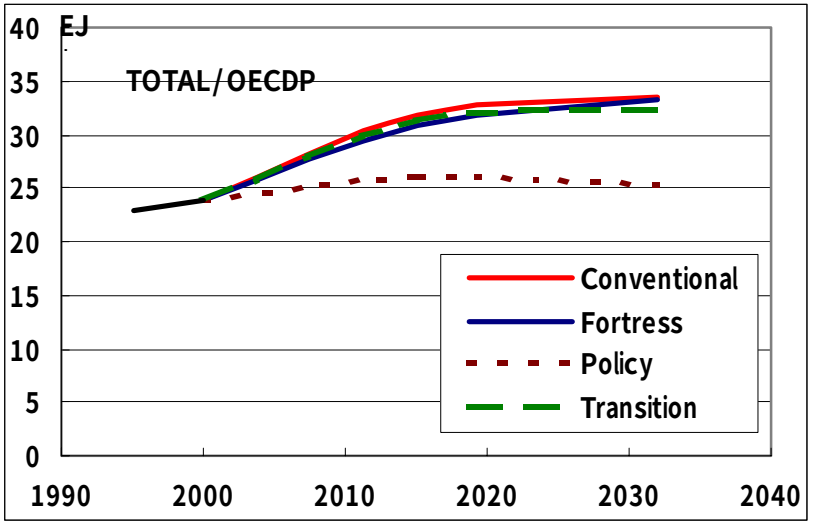


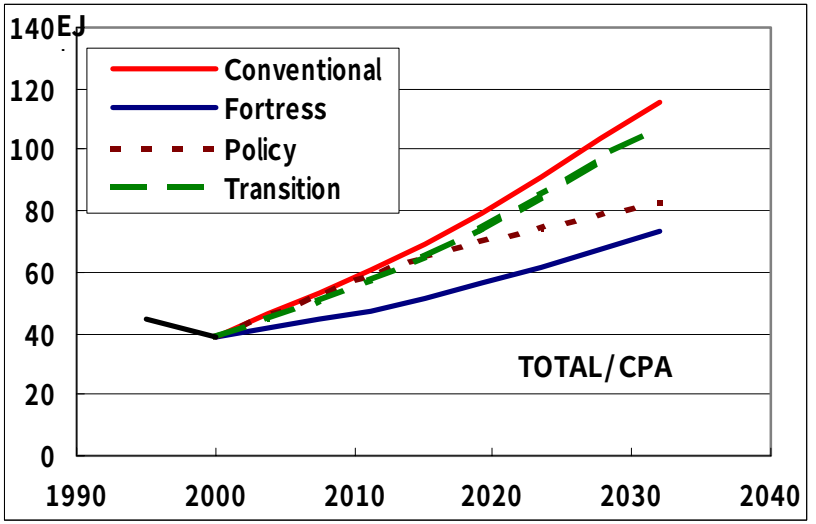


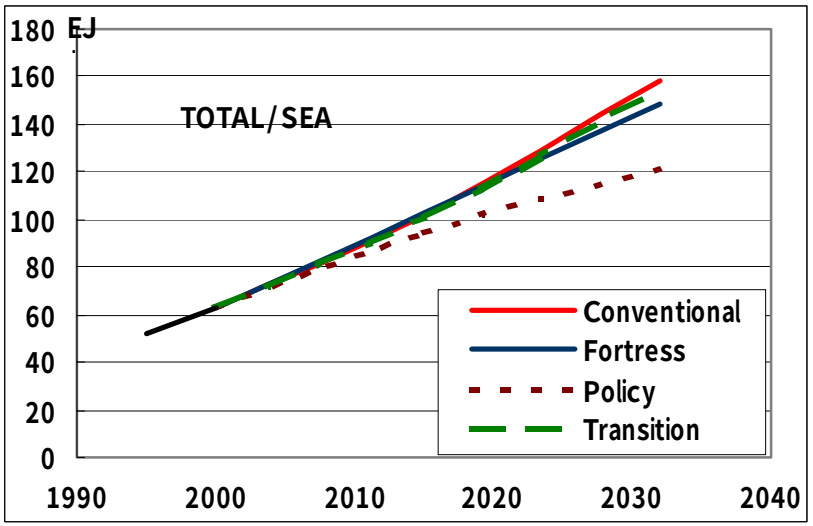


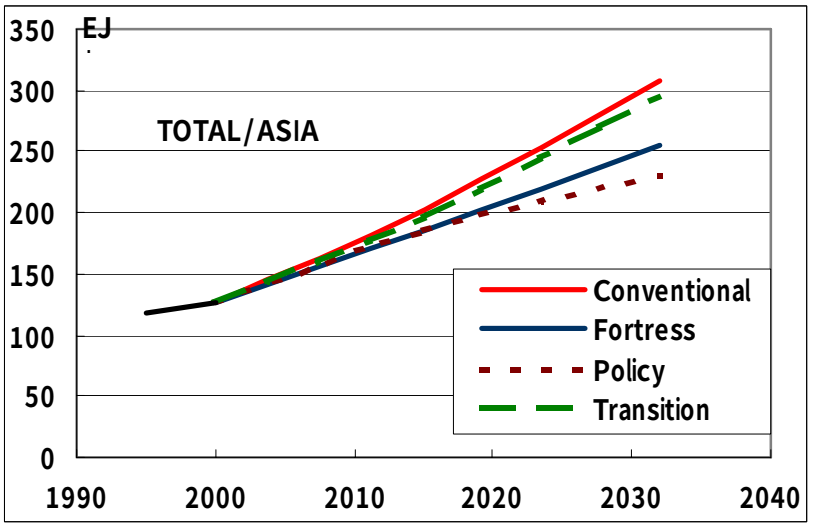
Future Perspectives

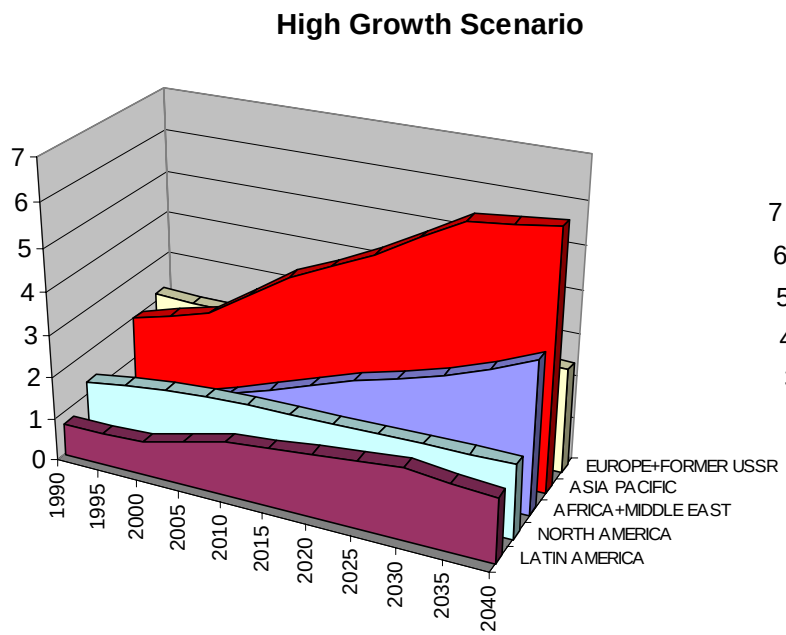
Primary energy supply



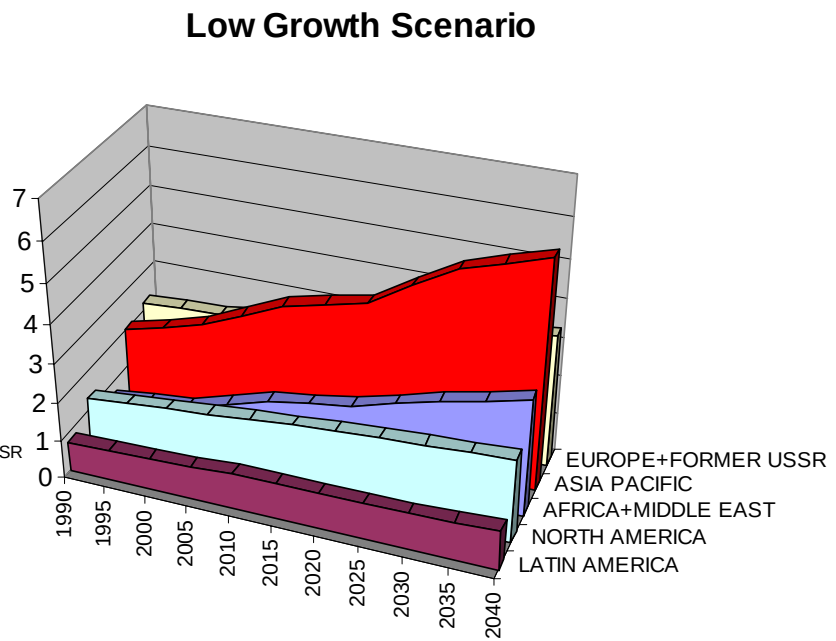








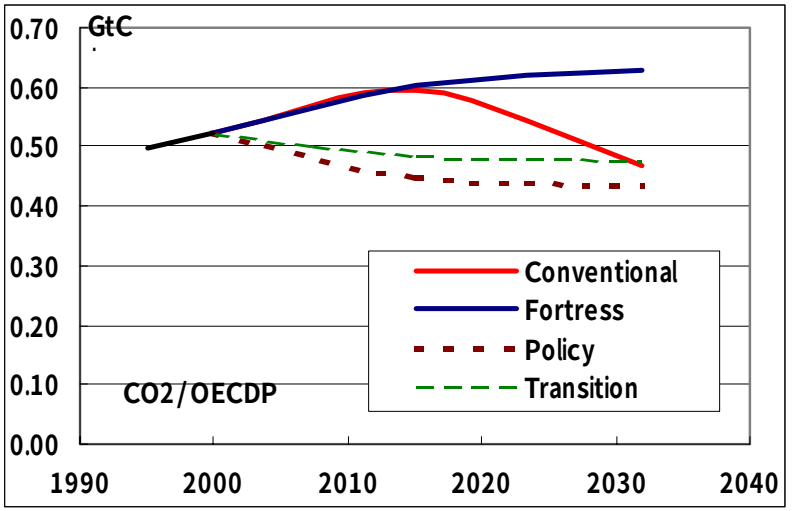
(a) CO2 projection under the Conventional Development Scenario

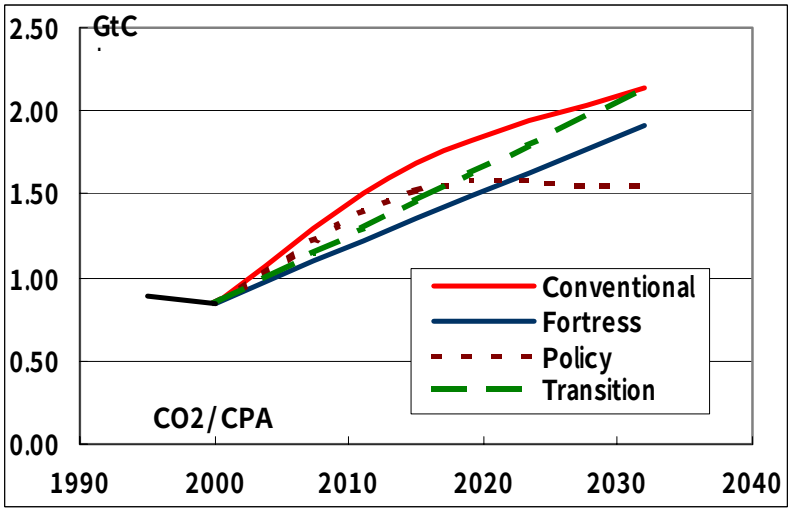


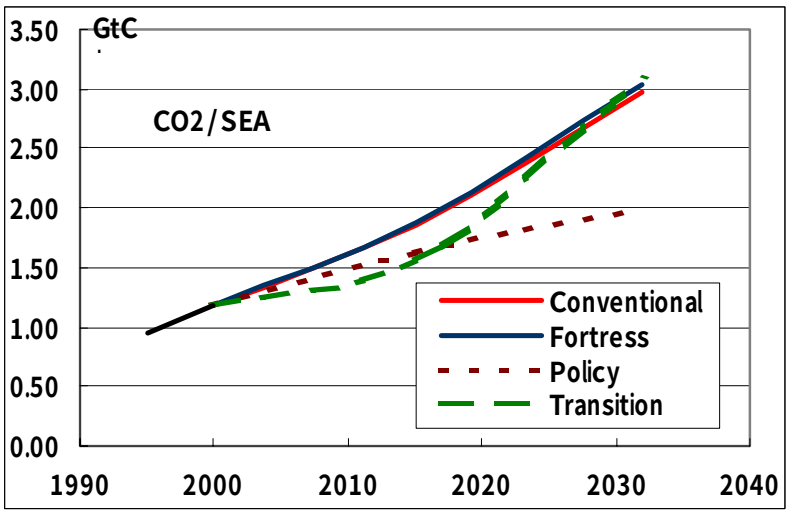
(b) CO2 projection under the Fortress World

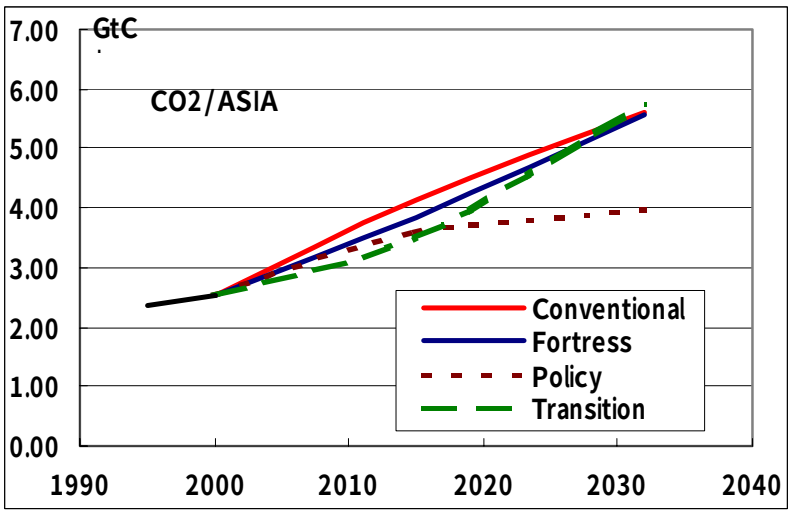
Figure 7 Projection of CO2 emission in the five regions

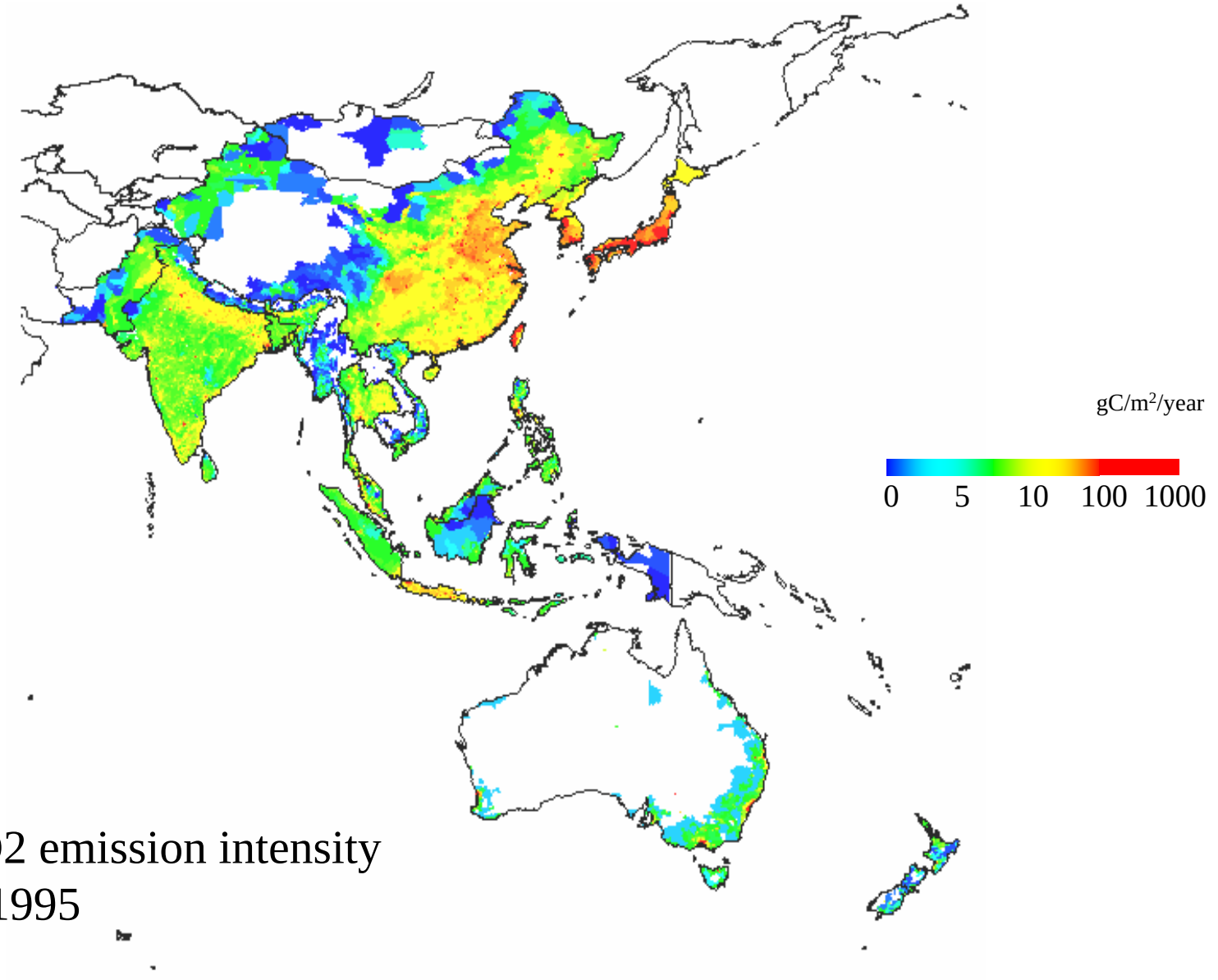
CO2 emission



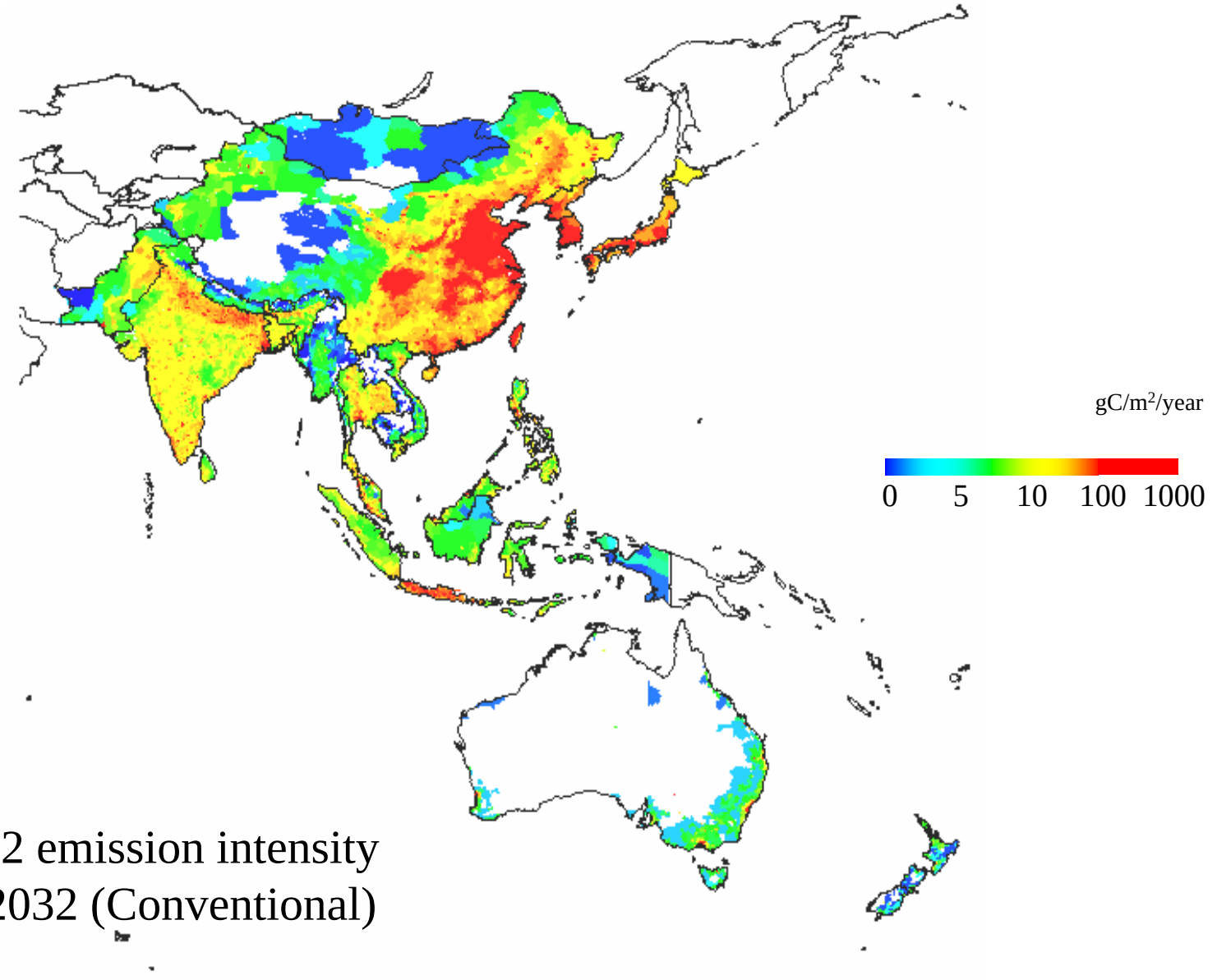




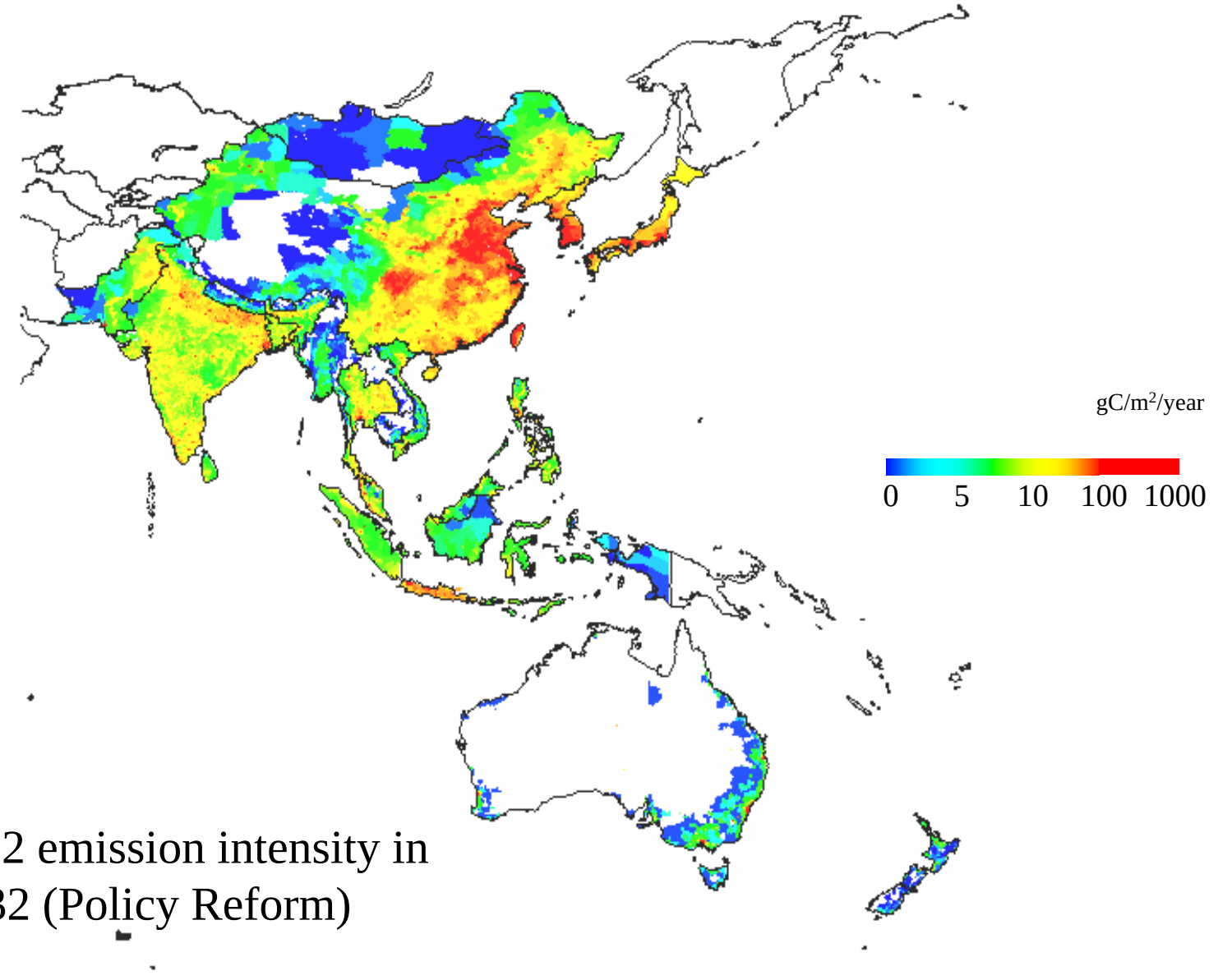




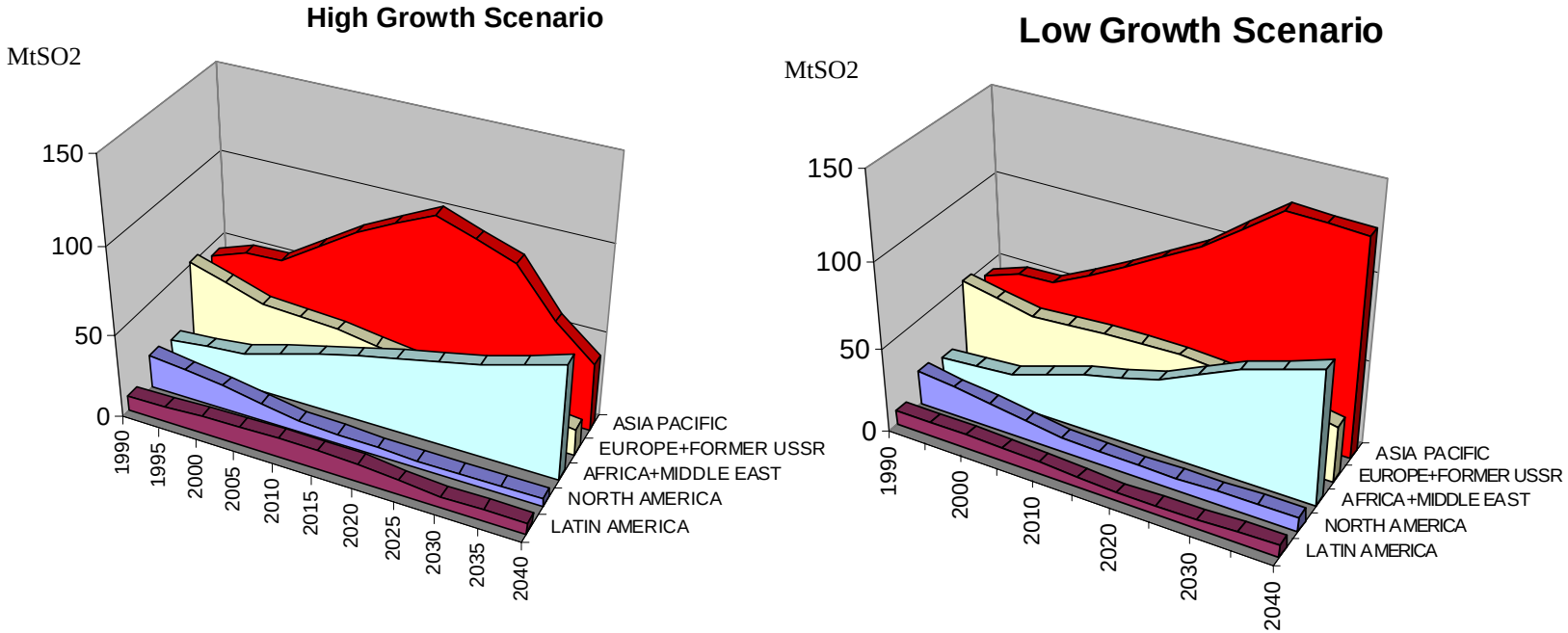
CO2 emission intensity
in 1995



CO2 emission intensity
in 2032 (Conventional)



CO2 emission intensity in 2032 (Policy Reform)

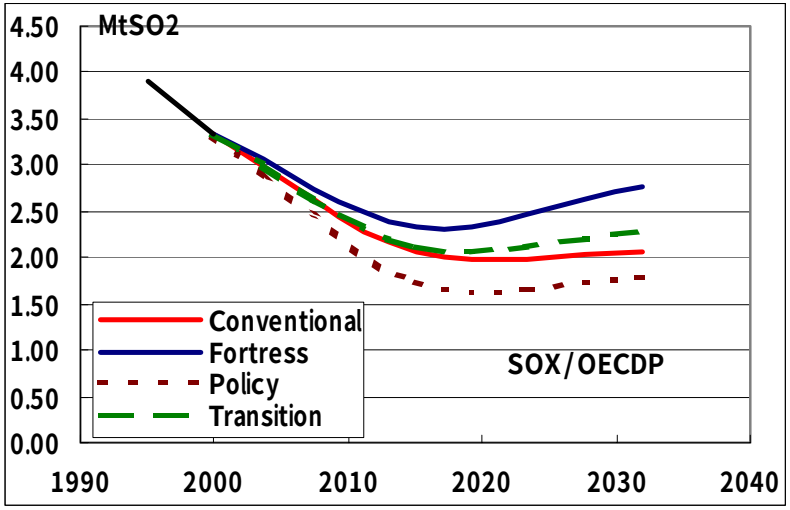


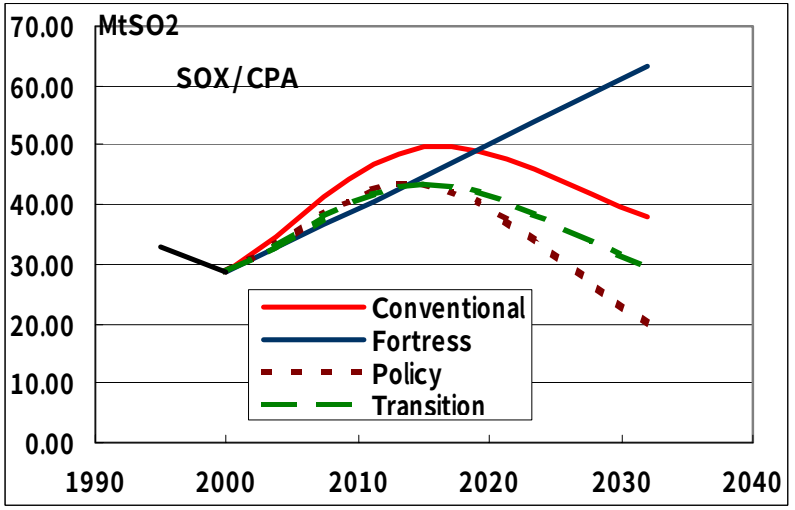
(a) SO2 projection under the Conventional Development Scenario

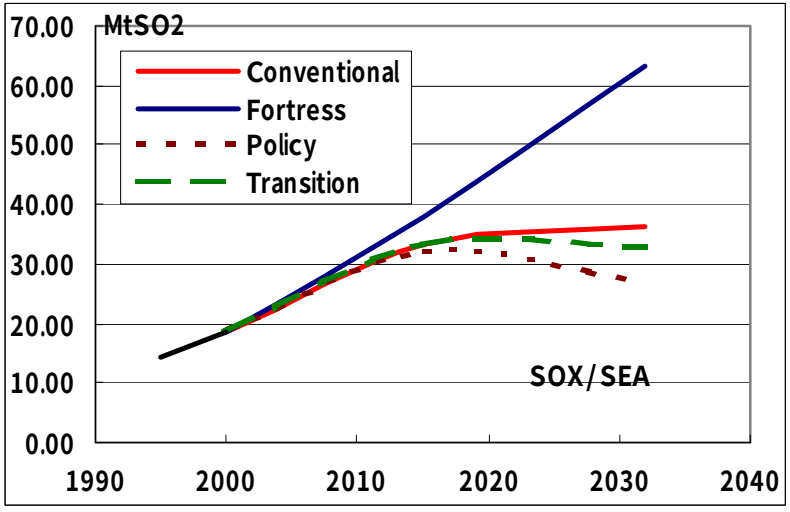
(b) SO2 projection under the Fortress World

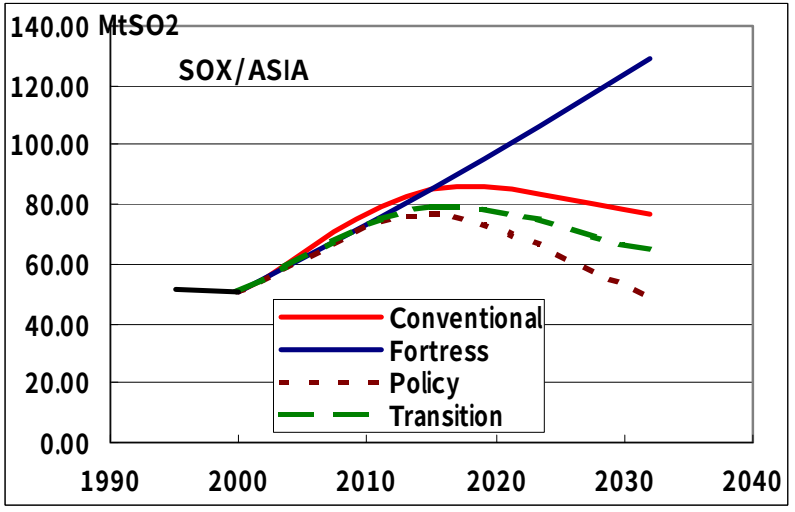
Figure 9 Projection of SO2 emission in the five regions

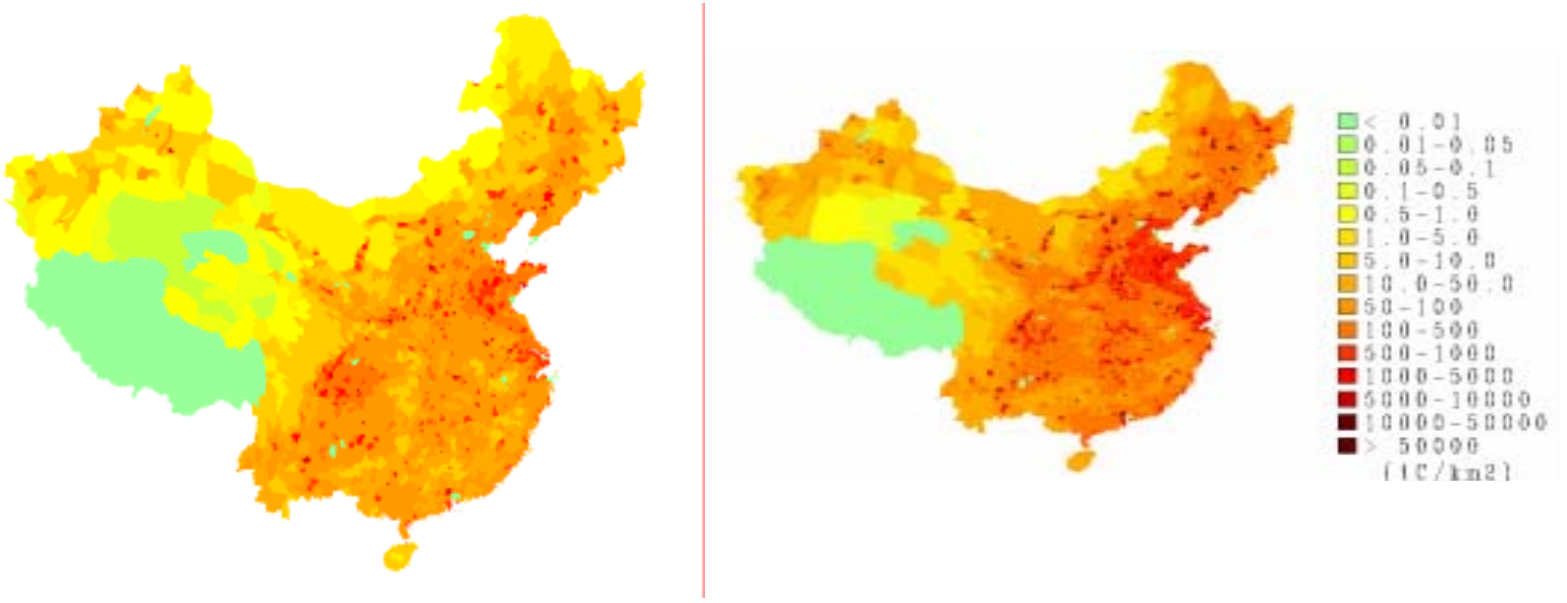
SO2 emission







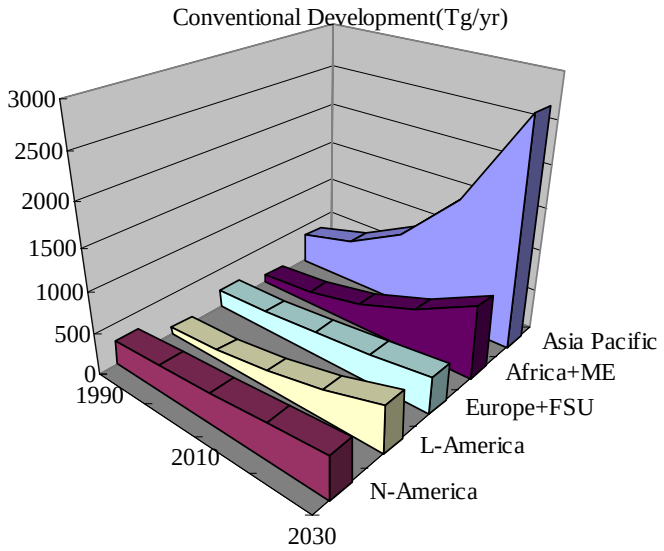




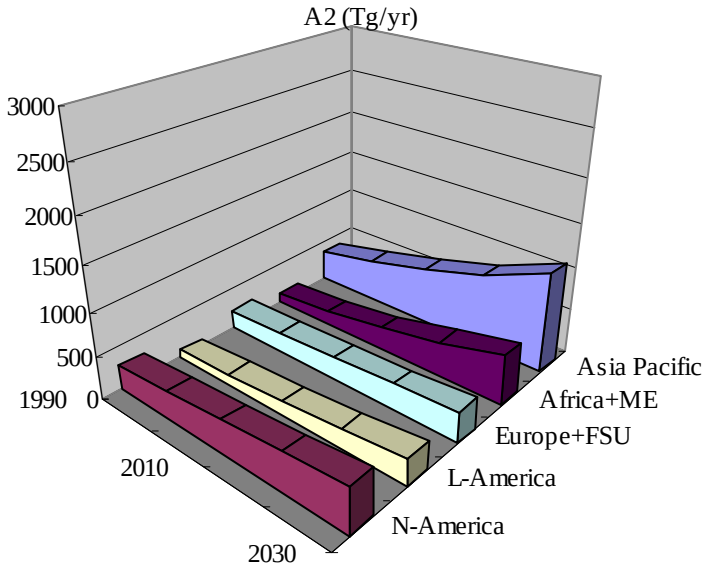
(a) SO2 emission intensity in 1990

(b) SO2 emission intensity in 2025 under the high growth scenario

Figure 10 Emission intensity in China



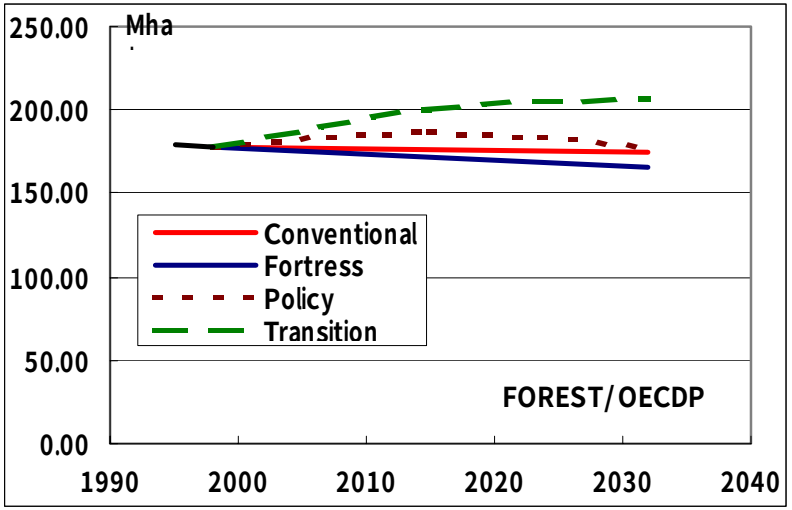
(a) municipal waste projection under the Conventional Development Scenario



(b) municipal waste projection under the Fortress World

Figure 11 Projection of municipal solid waste in the five regions

Forest area


Mha
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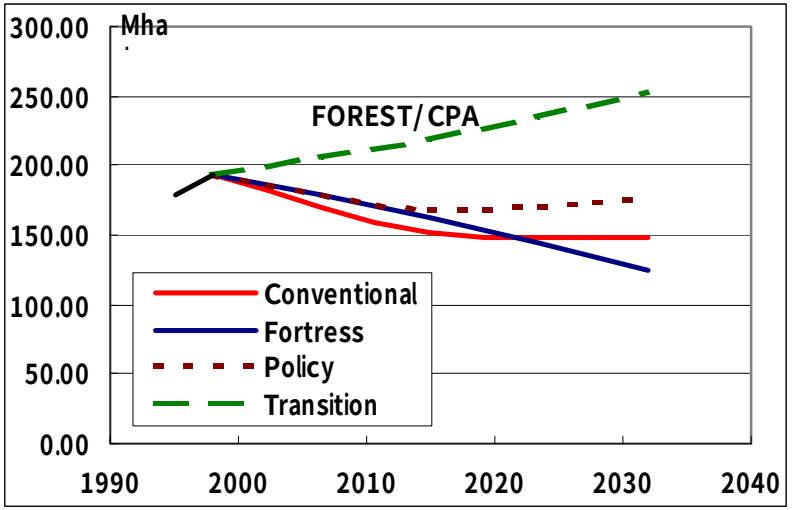
150.00
100.00
50.00
0.00
1990
2000
2010
2020
2030
2040
Conventional
Fortress
Policy
Transition
FOREST/OECDP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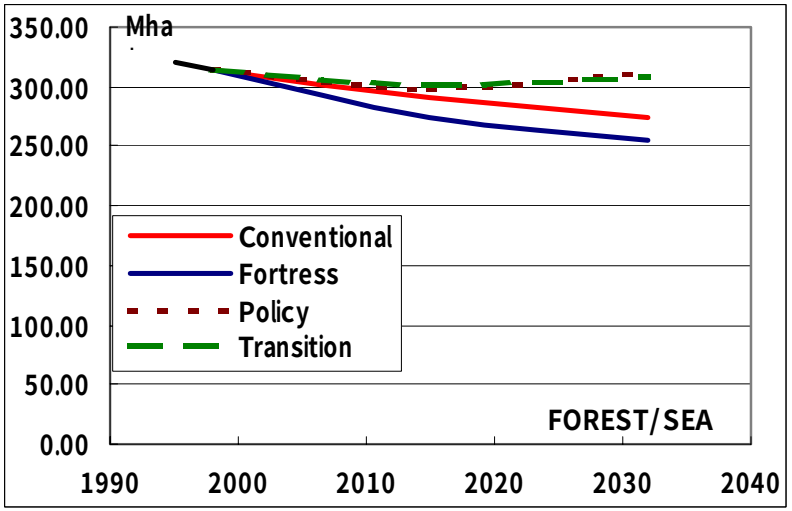
200.00
150.00
100.00
50.00
0.00
1990
2000
2010
2020
2030
2040
FOREST/CPA
Conventional
Fortress
Policy
Transition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250.00
200.00
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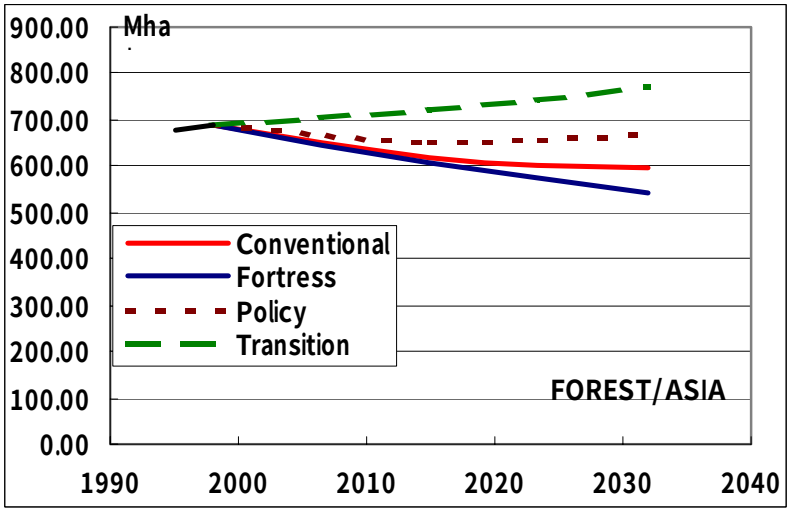
2000
2010
2020
2030
2040
Conventional
Fortress
Policy
Transition
FOREST/SEA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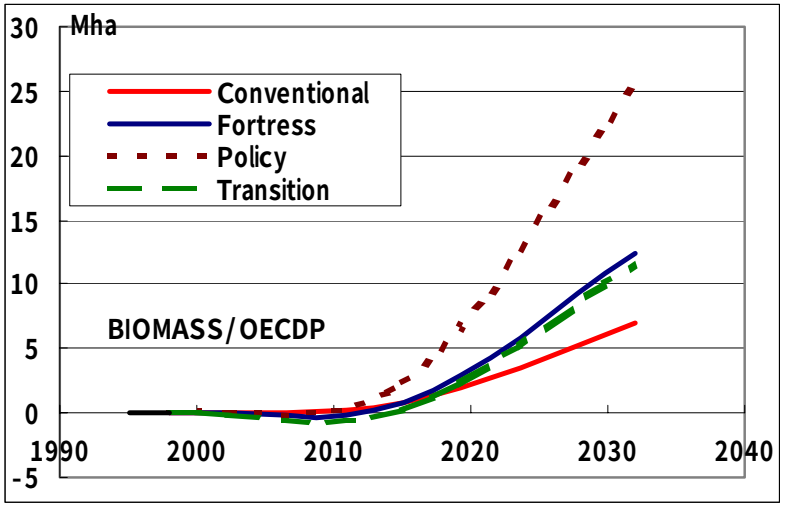
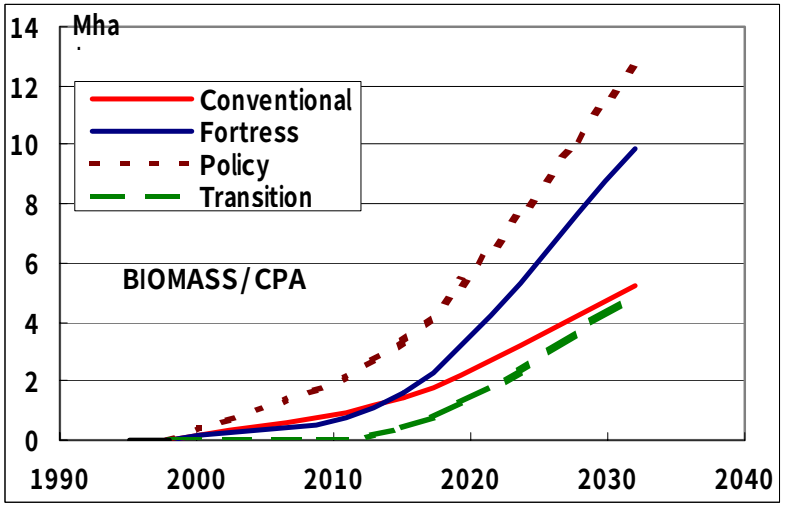
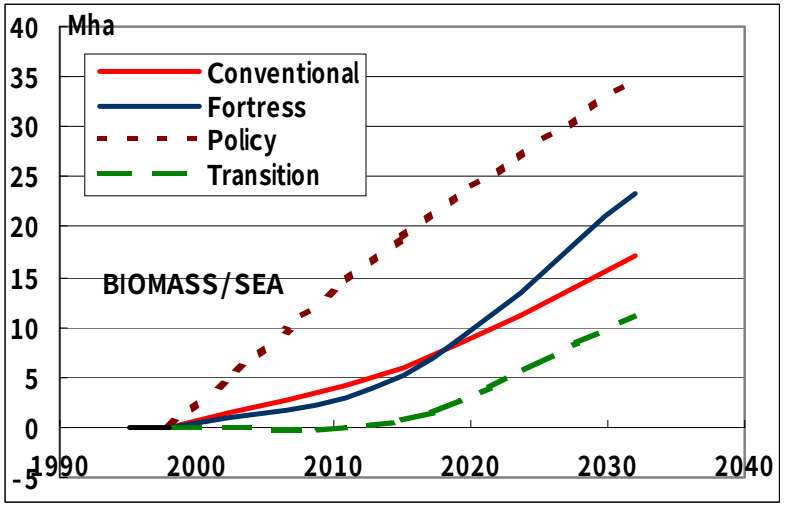
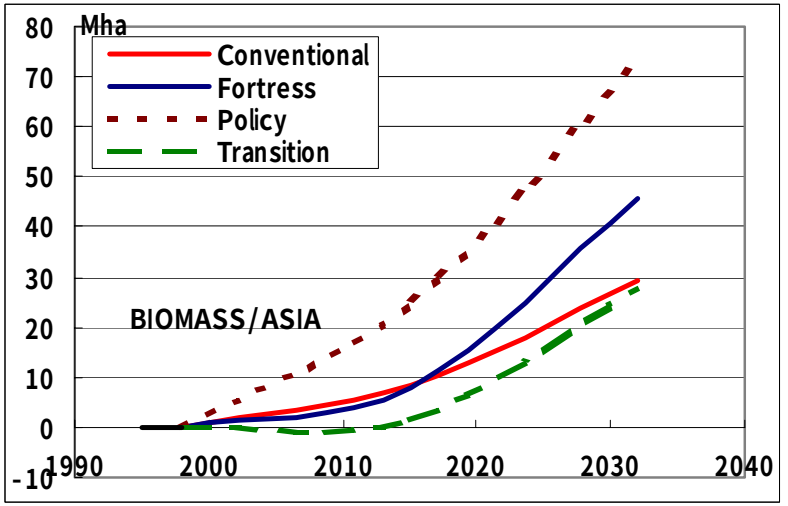
2000
2010
2020
2030
2040
Conventional
Fortress
Policy
Transition
FOREST/ASIA

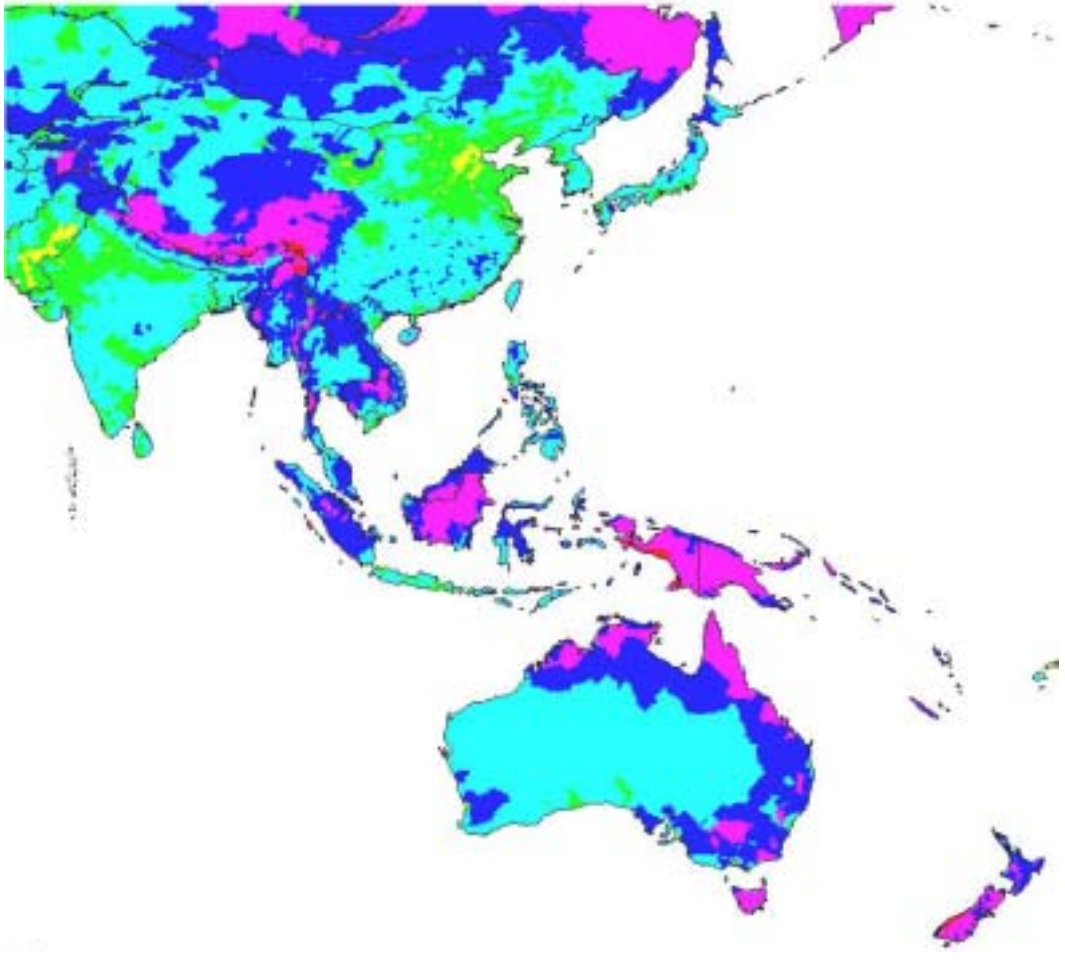
Biomass field





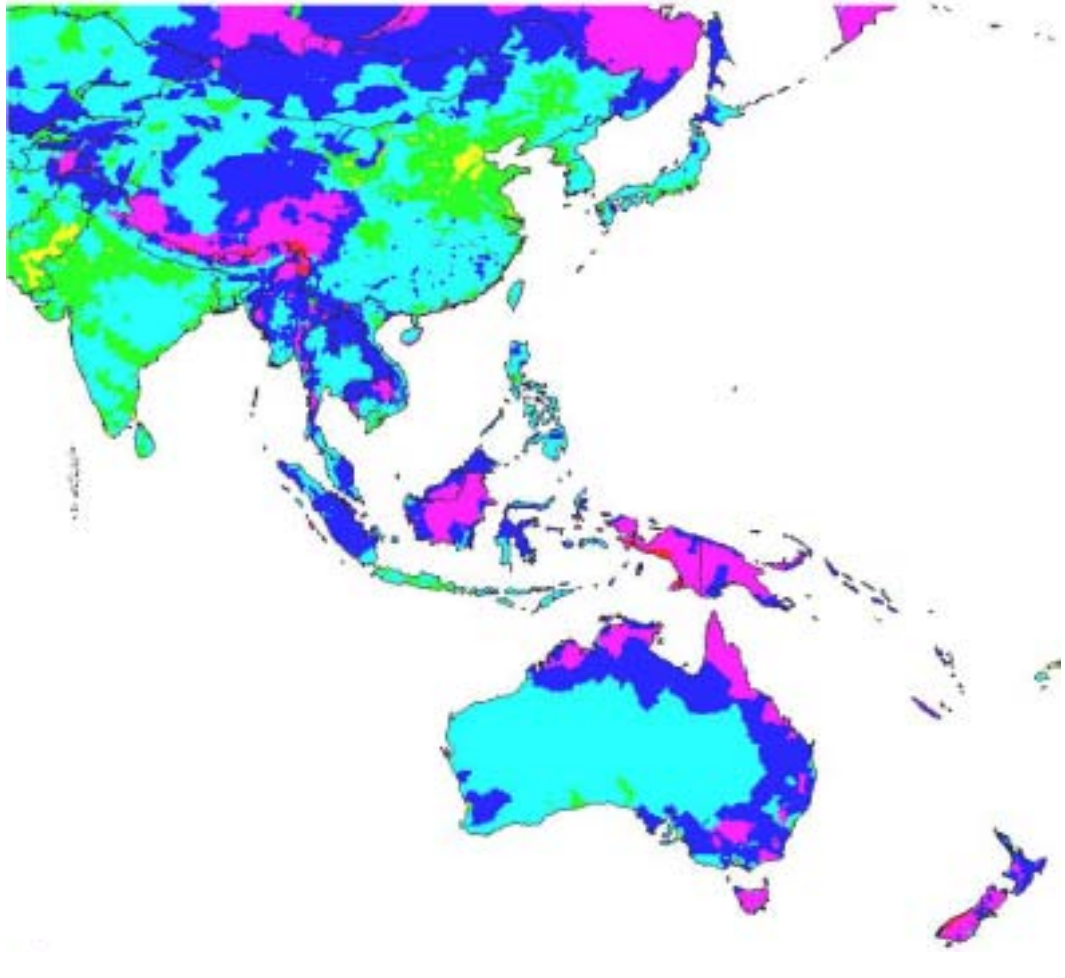






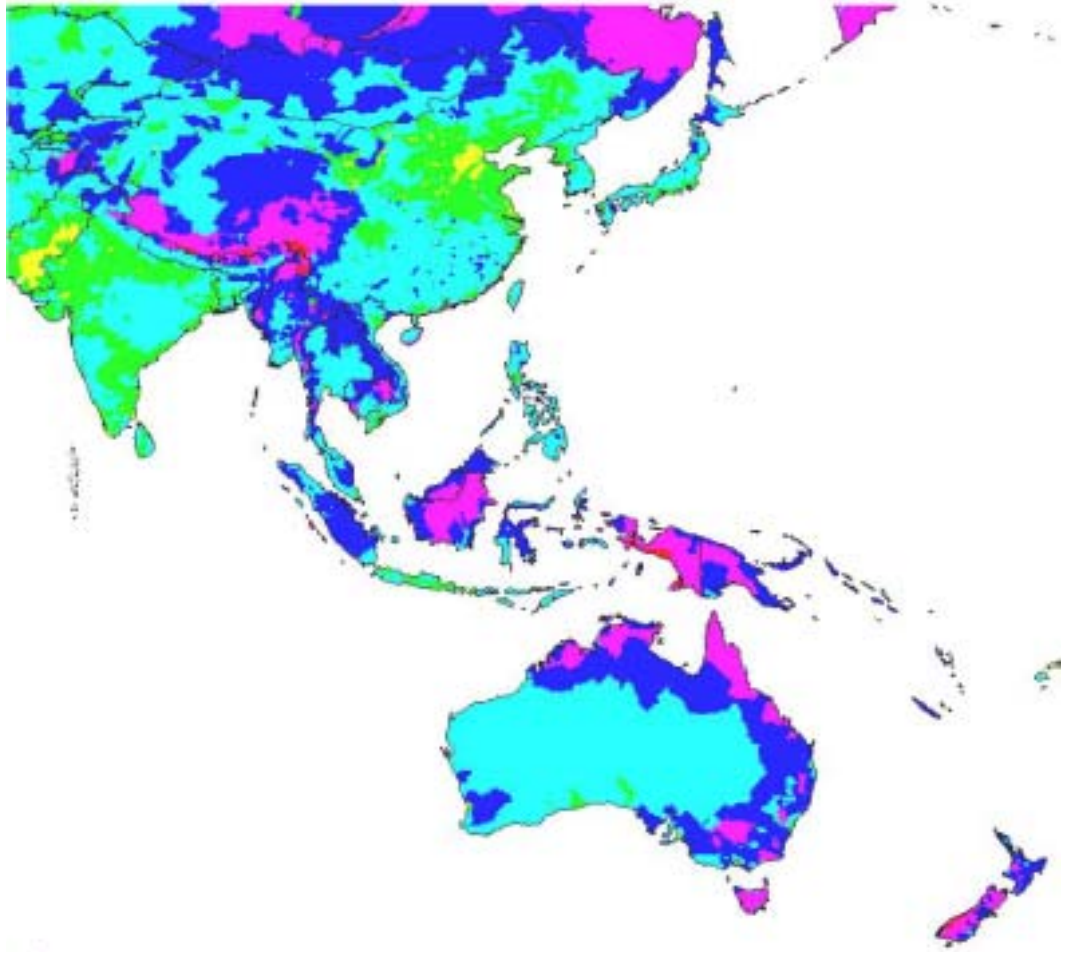
3 30 300 3000 30000 300000 (m^3/(year-capita)

Water availability per capita in 1990



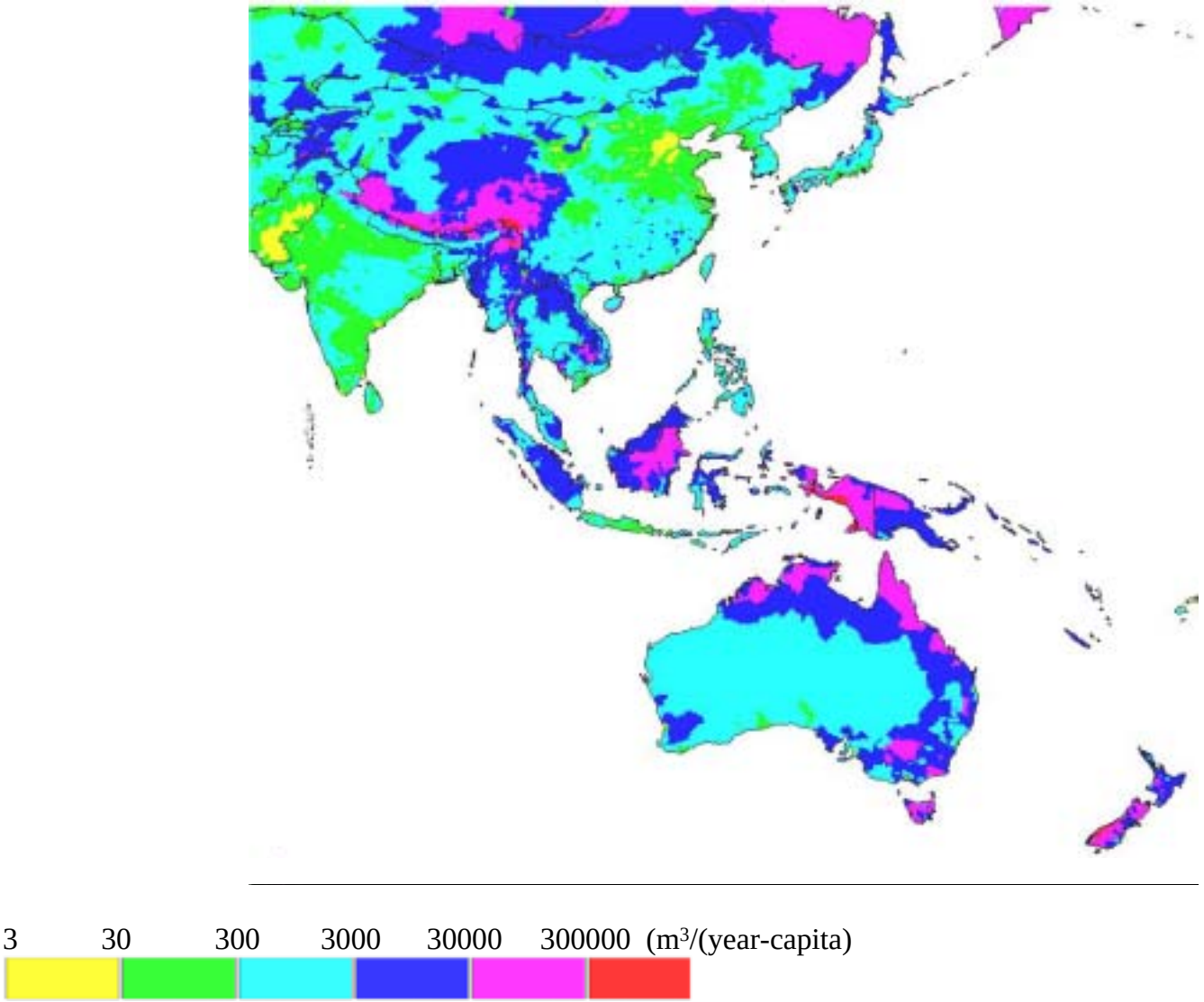
3 30 300 3000 30000 300000 (m^3/(year-capita)

Water availability per capita, 2000

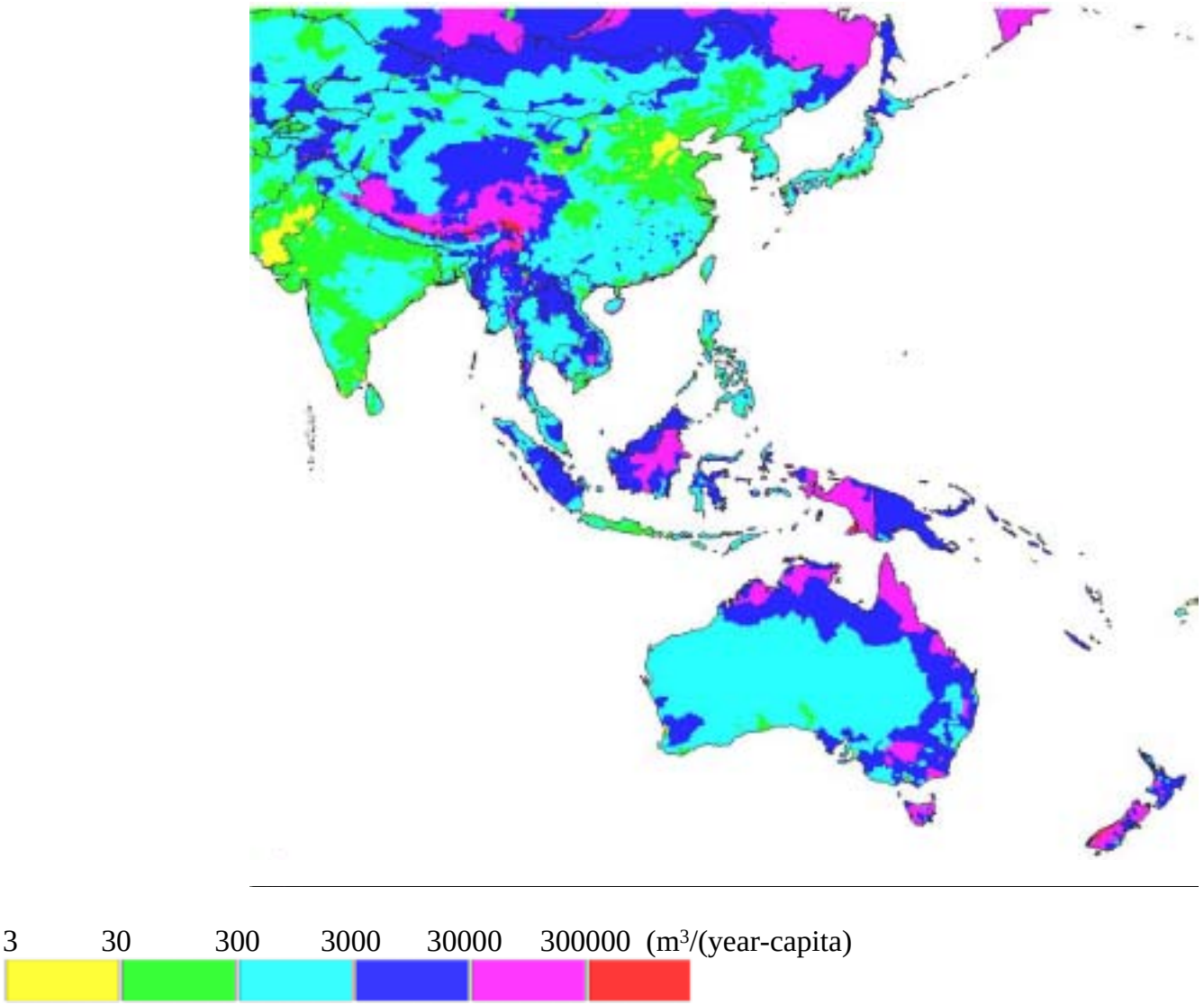


3 30 300 3000 30000 300000 (m^3/(year-capita)

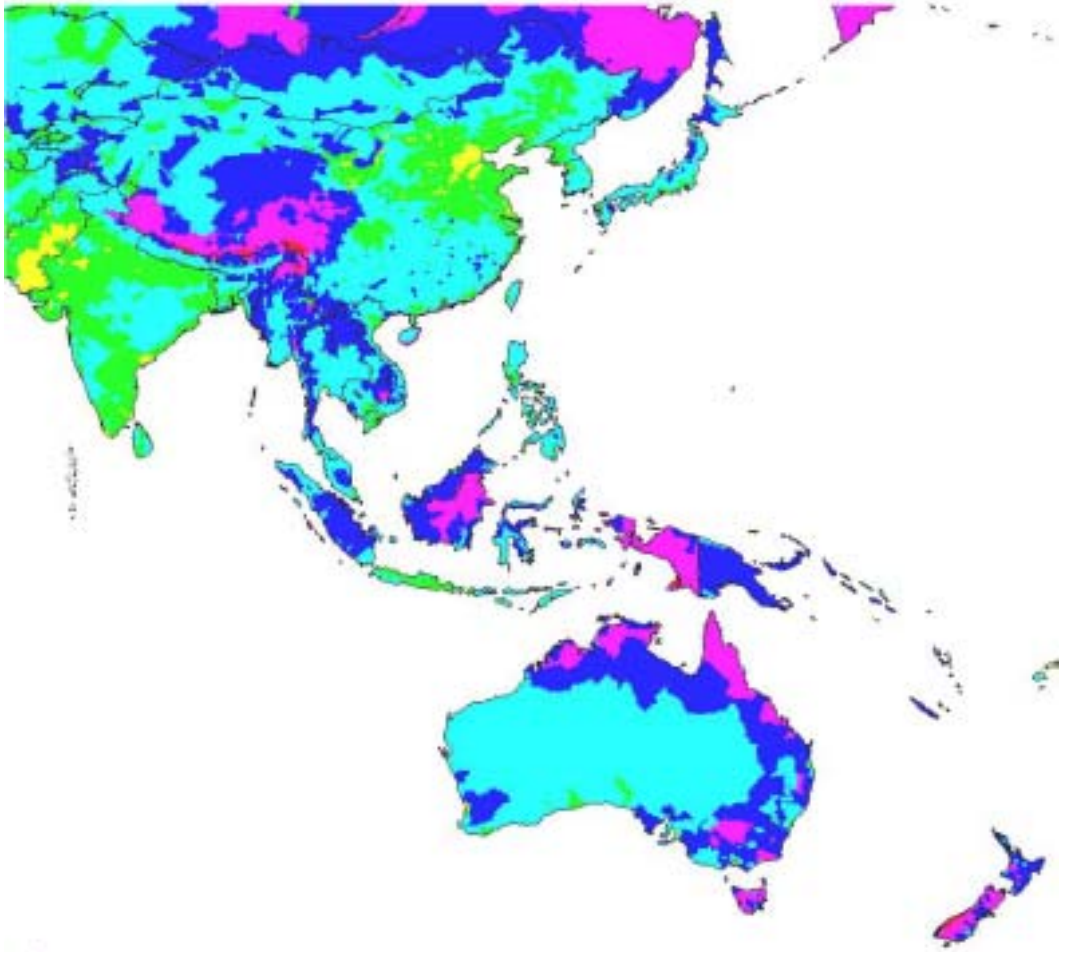
Water availability per capita, 2010



Water availability per capita, 2020

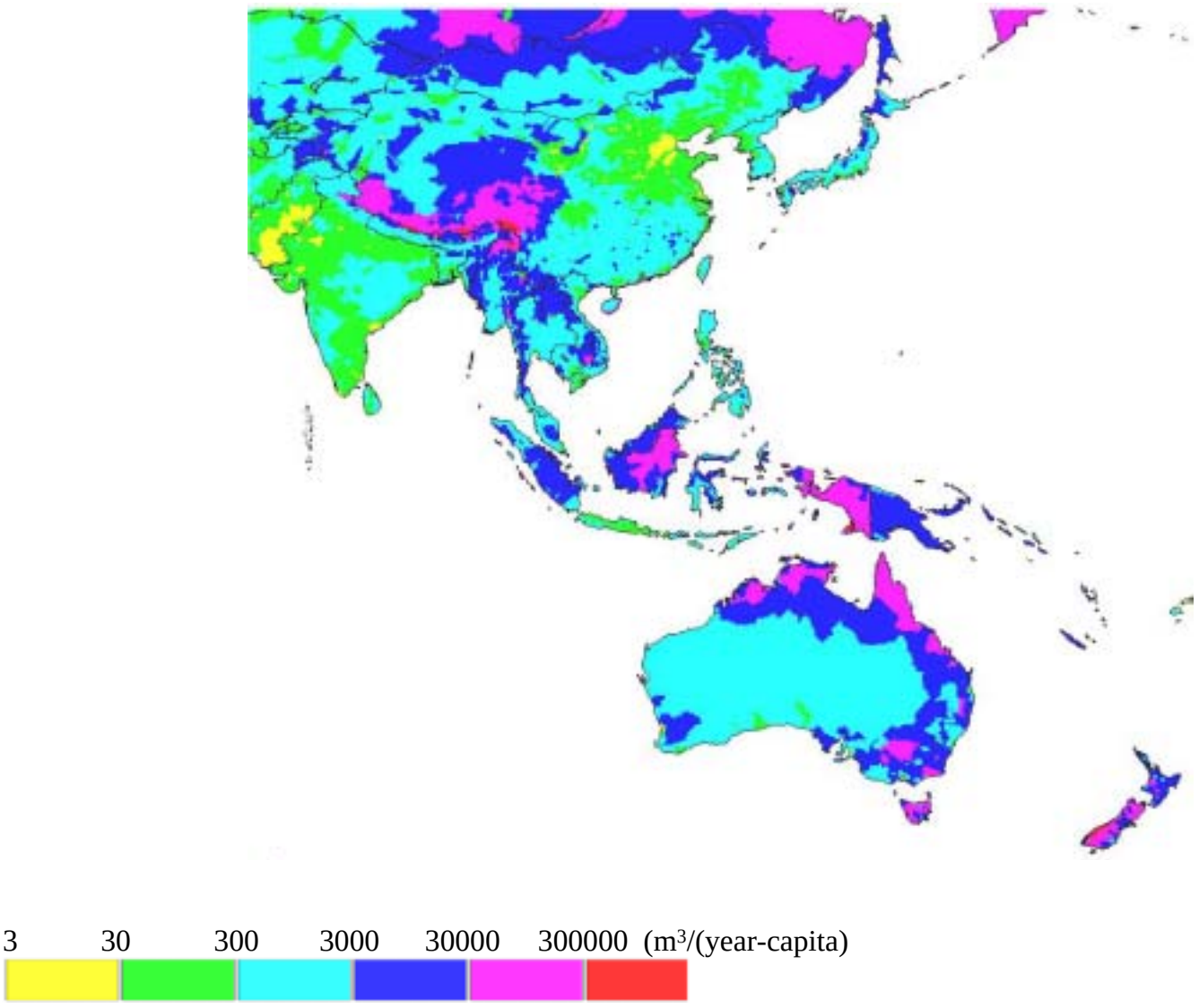


Water availability per capita, 2030

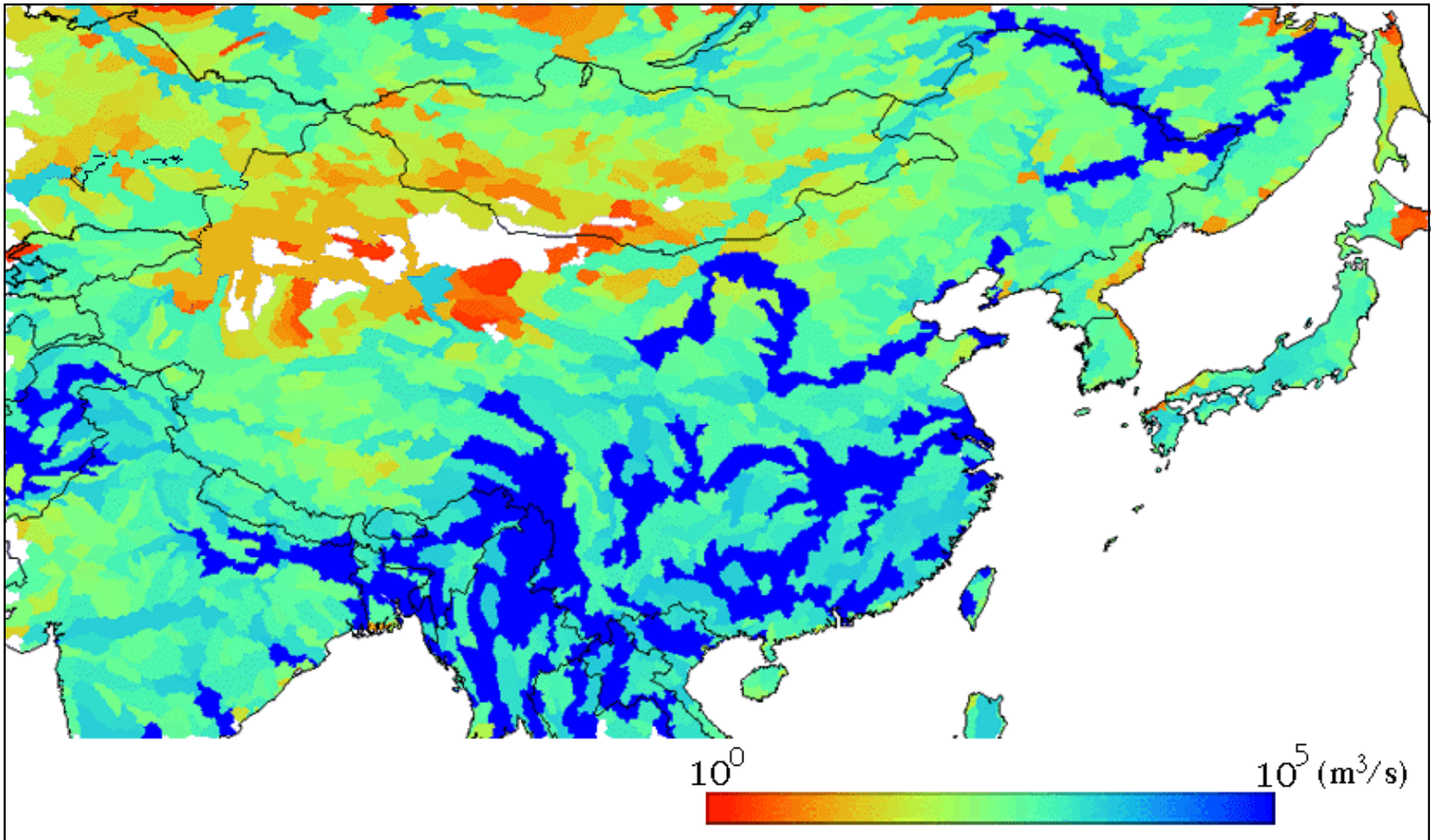


3 30 300 3000 30000 300000 (m^3/(year-capita)

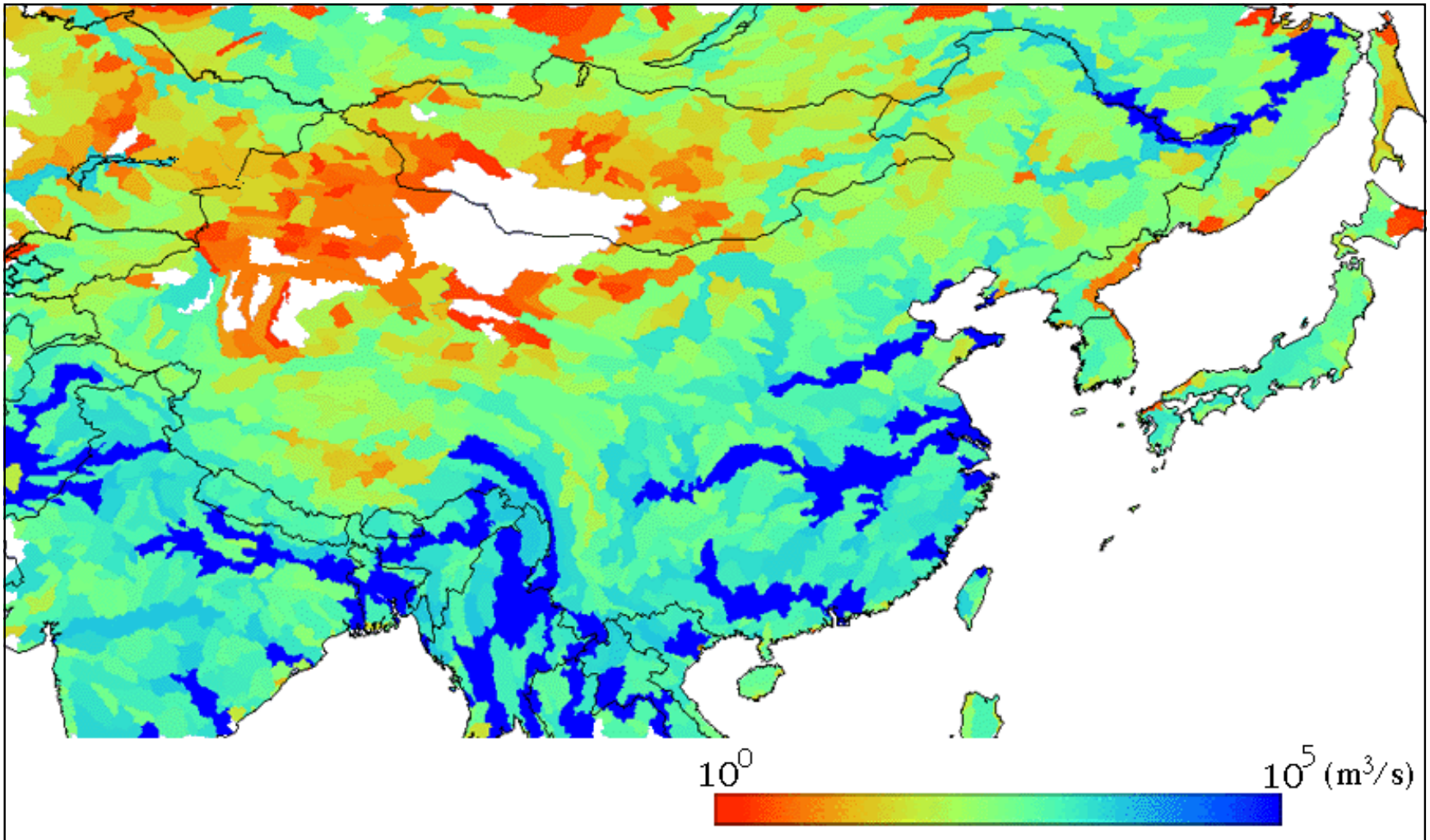
Water availability per capita, 2040



Water availability per capita, 2050

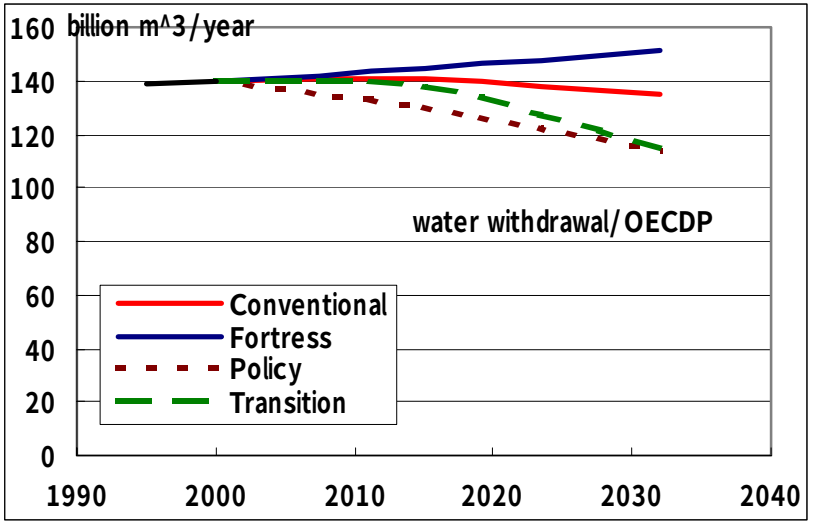


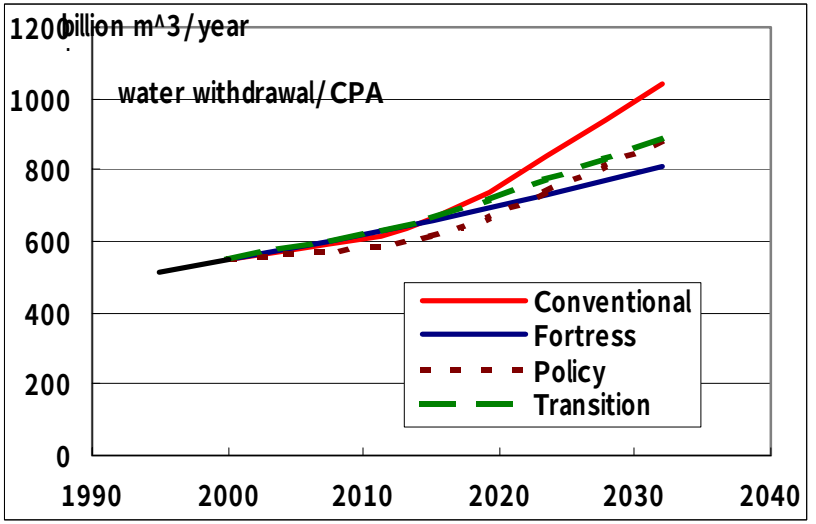
Annual averaged stream flow under current climate (1983)

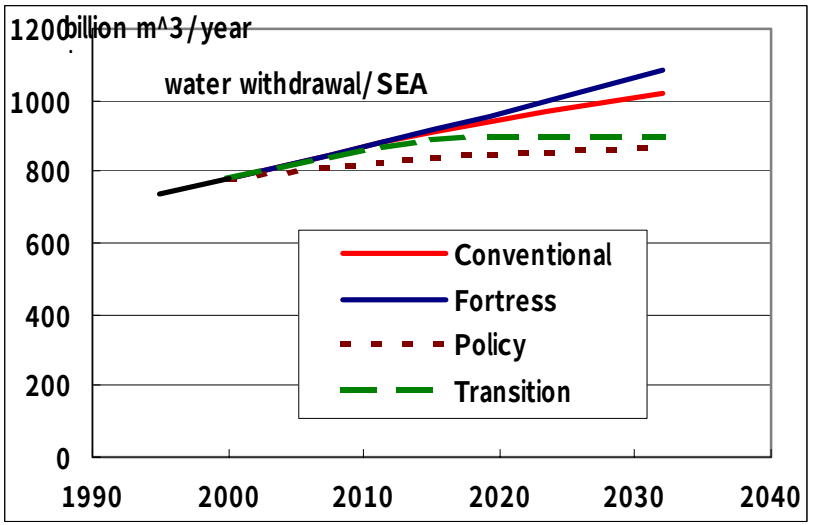


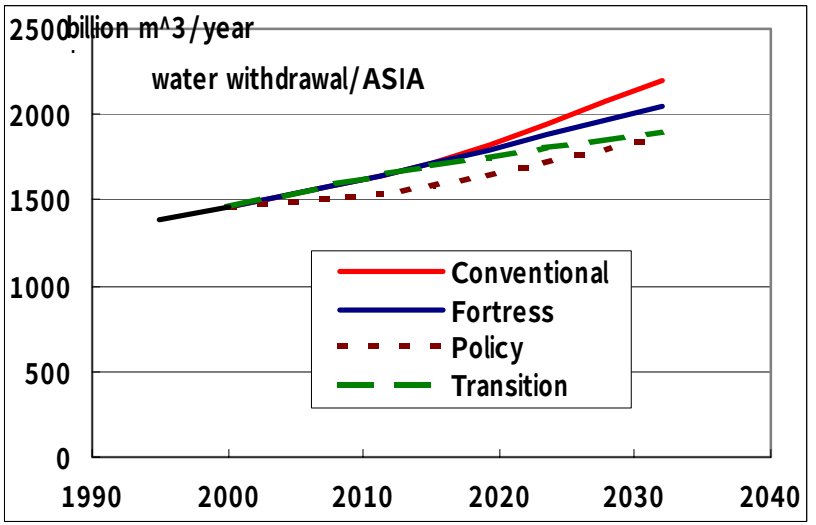
Annual averaged stream flow after changed climate (2100)

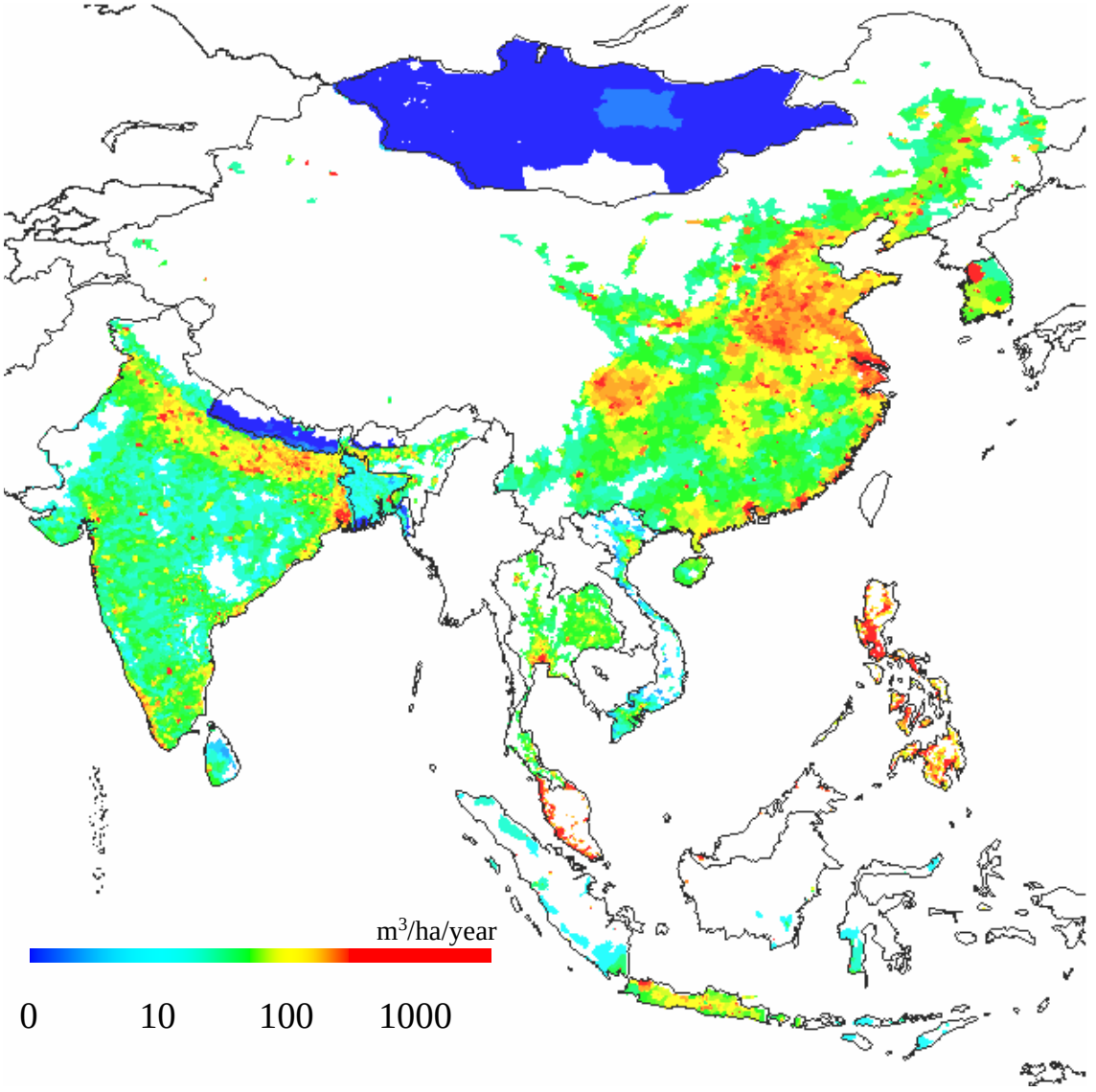
Water withdrawal



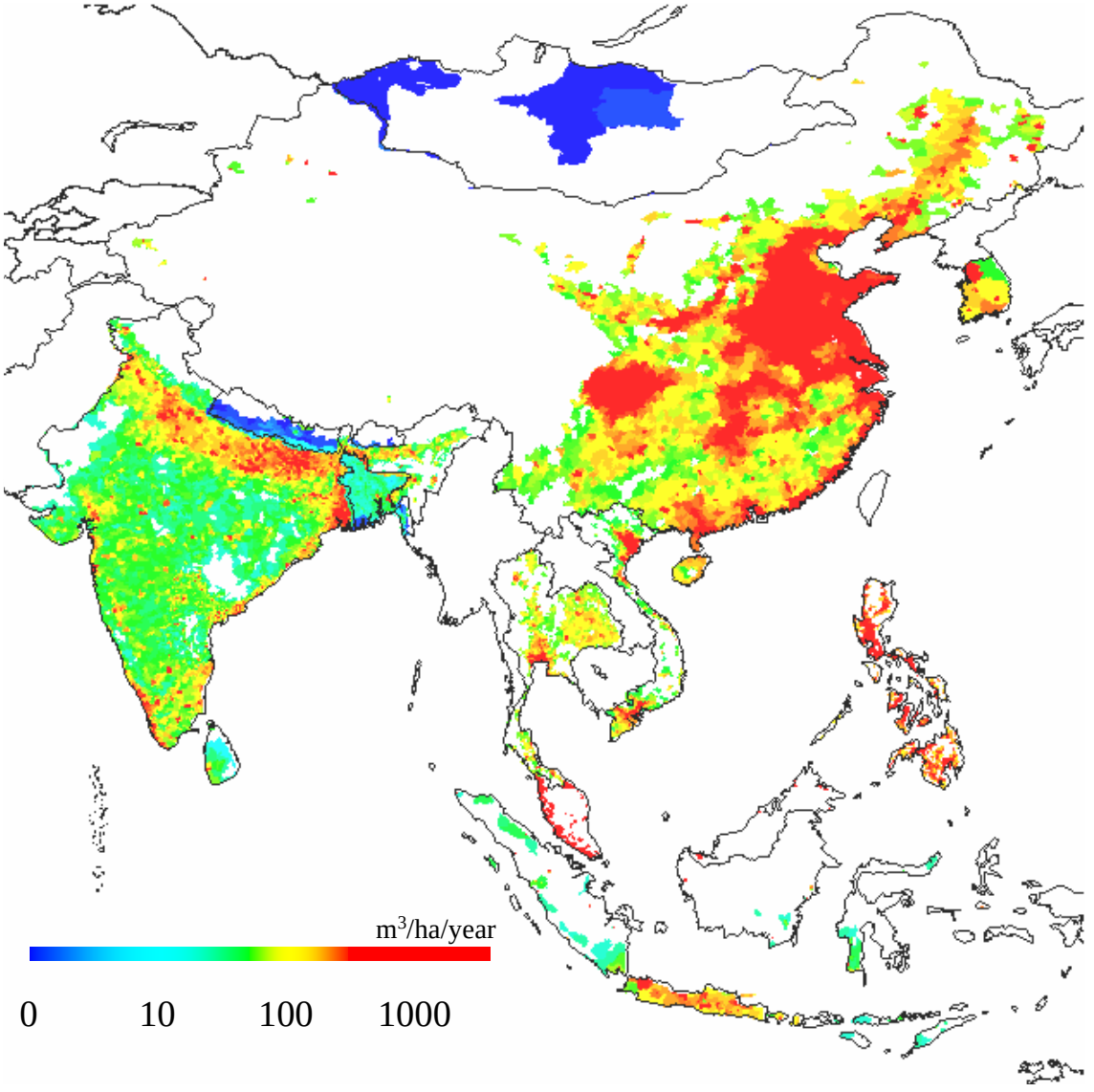




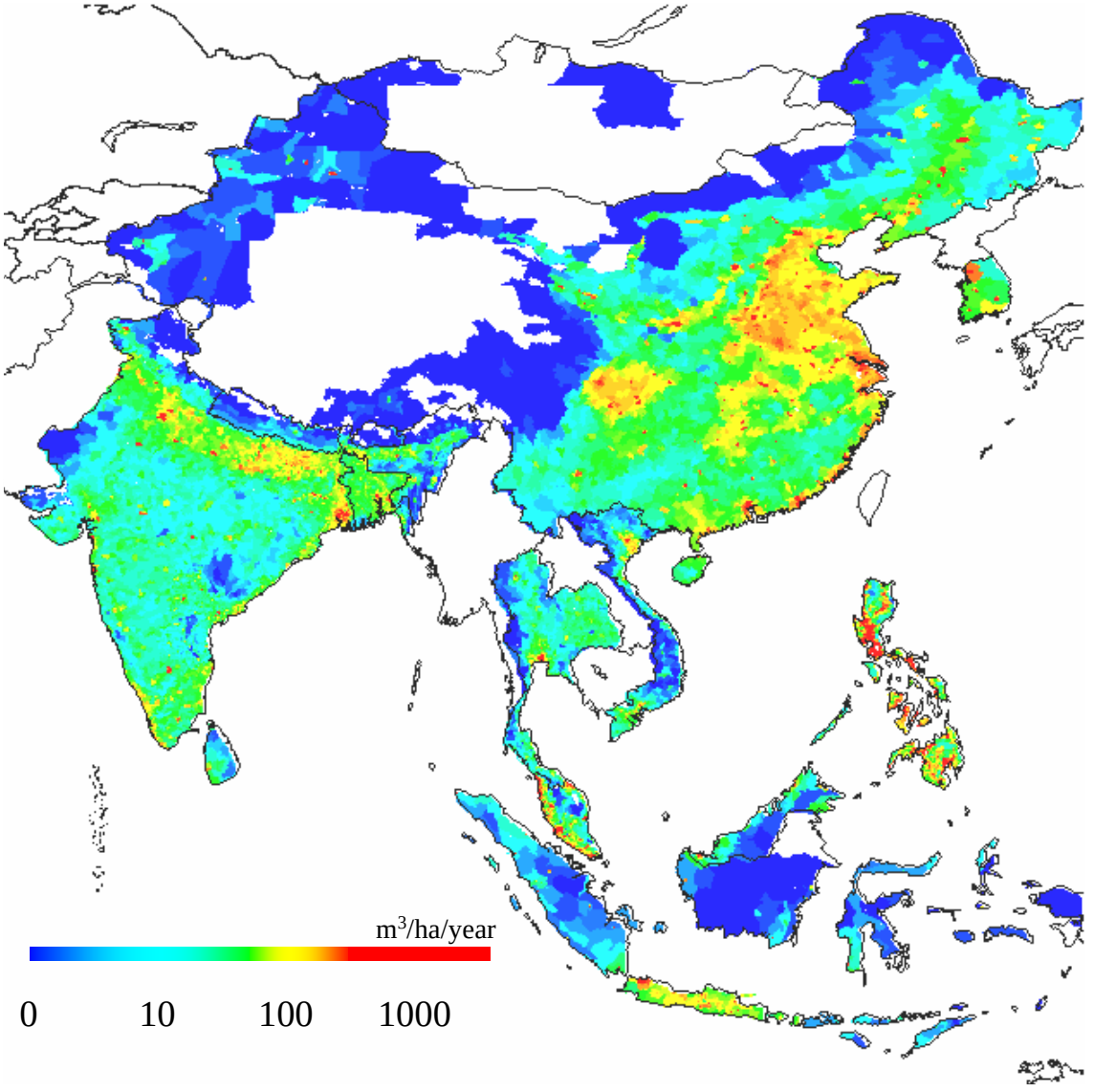




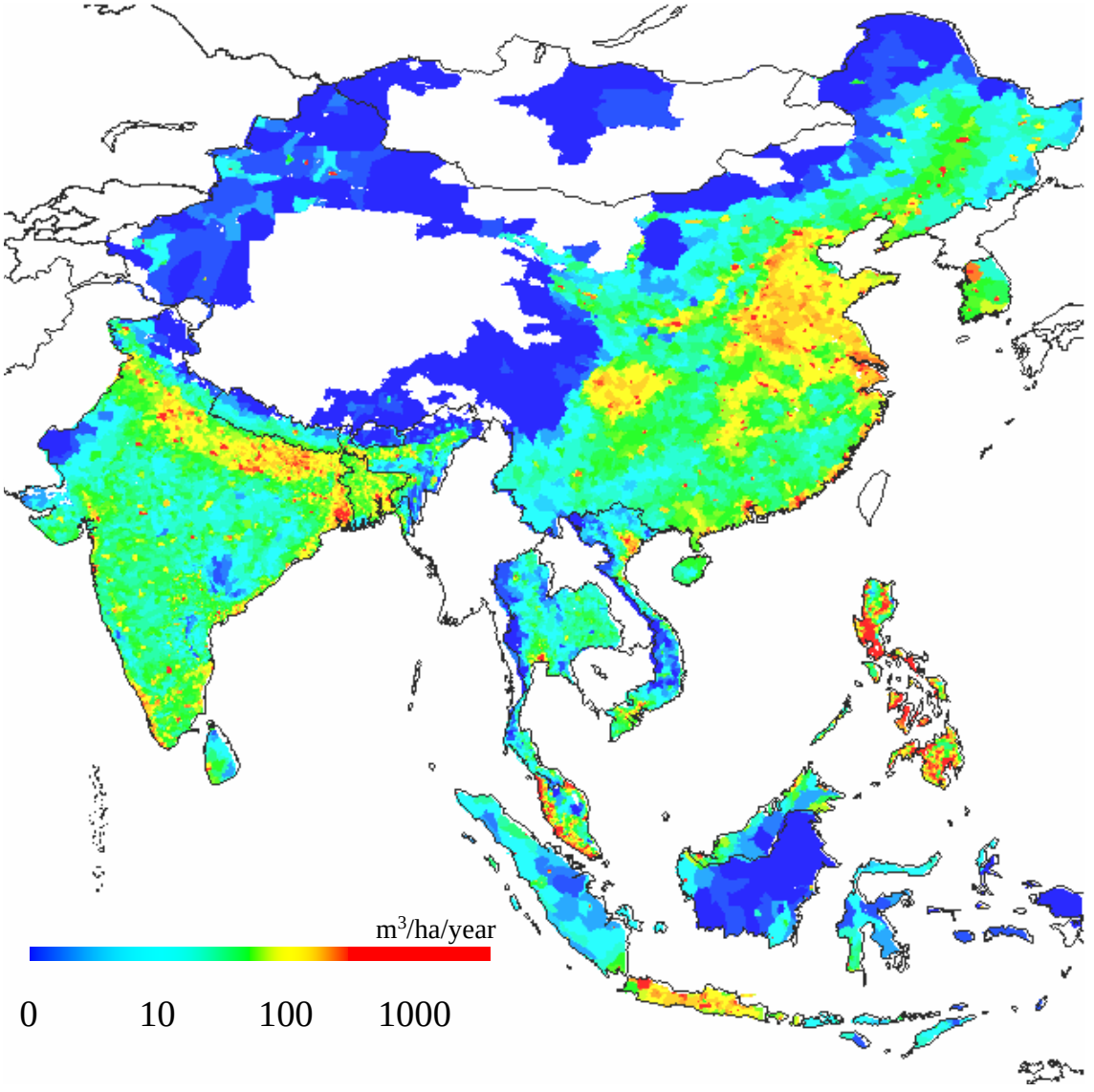
Industrial water withdraw intensity in Asia in 1990



Industrial water withdraw intensity in Asia in 2030

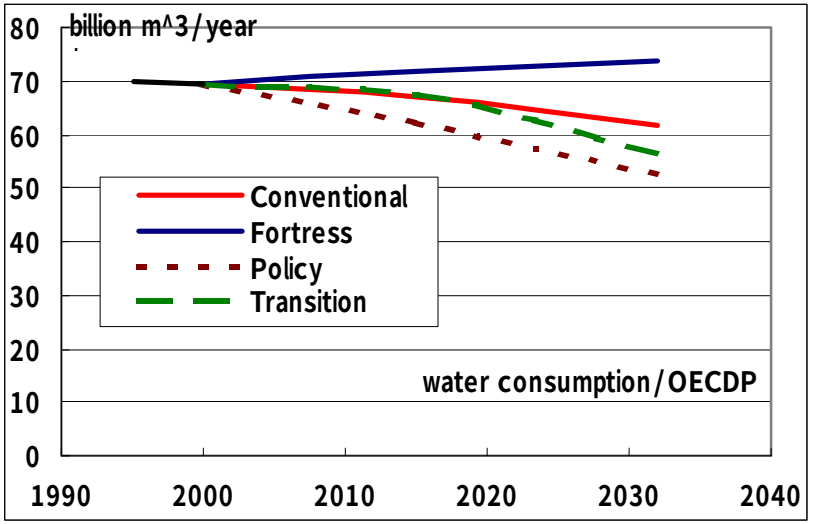


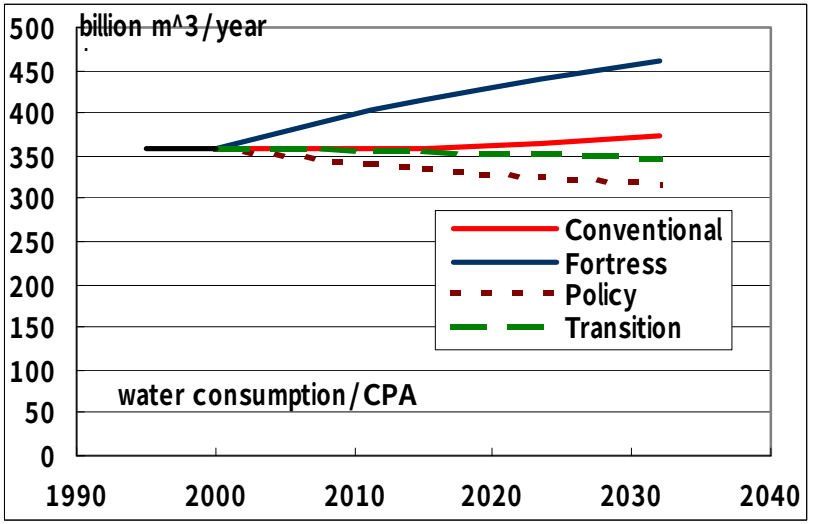
Domestic water withdraw intensity in Asia in 1990

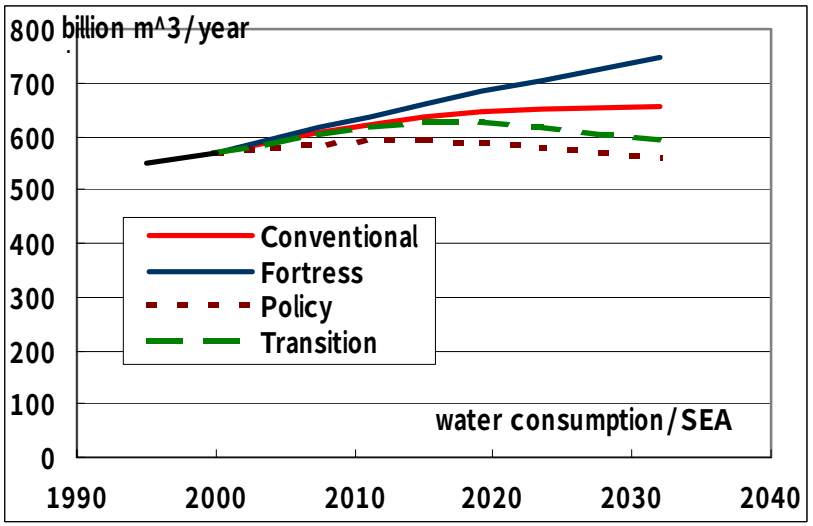


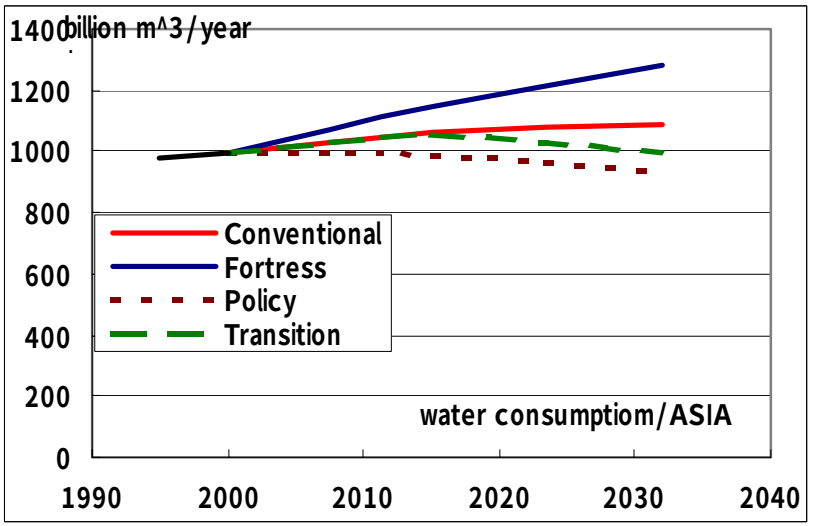
Domestic water withdraw intensity in Asia in 2030

Water consumption









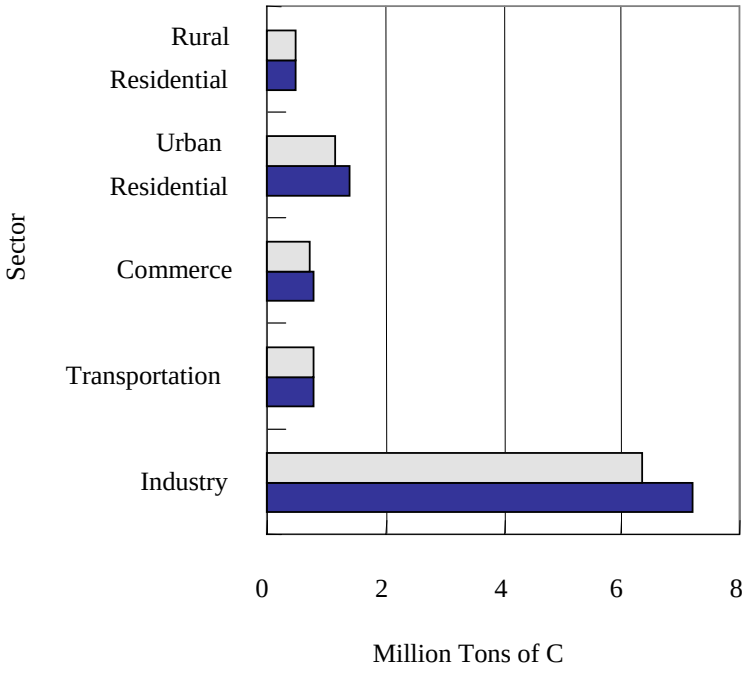
Eco-Policy Linkage

(1) Global climate change and local air pollution

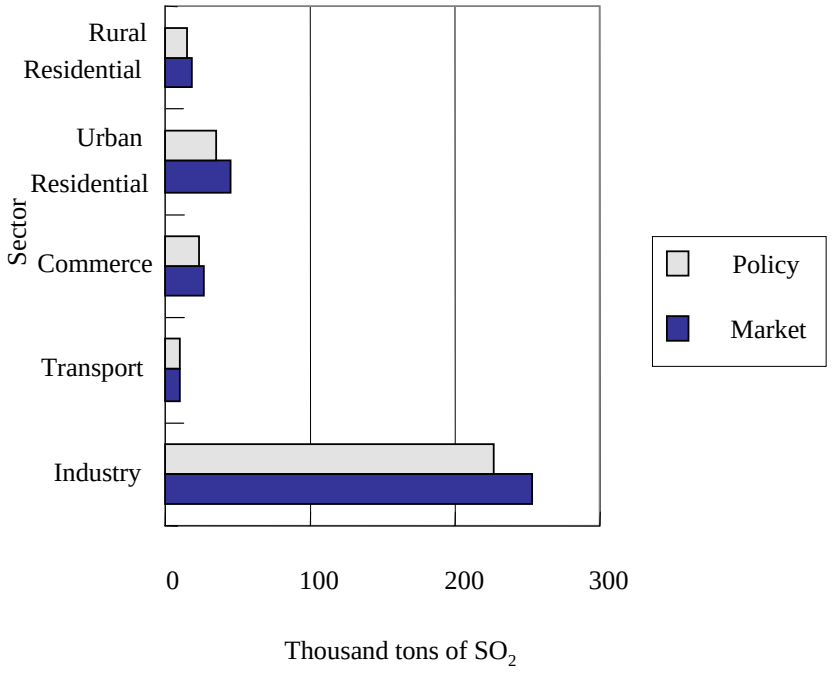
(2) Forest management

(3) Global climate change policy and recycling

(4) Water resource management



(a) CO_2 emission reduction



(b) SO_2 emission reduction

Figure 14 CO_2 and SO_2 emissions in Dalian in market and policy cases in 2010

Forest management

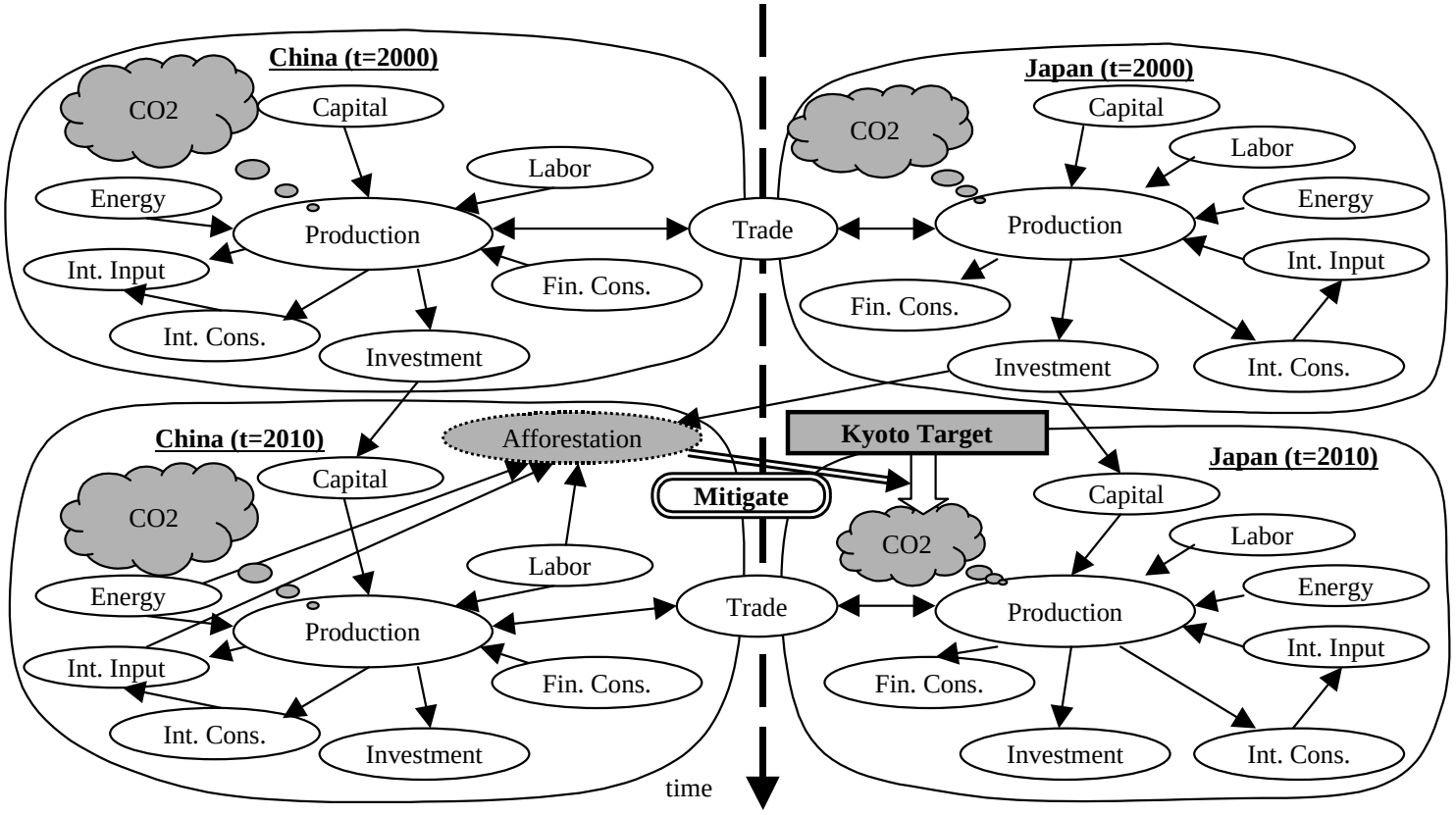


Figure 15 Outline of model for Eco-Policy Linkage of forest management

Table 2 Scenarios for this study

Scenario	CO2 reduction in Annex I countries	Afforestation
Scenario (1)	×	×
Scenario (2)	○	×
Scenario (3)	○	○ (in Japan)
Scenario (4)	○	○ (in China)

Non-Annex I countries have no responsibility to reduce CO2 emissions.

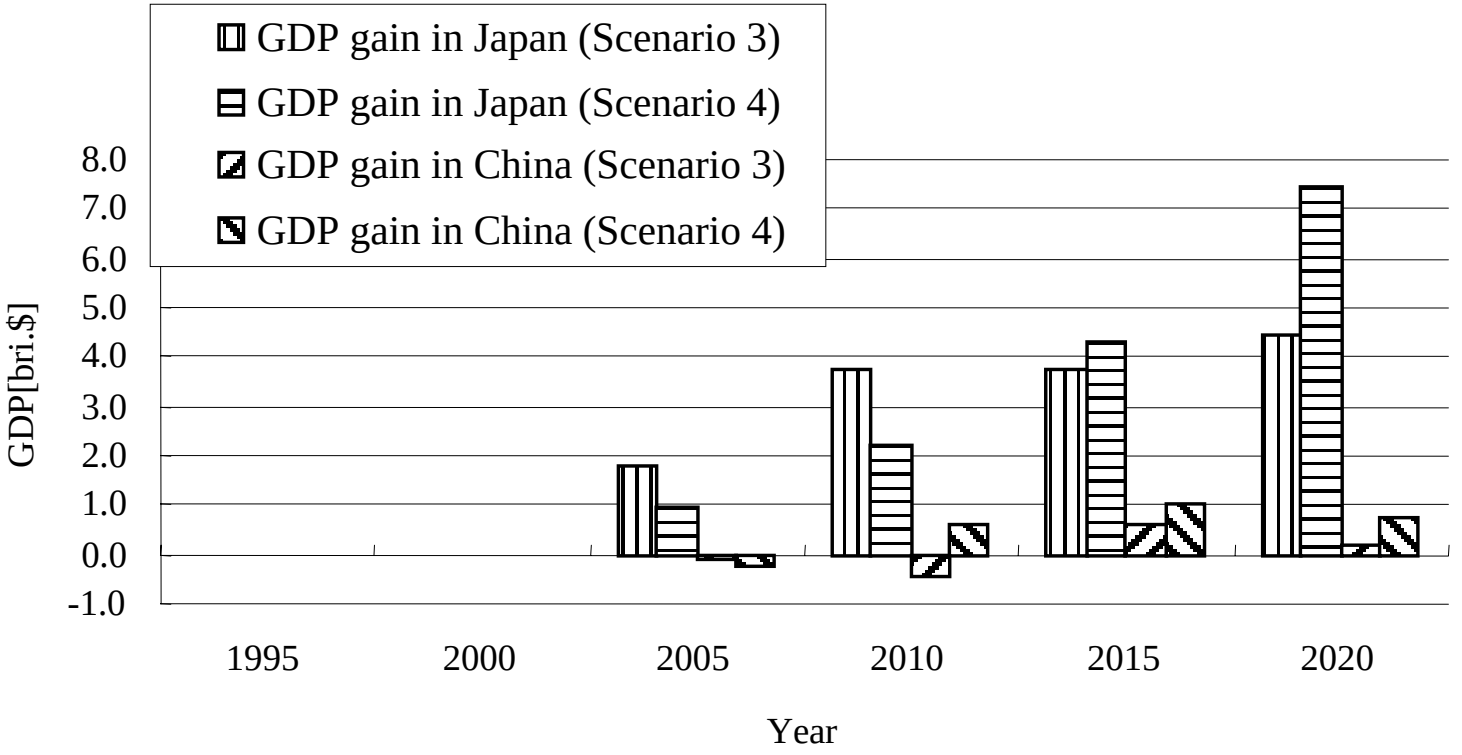


Figure 16 GDP gain from afforestation

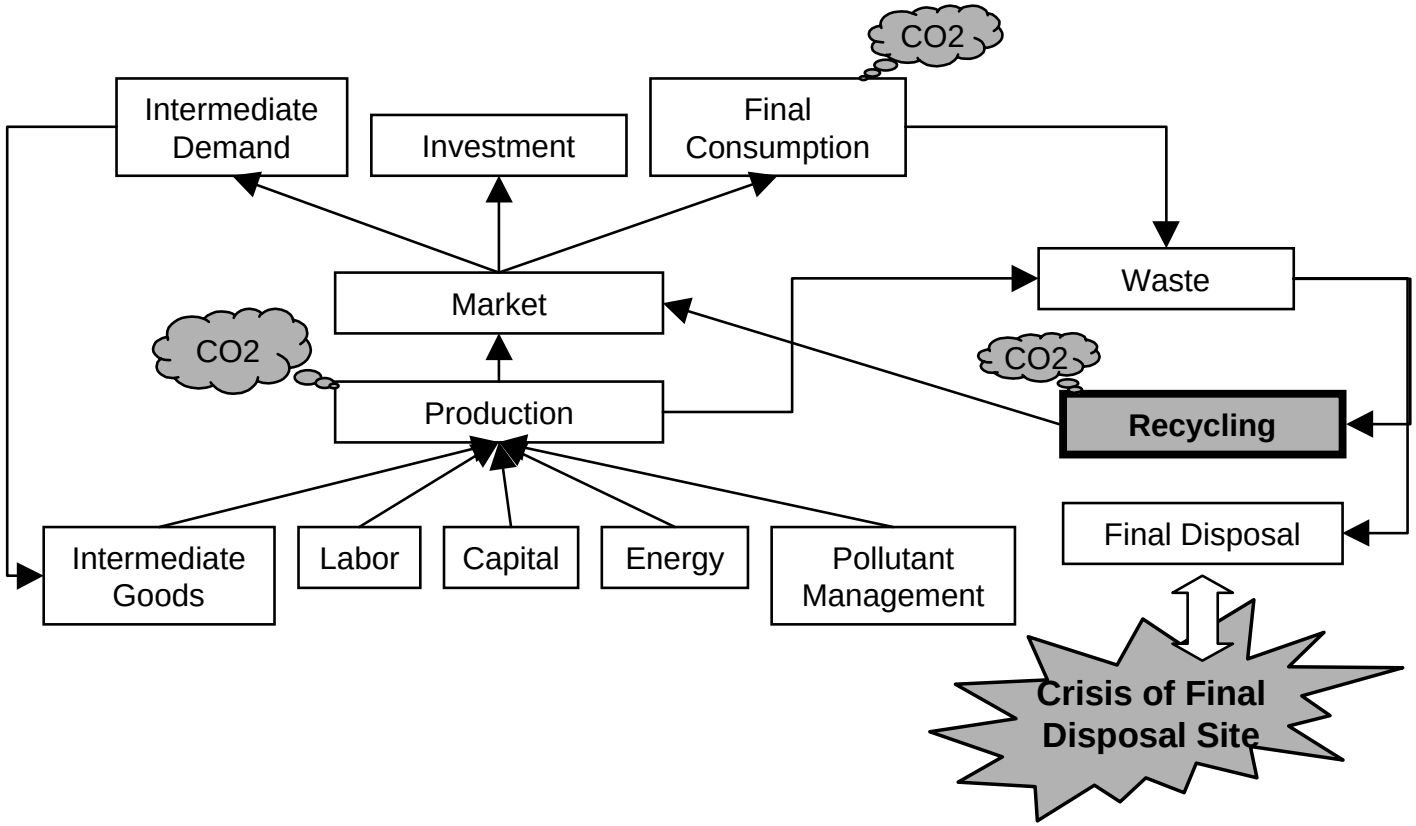


Figure17 Structure of a top-down model to analyze climate change and waste policies

Global climate change policy and recycling

Table 4 Scenarios for recycling model

scenario1	No constraint both CO2 emission and waste disposal
scenario2	CO2: Kyoto Target/ Waste: 5%/year reduction of final disposal, without recycling policy
scenario3a	Promotion of low recycled paper demand
scenario3b	Promotion of low emission vehicle demand
scenario3c	Promotion of both recycled paper and low emission vehicle
scenario4	Enhancement of investment for waste management

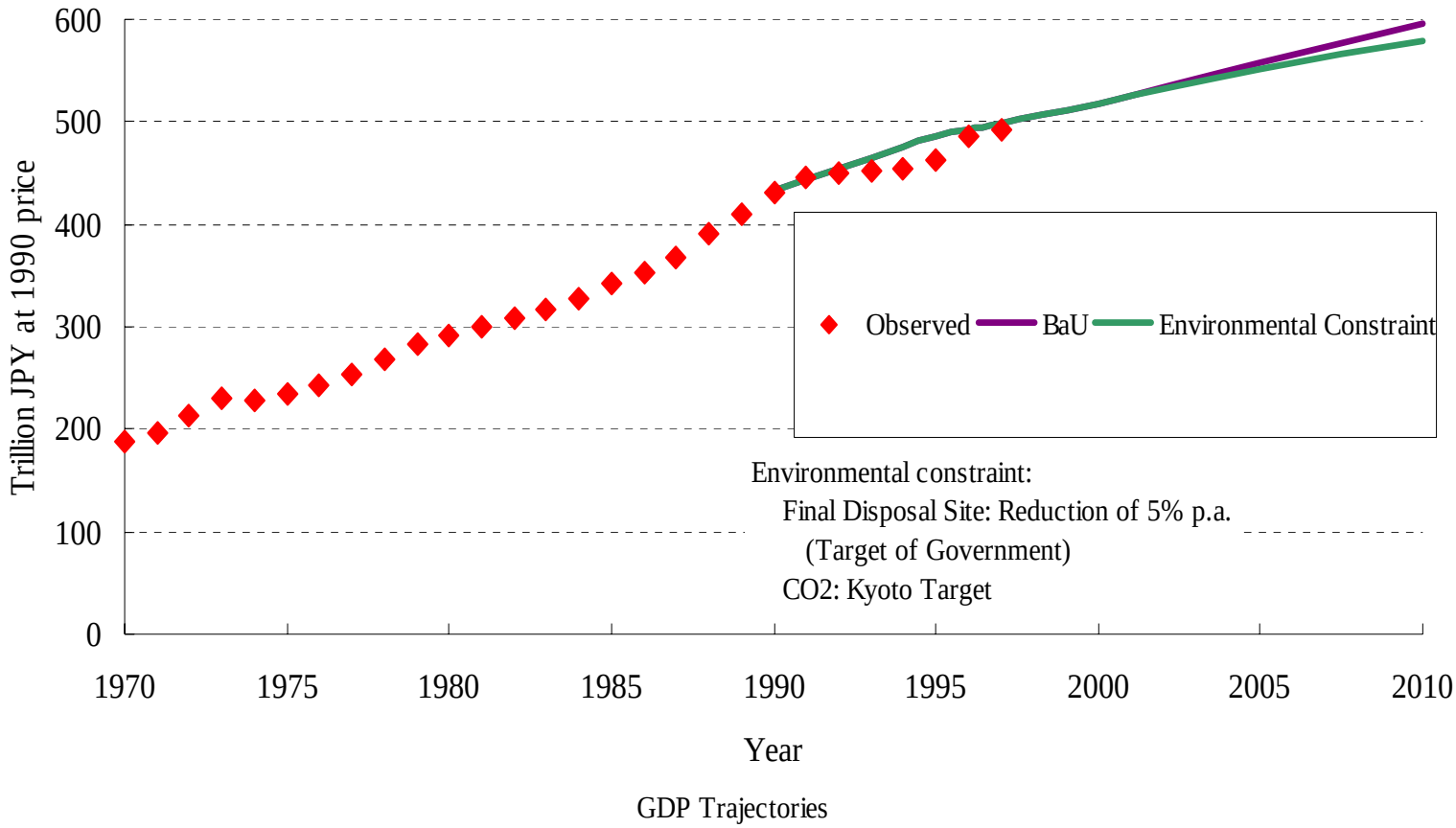
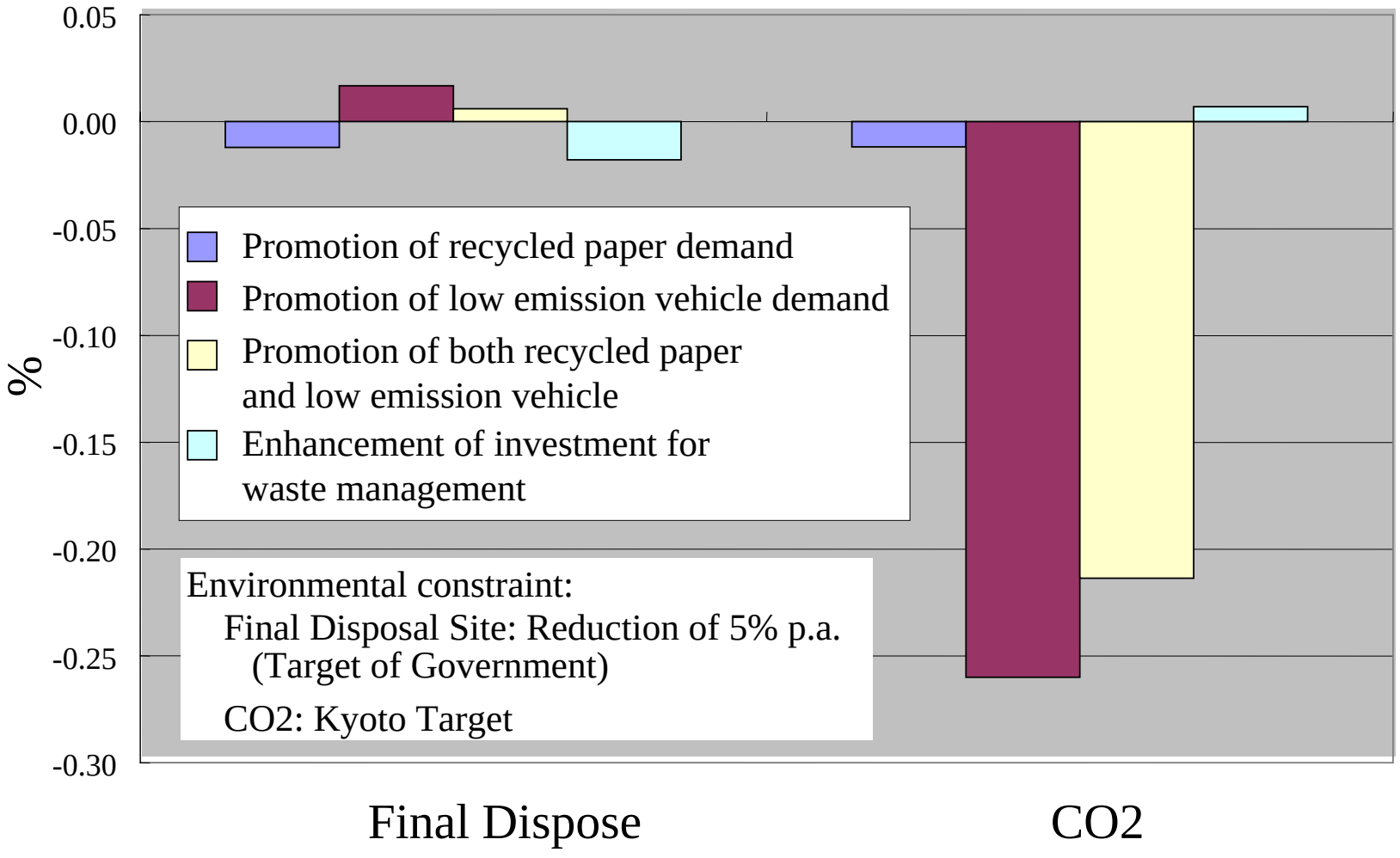
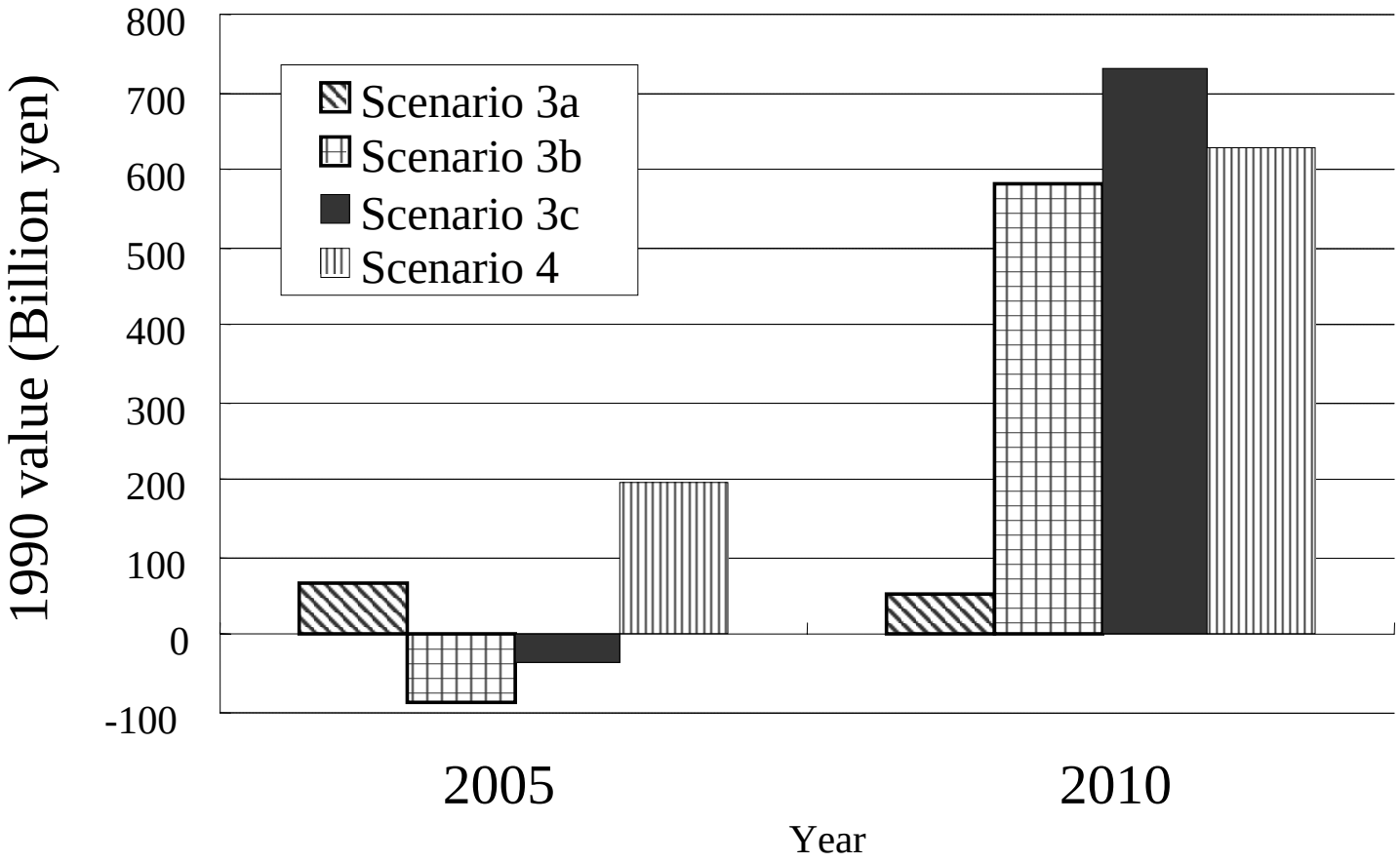


Figure 18 Change of GDP Trajectories



Changes of Cost Share to GDP



Change of GDP compared to Scenario2

Water resource management

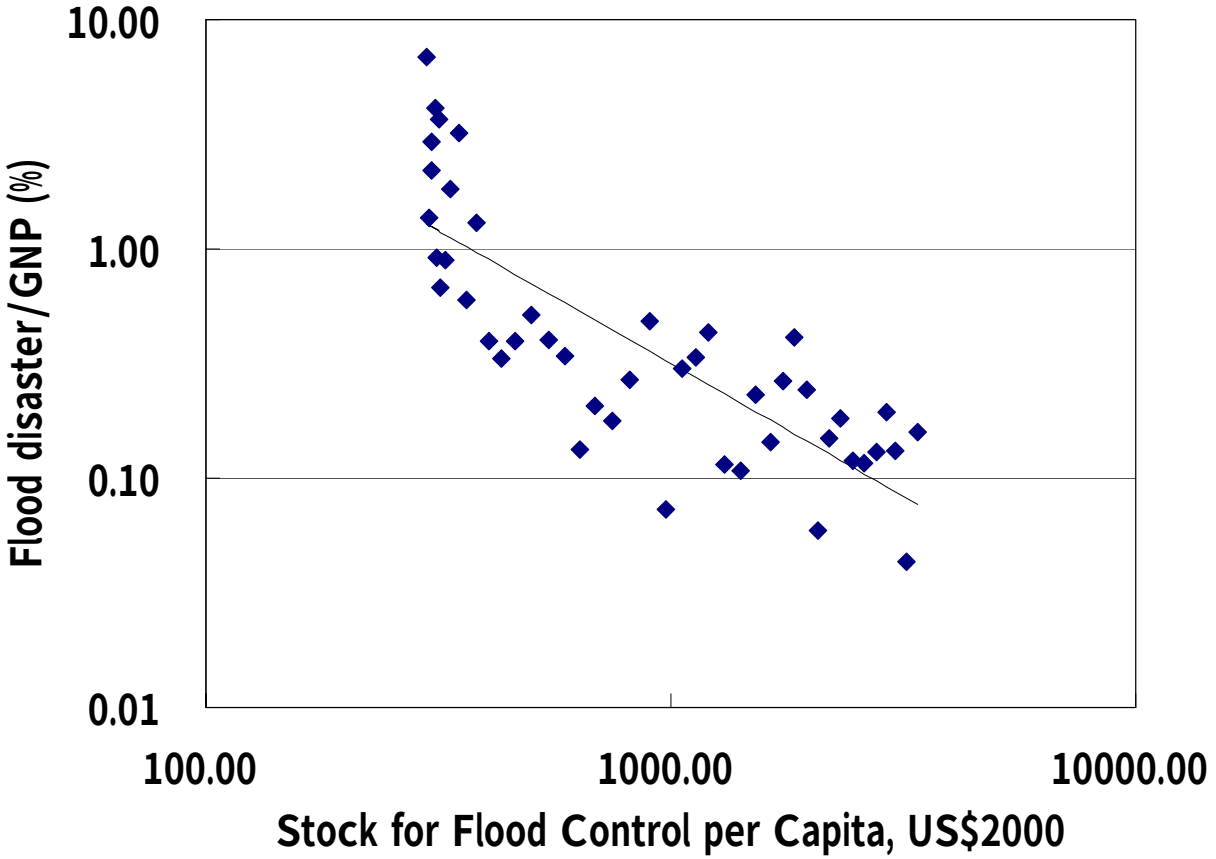


Figure 19 Japanese experience of reducing flood disaster

Table 5 Actual Safety Status of Main Rivers/Watershed in China

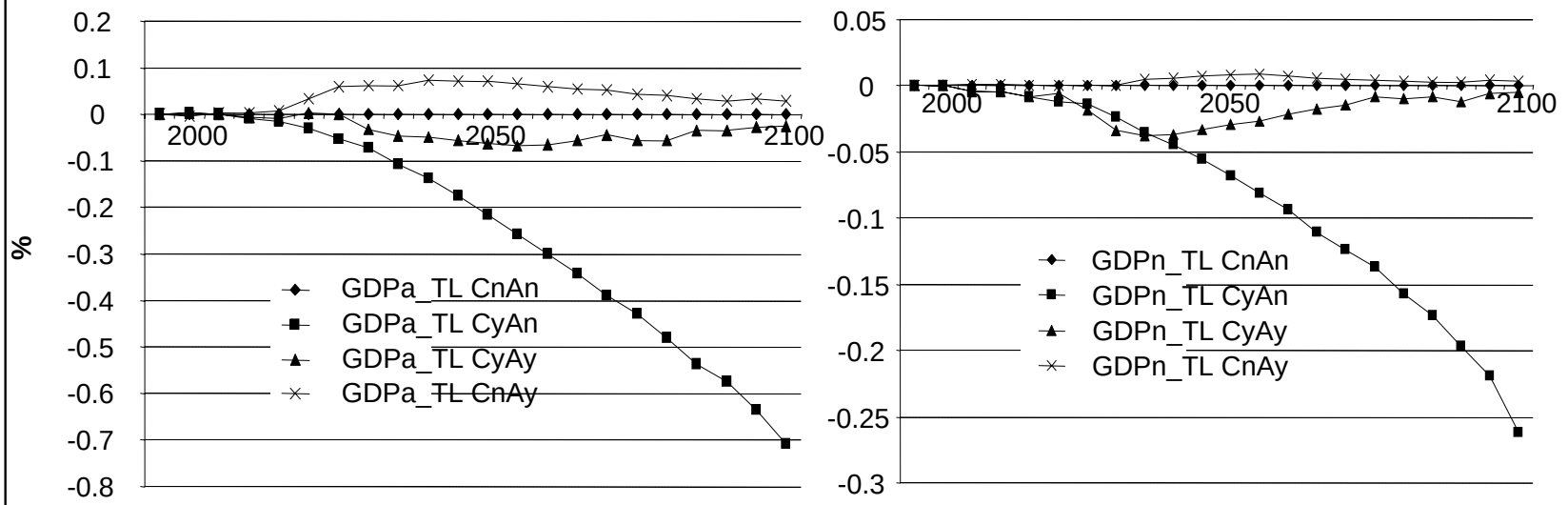
River/watershed	Location	Guaranteed Safety
Yellow River		1/60
Huaihe River	main streams in the middle reaches	1/40
	the lower reaches	1/50
	Main branches	1/10-1/20
Haihe River & Luanhe River		1/20
Yangtze River	The main streams and lakes in the middle and lower reaches	1/10-1/20
Taihu Lake & its Surrounding area		1/20
Pearl River	Some important economic area	1/50
	Other area	1/10-1/20
	The dikes of main streams in Xijiang	1/10-1/20
Liaohe River	Dikes of main streams	1/20
	Branches	1/10-1/20
	Shenyang, Liaoyang, Fushun	1/100
	Benxi	<1/20
Songhuajiang River	farmland	1/20
	Harbin, Qiqihaer, Jiamusi	1/40

* Data sources: (1) Liu, 1993, (2) China Agricultural cyclopedia - Water conservancy (A). Agricultural Publishing House, 1987, pp 151
* Safety standard of infrastructure against flood is expressed in terms of the frequency of overtopping the flood prevention system.

Table 6 National safety standard of flood prevention infrastructure in China

Standard of flood prevention	Cities (Non-agri. popu, in 1000 persons)	Mineral Area	Cultivated area (1000 ha.)
=< 1/200	>= 1500	Very Important	> 333.3
1/100~1/200	500~1500	Important	333.3~6.67
1/50~1/100	200~500	Medium	2~6.67
1/20~1/50	=< 200	Less	<2

Data source: (1) China Agricultural cyclopedia - Water conservancy (A). Agricultural Publishing House, 1987, pp 152; (2) Li, 1997



(a) GDP gain of agricultural sector

(b) GDP Gain of non-agricultural sector

Figure 20 Change of GDP of climate change policies compared to the case without climate change and adaptation

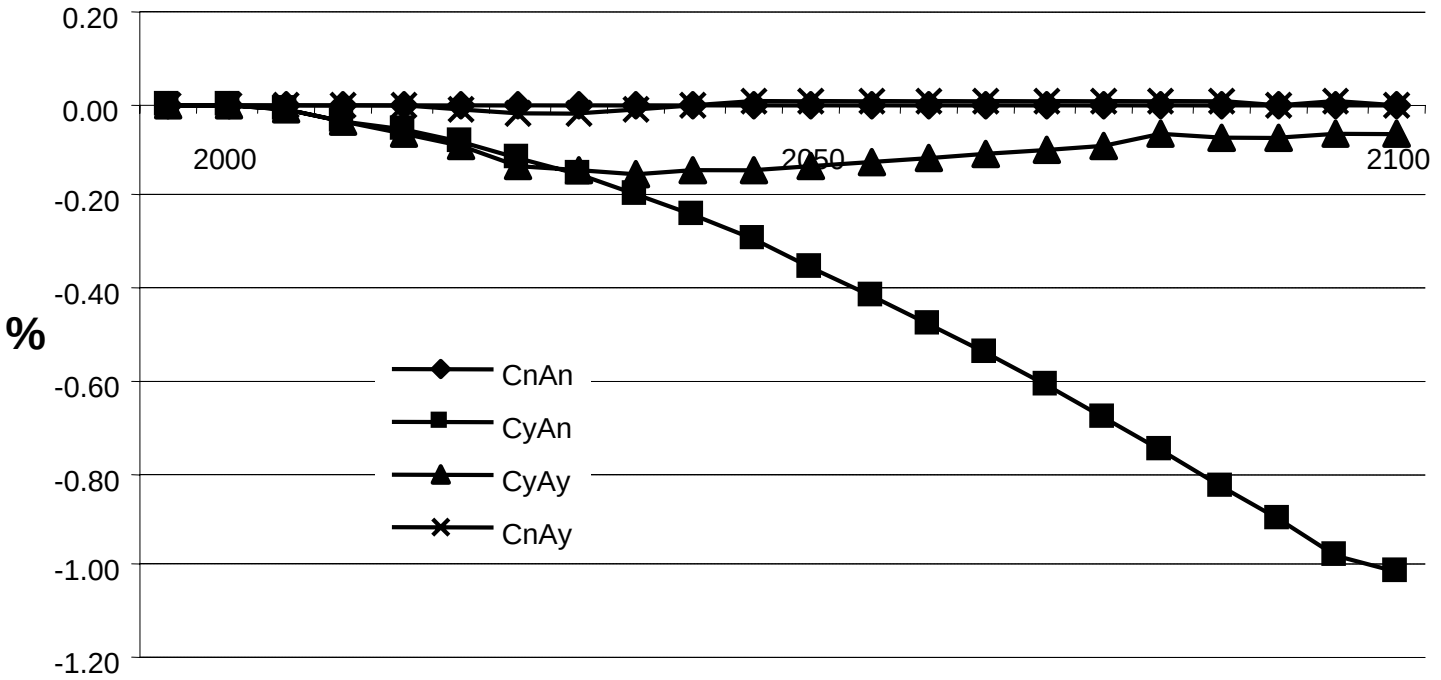


Figure 21 Consumption per capita

Overview of Model Development

(1) AIM local

Integration:

- **inventory, technology model, and GIS**
- **climate change and local environmental issues**

(2) AIM environmental industry

environment - economy

(3) AIM-trend => AIM-CGE

country based communication tool

(4) AIM-top down

GEO 3 regional scenario analysis

Overview of Model Development

(5) AIM-impact

- Assessment of water resource problem

  Shortage of water resources and various resultant environmental problems

- Adaptation

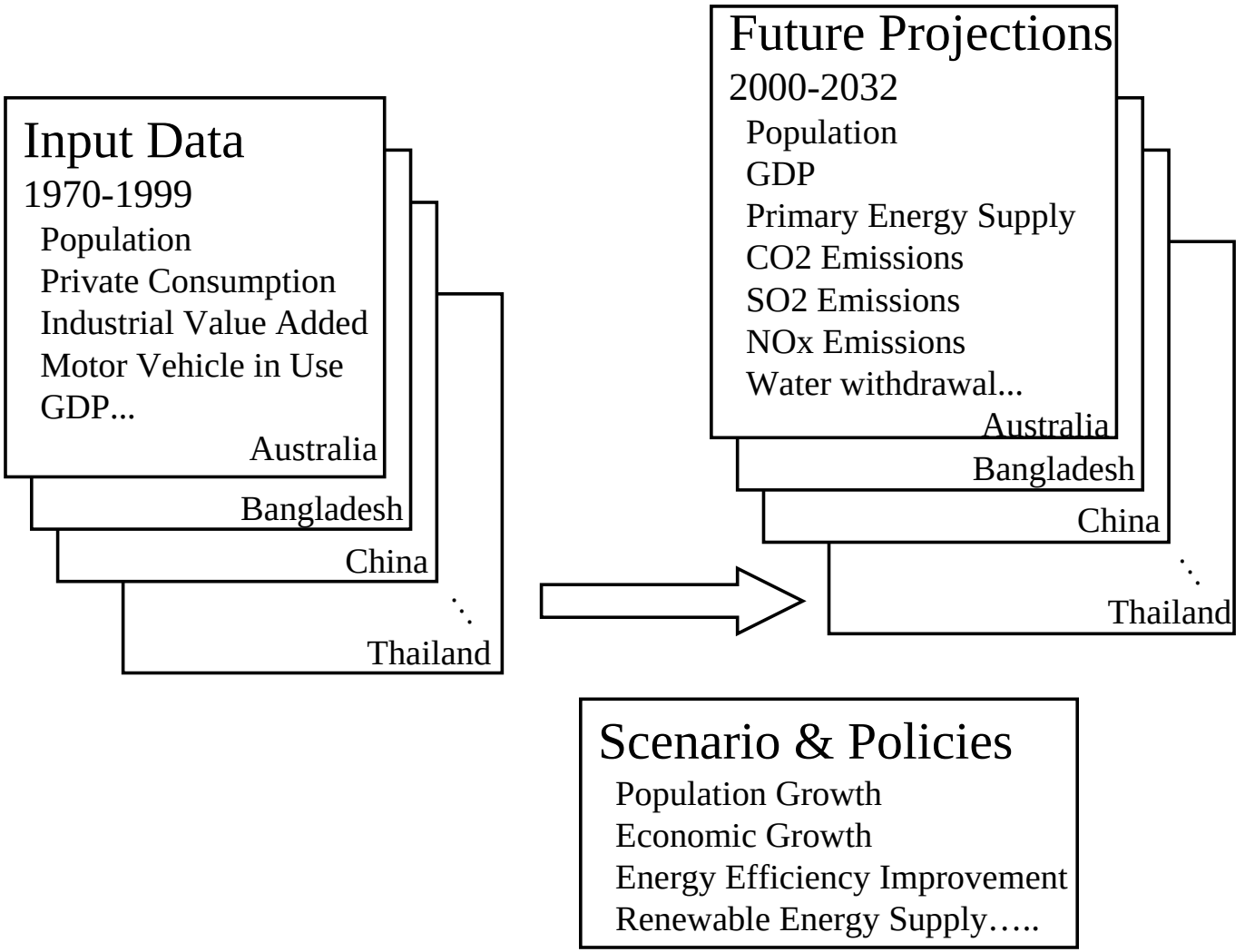
  (i) Policy integration of climate change and flood control

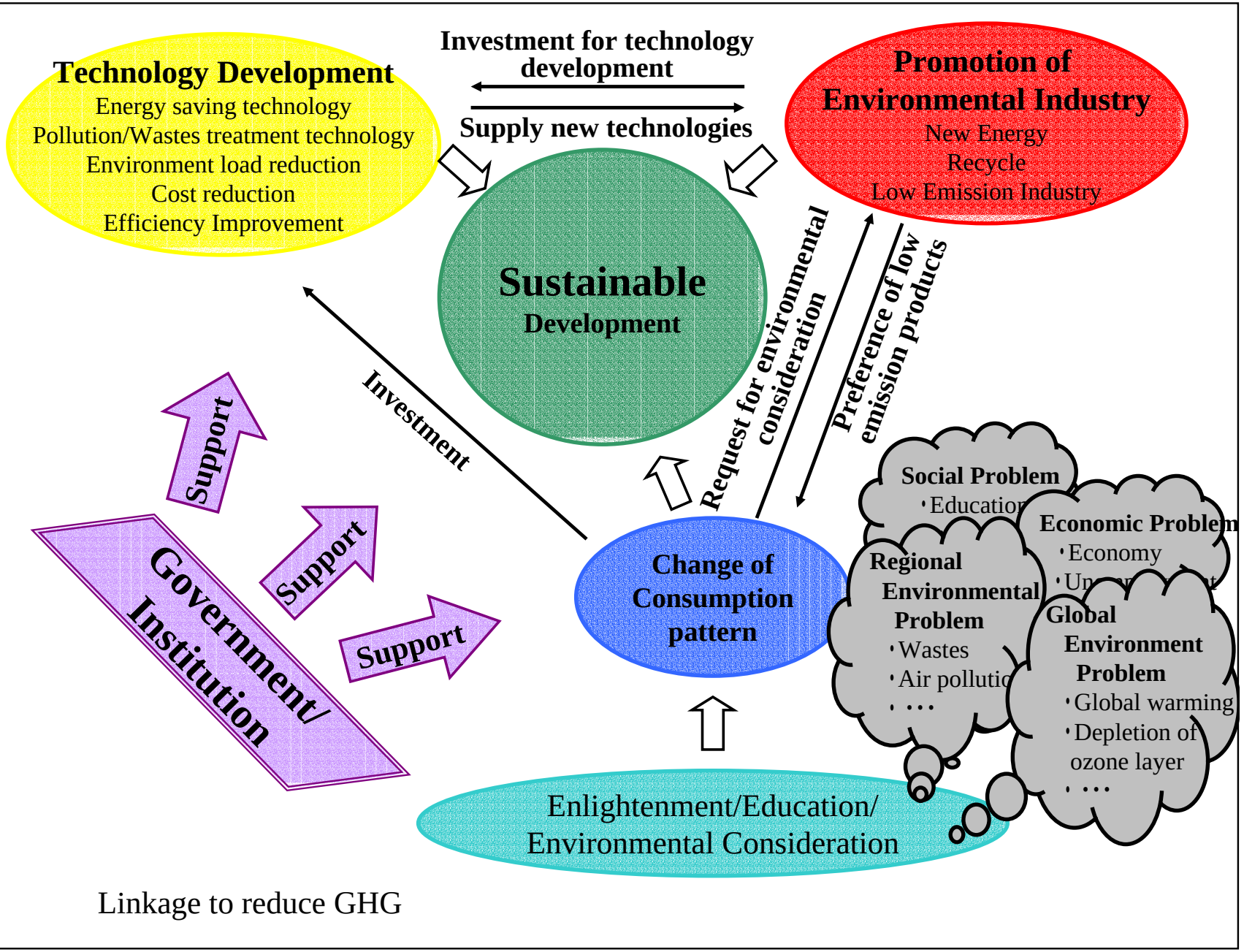
  (ii) Economic evaluation

Thank you

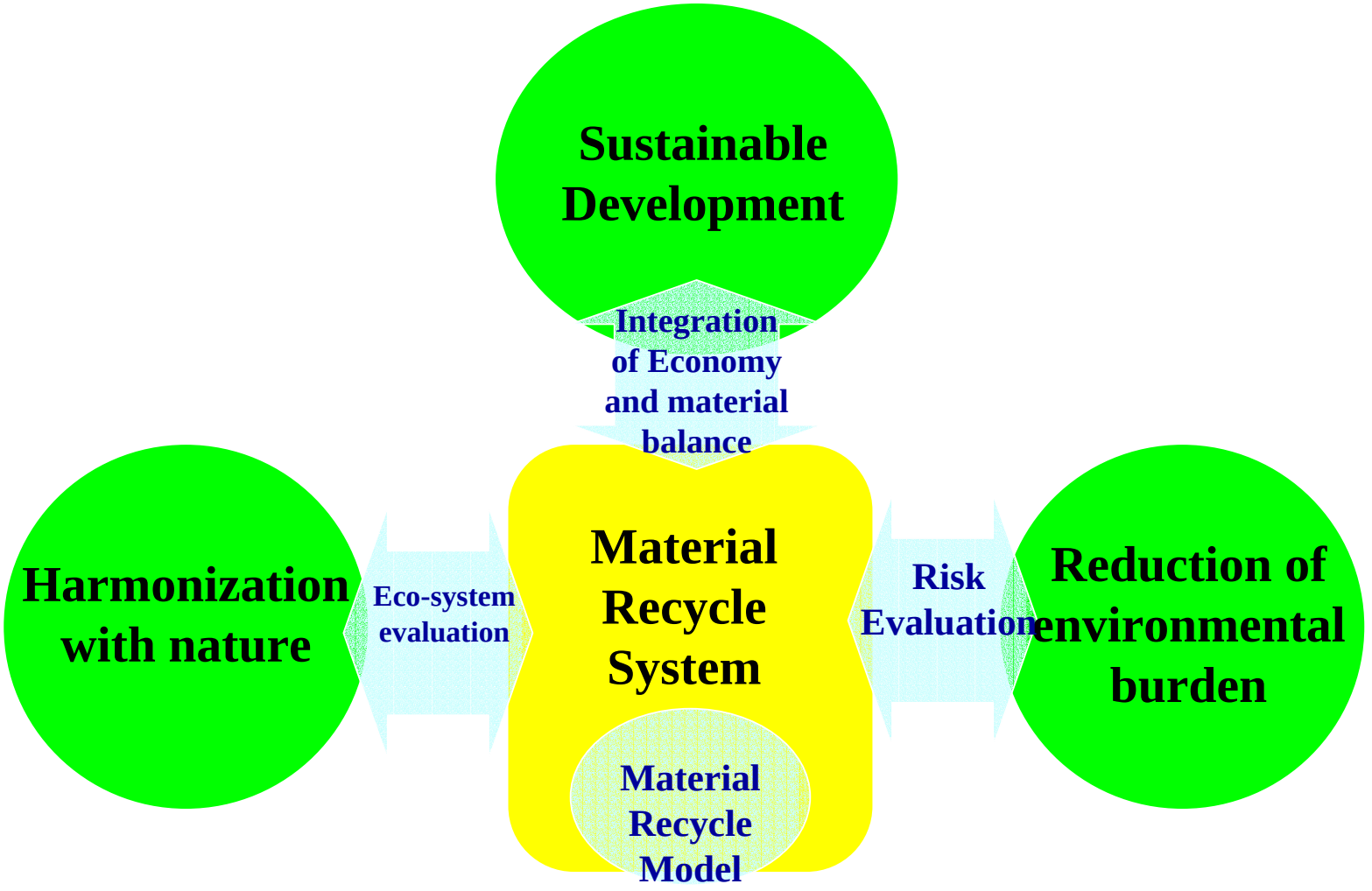
AIM-TREND

Country Model for Environmental Burdens in Asian-Pacific Regions



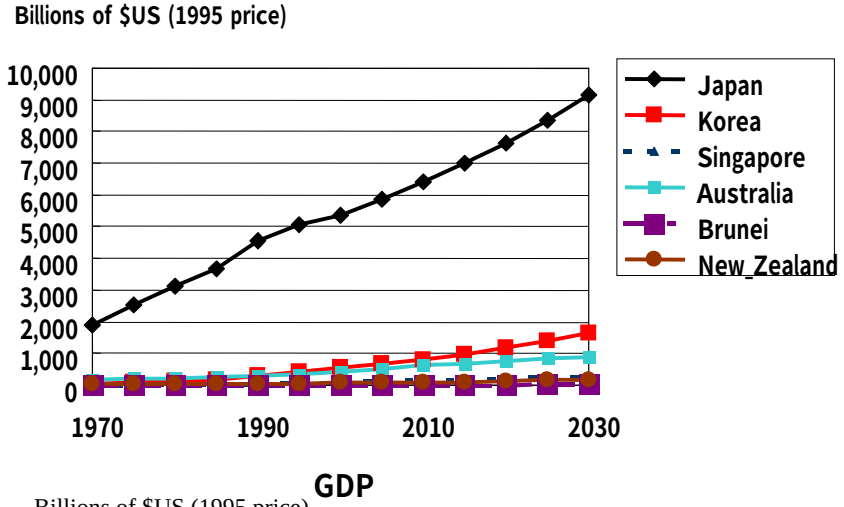


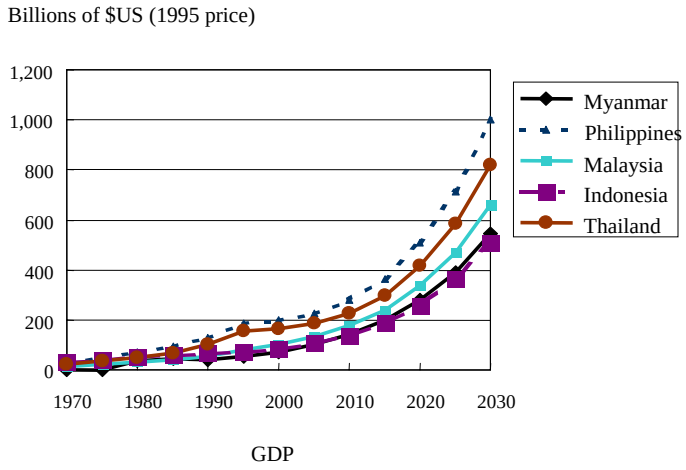
Linkage to reduce GHG

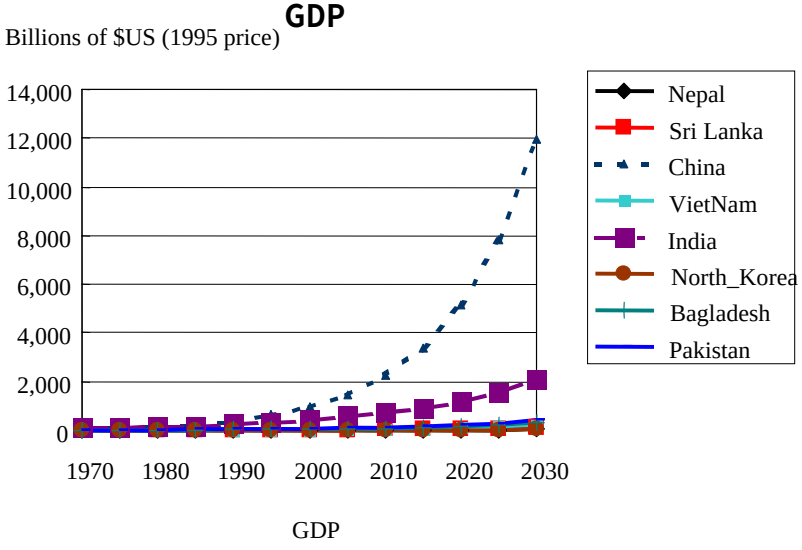


The structure to evaluate recycle society

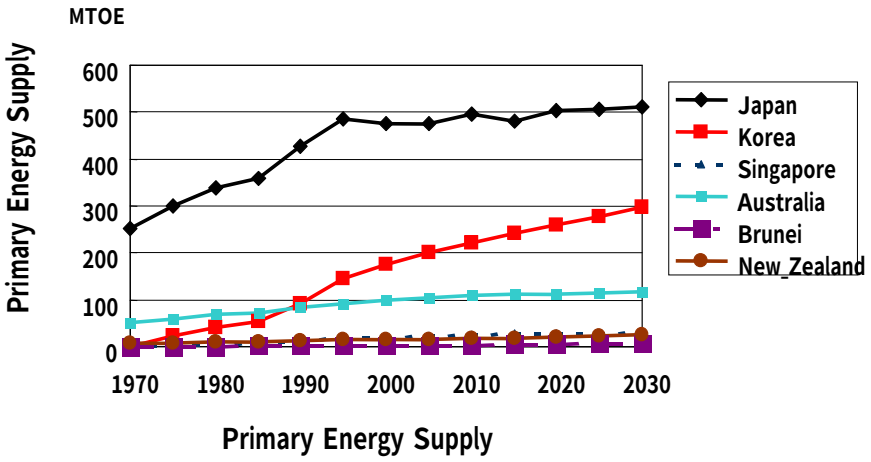
Examples of Country GDP

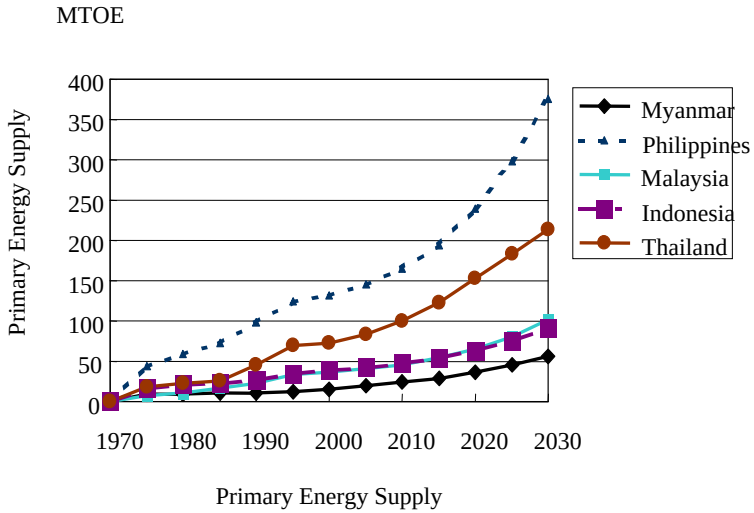


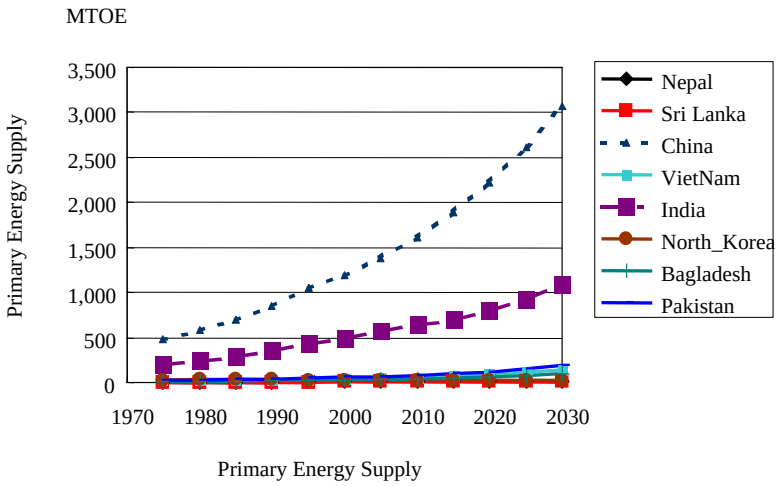




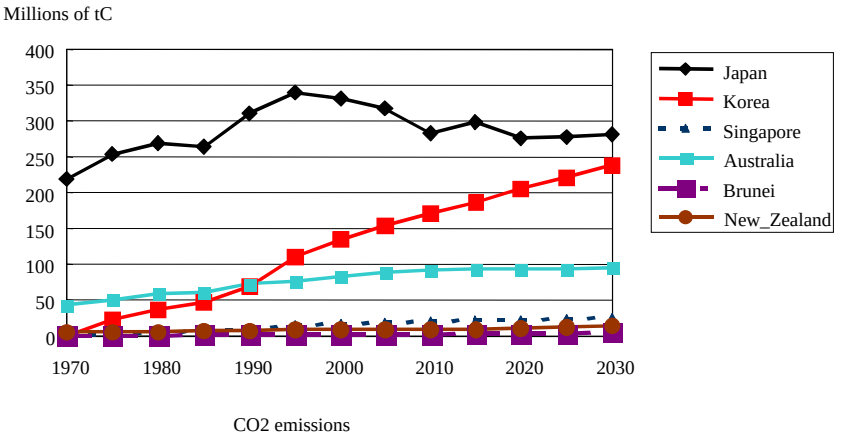
Examples of Country Primary Energy Supply

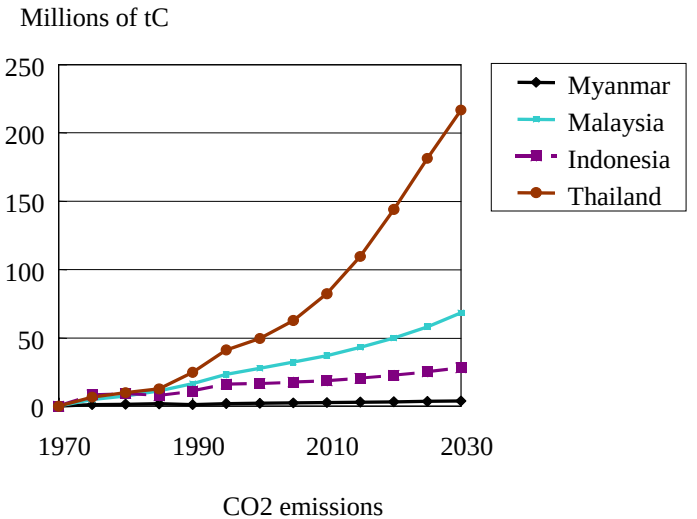


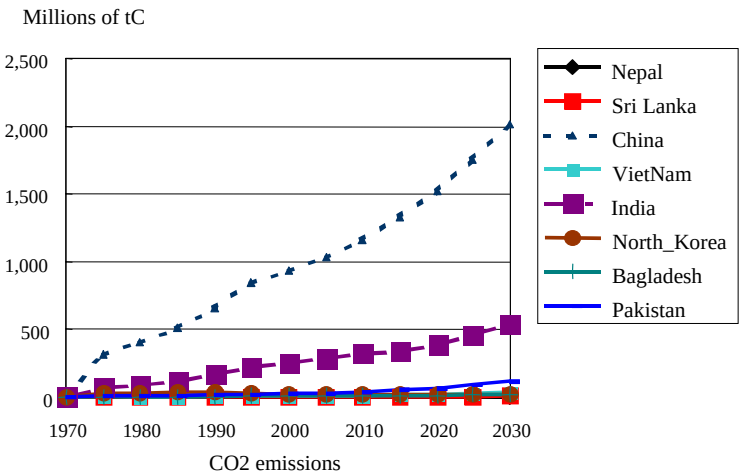




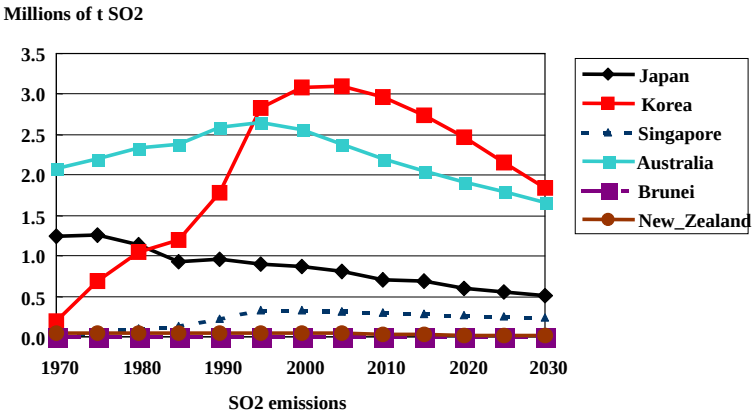
Examples of Country CO_2 Emissions

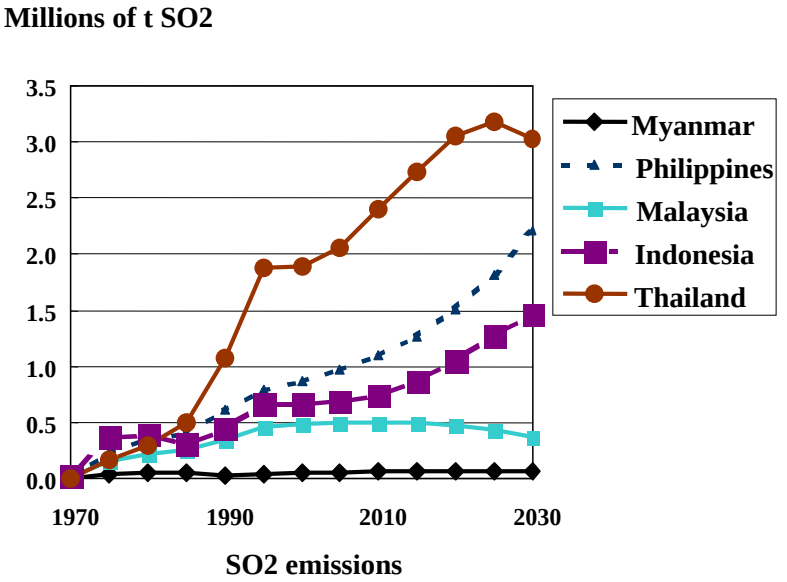


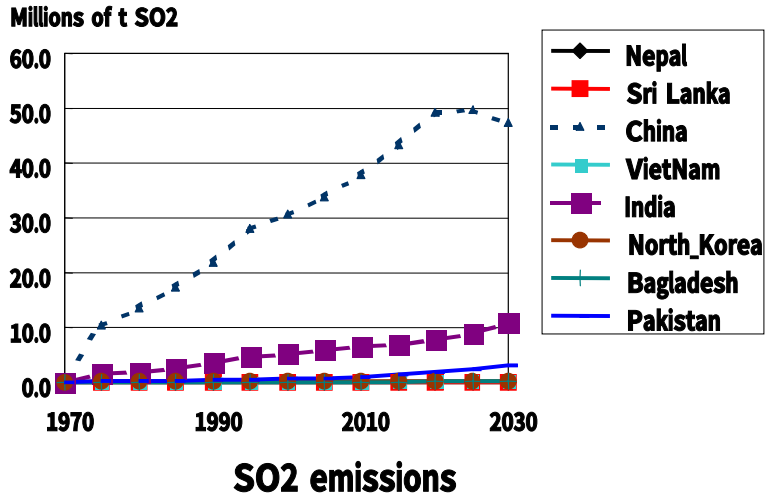




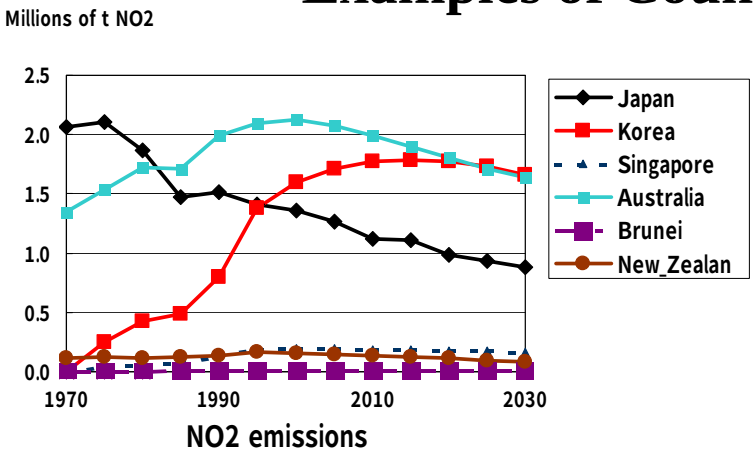
Examples of SO_2 Emissions

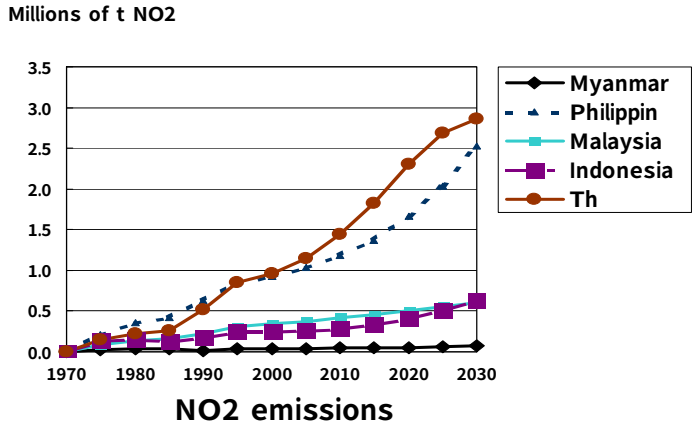


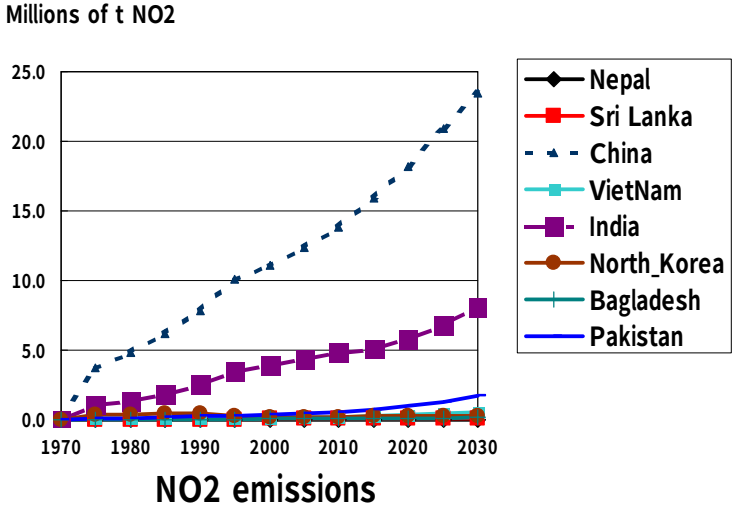


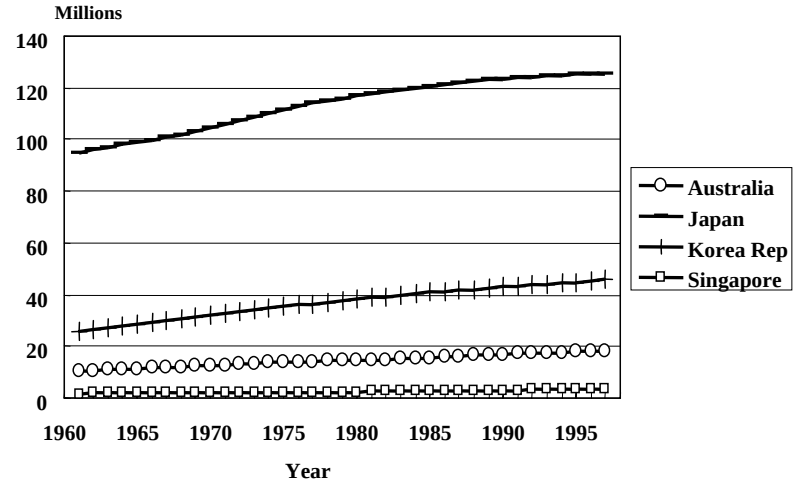


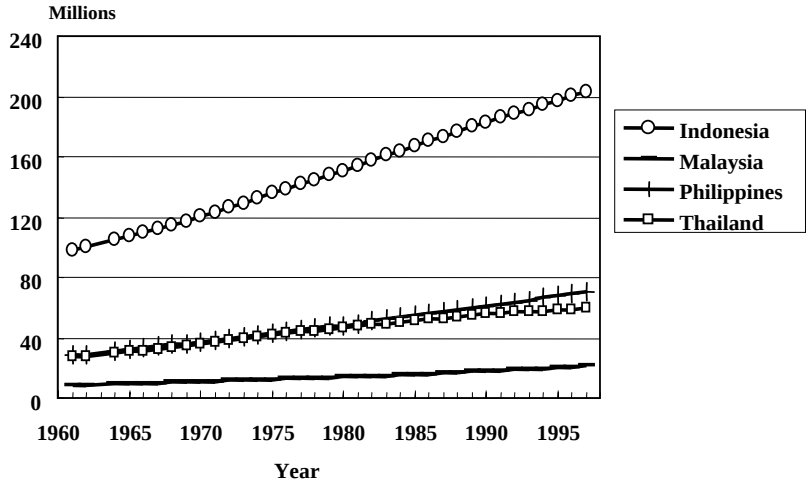
Examples of CountryNO_2 Emissions

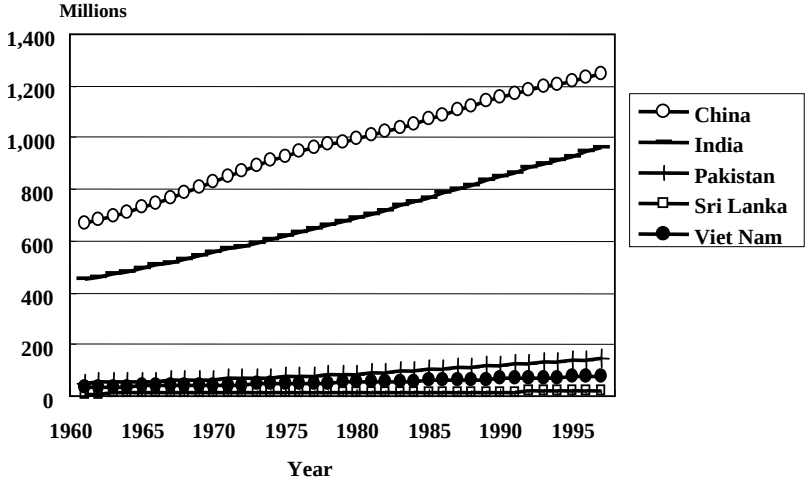




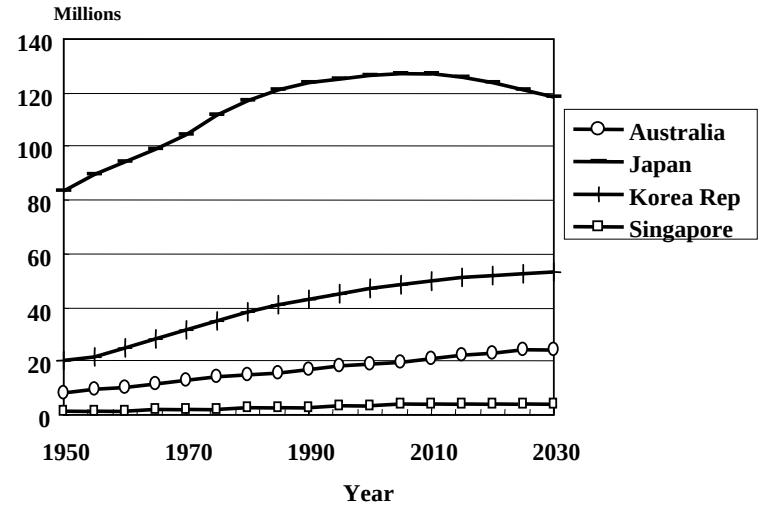


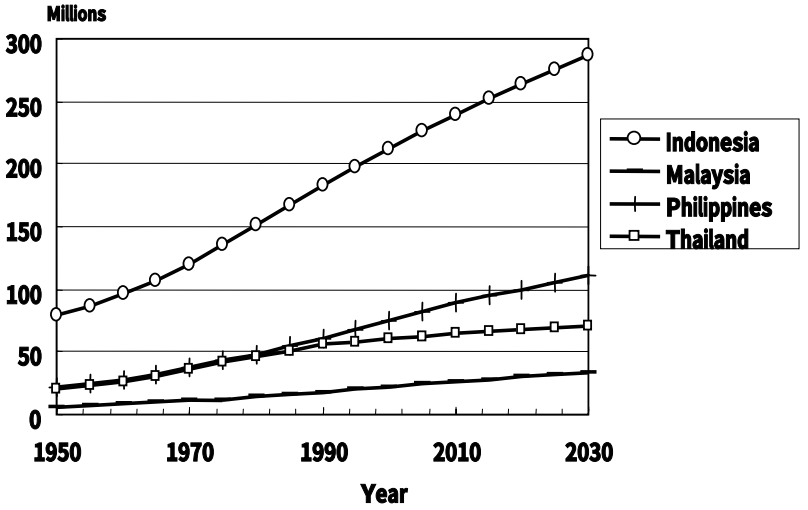


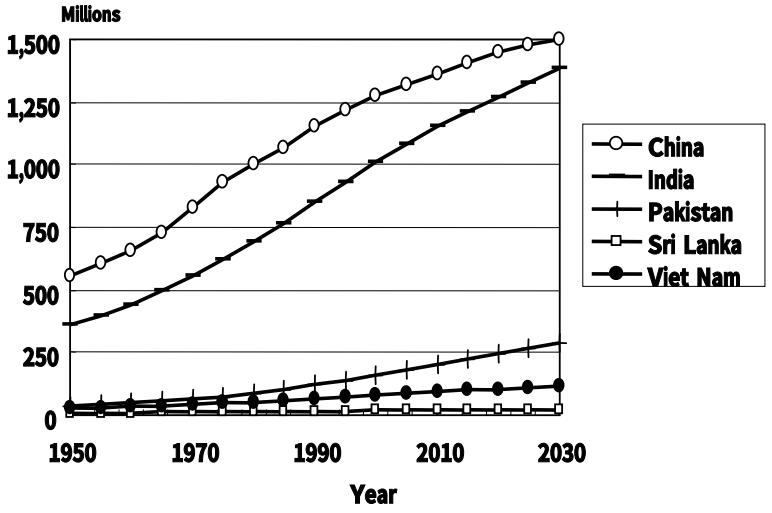




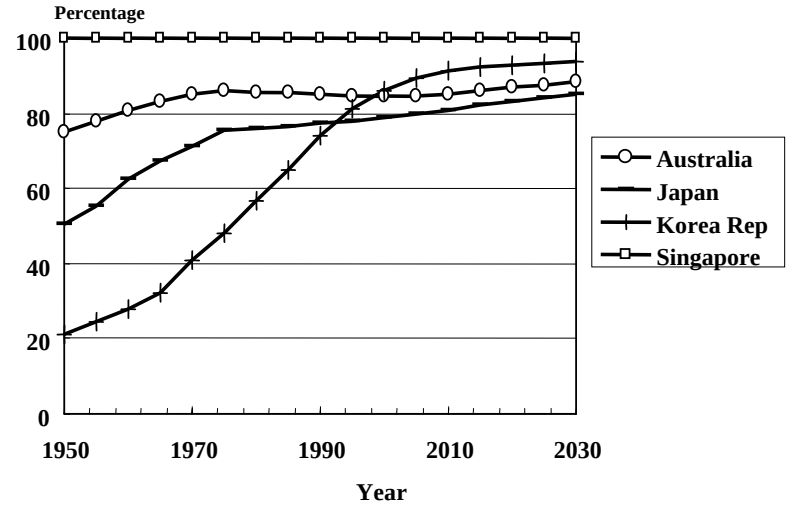
Population trends in selected countries of the Asia-Pacific Region (Source:FAO Statistical Database 98)

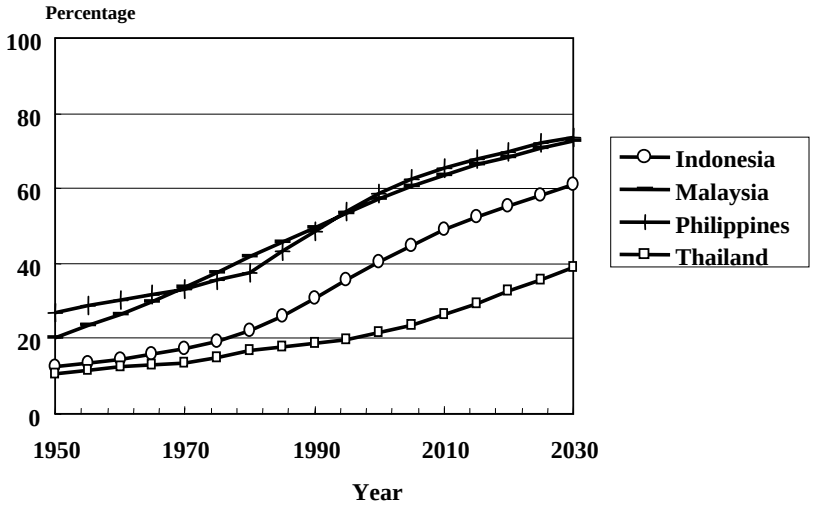


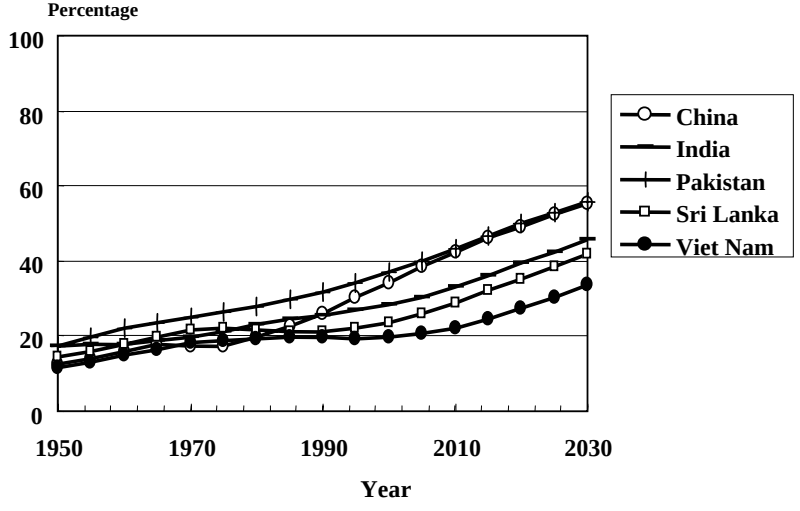




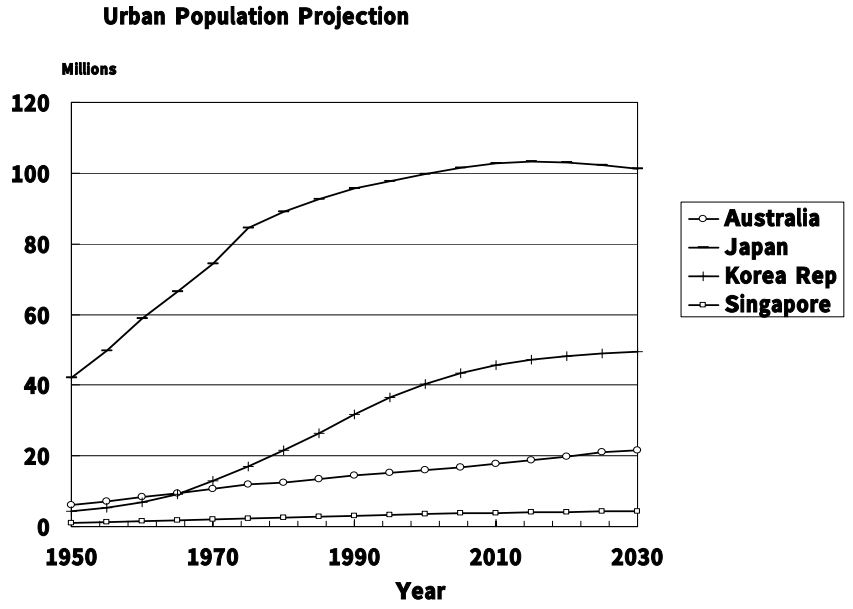
Population Projections in selected countries of the Asia-Pacific region (Source:FAO Statistical Database 98)

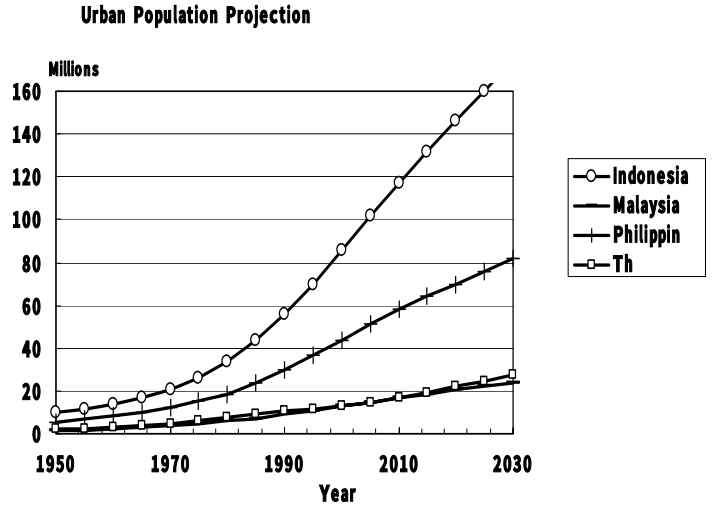


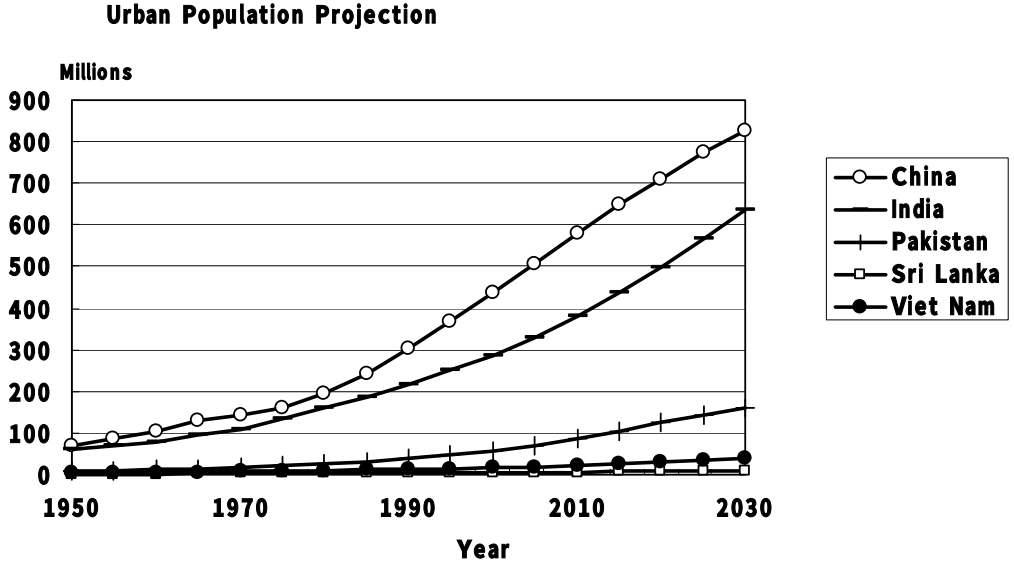


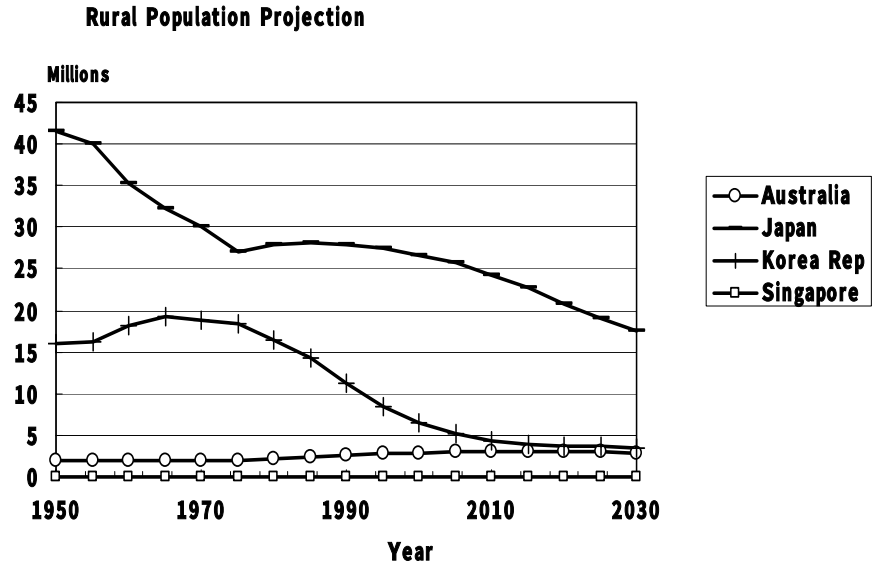


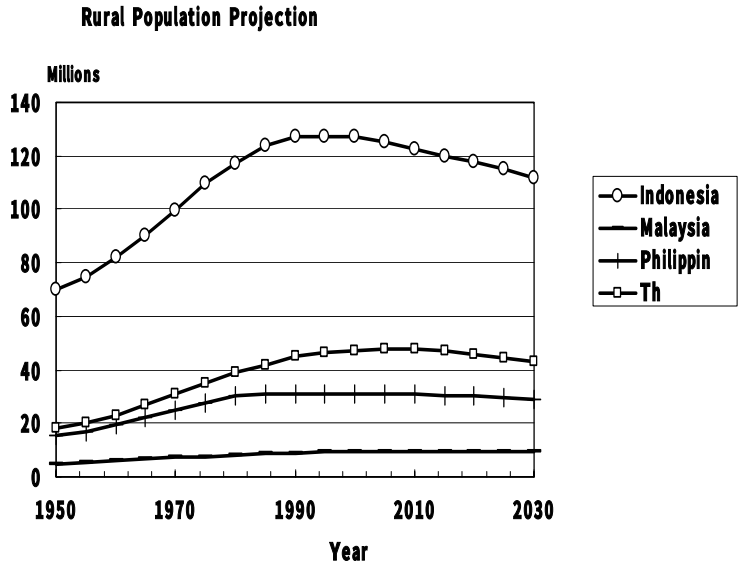
Ratio of Urban to Rural Population in selected countries of the Asia-Pacific region
(Source:FAO Statistical Database 98)

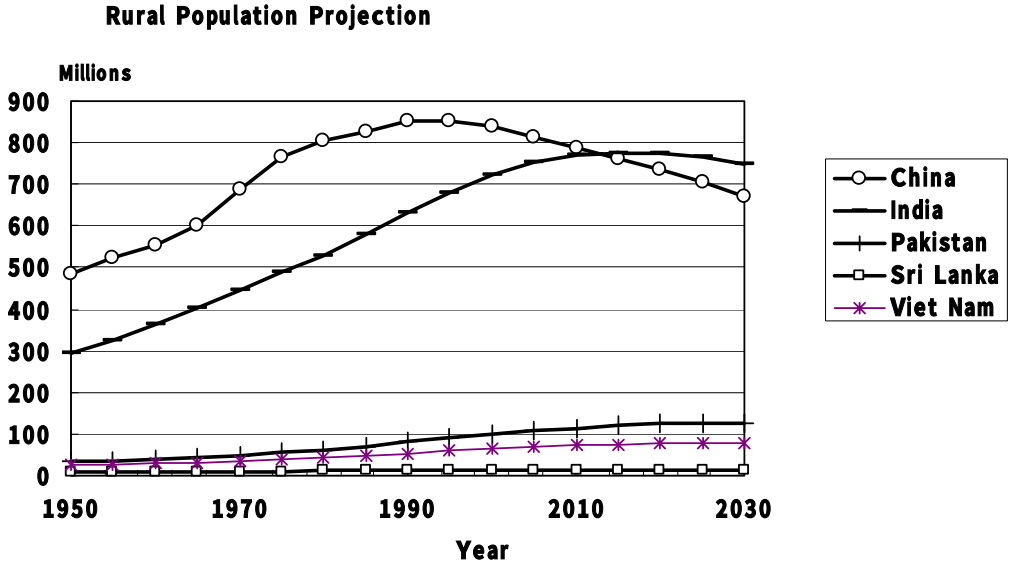

Urban Population Projection
Millions
120
100
80
60
40
20
0
1950
1970
1990
2010
2030
Year
Australia
Japan
Korea Rep
Singapore

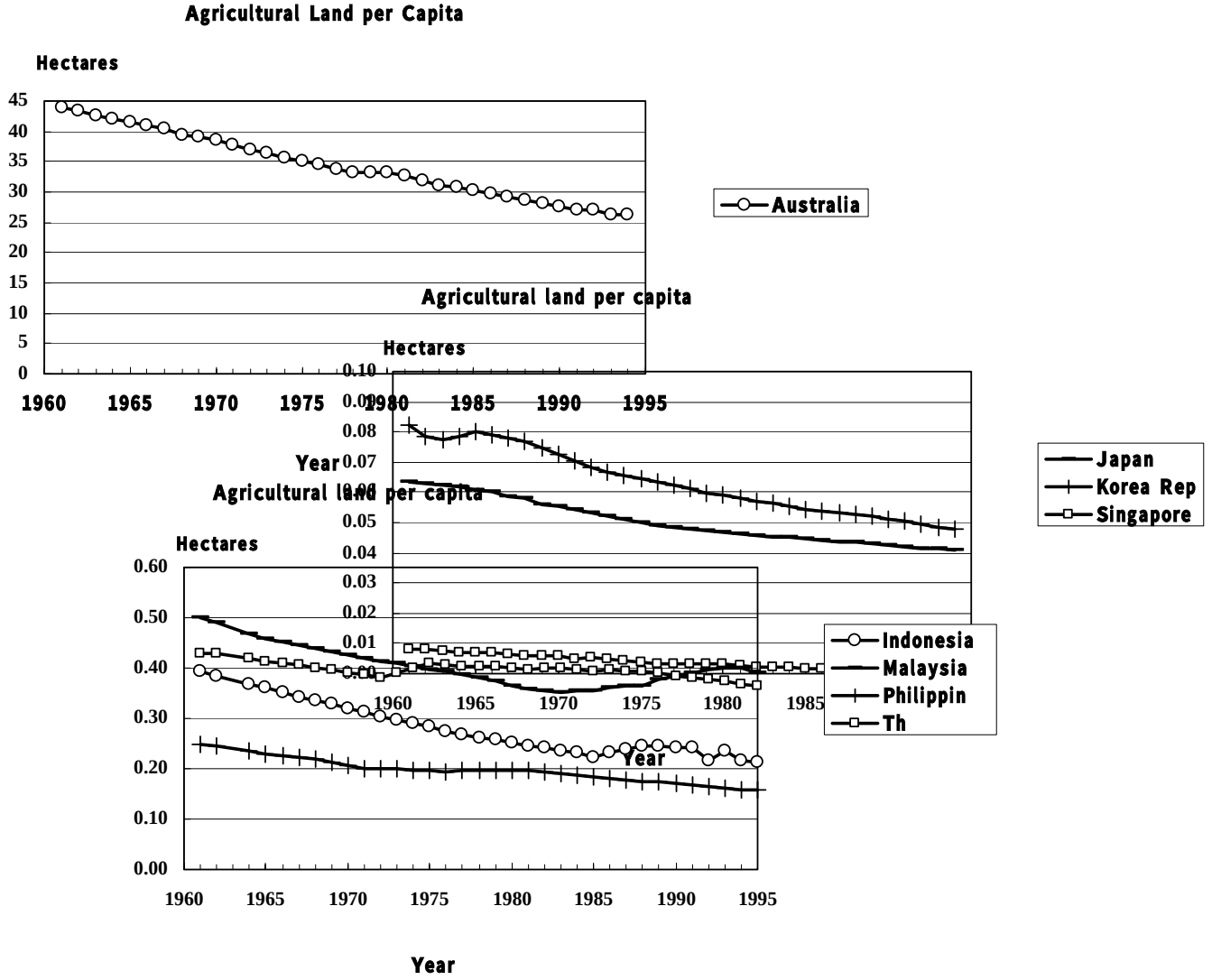

Urban Population Projection
Millions
160
140
120
100
80
60
40
20
0
1950
1970
1990
2010
2030
Year
Indonesia
Malaysia
Philippin
Th

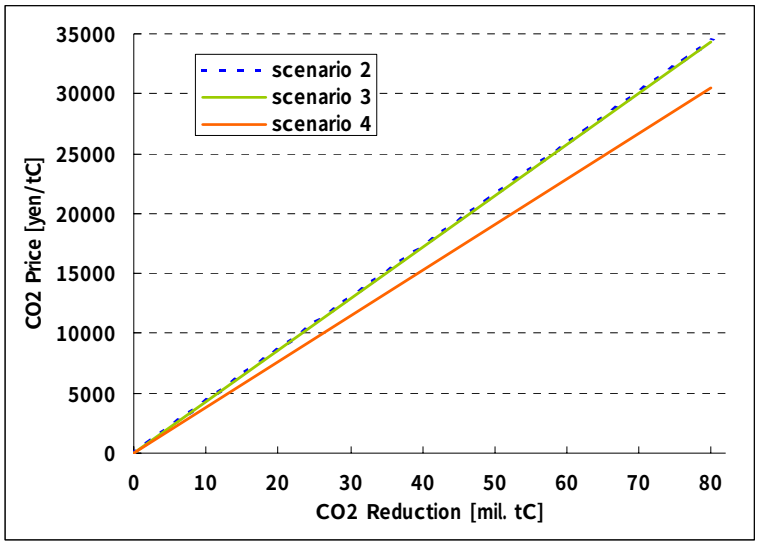

Urban Population Projection
Millions
900
800
700
600
500
400
300
200
100
0
1950
1970
1990
2010
2030
Year
China
India
Pakistan
Sri Lanka
Viet Nam

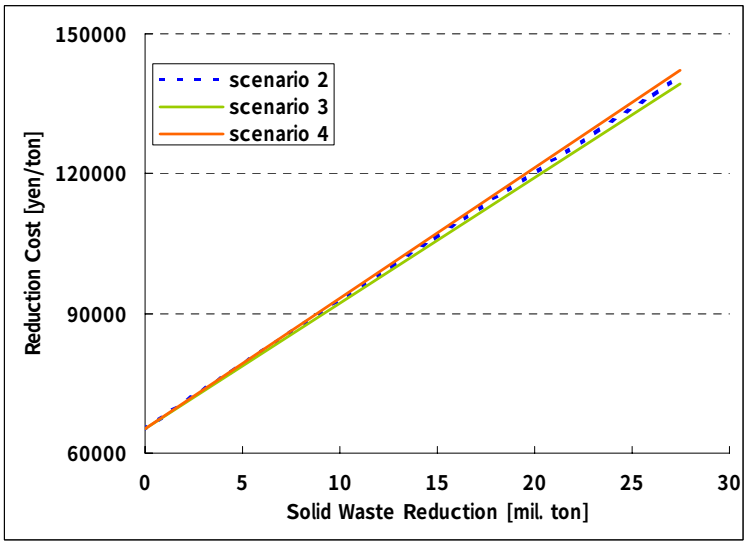

Rural Population Projection
Millions
45
40
35
30
25
20
15
10
5
0
1950
1970
1990
2010
2030
Year
Australia
Japan
Korea Rep
Singapore


Rural Population Projection
Millions
140
120
100
80
60
40
20
0
1950
1970
1990
2010
2030
Year
Indonesia
Malaysia
Philippin
Th

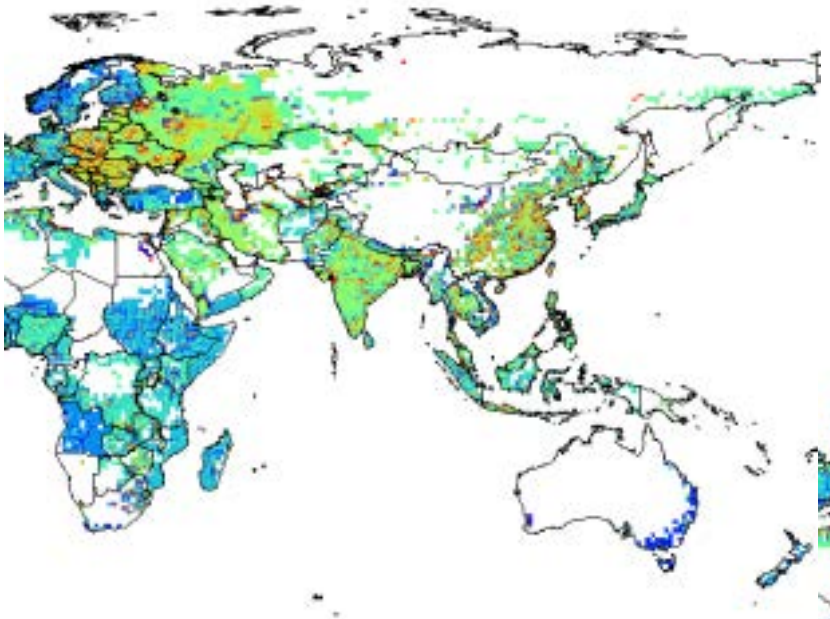

Rural Population Projection
Millions
900
800
700
600
500
400
300
200
100
0
1950
1970
1990
2010
2030
Year
China
India
Pakistan
Sri Lanka
Viet Nam


Agricultural Land per Capita
Hectares
45
40
35
30
25
20
15
10
5
0
1960
1965
1970
1975
1980
1985
1990
1995
Year
Australia
Agricultural land per capita
Hectares
0.10
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
Japan
Korea Rep
Singapore
Agricultural land per capita
Hectares
0.60
0.50
0.40
0.30
0.20
0.10
0.00
Indonesia
Malaysia
Philippin
Th
Year
Year

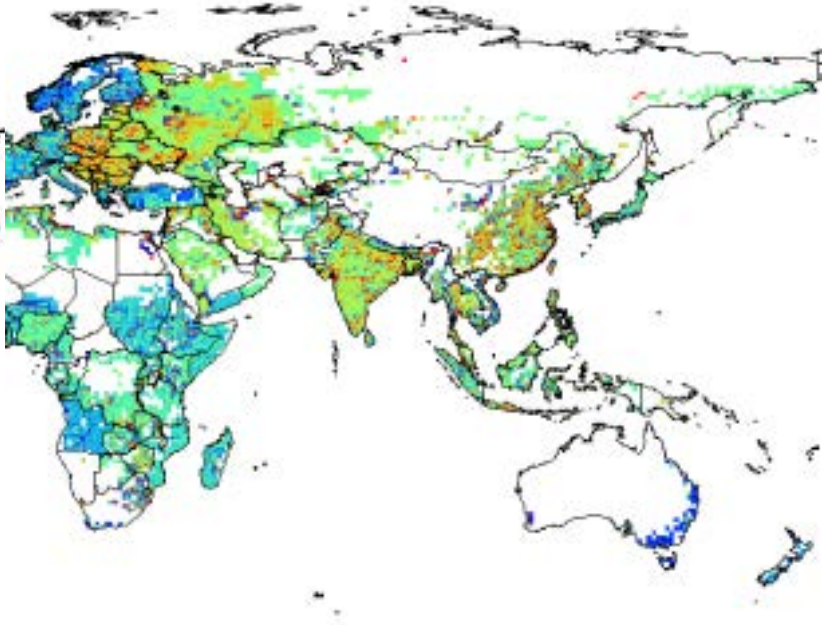

35000
30000
25000
20000
15000
10000
5000
0
CO2 Price [yen/tC]
scenario 2
scenario 3
scenario 4
0
10
20
30
40
50
60
70
80
CO2 Reduction [mil. tC]


150000
120000
90000
60000
Reduction Cost [yen/ton]
scenario 2
scenario 3
scenario 4
0
5
10
15
20
25
30
Solid Waste Reduction [mil. ton]

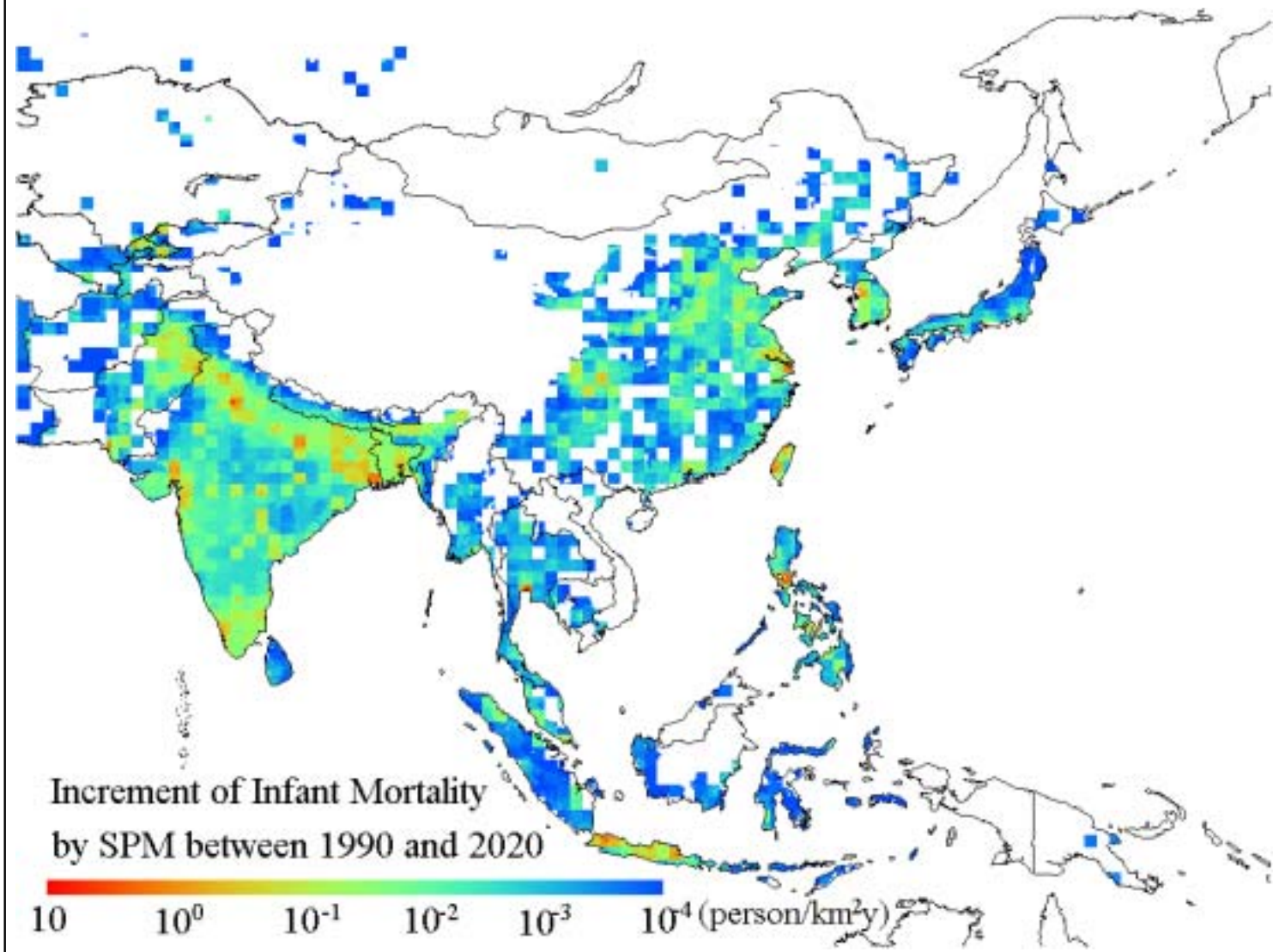
PM concentration

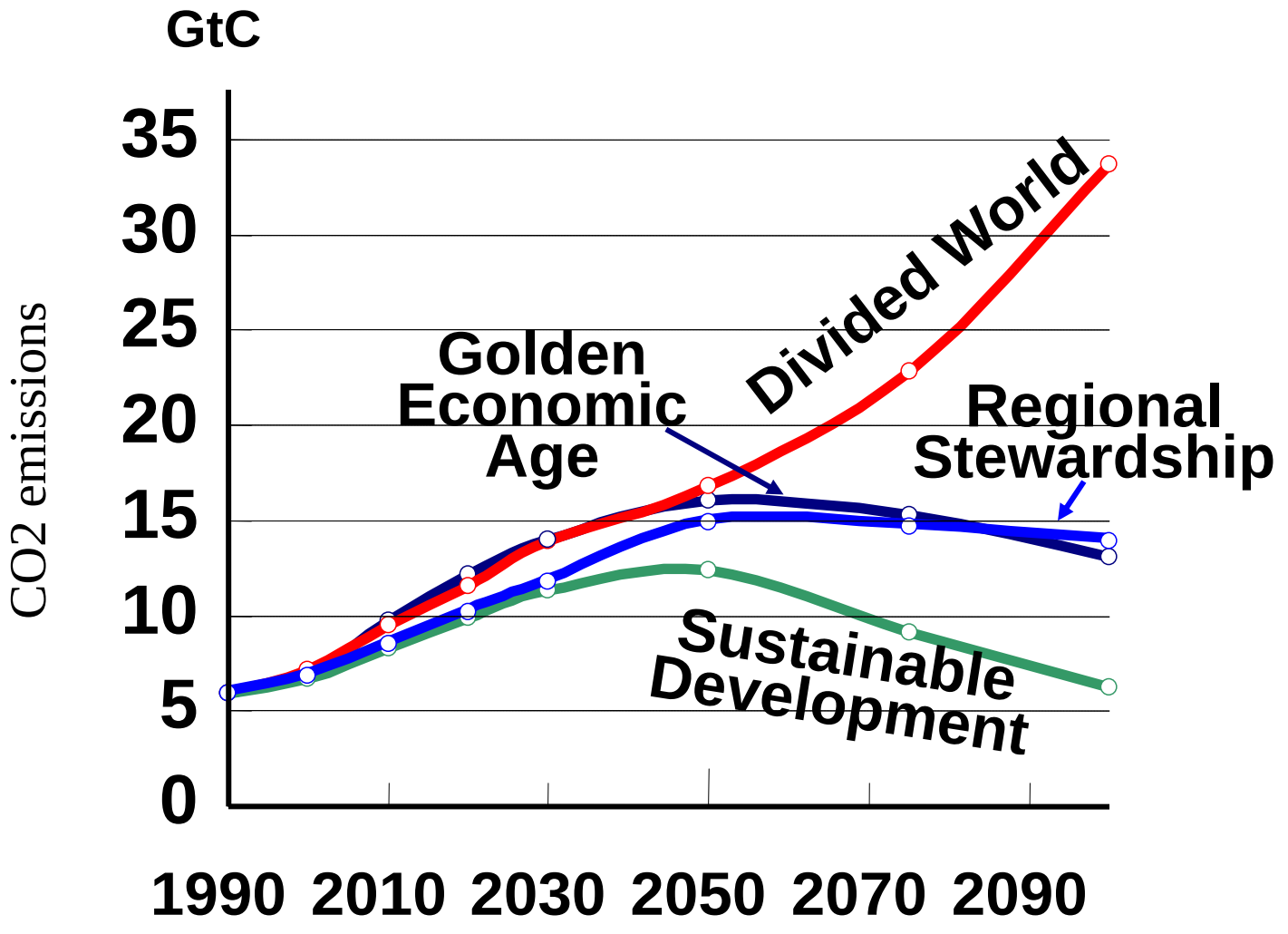


year 1990

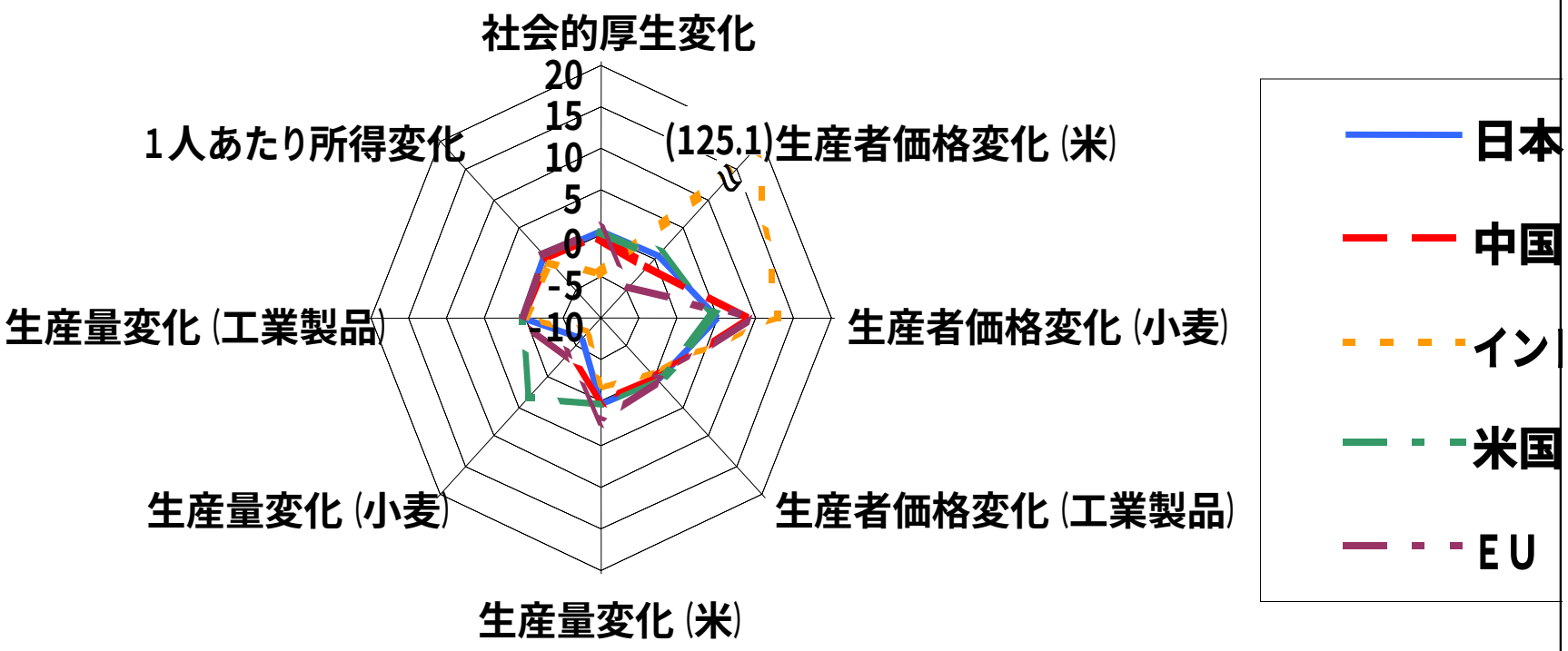


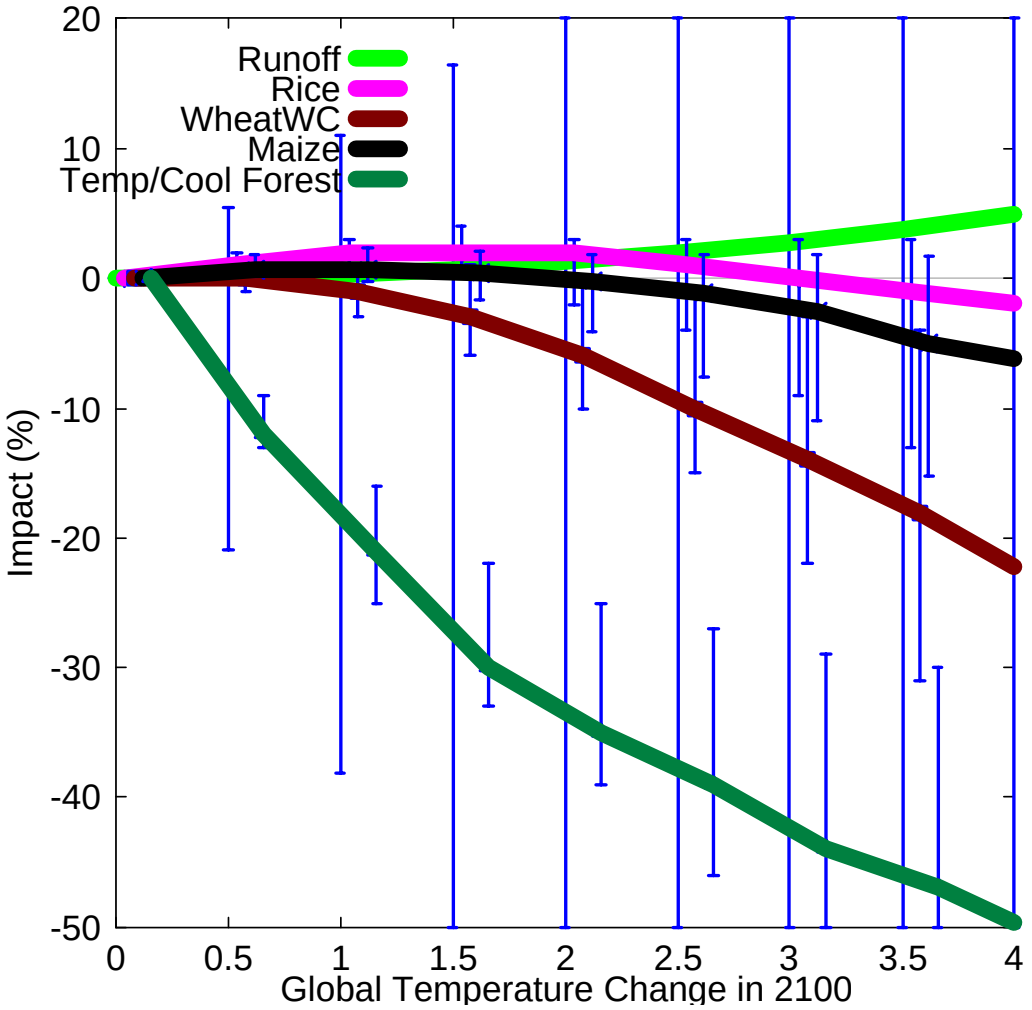
year 2050 (BaU)

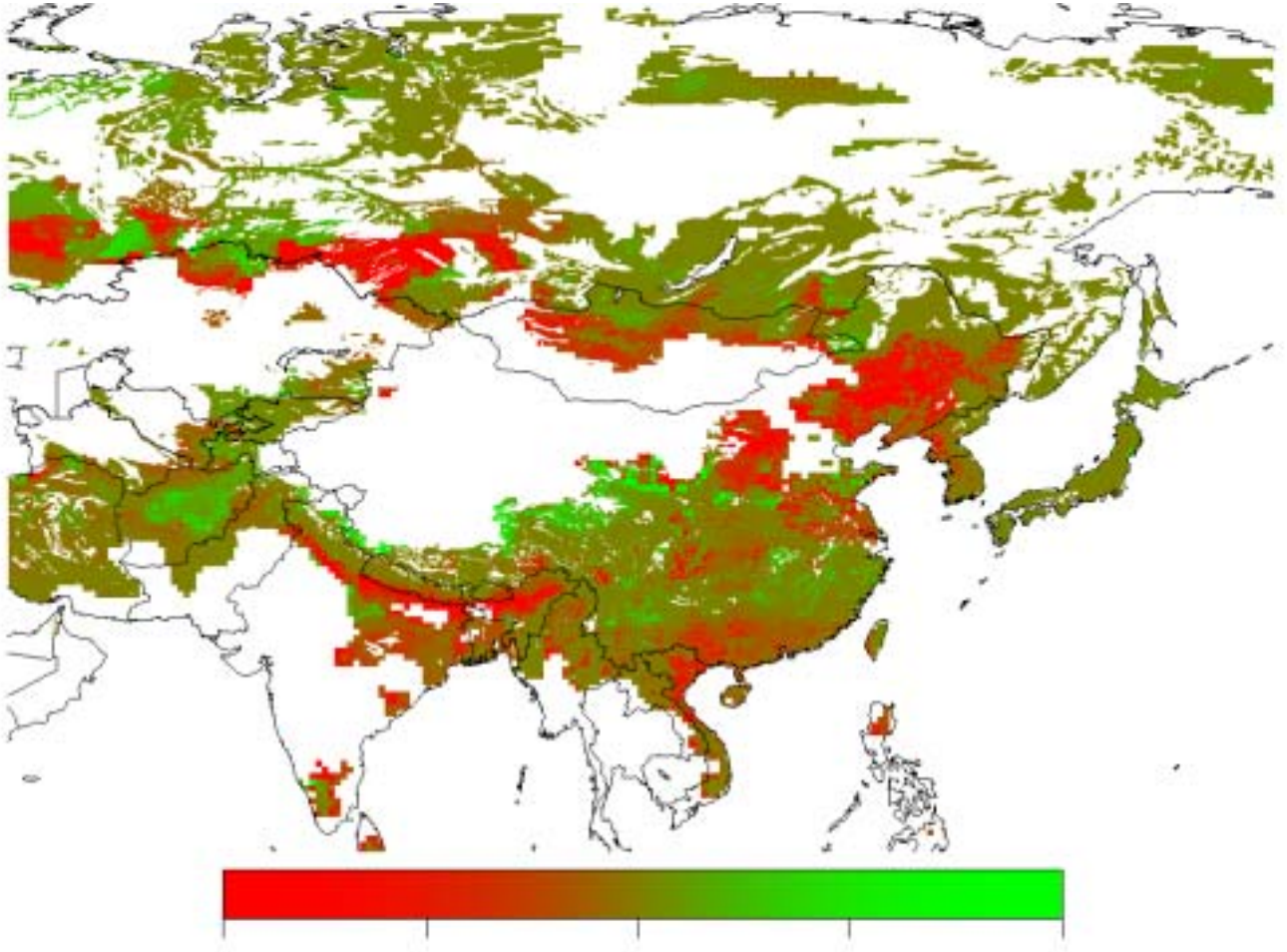

Increment of Infant Mortality
by SPM between 1990 and 2020
10
10^{0}
10^{-1}
10^{-2}
10^{-3}
10^{-4} (person/km²y)



World CO_2 emission projections (AIM)


社会的厚生変化
(125.1)生産者価格変化(米)
生産者価格変化(小麦)
生産者価格変化(工業製品)
生産量変化(米)
生産量変化(小麦)
生産量変化(工業製品)
1人あたり所得変化
20
15
10
5
0
-5
-10
日本
中国
インド
米国
EU


Runoff
Rice
WheatWC
Maize
Temp/Cool Forest
Impact (%)
20
10
0
-10
-20
-30
-40
-50
0
0.5
1
1.5
2
2.5
3
3.5
4
Global Temperature Change in 2100



Change of Potential Productivity, Winter Wheat, 2100-1990

Identify incentives for policy measures of climate change

- Compare costs and benefits of introducing global warming abatement policies
- Identify vulnerable regions and sectors to climate change
- Identify and estimate co-benefits of global warming abatement policies on regional and local environments

(policy needs of AIM)

Systematic assessment of climate change mitigation policy

- Assess technological and economical feasibility for GHG reduction considering costs and markets
- Assess consistency of mitigation policies, such as increasing biomass use and land availability
- Assess comprehensive approaches for GHG reduction including, energy saving, introduction of renewable energy, reforestation, methane emission reduction and CO_2 disposal

(policy needs of AIM)

Assessment of long-term policy option

- Prepare a common platform to discuss on long-term targets of atmospheric stabilization
- Compare short-term mitigations with long-term adaptation policies
- Assess the long-term interaction among mitigation policies, natural/socio-economical impacts of climate change, and global issues, such as economic development, food problem etc.

(policy needs of AIM)

The AIM (Asian-Pacific Integrated Model)

- Focuses on global warming problem,
- Integrates emission, climate and impact models,
- Prepares both country modules and global modules,
- Integrates bottom-up and top-down approach of socio-economic sectors,
- Based on a detailed geographic information system to evaluate and present the distribution of impacts,
- Has a focus on the Asian-Pacific region and an international collaborative network of research institutes.

ECO-ASIA Long-Term Perspective Project
8th International Workshop
27-28, February 2001,
Keio Plaza Hotel Shinjuku, Tokyo, Japan

Current Status and Future Perspectives

Mikiko Kainuma
National Institute for Environmental Studies