



Global food, feed, fiber and bioenergy demand prospects: Implications for natural resources –

Drawing on the Millennium Ecosystem
Assessment

Claudia Ringler

International Food Policy Research Institute
Challenge Program on Water and Food

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Theme 5

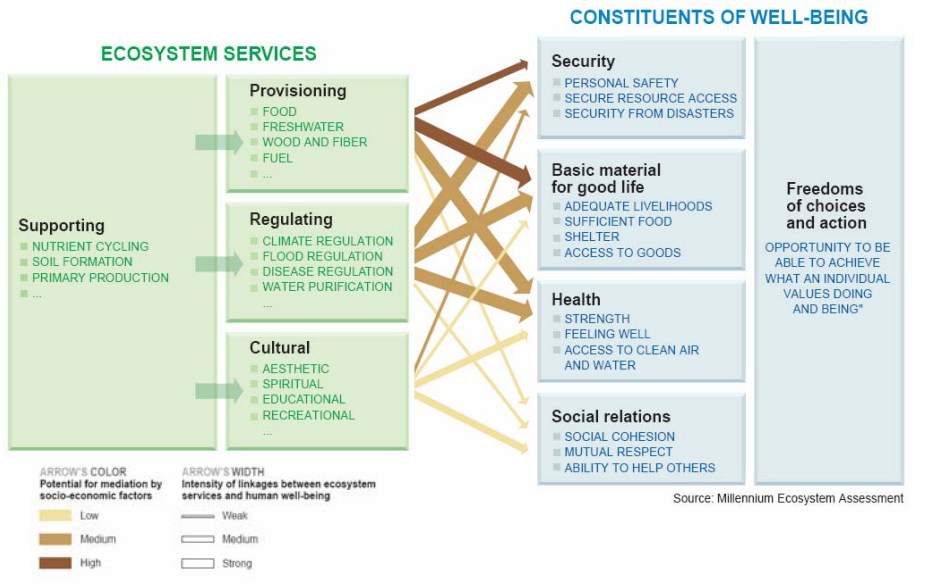


Outline

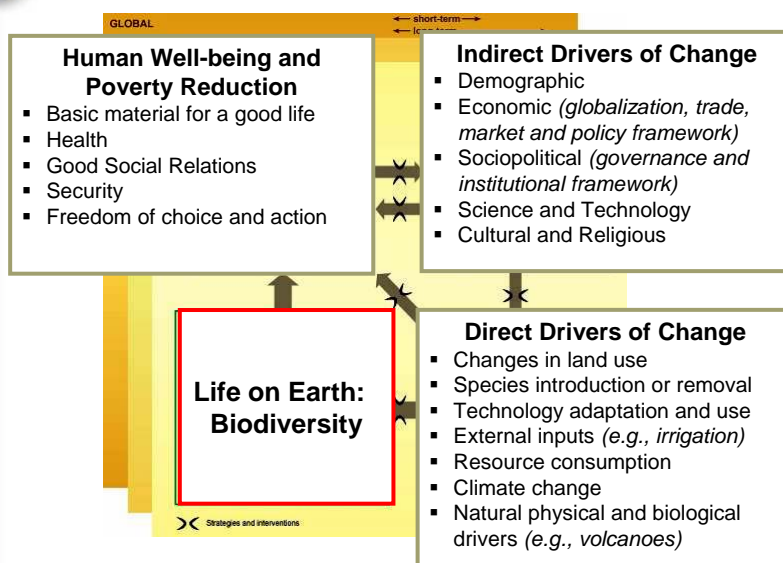
- Conceptual Framework, MA
- Assessment of Selected Trends and
Conditions of Ecosystem Services
- Alternative Scenarios - Outcomes for
Future Ecosystem services, focus on food
supply and related outcomes
- Conclusions



Ecosystem Services - Benefits people obtain from ecosystems



MA Conceptual Framework



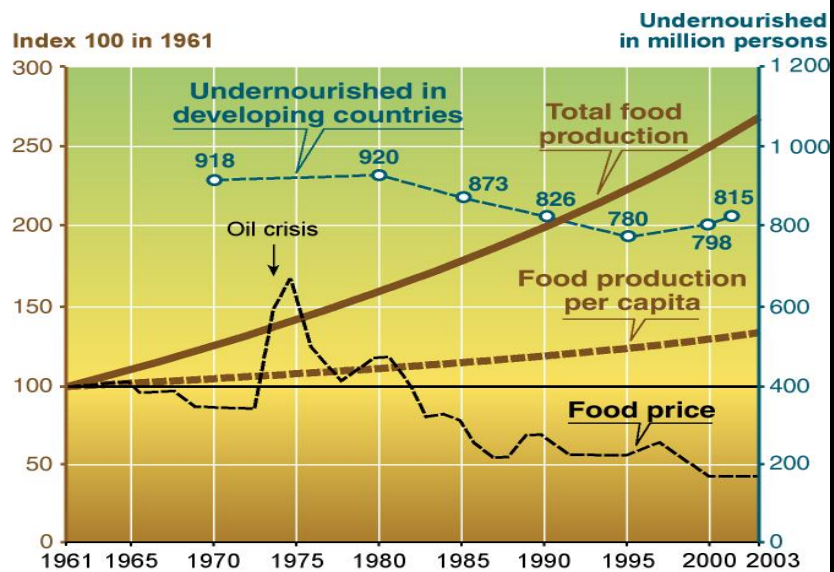


The Balance Sheet

Enhanced	Degraded	Mixed
Crops	Capture fisheries	Timber
Livestock	Wild foods	Fiber
Aquaculture	Wood fuel	Water regulation
Carbon sequestration	Genetic resources	Disease regulation
	Fresh Water	Recreation & ecotourism
	Air quality regulation	
	Regional & local climate regulation	
	Erosion regulation	
	Water purification	
	Pest regulation	
	Pollination	

Bottom Line: 60% of Ecosystem Services are Degraded

Increased Food Production

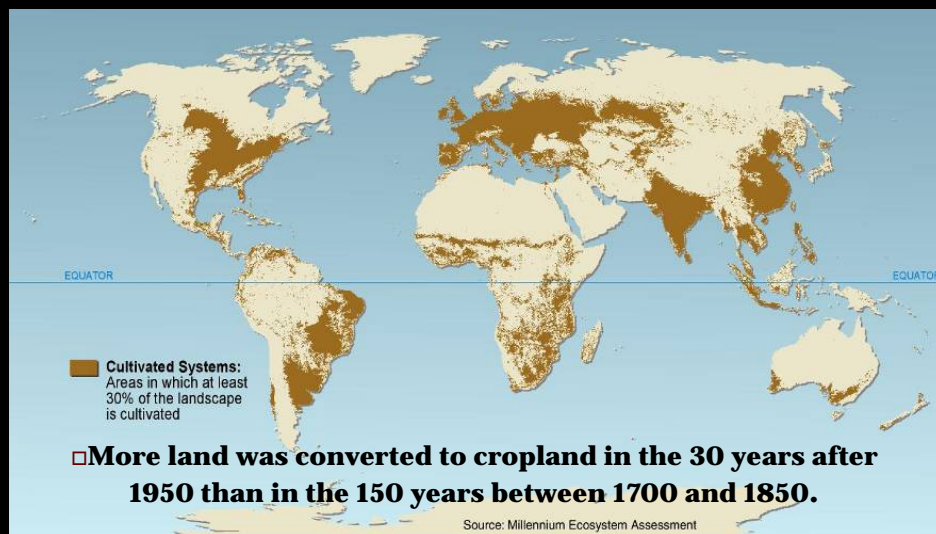




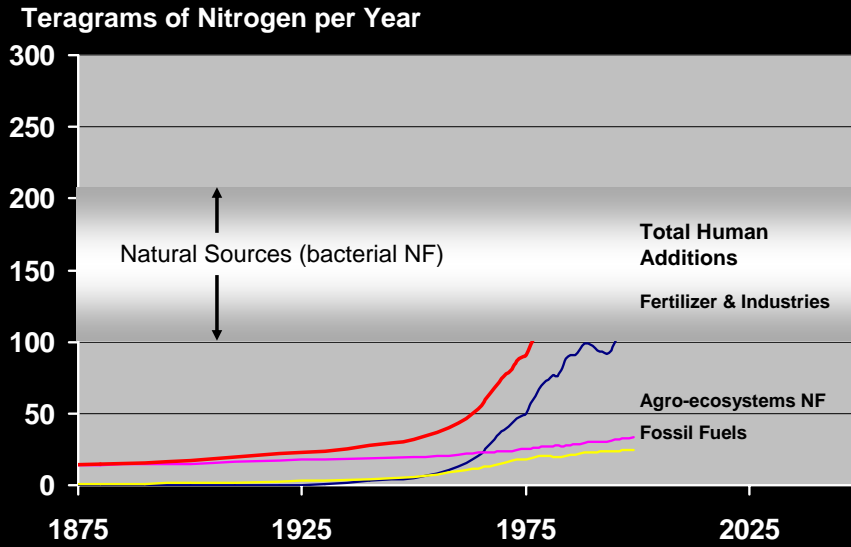
Provisioning Services

- Contributions of agriculture
 - Agricultural labor force accounts for 22% of the world's population and half the world's total labor force
 - Agriculture accounts for 24% of GDP in low income developing countries
- Market value of ecosystem-service industries
 - Food production: \$980 billion per year
 - Timber industry: \$400 billion per year
 - Marine fisheries: \$80 billion per year
 - Marine aquaculture: \$57 billion per year
 - Recreational hunting and fishing: >\$75 billion per year in the United States alone

Extent of Cultivated Systems (24% of the terrestrial surface)

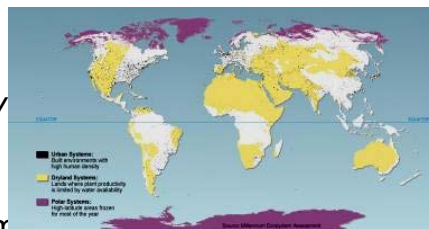


Global Trends in the Creation of Reactive Nitrogen







Gains and Losses from Ecosystem Services

- Gains and Losses from Ecosystem Change
 - Three major problems may decrease long-term benefits*
 - Degradation of Ecosystem Services
 - Increased Likelihood of Nonlinear Changes
 - Exacerbation of Poverty for Some People





MA Scenarios

		World Development	
		Globalization	Regionalization
Environmental Management	Reactive	 Global Orchestration	 Order from Strength
	Proactive	 TechnoGarden	 Adapting Mosaic



Scenario Storylines



- Global Orchestration** Globally connected society that focuses on global trade and economic liberalization and takes a reactive approach to ecosystem problems but that also takes strong steps to reduce poverty and inequality and to invest in public goods such as infrastructure and education.



- Order from Strength** Regionalized and fragmented world, concerned with security and protection, emphasizing primarily regional markets, paying little attention to public goods, and taking a reactive approach to ecosystem problems.



Scenario Storylines



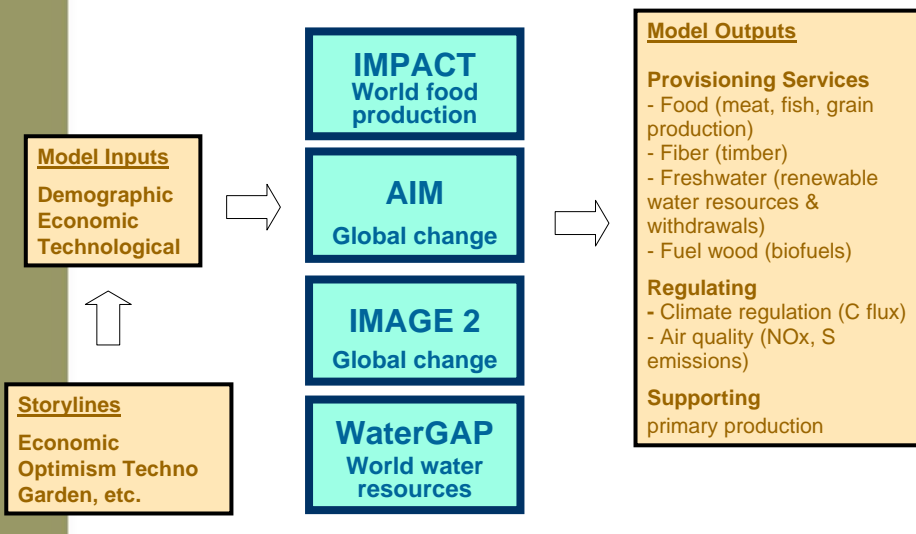
- **Adapting Mosaic** Regional watershed-scale ecosystems are the focus of political and economic activity. Local institutions are strengthened and local ecosystem management strategies are common; societies develop a strongly proactive approach to the management of ecosystems.



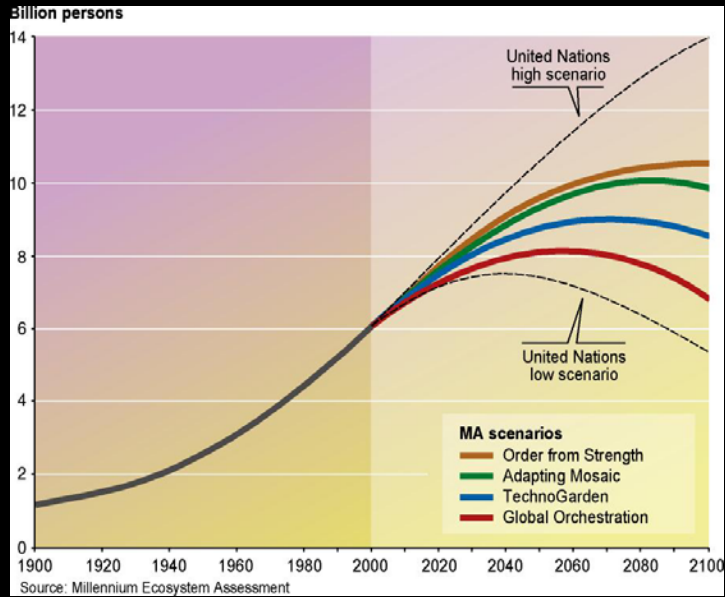
- **TechnoGarden** Globally connected world relying strongly on environmentally sound technology, using highly managed, often engineered, ecosystems to deliver ecosystem services, and taking a proactive approach to the management of ecosystems in an effort to avoid problems.



Modeling to quantify parts of the MA scenarios



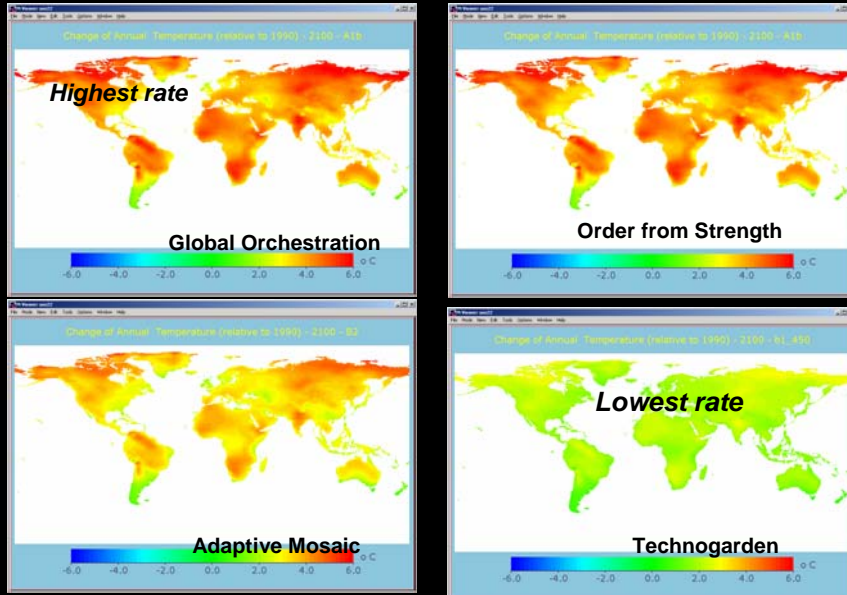
Population Growth, MA Scenarios



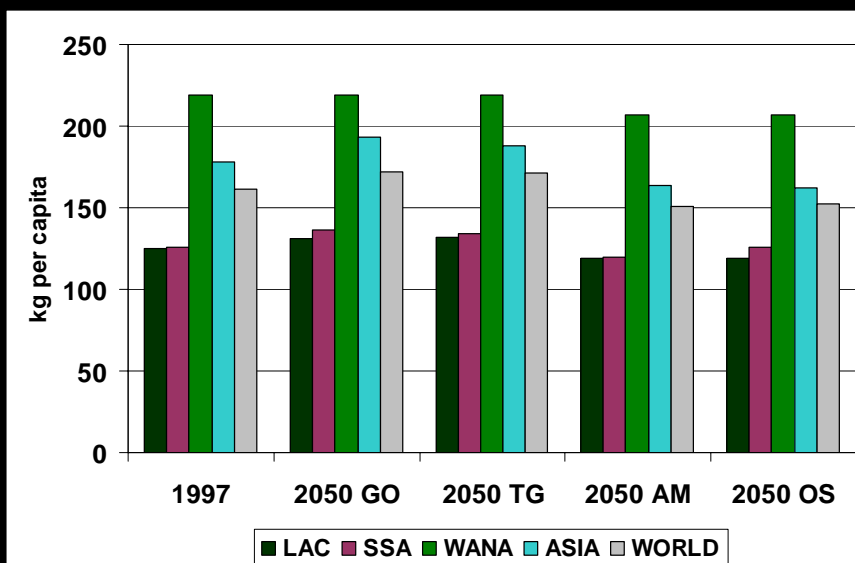
Per Capita Income Growth, MA Scenarios

Economic Growth Rates (percent per year)													
Region	Historic	Global Orchestration			Techno Garden			Order from Strength			Adapting Mosaic		
		1971-2000	1995-2020	2020-2050	2050-2100	1995-2020	2020-2050	2050-2100	1995-2020	2020-2050	2050-2100	1995-2020	2020-2050
Former SU	0.4	3.50	4.91	3.14	2.94	4.49	3.14	2.24	2.64	2.72	2.60	4.03	3.08
Latin America	1.2	2.80	4.28	2.24	2.36	3.93	2.24	1.78	2.29	1.77	2.06	2.99	2.23
Middle East/North Africa	0.7	1.96	3.42	2.50	1.74	3.27	2.50	1.51	1.75	1.93	1.61	2.43	2.40
OECD	2.1	2.45	1.93	1.34	2.22	1.74	1.35	2.06	1.31	0.86	2.00	1.56	1.19
Asia	5.0	5.06	5.28	3.08	4.24	4.70	3.13	3.22	2.43	2.07	3.76	4.12	2.52
Sub-Saharan Africa	-0.4	1.69	3.97	4.08	1.44	3.80	4.08	1.02	2.12	2.16	1.21	2.85	3.31
World	1.4	2.38	3.00	2.26	1.90	2.46	2.25	1.39	1.04	1.26	1.46	1.91	1.88

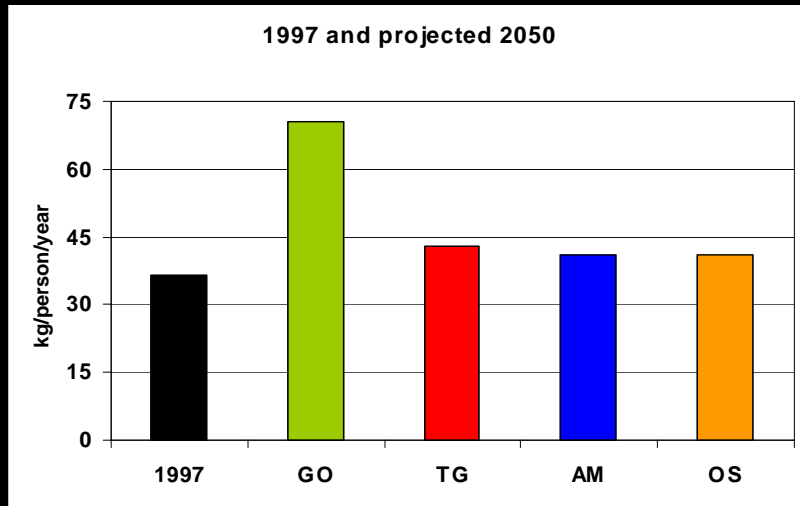
Climate Change in MA Scenarios



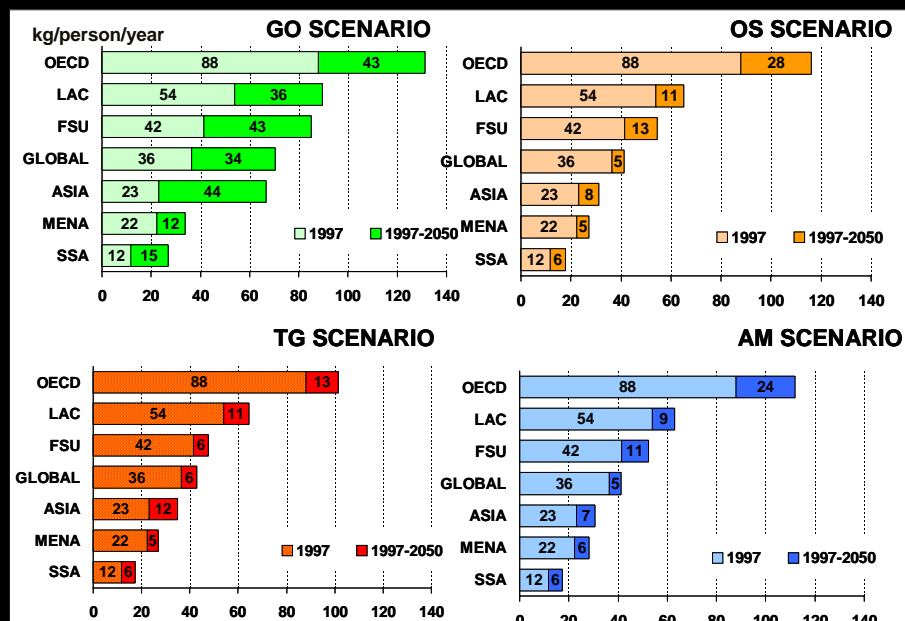
Projected Per Capita Cereal Availability as Food



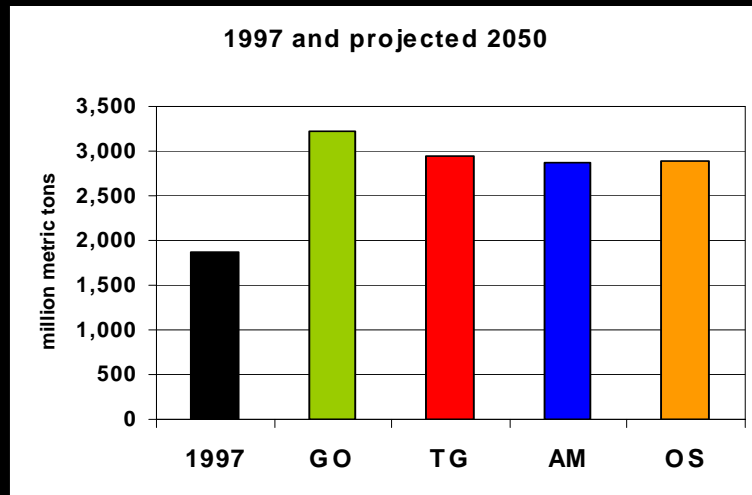
Projected Global Per Capita Meat Demand



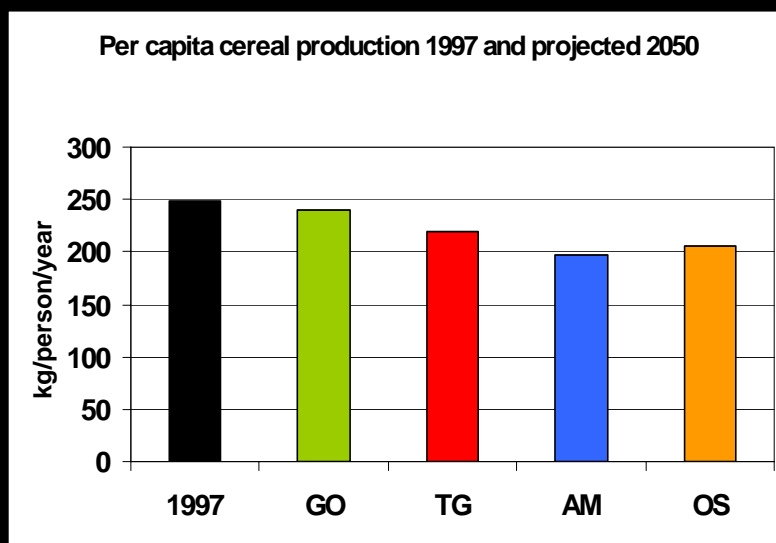
Projected Regional Meat Demand



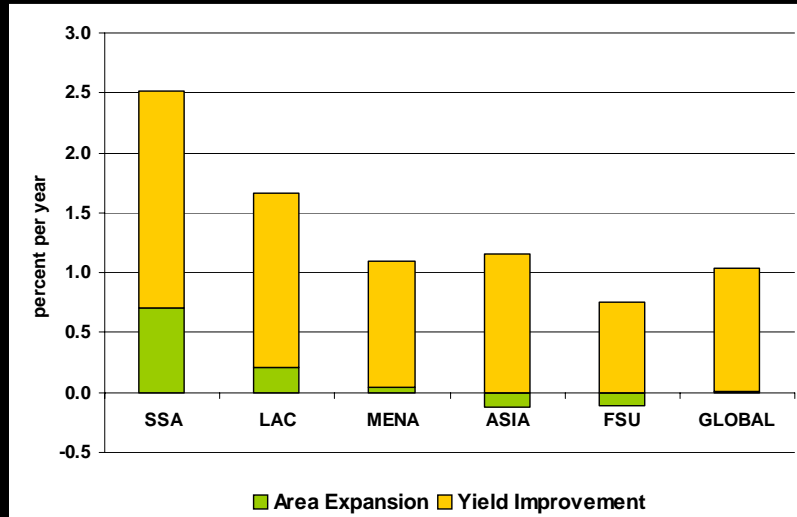
Projected Global Cereal Production



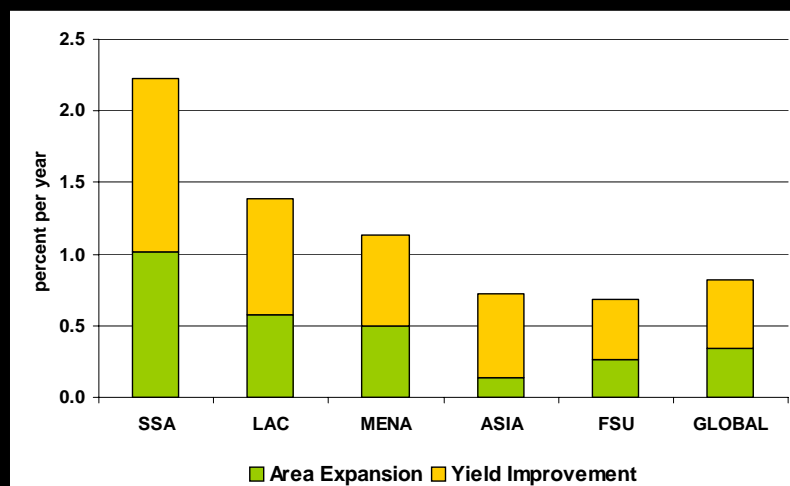
Per Capita Production in MENA



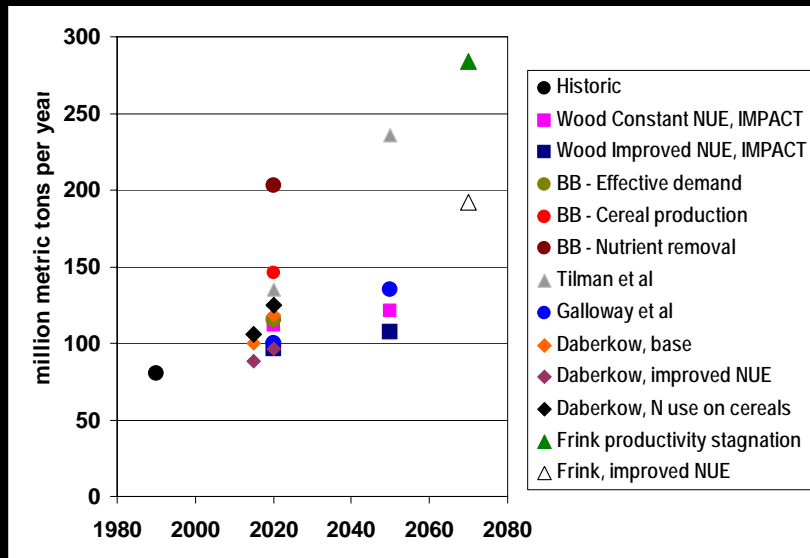
Sources of Growth, Global Orchestration



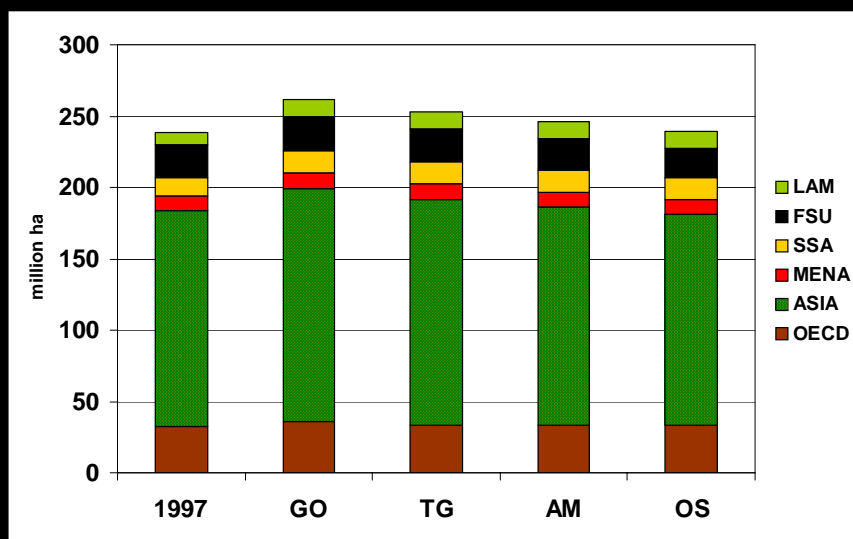
Sources of Growth, Order from Strength



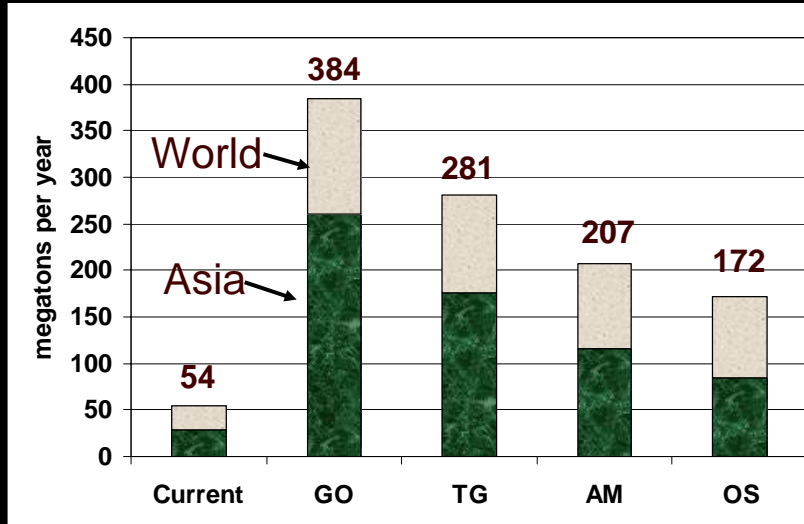
Projected Fertilizer N Use



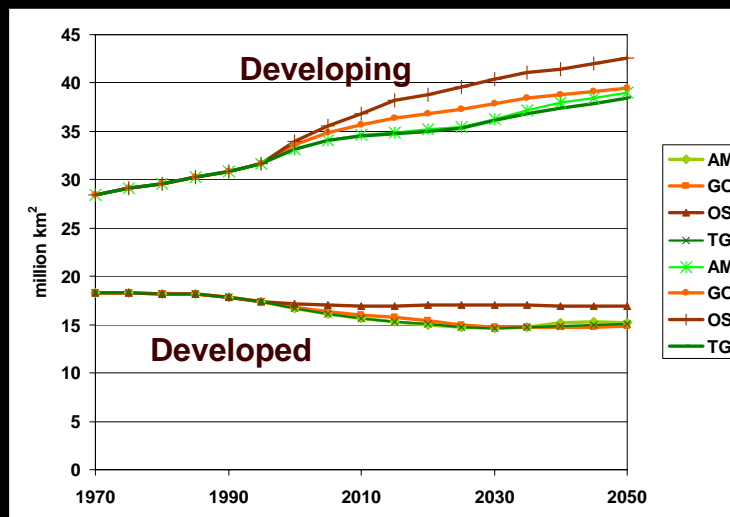
Projected Irrigated Area, 2050



Projected Biofuel Production, Asia and Global, 2050

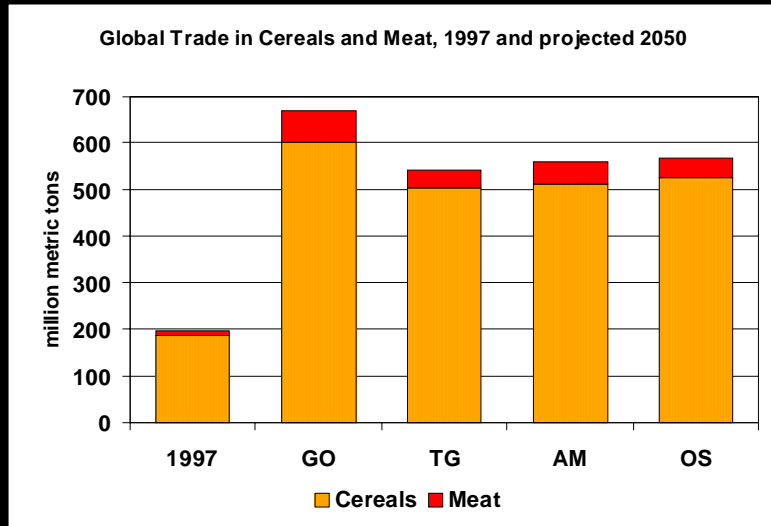


Change in Agricultural Land Under MA Scenarios

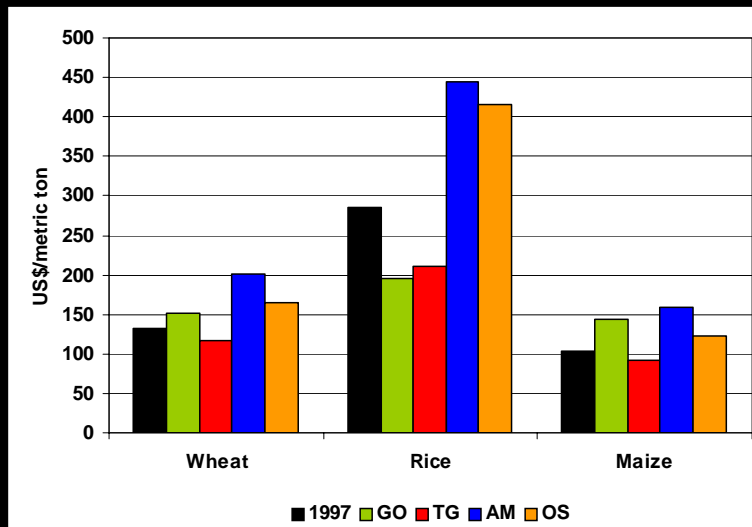


Source: Millennium Ecosystem Assessment

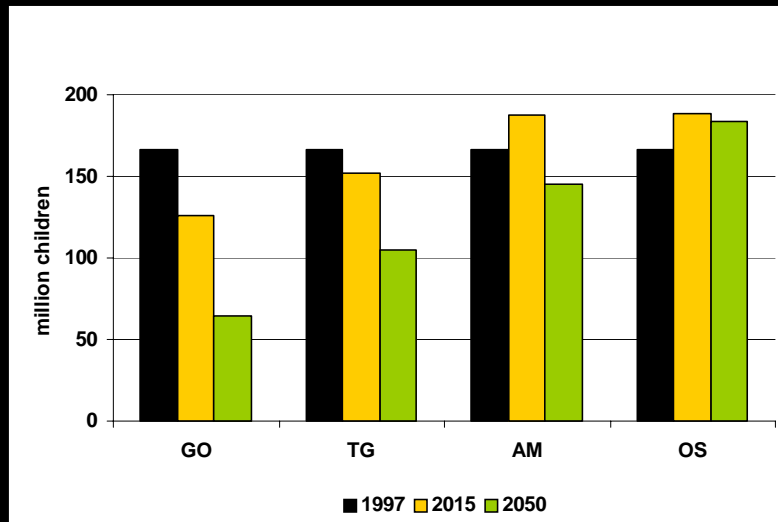
Projected International Cereal & Meat Trade



Projected International Cereal Prices

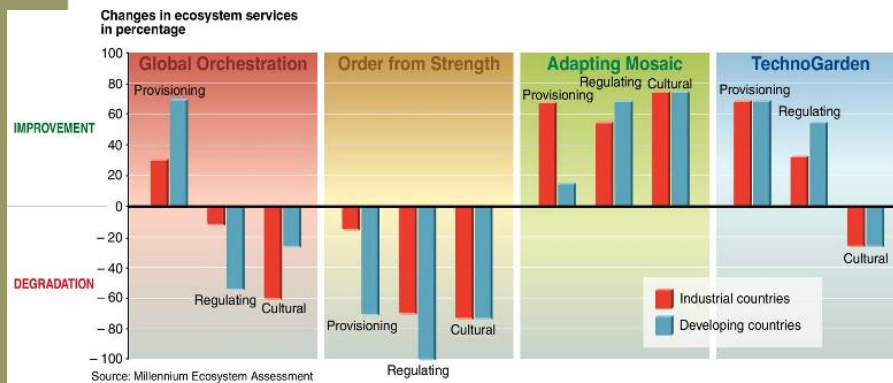


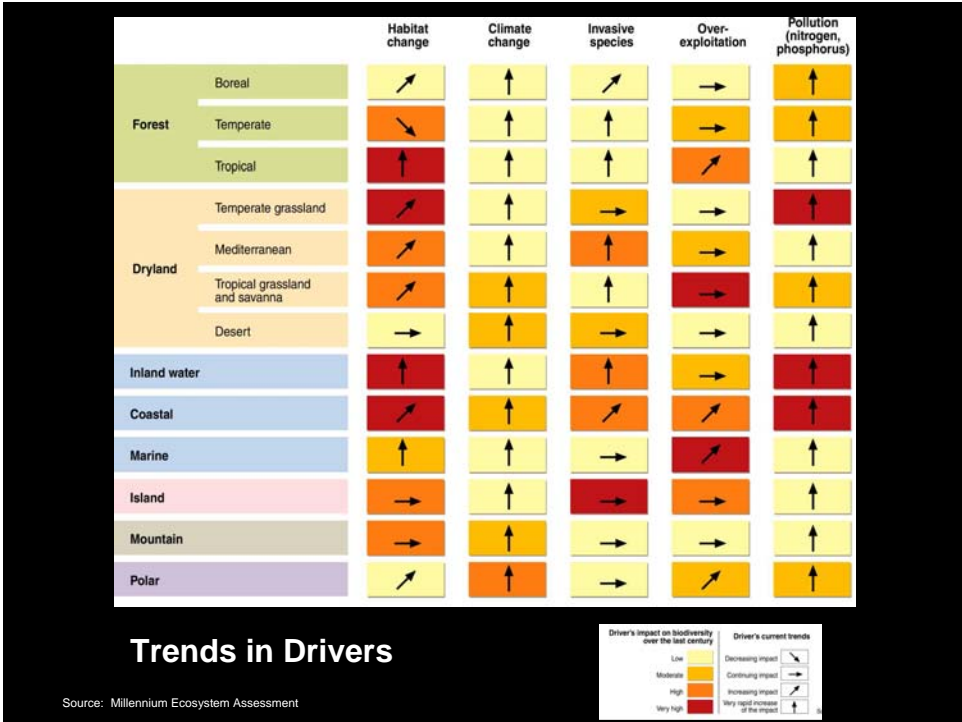
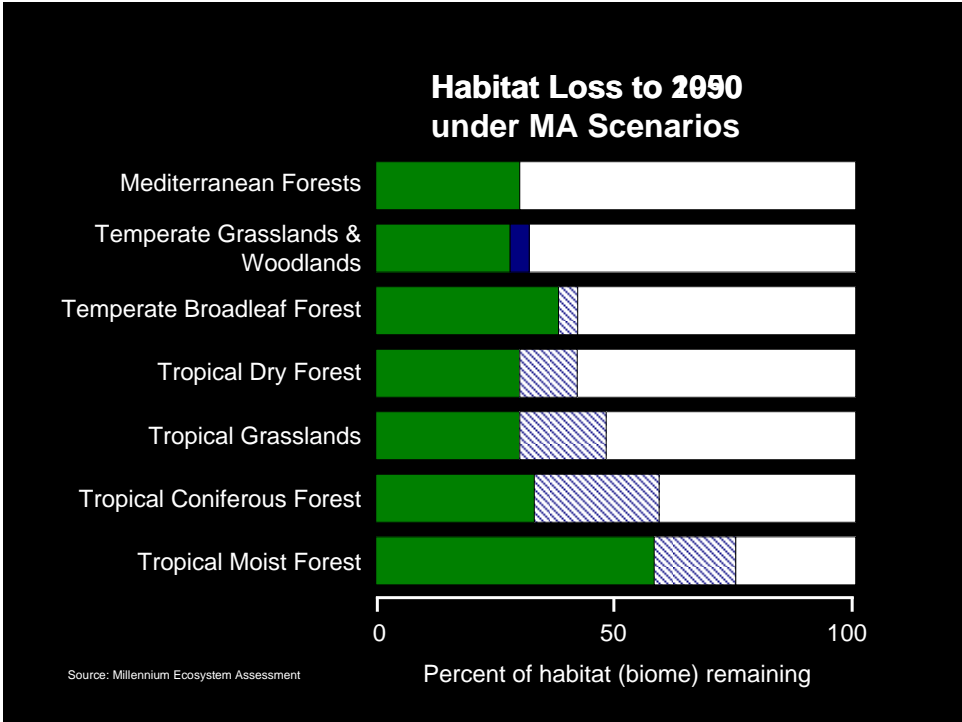
Projected Number of Malnourished Children



Degradation of many services can be reversed by 2050

□ In three of the four MA scenarios, many currently degraded ecosystem services were enhanced by 2050







Conclusions

- While ecosystem service provision, including water, food and fiber will increase substantially, adverse impact on ecosystems will also grow in magnitude
- While in the coming decades most adverse impacts on ecosystems will likely derive from land use change, in the longer term, impacts from climate change might likely be more decisive for ecosystem changes
- Many poor people will still be food insecure by 2050, even with increased production seen under all 4 scenarios



Conclusions

- The MA has shown significant tradeoffs among ecosystem services, including tradeoffs among increased food security and environmental outcomes – and fertilizer use is at the center of these tradeoffs
- The challenge of reversing the degradation of ecosystems while meeting increasing demands for their services involves significant changes in policies, institutions and practices, that are not currently under way
- More research and policy focus is needed for
 - land use change impacts on ecosystems and biodiversity
 - mitigation strategies for climate change
 - increasing water security
 - “Hot Spot” regions, in particular, MENA, SSA and South Asia