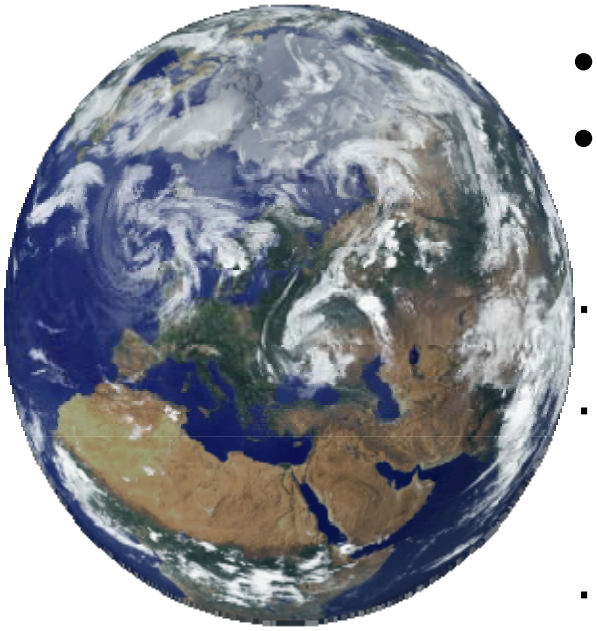
GEOBENE

GEOBENE

Benefit Assessment Now, Next and Emerging

The world in 2030 will be a world of change:



- 7.5 billion people
- temperature increase > 1 degree
- little wilderness, new diseases....

… governments will be asking for information

… observations systems need 20 years to be designed, tested, implemented

… the time to start their design is now

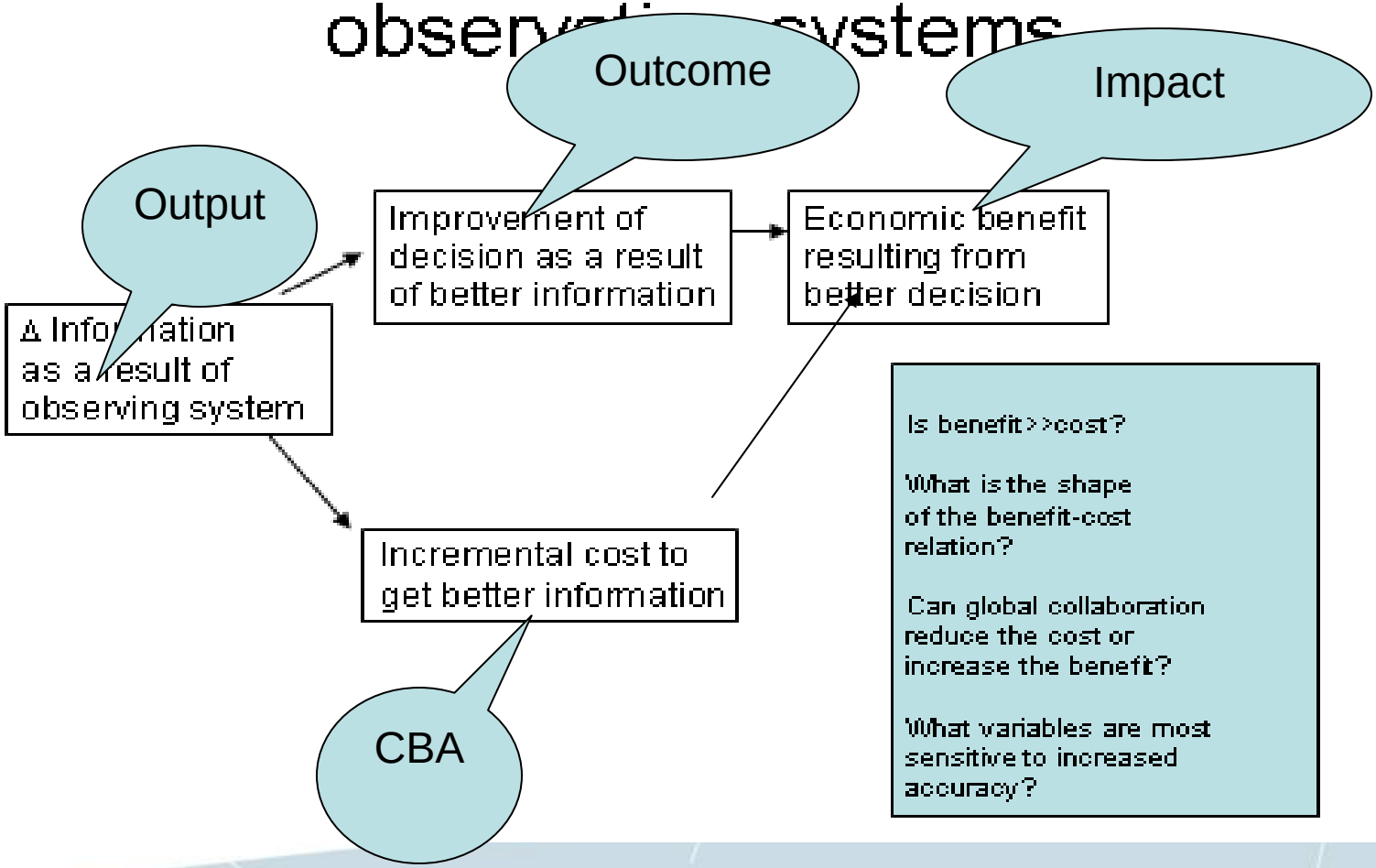
… and we need to document today‘s baseline of a world with only „small“ change

Objective of GEOBENE

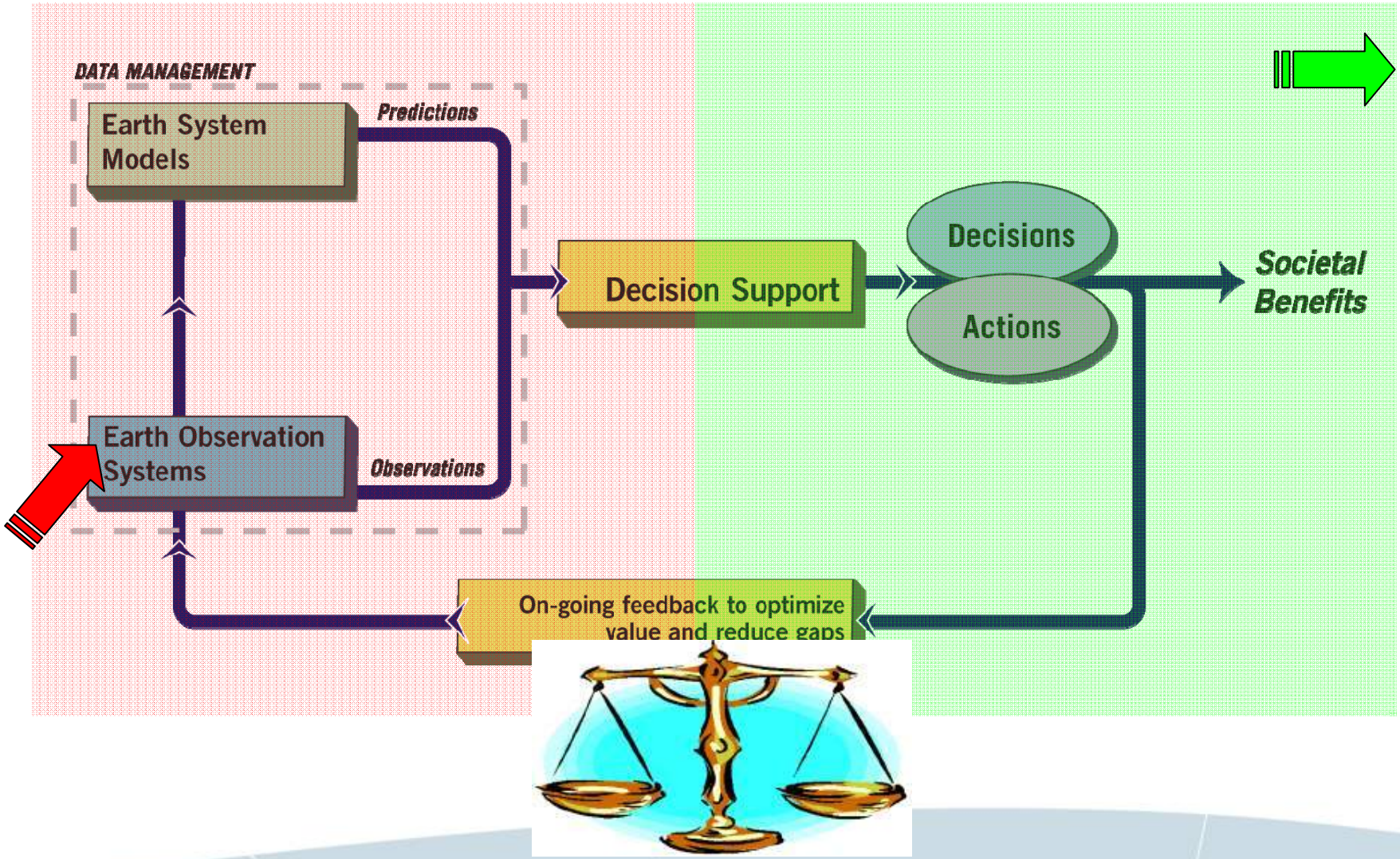
… to develop **methodologies (Ph1)** and **analytical tools (Ph2)** to assess societal benefits of GEO and to **perform benefit assessments (Ph3)**.

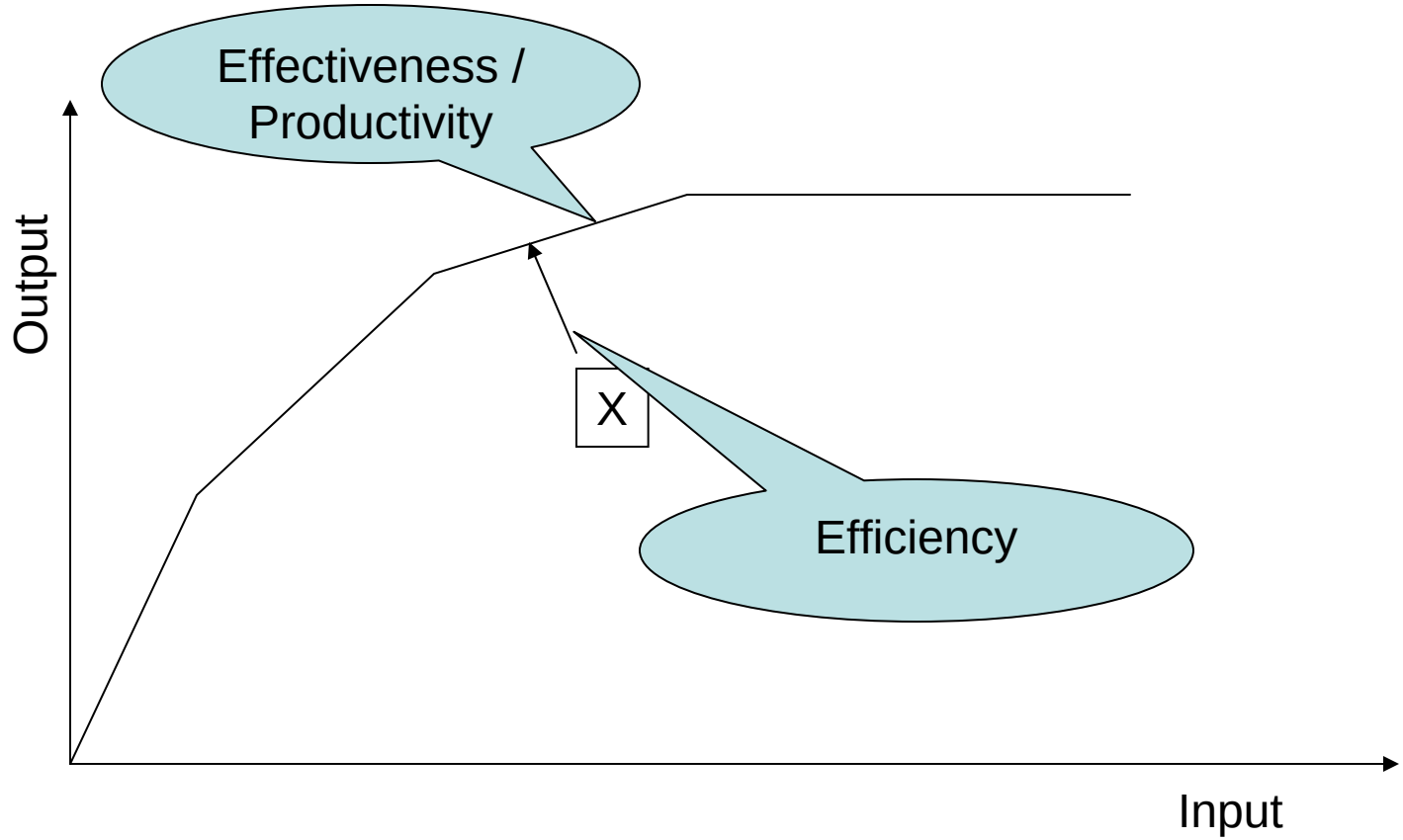
P.S.: We spent most of our time building our geo-spatial DB

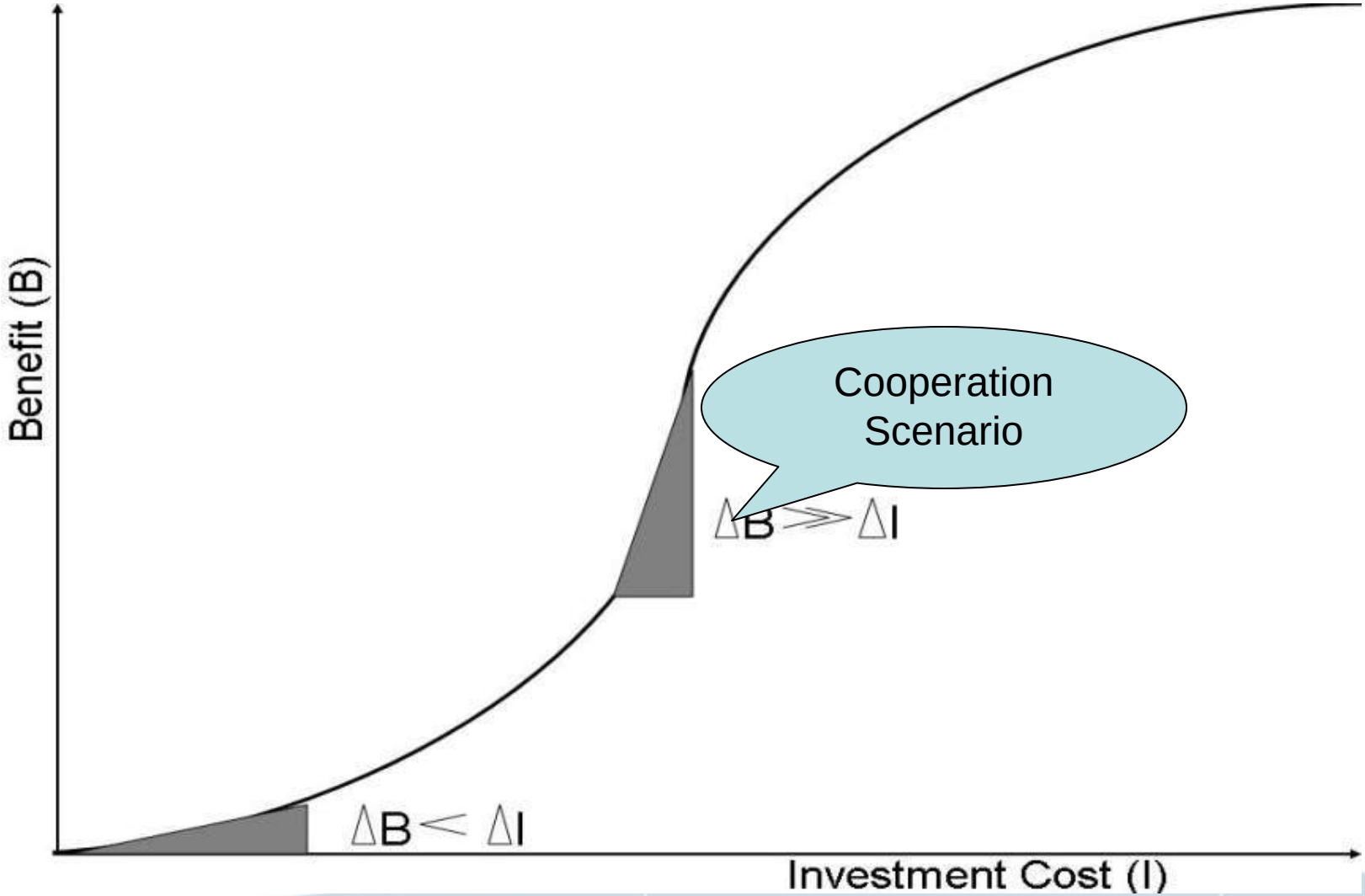
Building a value chain for observing systems



COSTS ⟷ **BENEFITS**







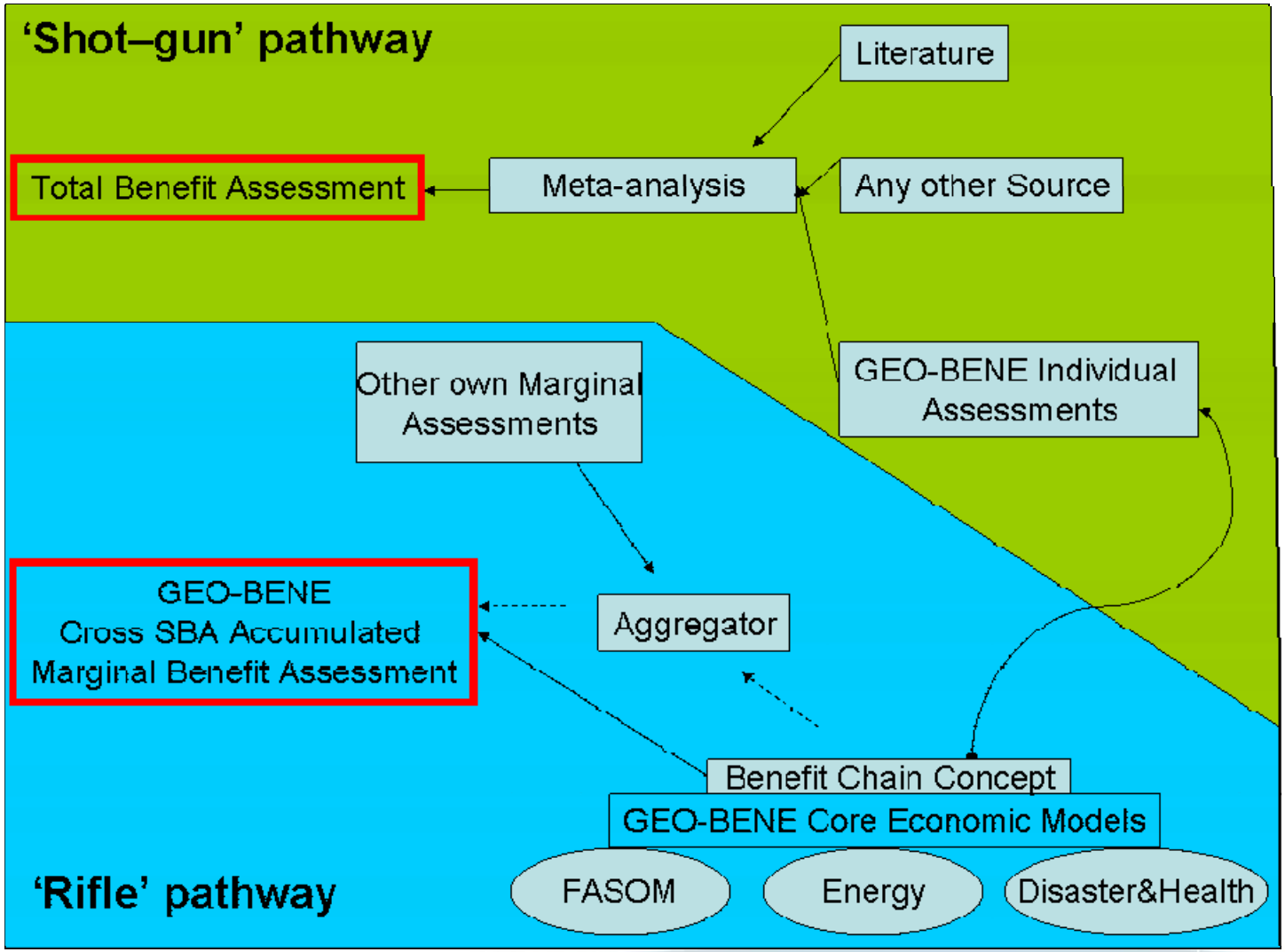


Table 10.1 GEOSS Ten-Year Implementation Plan: Relative Phasing and Maturity of Earth Observation Application

An initial synoptic description of the phasing of GEOSS implementation.

Topics	Disaster			Health			Energy			Climate			Water			Weather			Eco-systems			Agri-culture			Bio-diversity		
Periods (years)	2	6	10	2	6	10	2	6	10	2	6	10	2	6	10	2	6	10	2	6	10	2	6	10	2	6	10
Observation:																											
1 *In situ* and airborne	I	I	I				I	O	O	I	O	O	I	I	O	O	O	O	I	I	O	I	I	O	I	I	O
2 Space-based	I	I	I				I	O	O	I	O	O	I	I	O	O	O	O	I	I	O	P	I	O	P	I	O
3 Convergence of Obs.	P	I	I				P	I	O	I	O	O	P	I	O	O	O	O	P	I	O	P	O	O	P	I	O
4 Continuity	P	P	I				I	I	O	I	I	O	I	I	O	O	O	O	P	I	O	P	P	I	P	I	O
Product:																											
5 Key Products	P	I	O													O	O	O	I	I	O	I	I	O	I	I	O
6 Modeling/Assimilation	P	I	I													O	O	O	P	I	O	P	I	O	P	I	O
7 Synergy of Products	P	I	I													P	I	O	P	I	O	P	I	O	P	I	O
8 Quality Control	P	P	I				I	I	O	P	I	O	P	I	O	O	O	O	P	I	O	P	I	O	P	I	O
Data Management:																											
9 Accessibility	I	I	O				I	I	O	P	I	O	I	I	O	O	O	O	P	I	O	I	I	O	P	I	O
10 Data Exchange	I	I	O				I	I	O	P	I	O	P	I	O	O	O	O	P	I	O	P	I	O	P	I	O
11 Interoperability	P	I	I				P	I	O	P	I	O	P	I	O	P	I	O	P	I	O	P	I	O	P	I	O
12 User Involvement	I	I	I				P	I	O	I	O	O	P	O	O	O	O	O	P	I	O	I	O	O	P	I	O
13 R & D for Observation	I	I	I				I	I	I	I	I	I	I	I	I	I	I	I	P	I	I	P	I	O	P	I	I
Capacity Building:																											
14 Capacity Building	P	I	I				I	I	O	I	I	O	P	I	O	I	I	O	P	I	O	I	O	O	P	I	O

Representation of the phasing has not yet been determined

Most operational area: weather

Legend	P	Planning Phase	I	Implementation Phase	O	Operational Phase

Table 10.1 GEOSS Ten-Year Implementation Plan: Relative Phasing and Maturity of Earth Observation Application

An initial synoptic description of the phasing of GEOSS implementation.

Topics	Disaster			Health			Energy			Climate			Water			Weather			Eco-systems			Agri-culture			Bio-diversity		
Periods (years)	2	6	10	2	6	10	2	6	10	2	6	10	2	6	10	2	6	10	2	6	10	2	6	10	2	6	10
Observation:				Representation of the phasing has not yet been determined																							
1 *In situ* and airborne	I	I	I				I	O	O	I	O	O	I	I	O	O	O	O	I	I	O	I	I	O	I	I	O
2 Space-based	I	I	I				I	O	O	I	O	O	I	I	O	O	O	O	I	I	O	P	I	O	P	I	O
3 Convergence of Obs.	P	I	I				P	I	O	I	O	O	P	I	O	O	O	O	P	I	O	P	O	O	P	I	O
4 Continuity	P	P	I				I	I	O	I	I	O	I	I	O	O	O	O	P	I	O	P	P	I	P	I	O
Product:																											
5 Key Products	P	I	O				I	I	O	P	I	O	P									I	I	O	I	I	O
6 Modeling/Assimilation	P	I	I				I	I	O	P	I	O	I									P	I	O	P	I	O
7 Synergy of Products	P	I	I				P	I	O	P	I	O	P									P	I	O	P	I	O
8 Quality Control	P	P	I				I	I	O	P	I	O	P									P	I	O	P	I	O
Data Management:																											
9 Accessibility	I	I	O				I	I	O	P	I	O	I									I	I	O	P	I	O
10 Data Exchange	I	I	O				I	I	O	P	I	O	P									P	I	O	P	I	O
11 Interoperability	P	I	I				P	I	O	P	I	O	P									P	I	O	P	I	O
12 User Involvement	I	I	I				P	I	O	I	O	O	P									I	O	O	P	I	O
13 R & D for Observation	I	I	I				I	I	I	I	I	I	I									P	I	O	P	I	I
Capacity Building:																											
14 Capacity Building	P	I	I				I	I	O	I	I	O	P									I	O	O	P	I	O

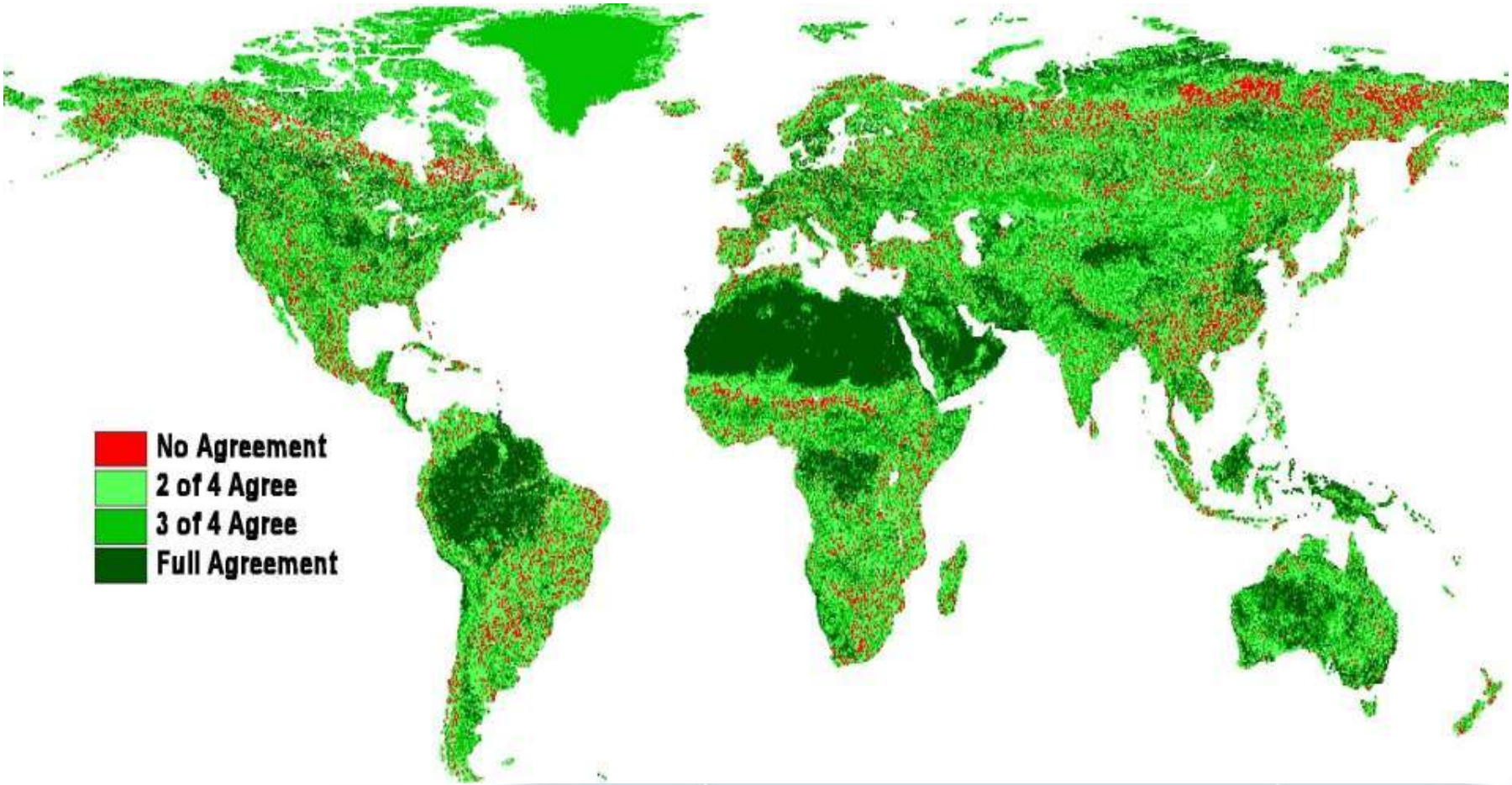
2nd most obvious areas Water & Agriculture: still mostly in planning!!? (→ huge benefits …)

Legend	P	Planning Phase	I	Implementation Phase	O	Operational Phase

CASE I: Value of Land cover uncertainty reduction

- Biofuels – Food Security – Water - GHG – Ecosystem Trade-off

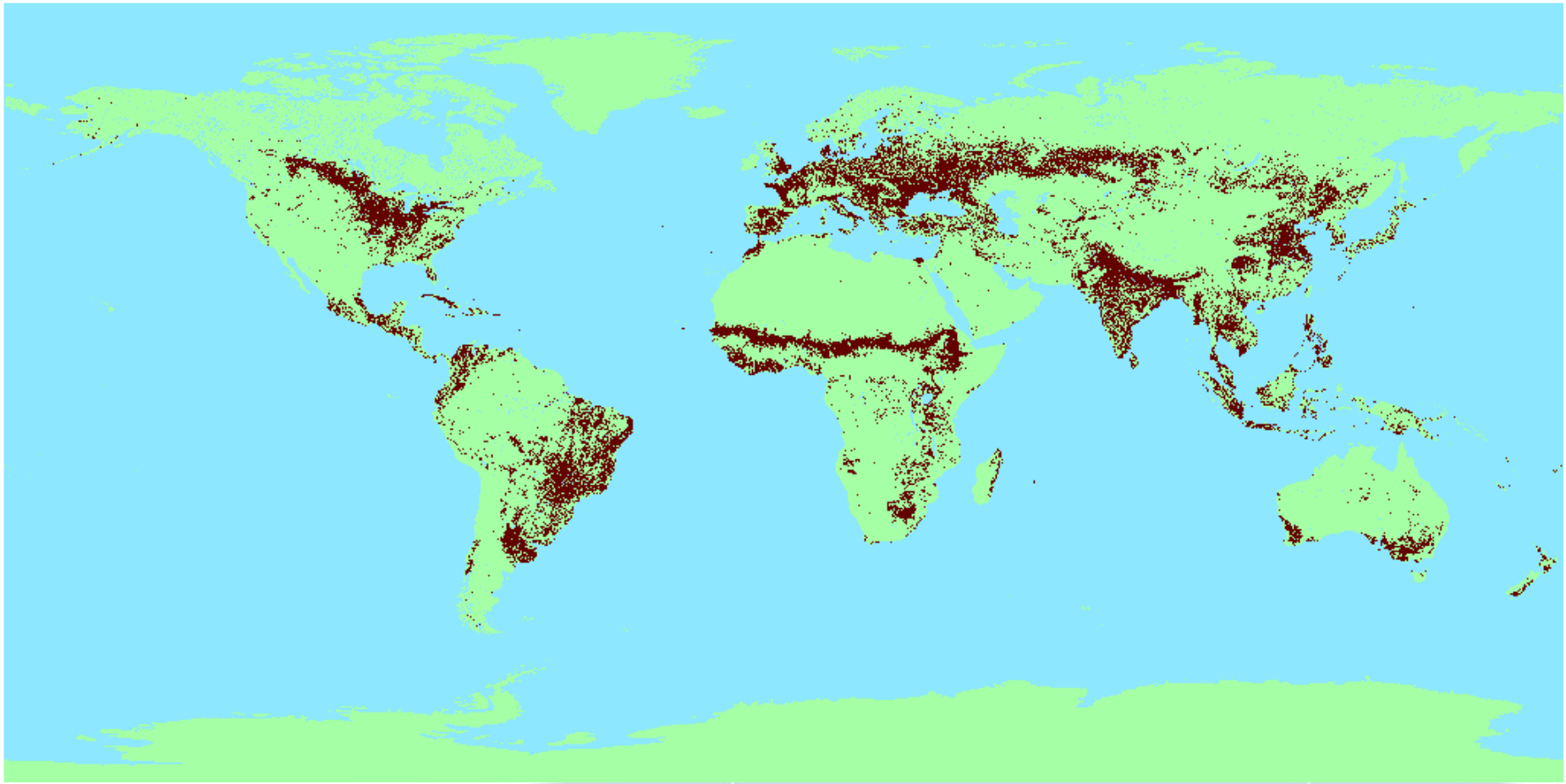
The global level of agreement among the four datasets using complete IGBP classification



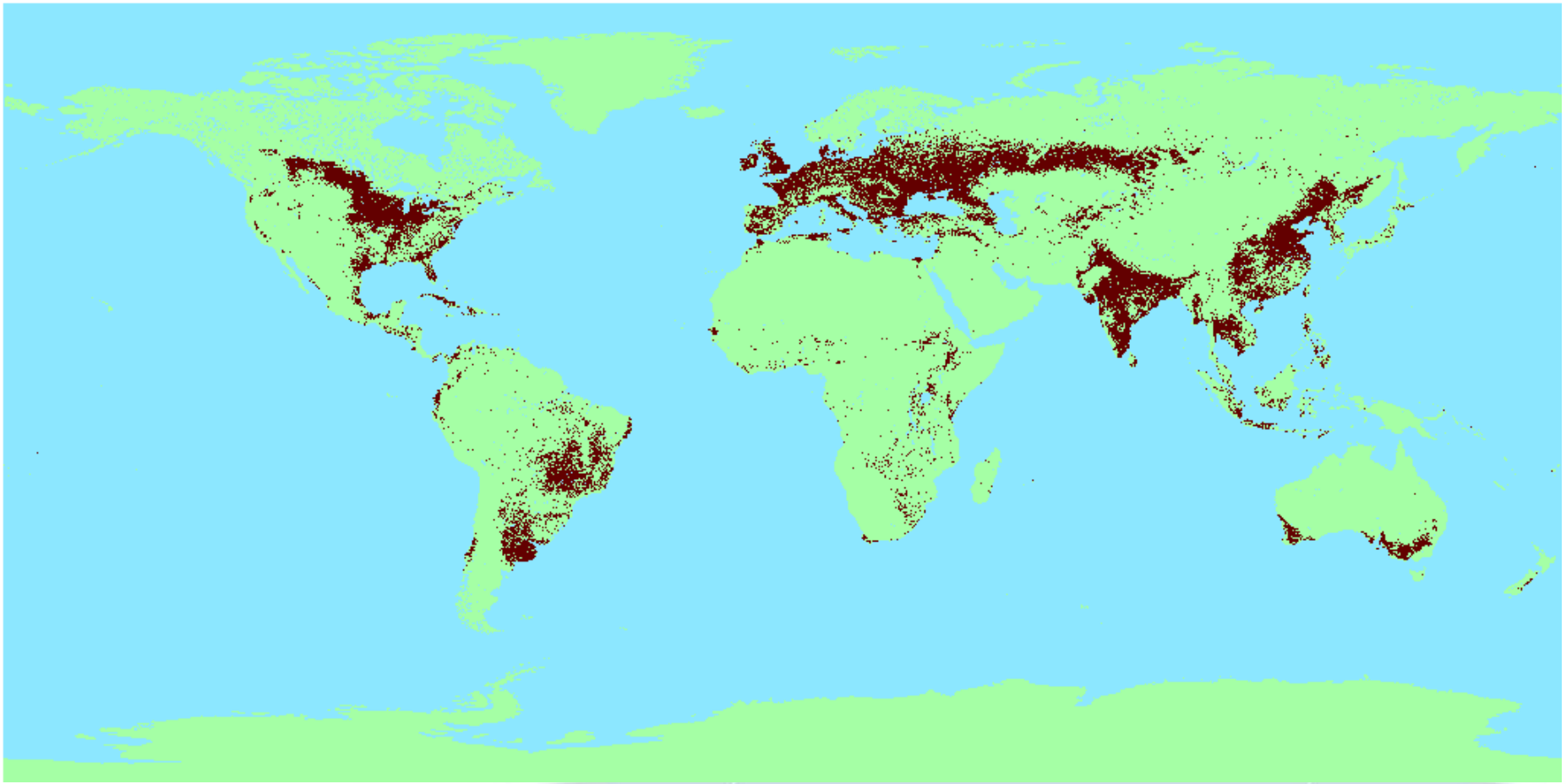
McCallum et al. 2006

Land Constraint World Scenarios

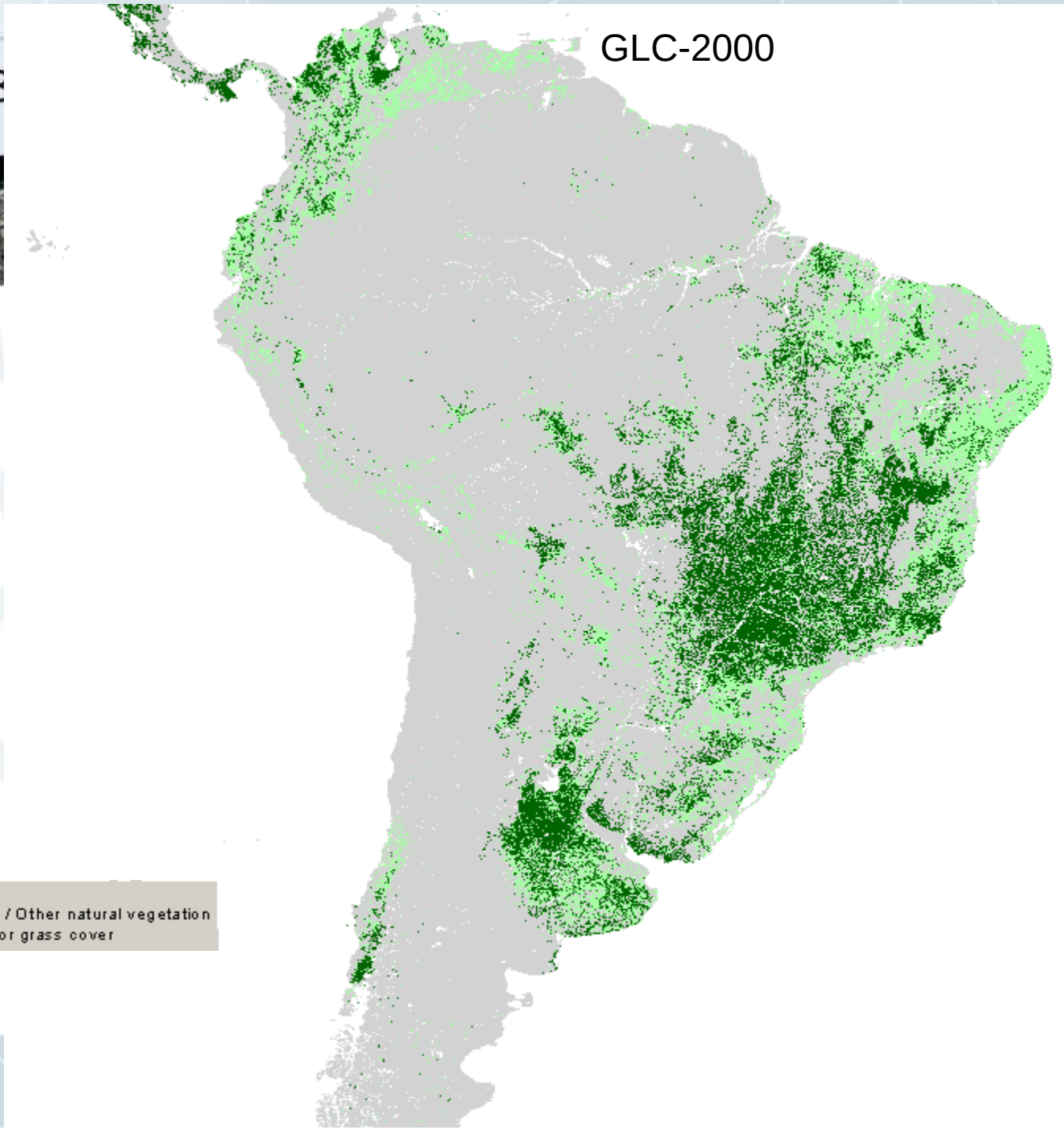
GLC-2000 agricultural land: 2 363 M ha



MODIS-2000 agricultural land: 1 937 M ha

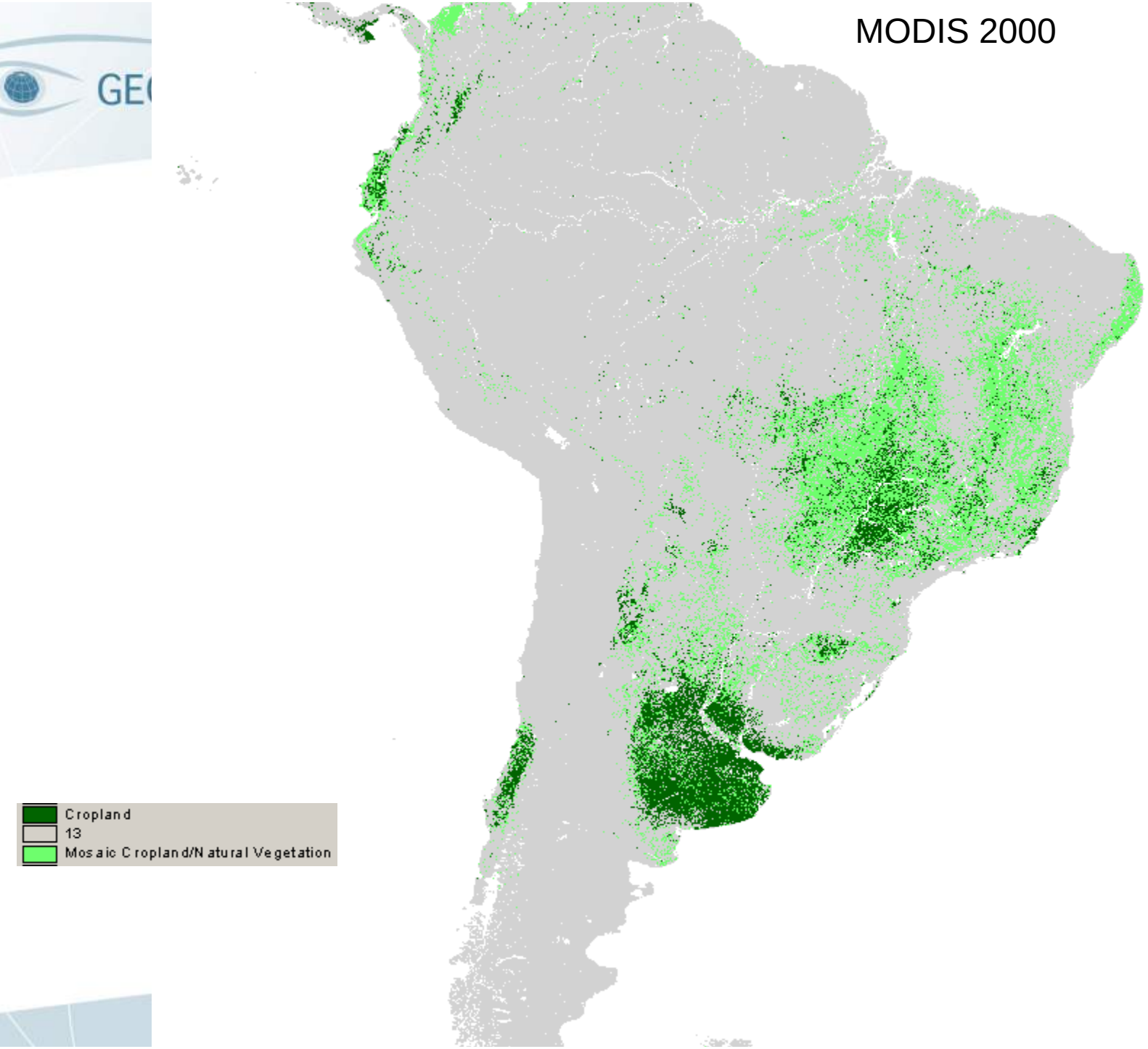


GLC-2000

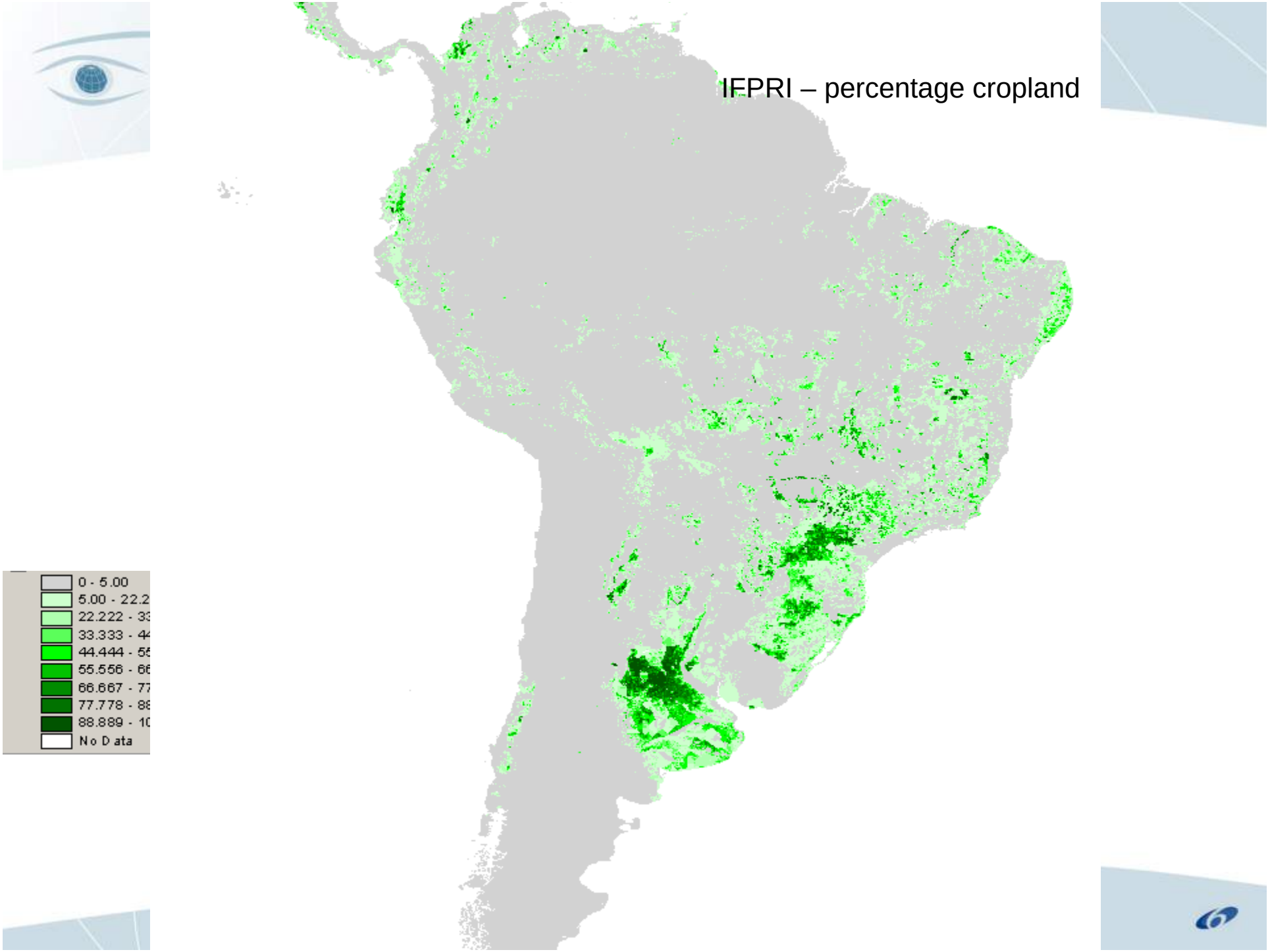


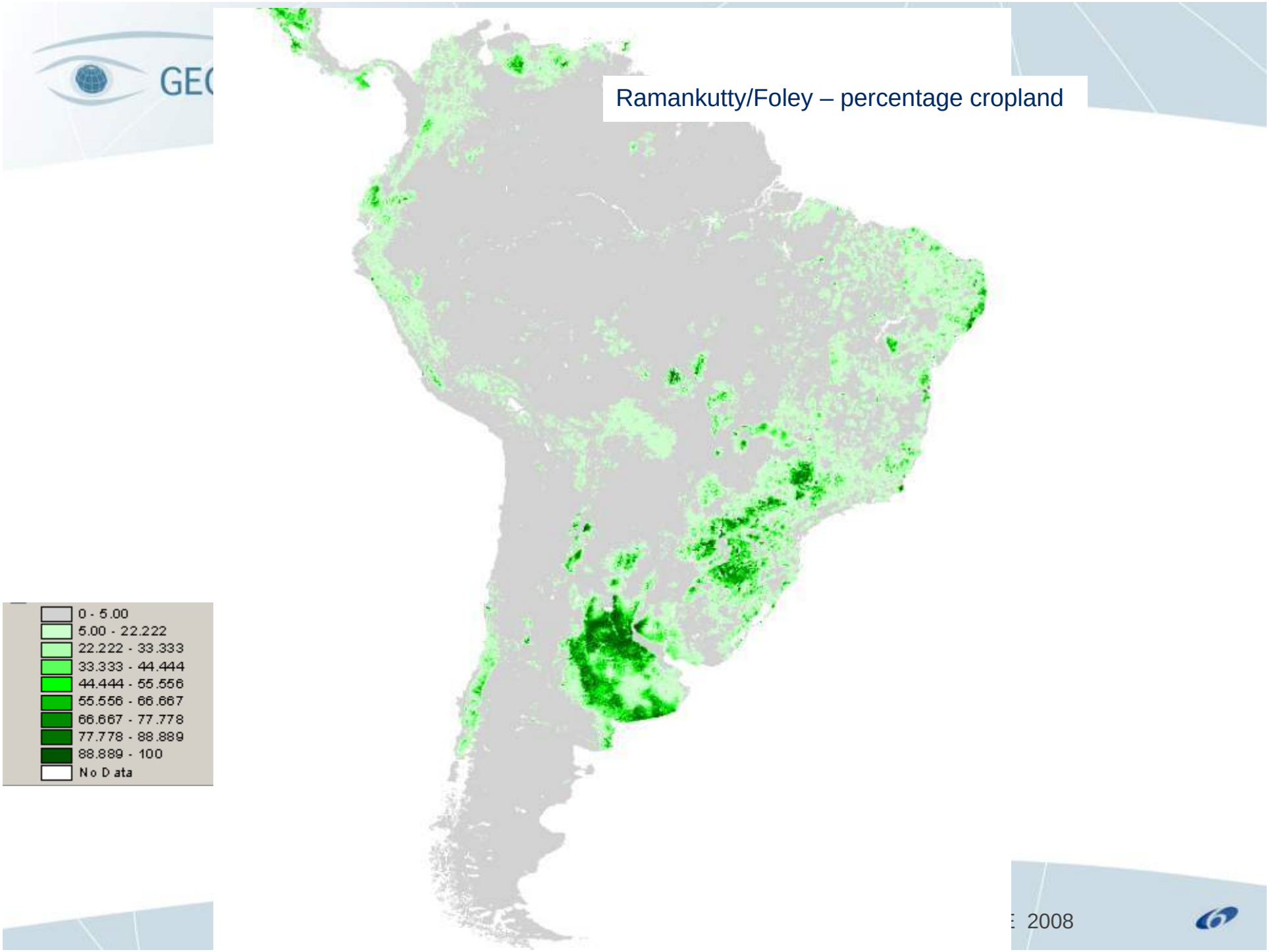
Cultivated and managed areas
Mosaic: Cropland / Tree Cover / Other natural vegetation
Mosaic: Cropland / Shrub and/or grass cover

MODIS 2000

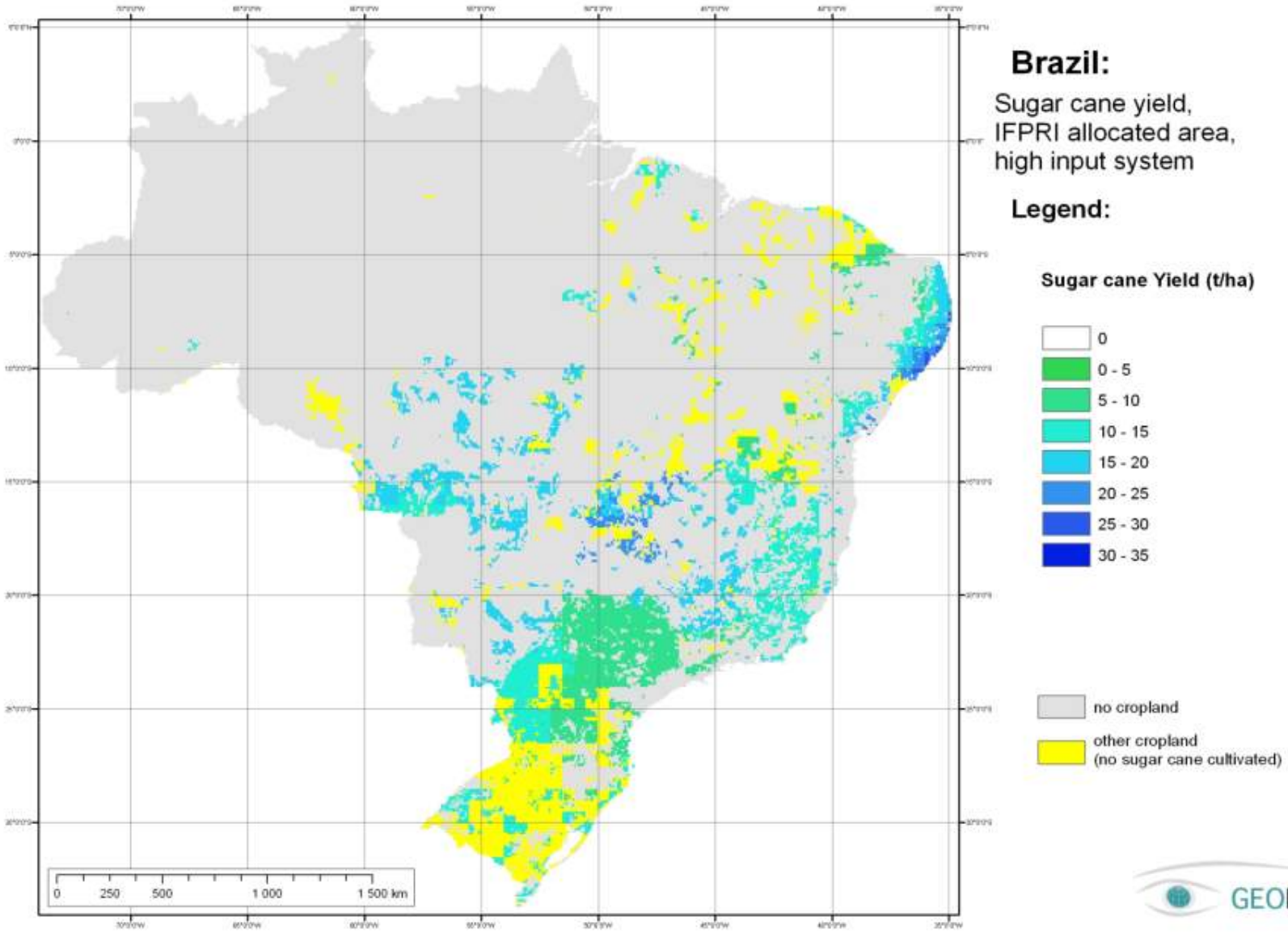


IFPRI – percentage cropland




Ramankutty/Foley – percentage cropland
0 - 5.00
5.00 - 22.222
22.222 - 33.333
33.333 - 44.444
44.444 - 55.556
55.556 - 66.667
66.667 - 77.778
77.778 - 88.889
88.889 - 100
No Data

Wanted to assimilate the new GLOBCOVER product



Scenario to compute value of land availability uncertainty

GLOBIOM calculations

2030 estimated food and wood demand

+

Substitution of up to **10% of transport oil energy** consumption
according to IPCC/GGI A2r baseline scenario 2030 in each of the 11 regions
by **ethanol**.

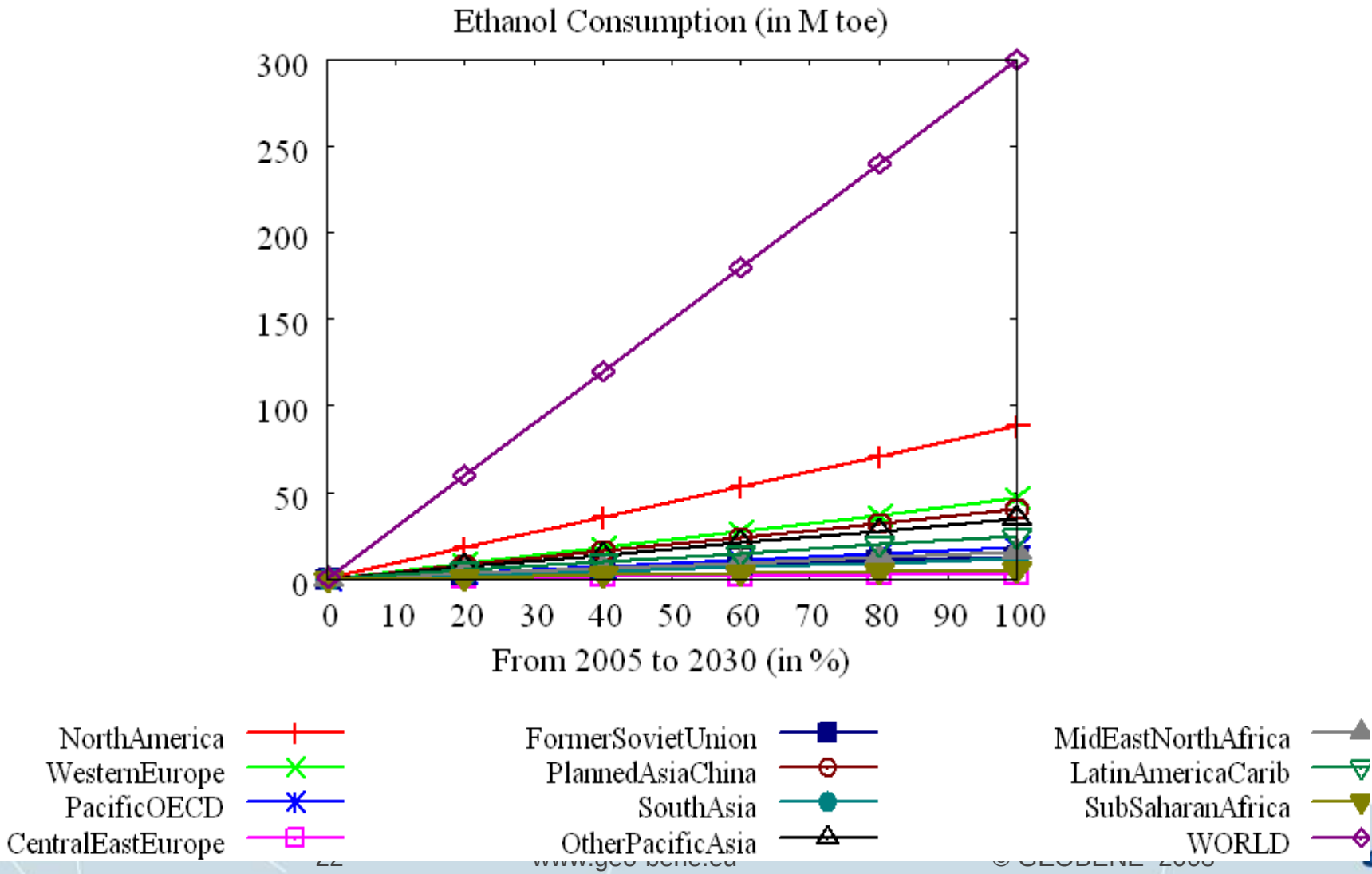
Variants

a) WITH additional land (explicit supply function)

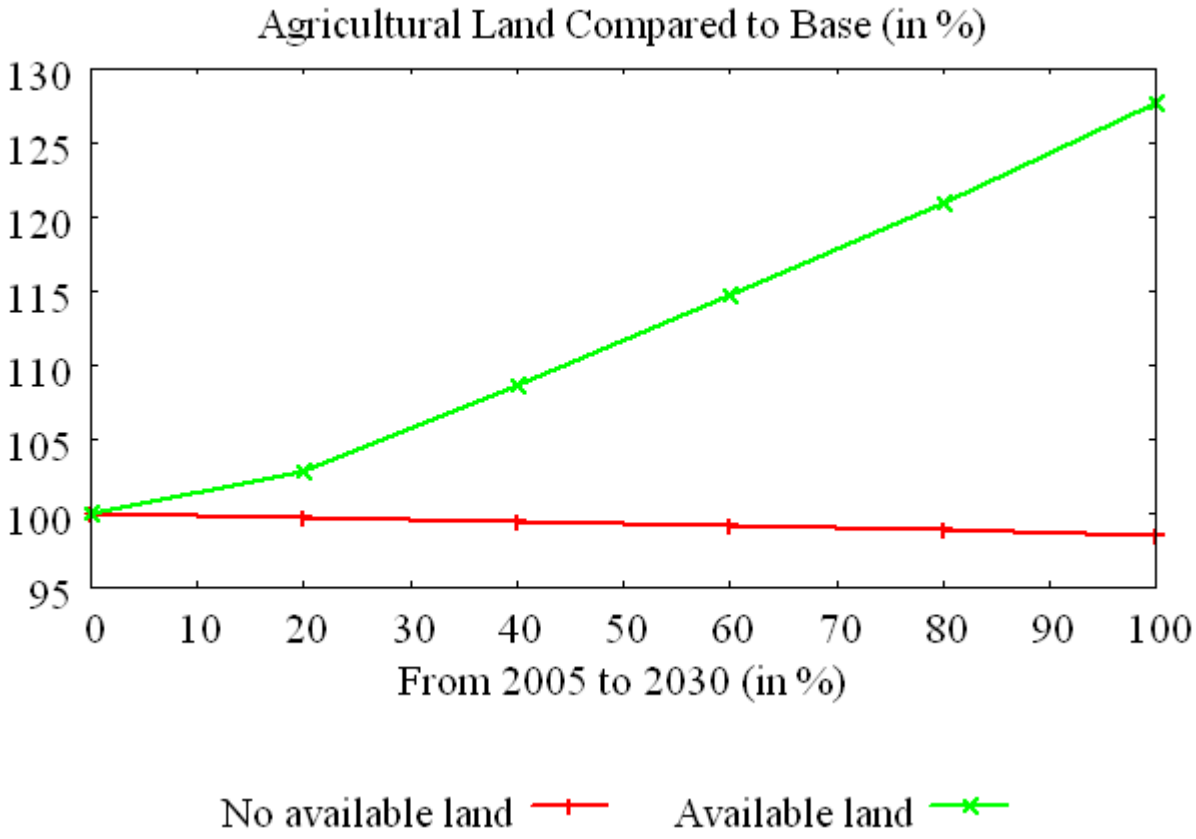
b) WITOUT additional land

+ avoided deforestation

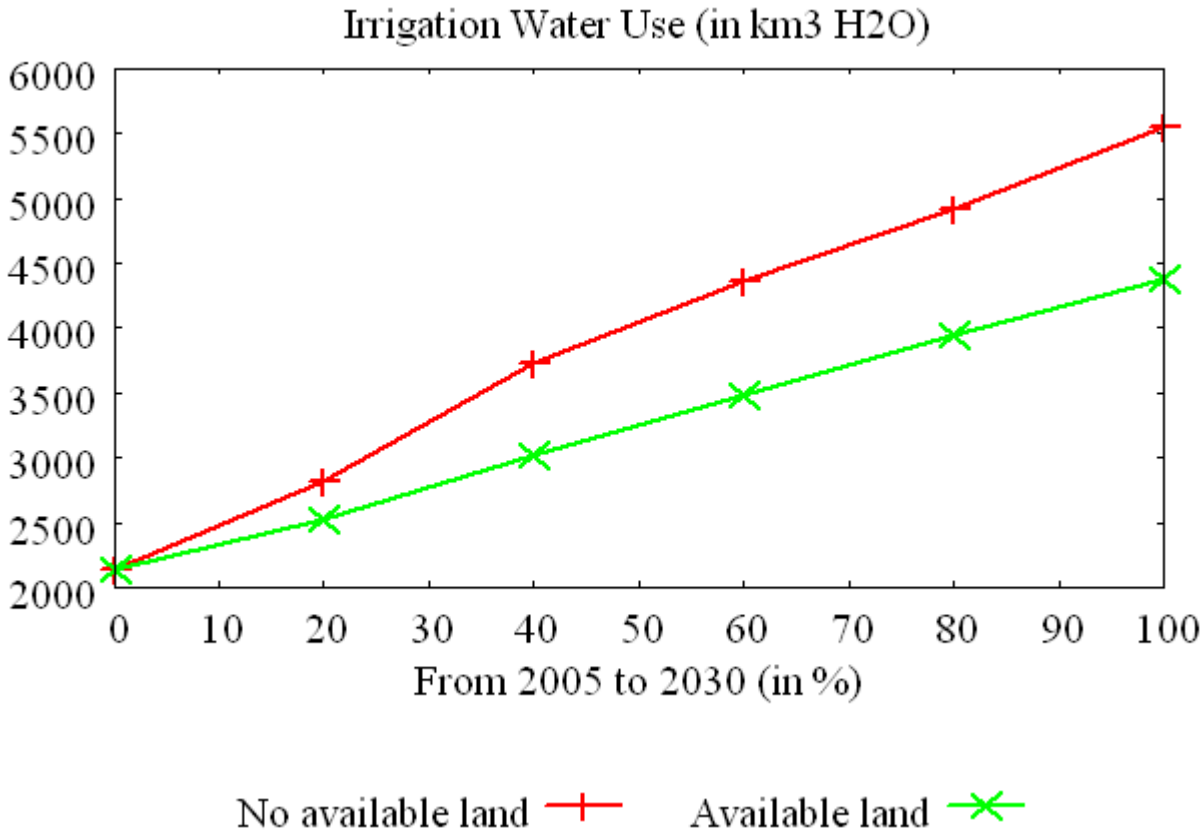
Ethanol Consumption



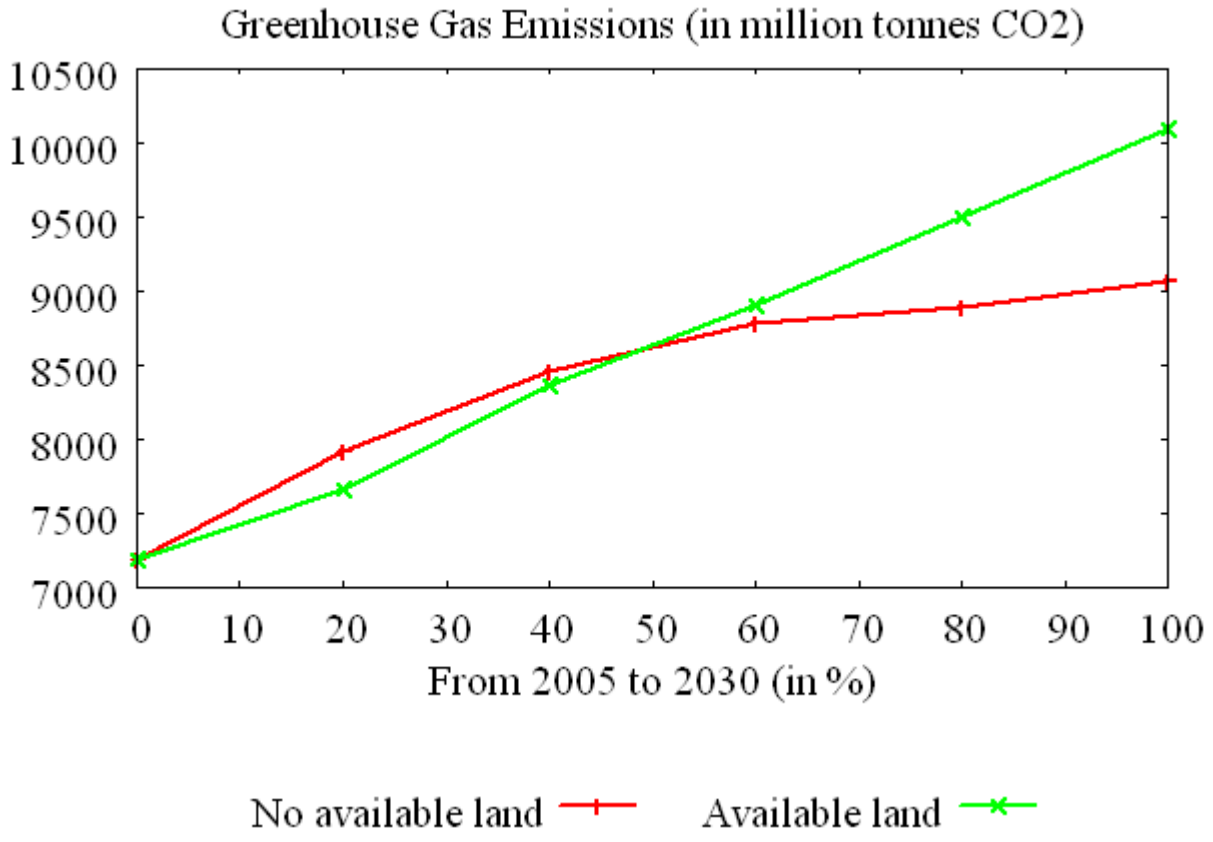
AgLand Use Scenario



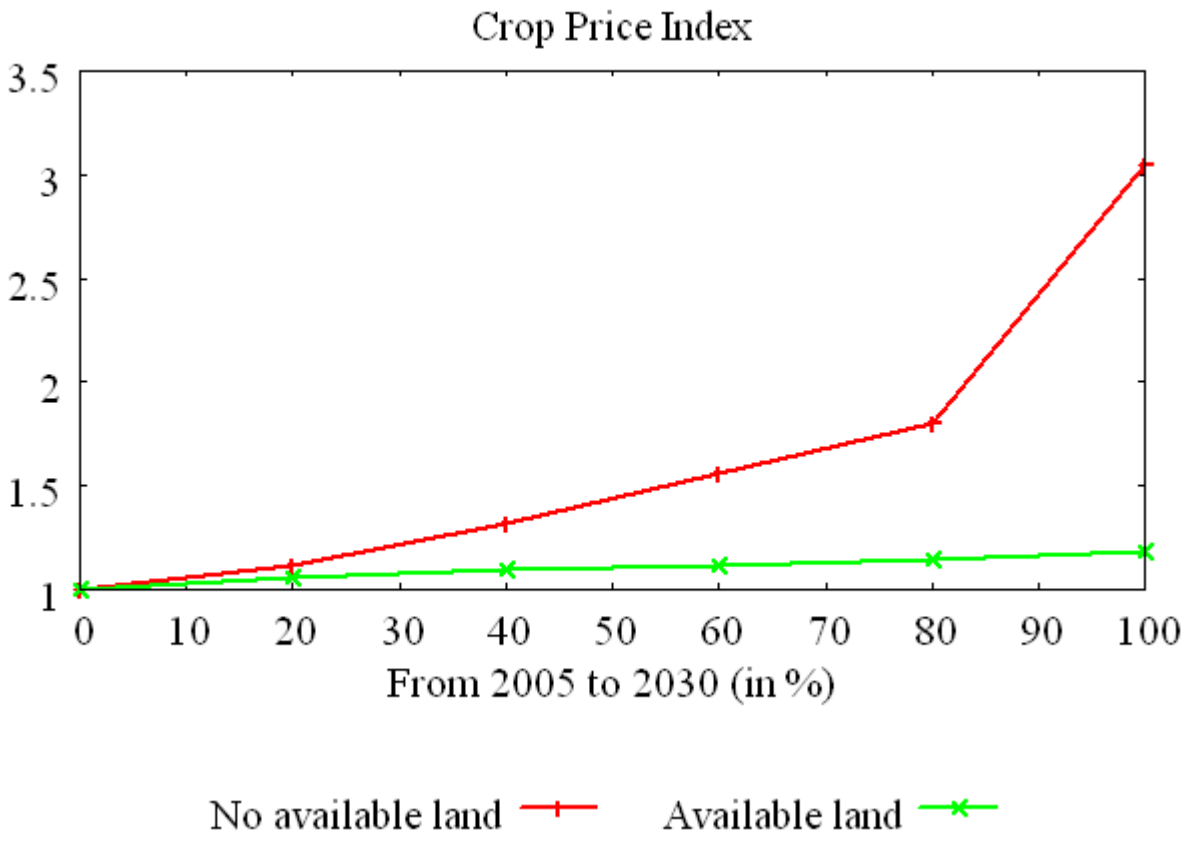
Water Use



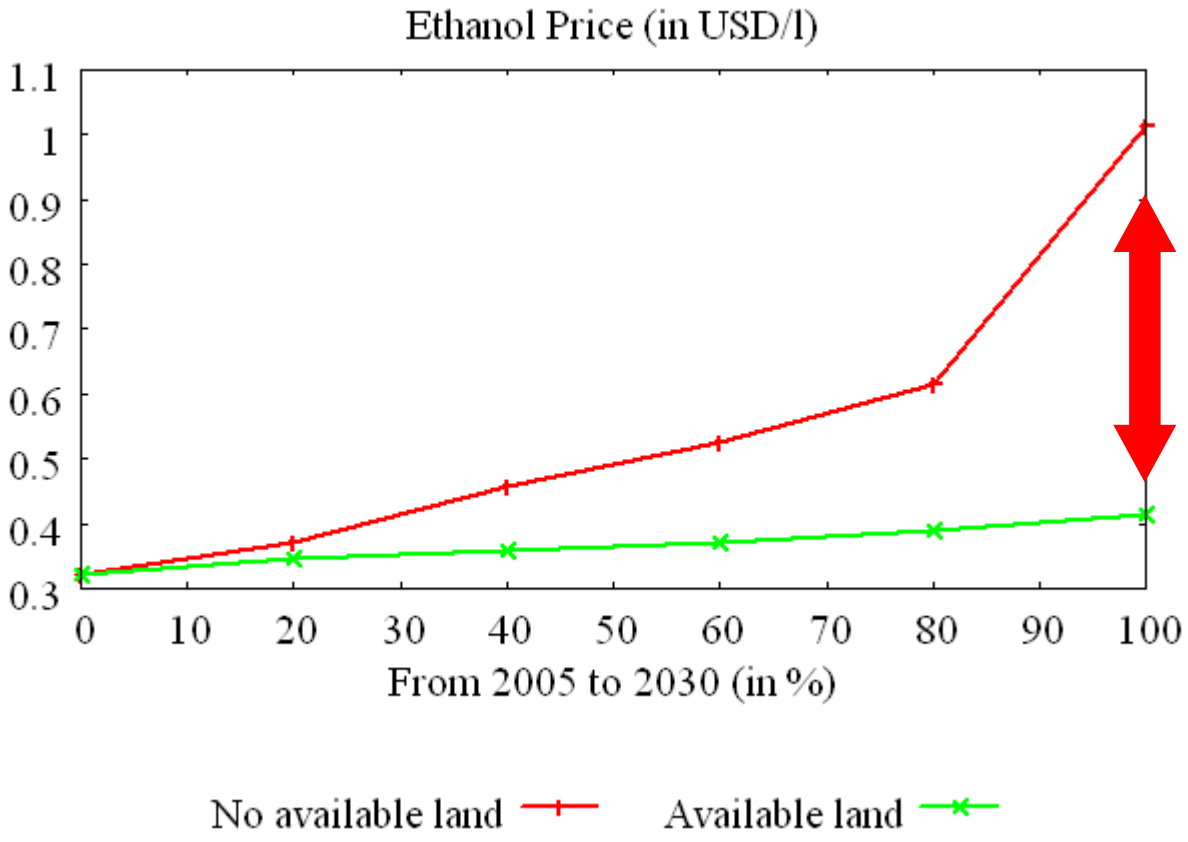
GHG Balance



Crop Prices



III. Illustrative application

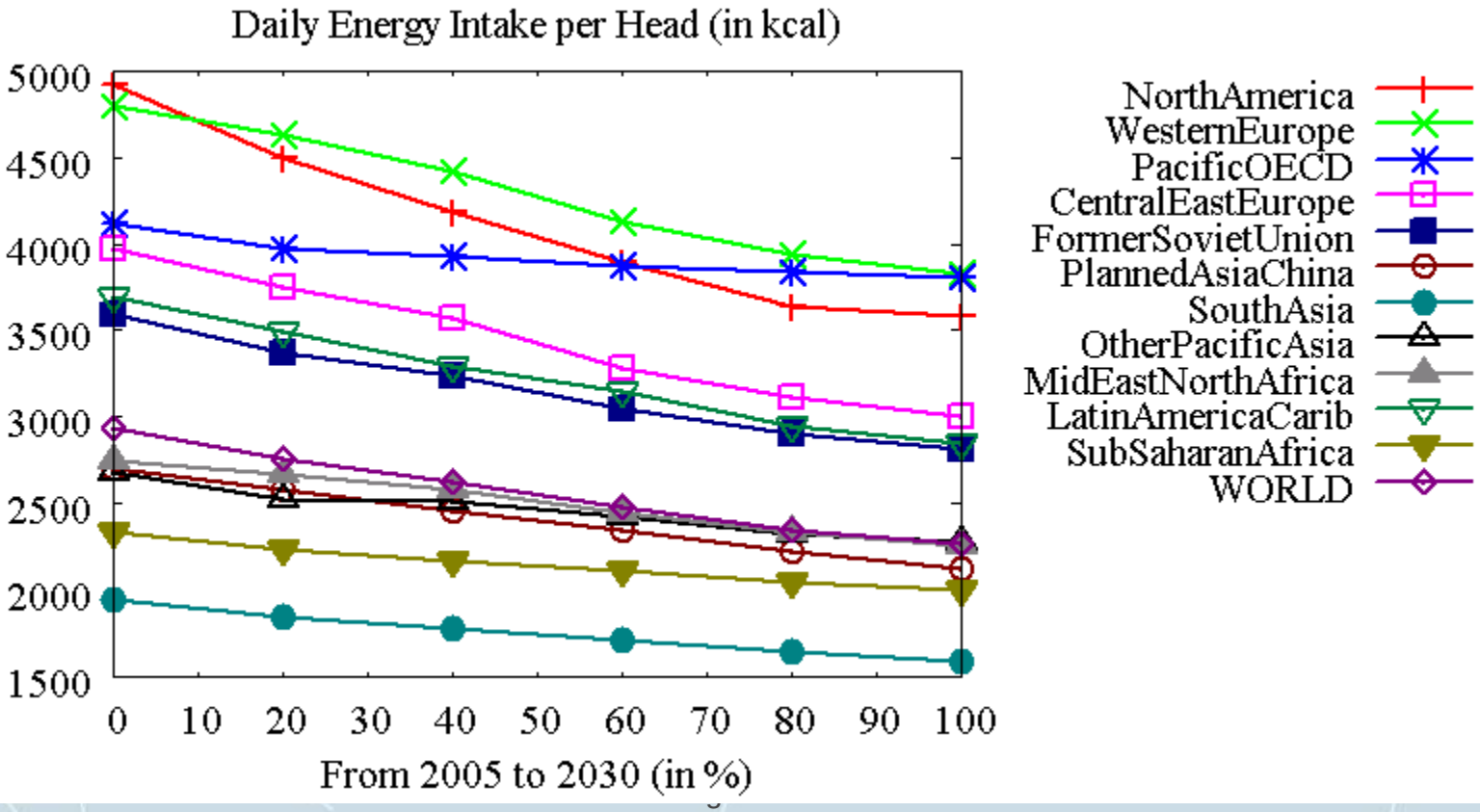


Land availability uncertainty is a USD 350 billion Gas bill Question in the scenario

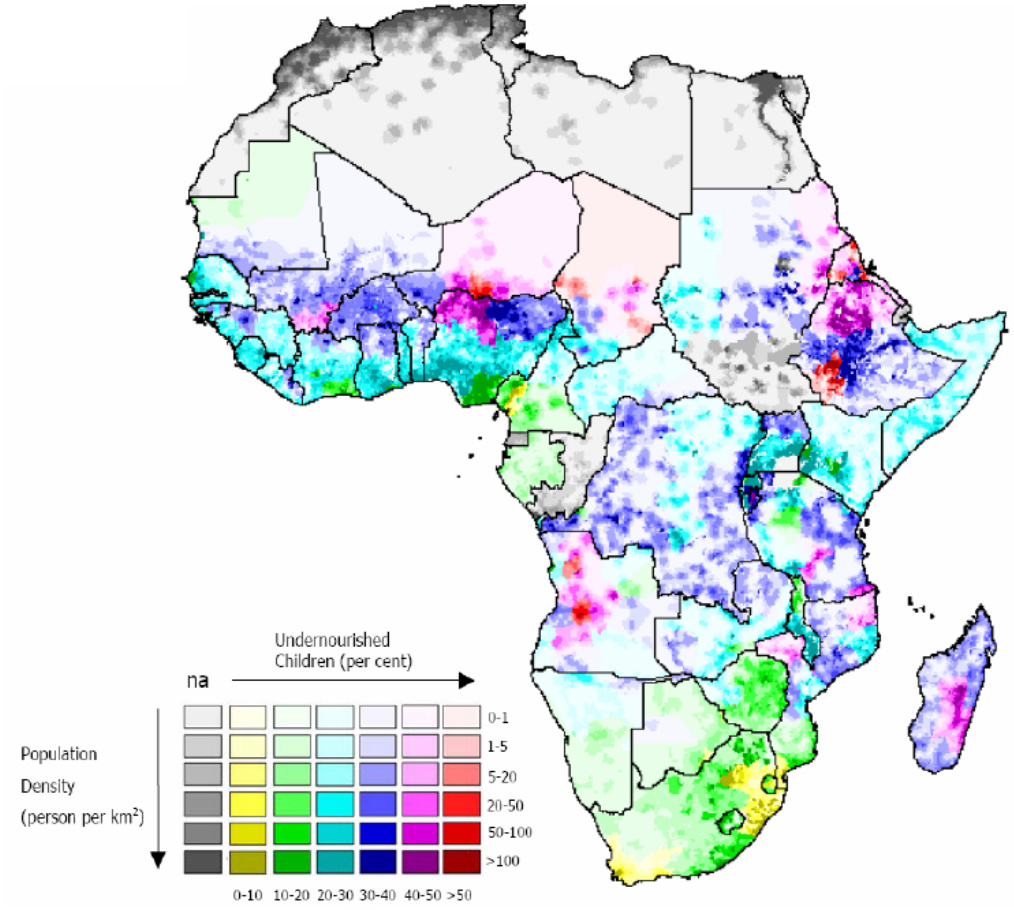
III. Illustrative application

Further applications:

Ethanol production x Food security (Obesity)



Undernourished children

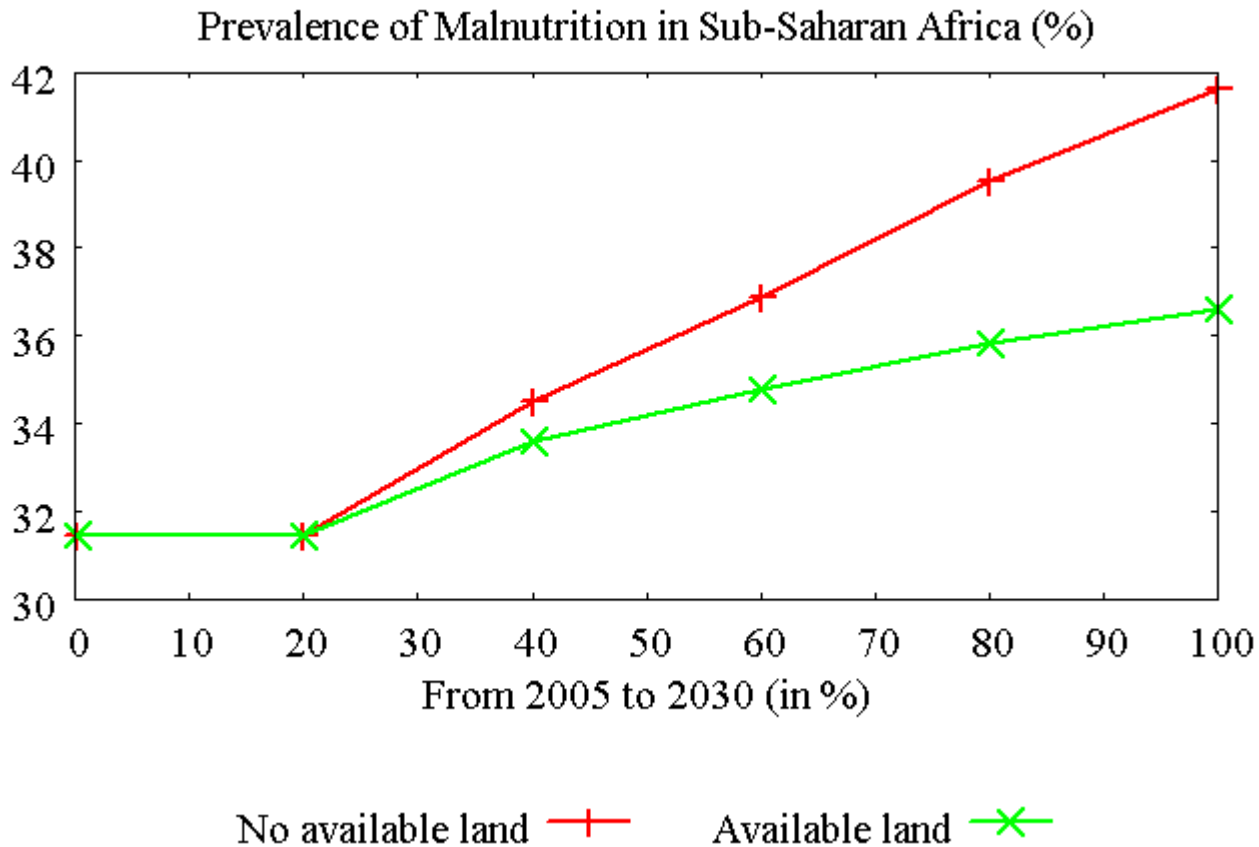


Source: Keyzer 2006

Human Cost

Further applications:

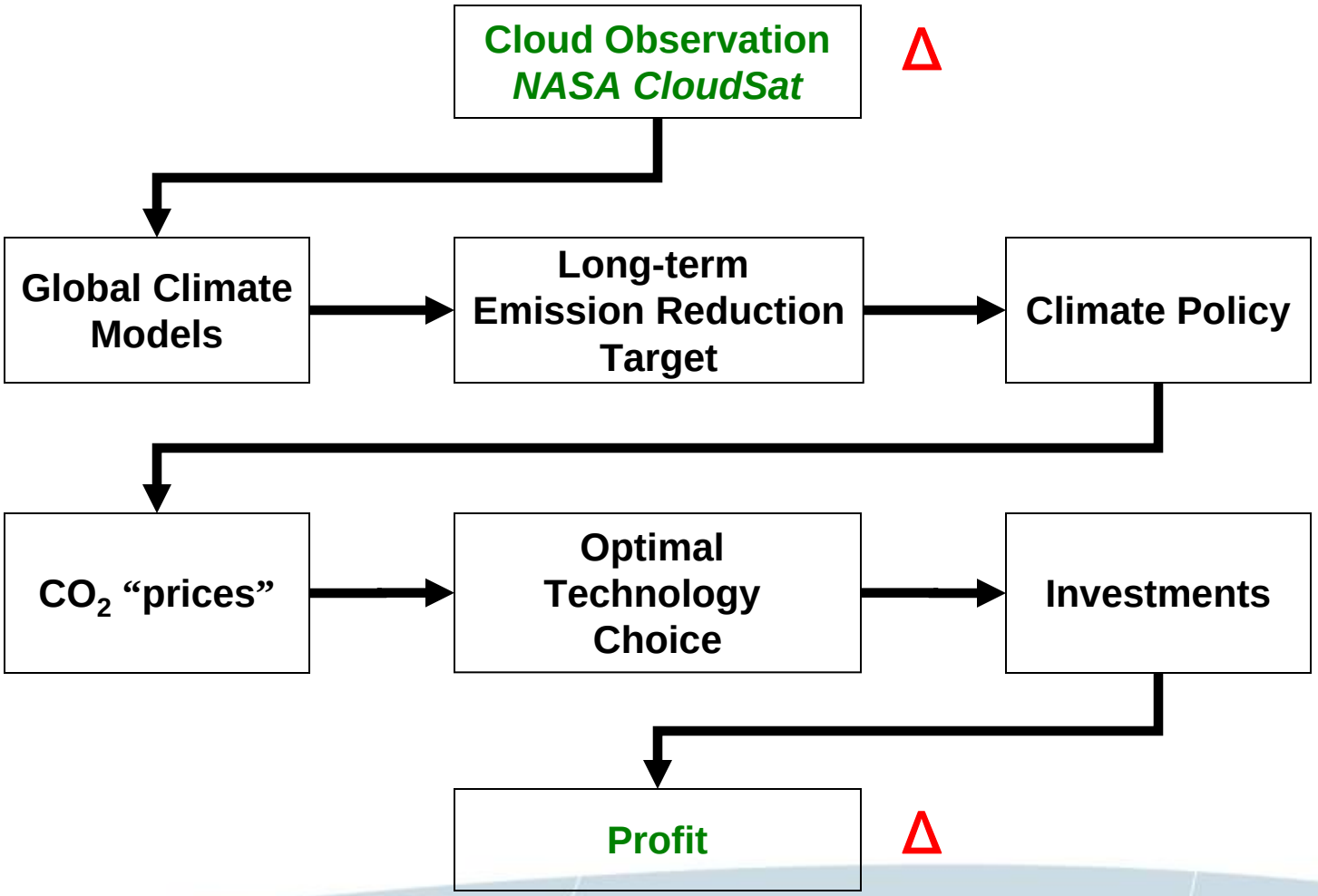
Ethanol production x Food security (Obesity)



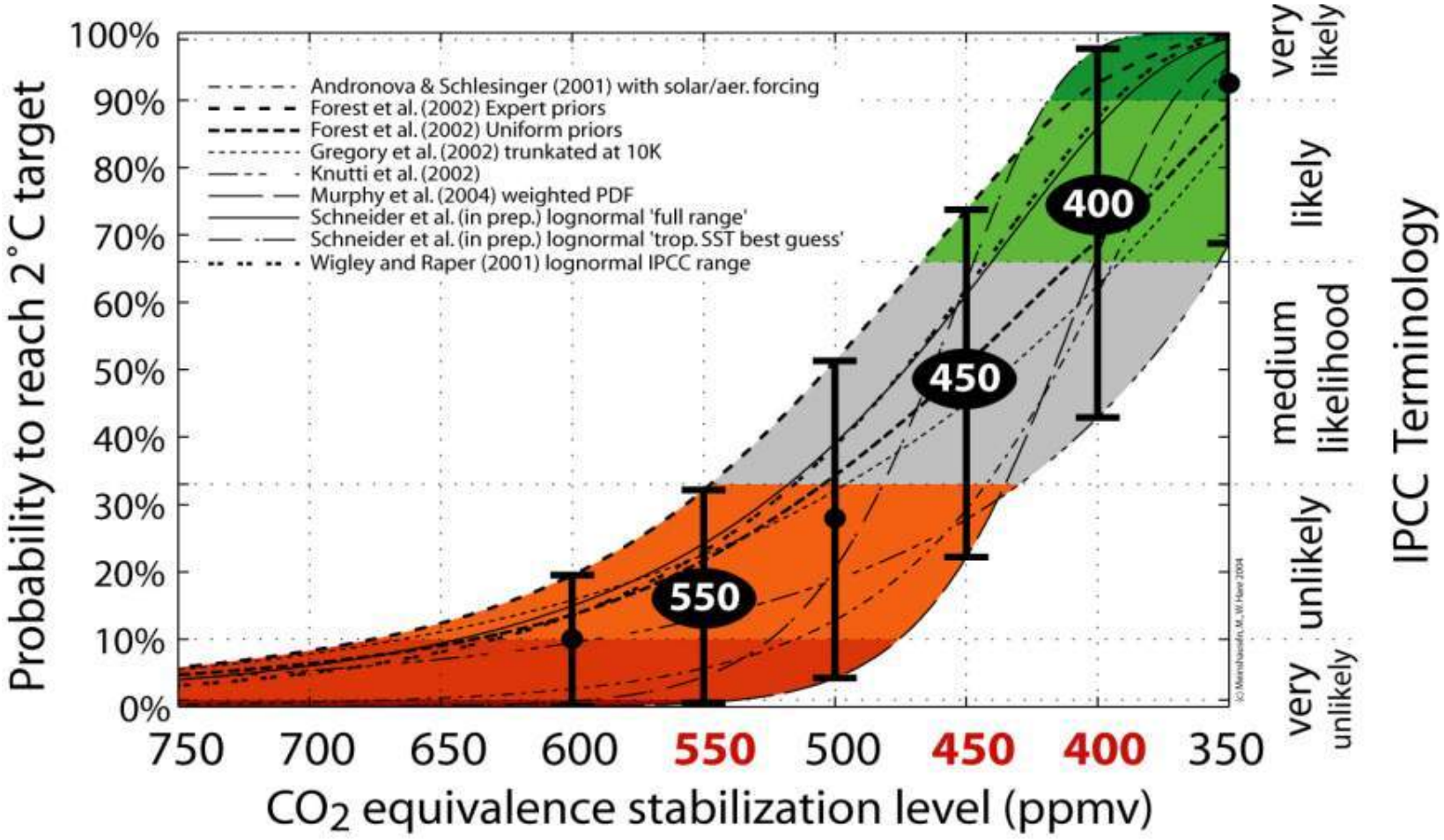
CASE II: Value of Climate sensitivity uncertainty reduction

- Energy Investment Problem

Observations ⇔ Benefits Chain

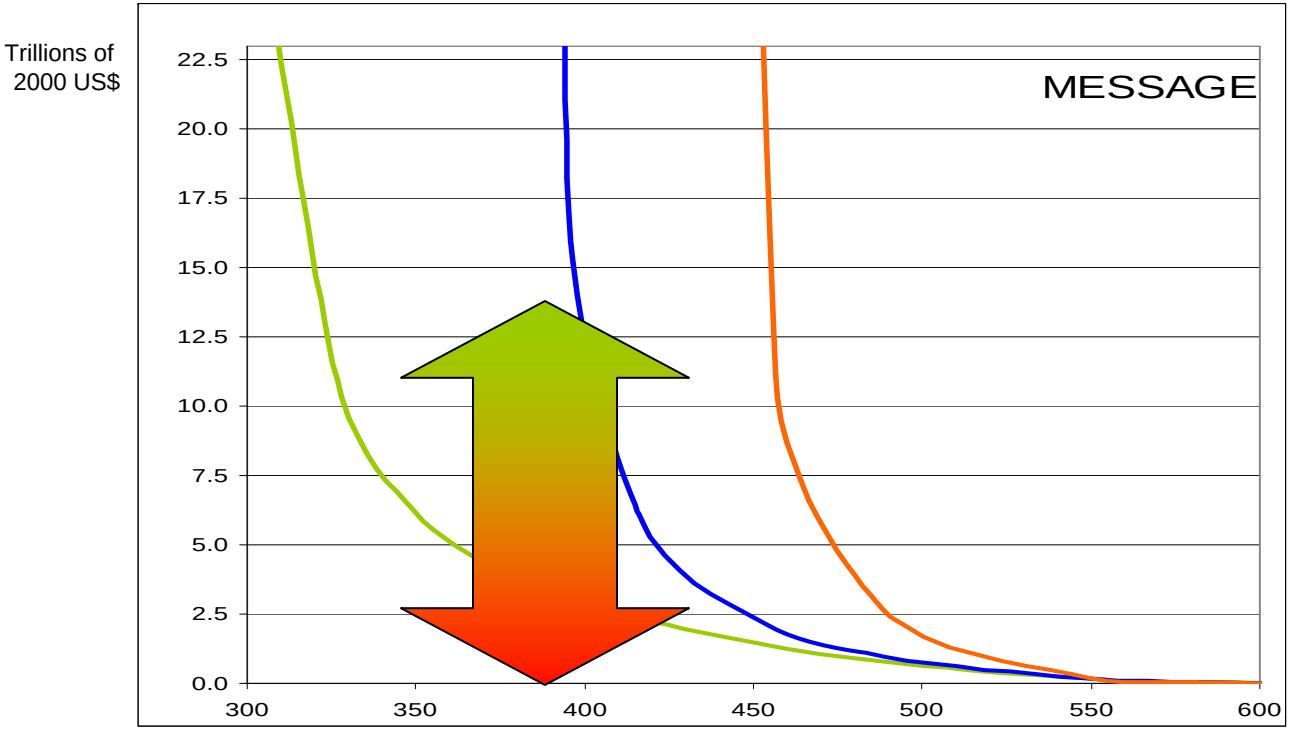


Meeting the 2°C objective



Source: Mainshausen, Hare 2004

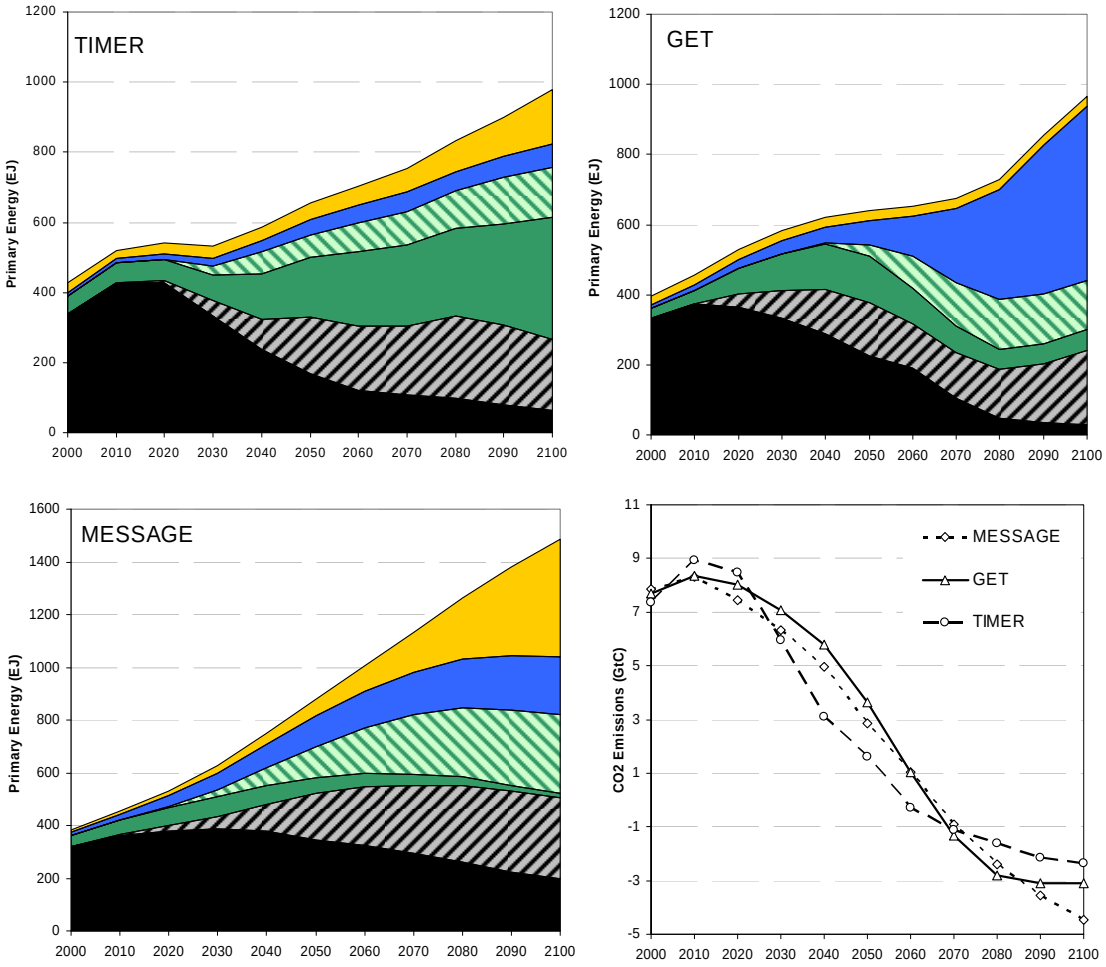
Net present value costs for atmospheric CO_2 stabilization by the year 2100



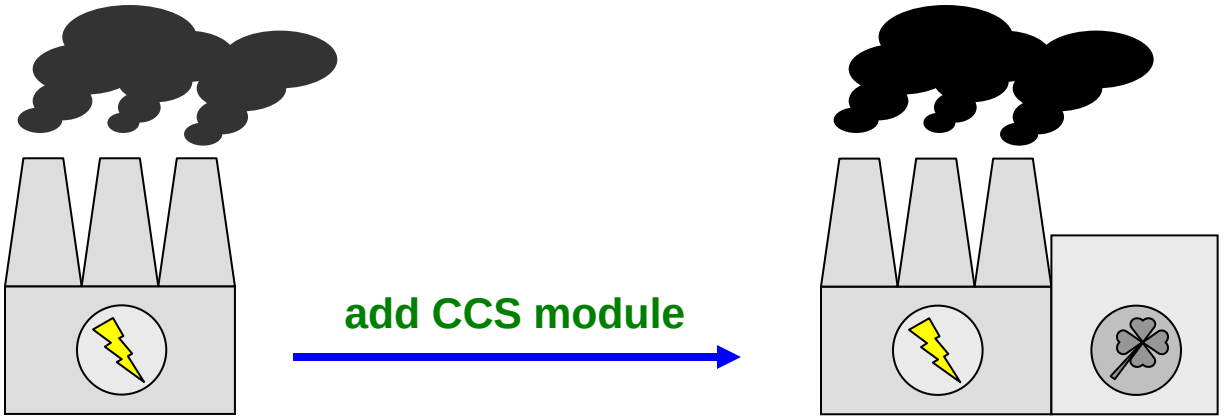
Green ~ BECCS is included
Blue ~ fossil CCS only
Red ~ no CCS

Source: Azar et al. 2007

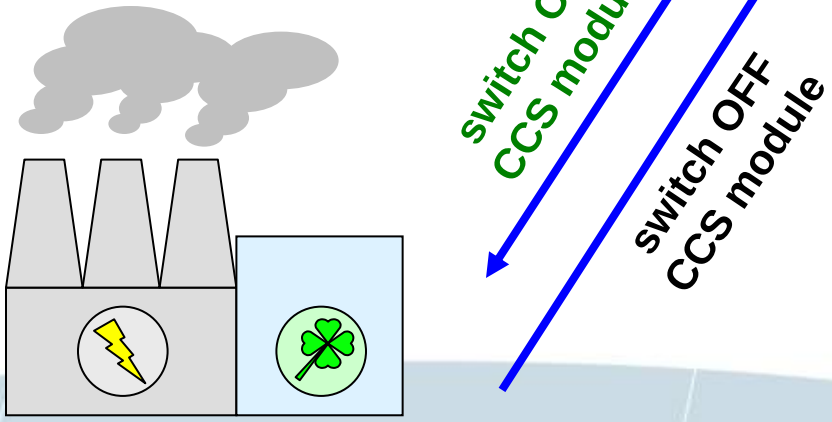
Global



Real Options Model in the Power Generation Setup



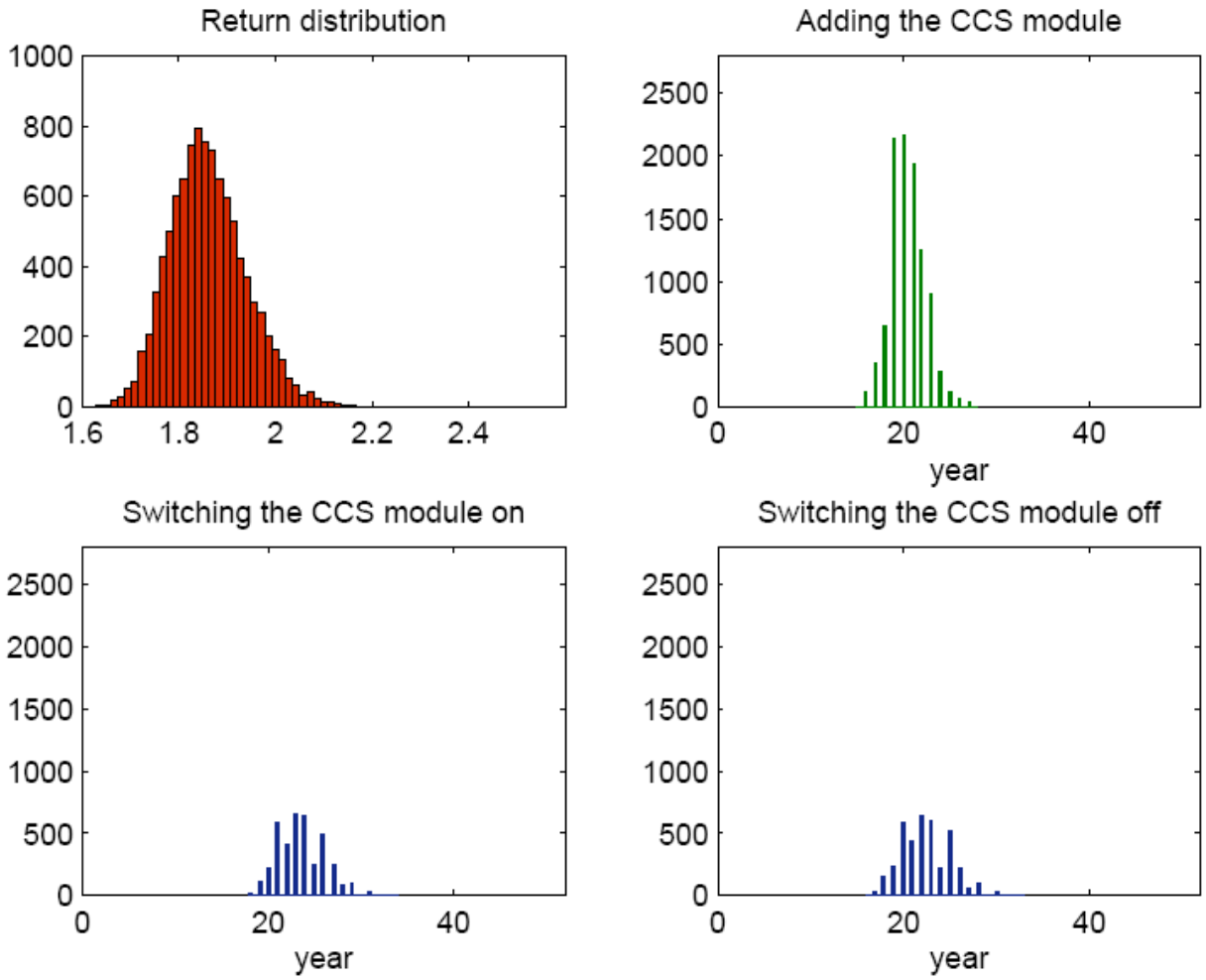
options to add Carbon Capturing and Sequestration module and switch it on/off during the operation



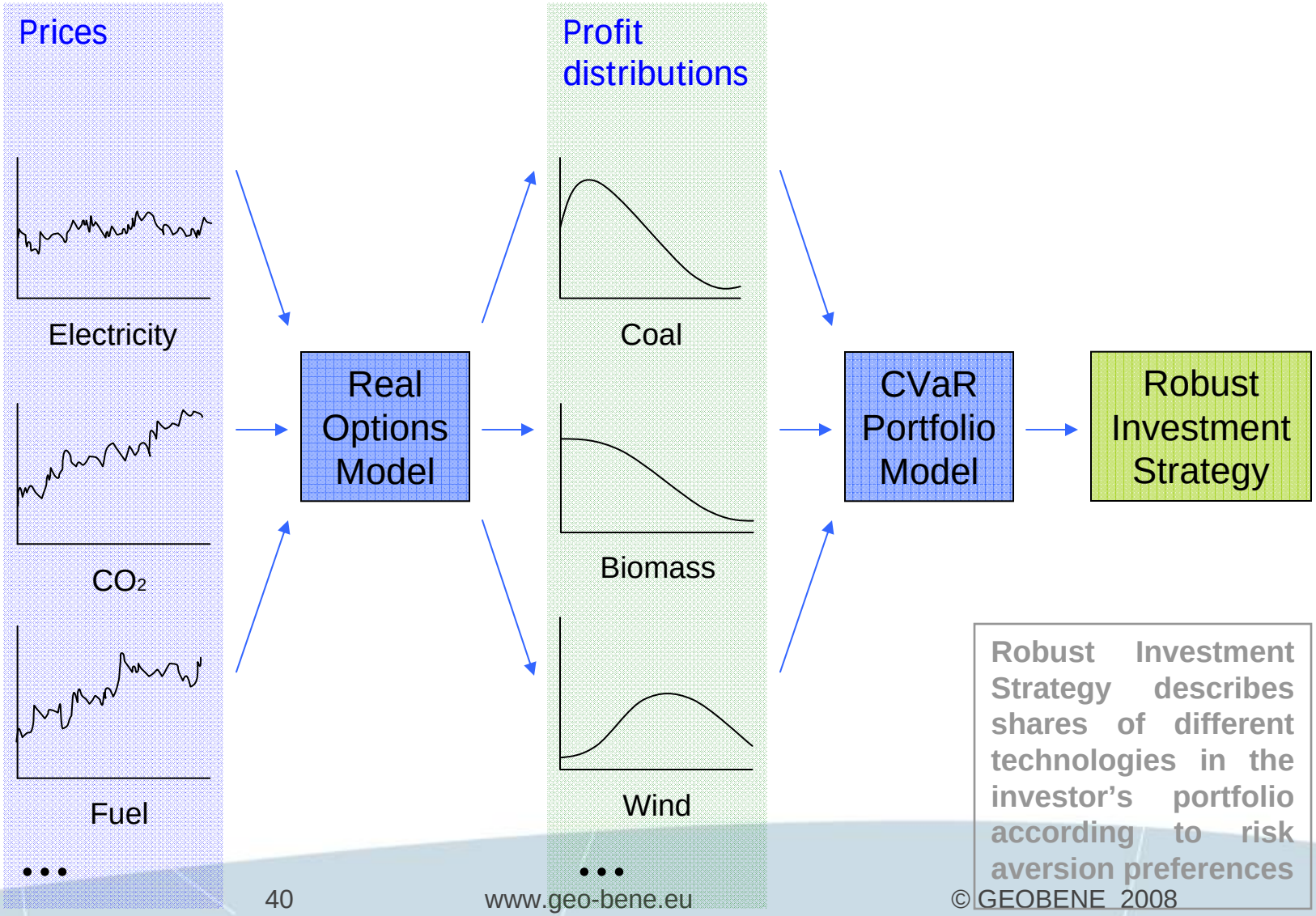
Purpose of the Real Options Approach

Maximizing of expected discounted profit facing uncertainty due to incomplete information on future prices and find:

1. Optimal time for investment in CCS module
2. Optimal control of the CCS module



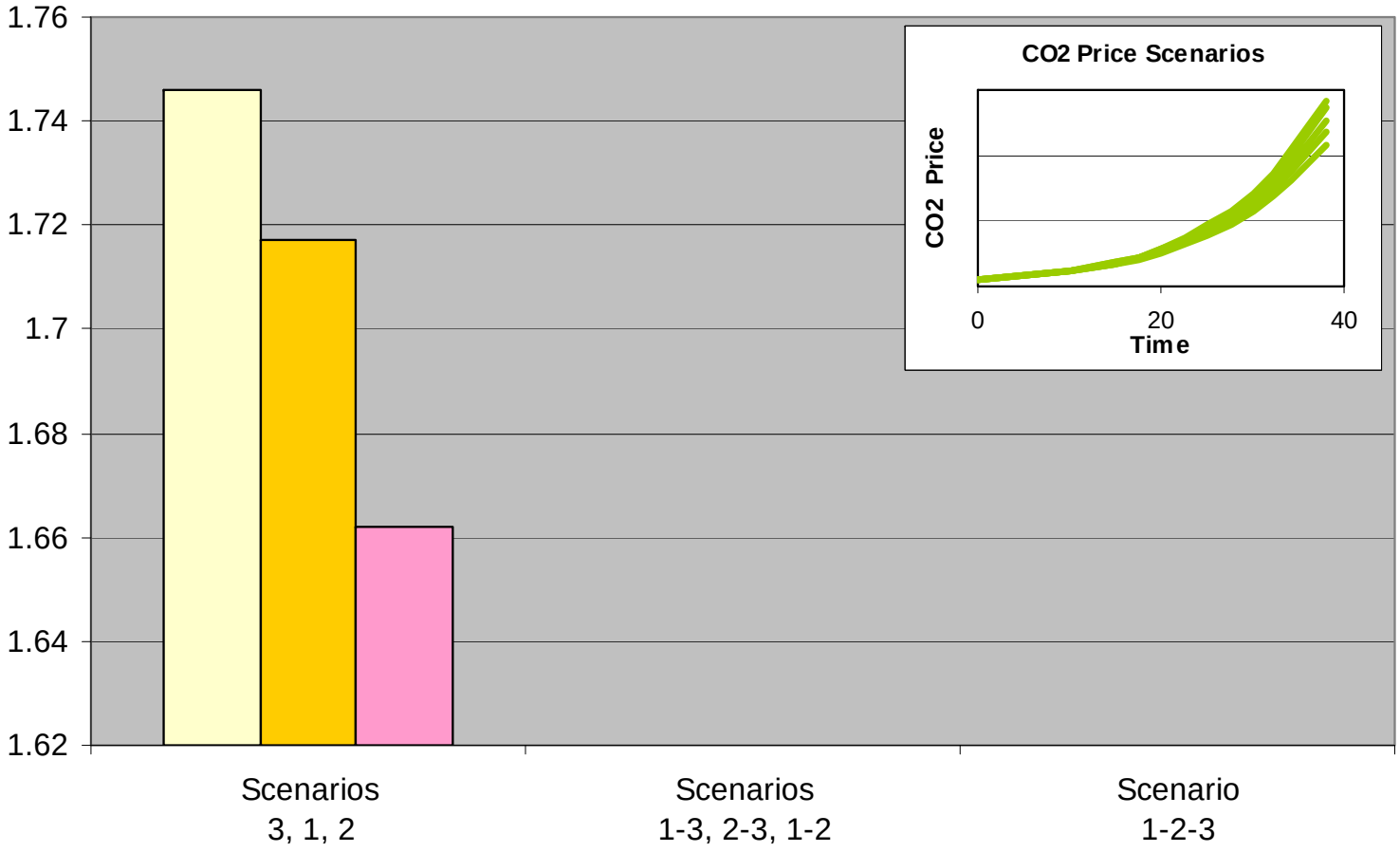
Combined Real Options & Risk Management Framework



Robust Investment Strategy describes shares of different technologies in the investor's portfolio according to risk aversion preferences

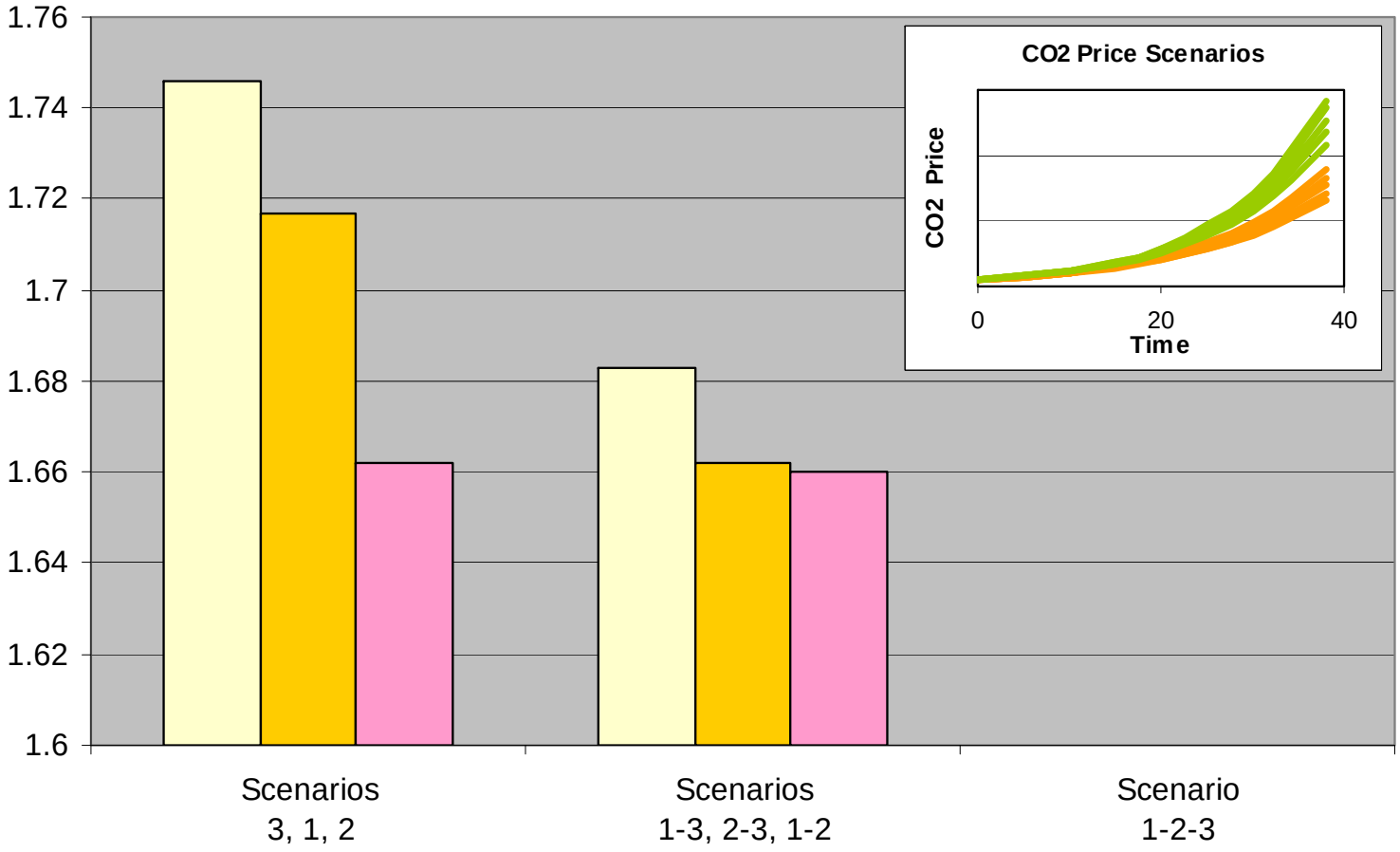
Impact of Uncertainty Reduction on Returns

Optimal Maximin Portfolios and 95%-CVaRs



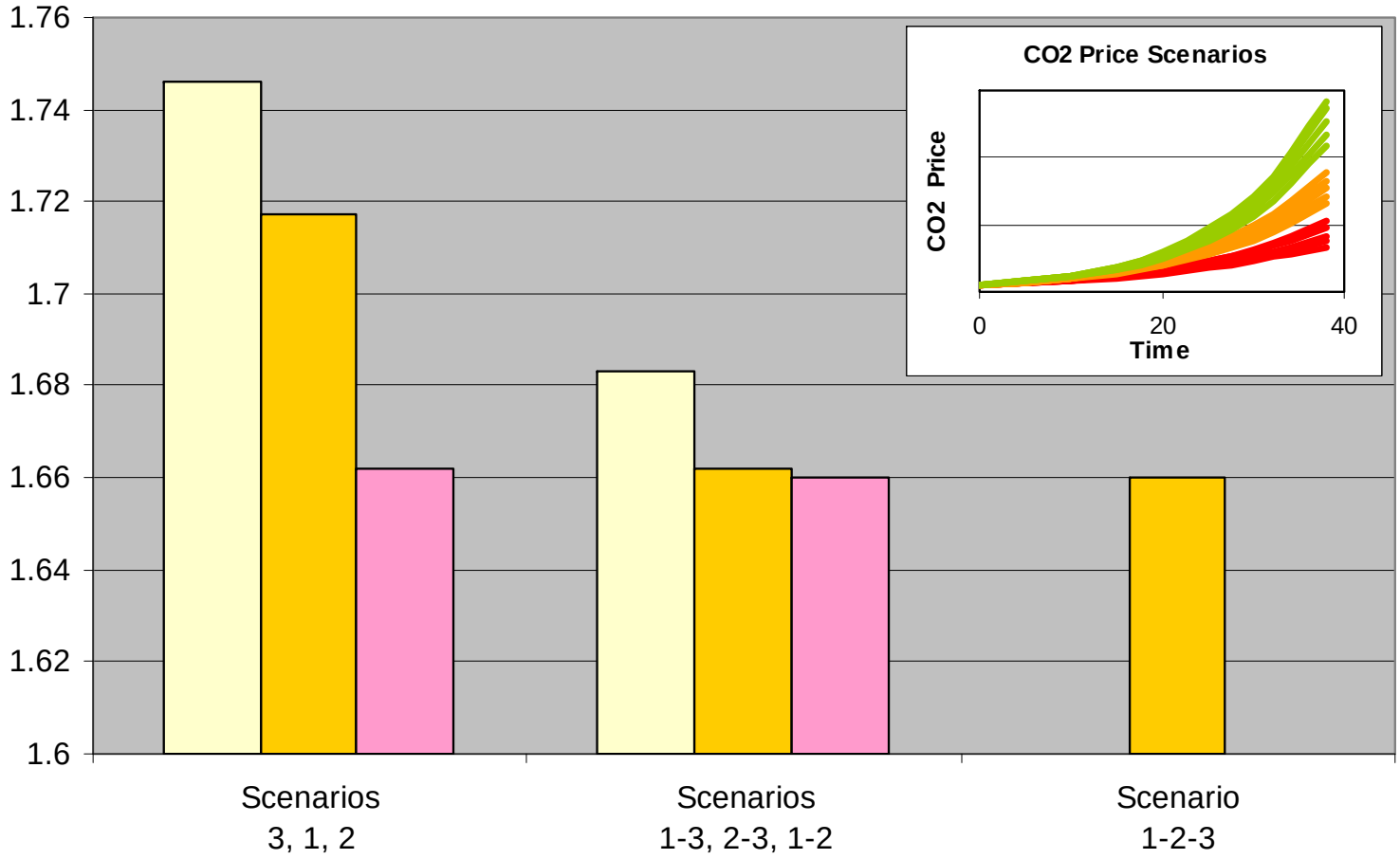
Impact of Uncertainty Reduction on Returns

Optimal Maximin Portfolios and 95%-CVaRs



Impact of Uncertainty Reduction on Returns

Optimal Maximin Portfolios and 95%-CVaRs



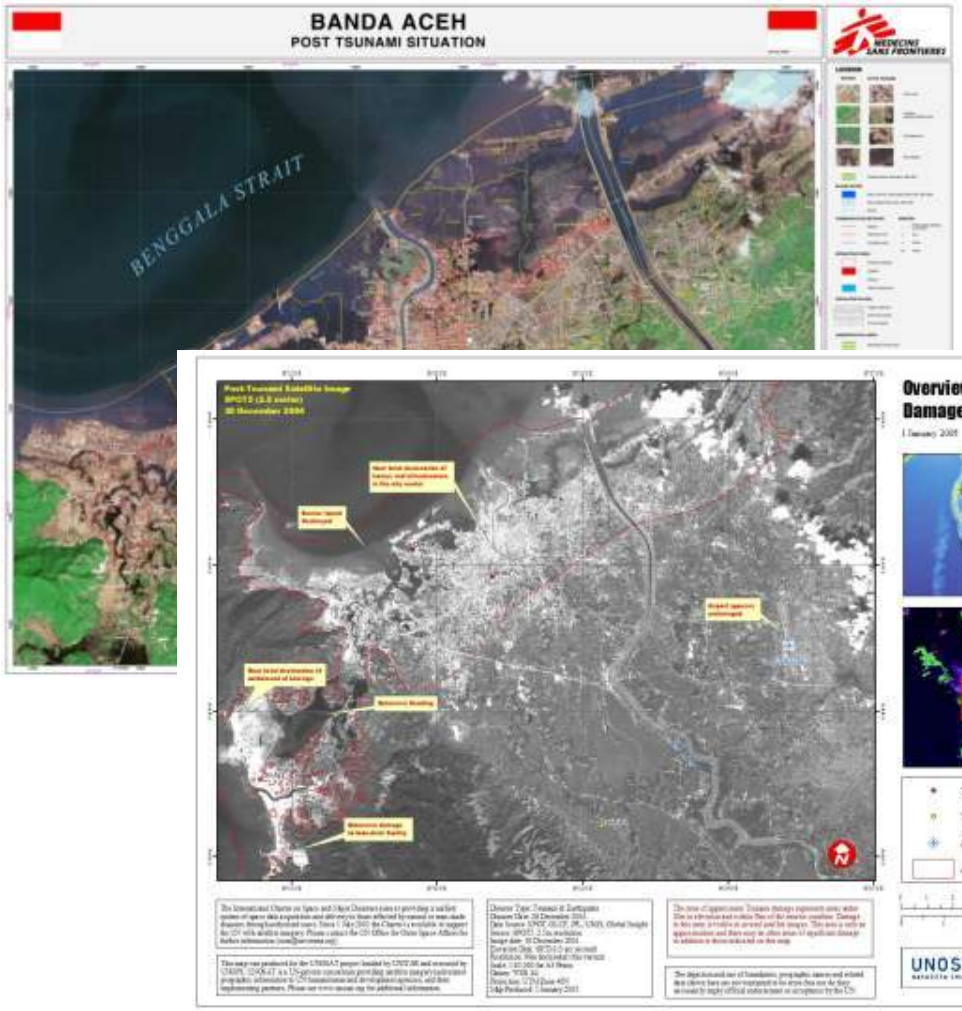
CASE III: Banda Aceh Case Study

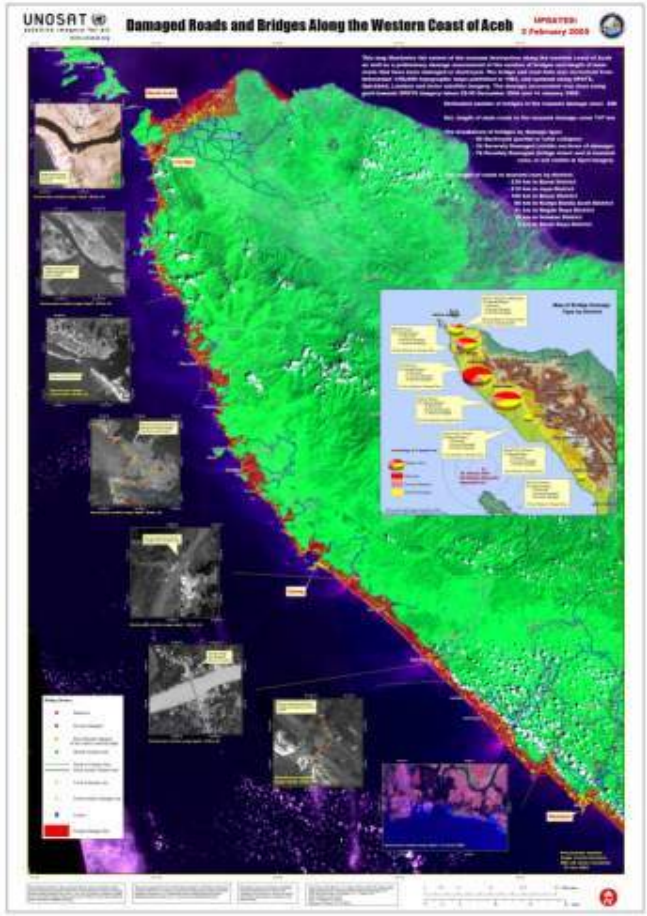
- Determine value of information used by Space Charter
- Assess value of information in disaster recovery – Banda Aceh case study

Space Charter

- ESA reports that 210 individual maps combining over 19 different satellite data sources were used towards the International Charter's mission for the Boxing Day Tsunami.
- Thanks to the availability of a pool of satellite imagery through the Charter, damage assessment evaluations have accelerated recovery processes for infrastructure rebuilding (houses for example).

http://unosat.web.cern.ch/unosat/





Relief Effort

- According to the RAN Database (Recovery Aceh Nias *rand.brr.go.id*), as of 10.01.08 a total of 490 agencies have commited 3.8 billion USD.
- Among this vast amount of support are various types of Earth Observation (EO) data (ie. orthophotos, satellite scenes and the creation of a group – SimCenter, to administer this data).

Preliminary Efforts

- Accomplished initial round of interviews
- Met with 20 different groups, over 50 people
- All organizations using to some extent spatial data
- Identified organizations with specific examples for further analysis

Org. Type	Organisation	Contact
Nat. Gov	BRR, Pusdatin	Mr. E. Darajat
Nat. Gov	BRR, Bakosurtanal	Mr. Darmawan
University	UNSYIAH, GIS & RS	Mr. M. Affan
University	UNSYIAH, Vice Rector	Mr. Dhalan
University	UNSYIAH, TDMRC	Mr. Dirhamsyah
Local Gov	BPN	Mr. G. Suprato
Local Gov	AGDC	Mr. S. Gan
NGO	ABD - ETESP	Mr. E. Van Der Zee
NGO	Sea Defence Cons.	Mr. J. Kraaij
UN	UN ORC	Mr. H. Busa
UN	UNICEF	Mr. B. Cahyanto
UN	UNFAO	Mr. Sugianto
NGO	LOGICA	Mr. D. Hurst
NGO	GTZ-SLGSR	Mr. M. Widodo
NGO	ManGEONAD	Mr. T. Rehman
NGO	Leuser Int. Fnd. (YLI)	Ms. D. R. Sari
NGO	Flora Fauna Int. (FFI)	Mr. Syaifuddin
NGO	Sogreah	Mr. B. Coiron

Preliminary Findings

Several main issues repeating (ranked)…

- Frequency of receiving data low
- Access to data
- Need for more/better trained staff
- Need for higher resolution data in some cases
- Sharing data - Vendor restrictions
- Downloading speed
- A lot of uninformed decisions are made => inefficient allocation of 3.8 Billion $

Conclusions

- Integrated Long-run benefits can be measured in the trillions - demand pull
- Operational GLOBAL GEOSS …. Supply push is a "?"