

Forest management for climate change mitigation

The challenge of projecting the regional forest carbon balance and accounting of activities

Hannes Böttcher
IIASA, Laxenburg, Austria

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Fighting climate change: adapting forest policy and forest management in Europe

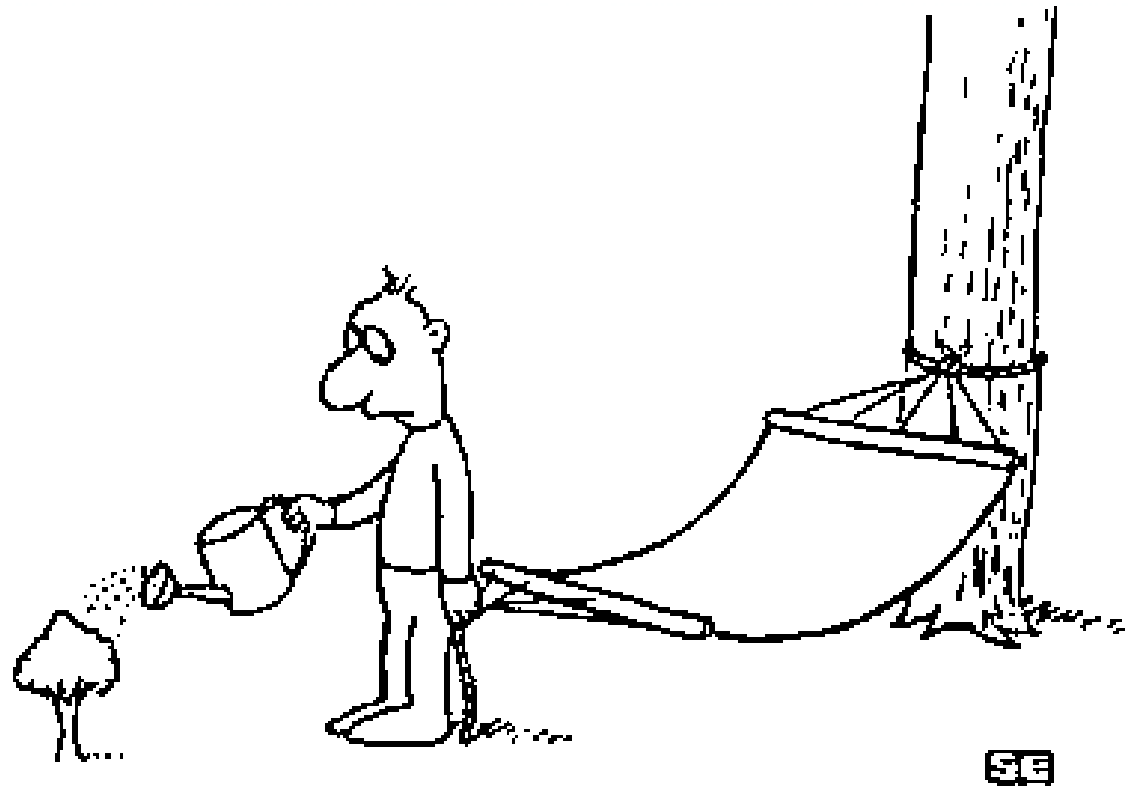


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Content

- ◆ Background and motivation
- ◆ Modeling the carbon balance of the forestry sector
 - Model description
 - Model performance
- ◆ Projections of forest sector carbon sinks and sources
- ◆ Assessment of indirect effects
 - Effects of age class structure
 - Accounting options
- ◆ Conclusions

High hopes



Kyoto Protocol on one slide

- ◆ Industrialized nations: commitment of a reduction of emissions of 6 greenhouse gases (GHG, among them CO₂) by 5,2% compared to 1990
- ◆ Mechanisms allowed:
 - Industrialized countries help each other (JI)
 - Industrialized countries support reduction in developing countries (CDM)
 - Trade of emission allowances
- ◆ Consideration of „sinks“
- ◆ Accounting through commitment periods (5 years)
- ◆ Start: 2008 - 2012

Legal background: sinks in the Kyoto Protocol

Most relevant articles of Kyoto Protocol:

◆ Article 3.3 (mandatory)

- Afforestation
- Reforestation
- Deforestation

◆ **Article 3.4 (optional)**

Additional forest management

- Existing forests
- Only stock changes due to direct human-induced activities
- Cap for first commitment period

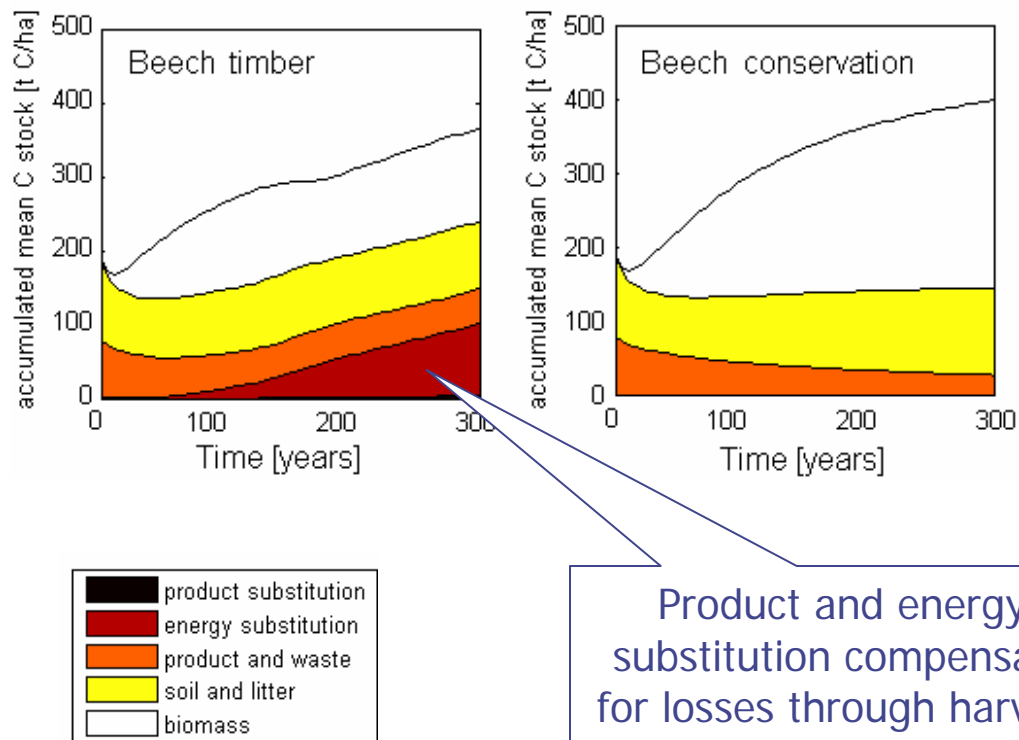
Impact of forest management

Management option	Impact on C stocks		
	Biomass	Soil	Products
Afforestation			
Shortening of rotation			
Prolongation of rotation			
Thinning			

Thinnings stabilize biomass stocks at lower level

Afforestation of grassland might lead to losses of soil C first

Full carbon budget of land management



Modeling approach

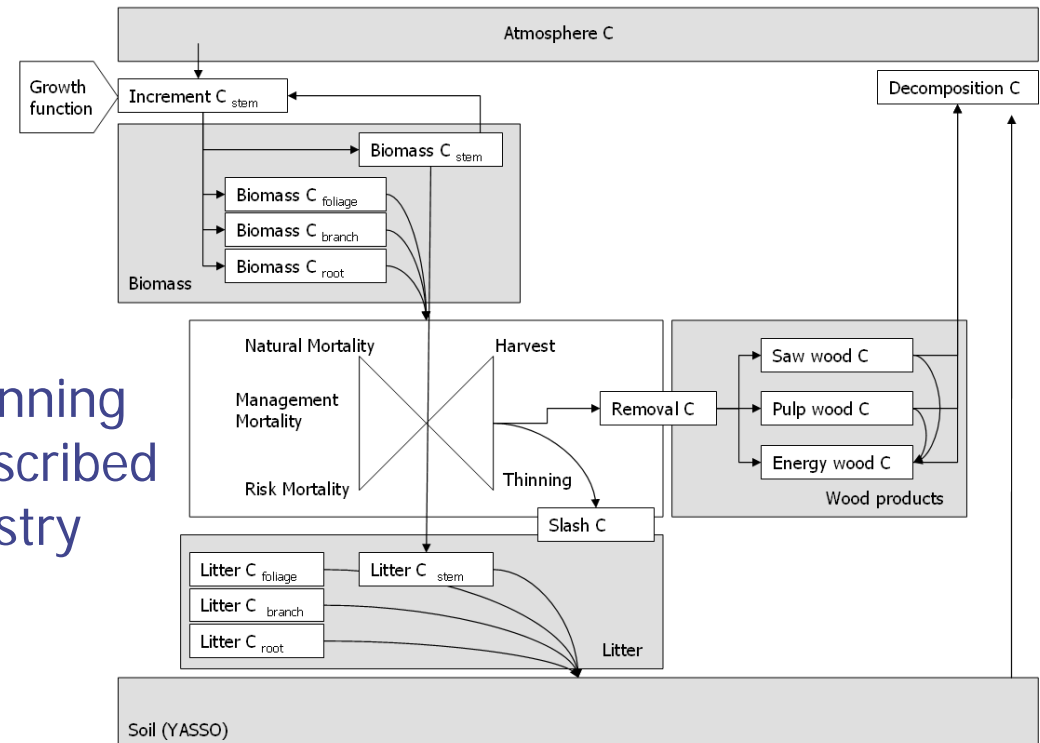
- ◆ Forestry model FORMICA (MPI-BGC/IIASA) consisting of submodels for products and soil (YASSO, litter driven, Liski et al. 2005)

- ◆ Considered pools:

- aboveground biomass
- belowground biomass
- litter and soil
- harvested products

- ◆ Management: different thinning regimes, harvest after prescribed schedule; sustainable forestry (Annual Allowable Cut)

Overview of FORMICA



Modeling approach 2

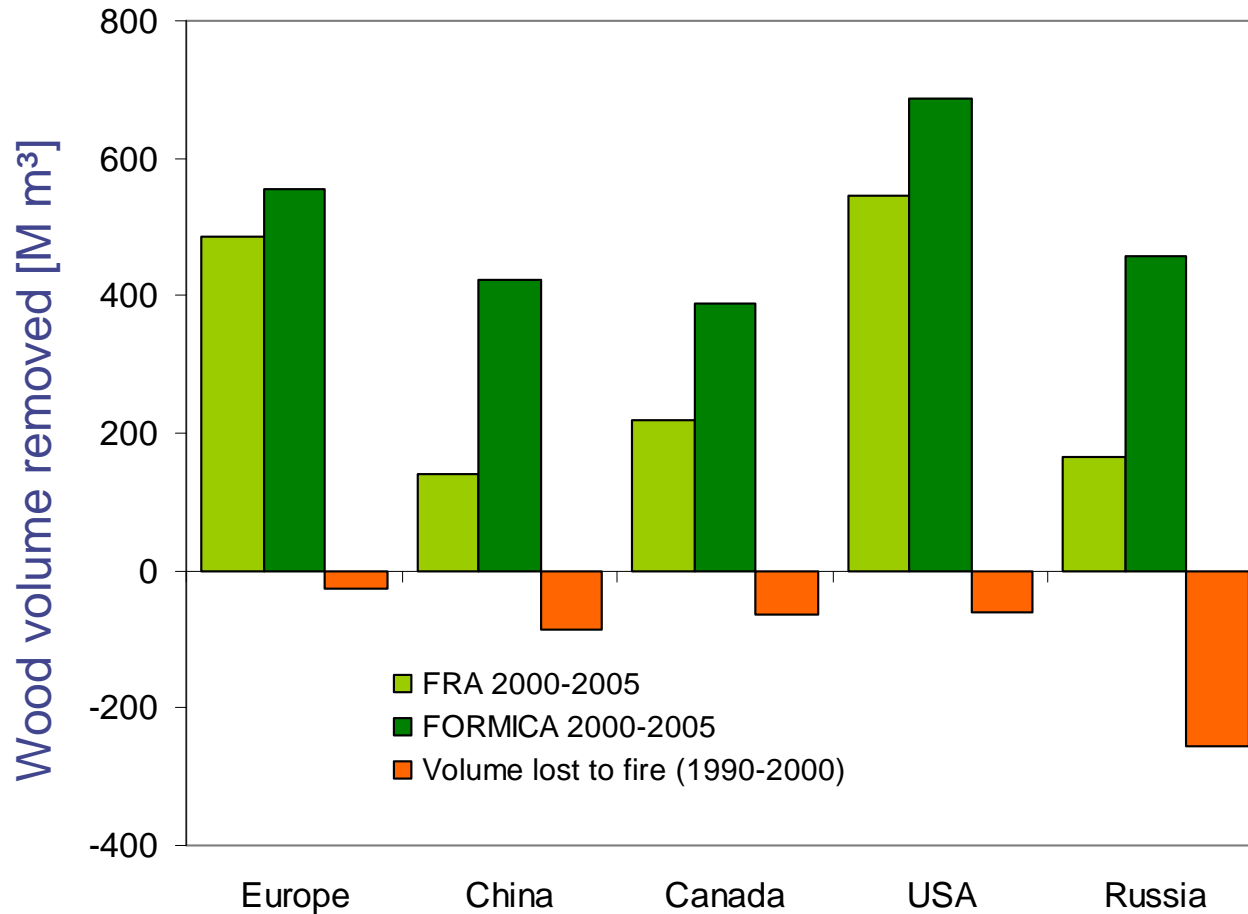
- ◆ Canada, China, Europe (35, EU 27), Russia and USA
- ◆ 90% of forest area of Annex I countries
- ◆ Strata of forest types, management types, age classes and geographic regions

Countries	Strata	Start	Data set	Volume	Increment	Age classes
Europe	9520/280	~1990	EFISCEN	+	+	+
China	120	1985	CERN	+	-	-
Canada	260	1995	CANFI	+	-	+
USA	630	1997	USDA FIA	+	-	+
Russia	240	1993	IIASA	+	+	+



Model evaluation - removals

Harvested wood volume of different regions compared to FAO numbers and losses to fire

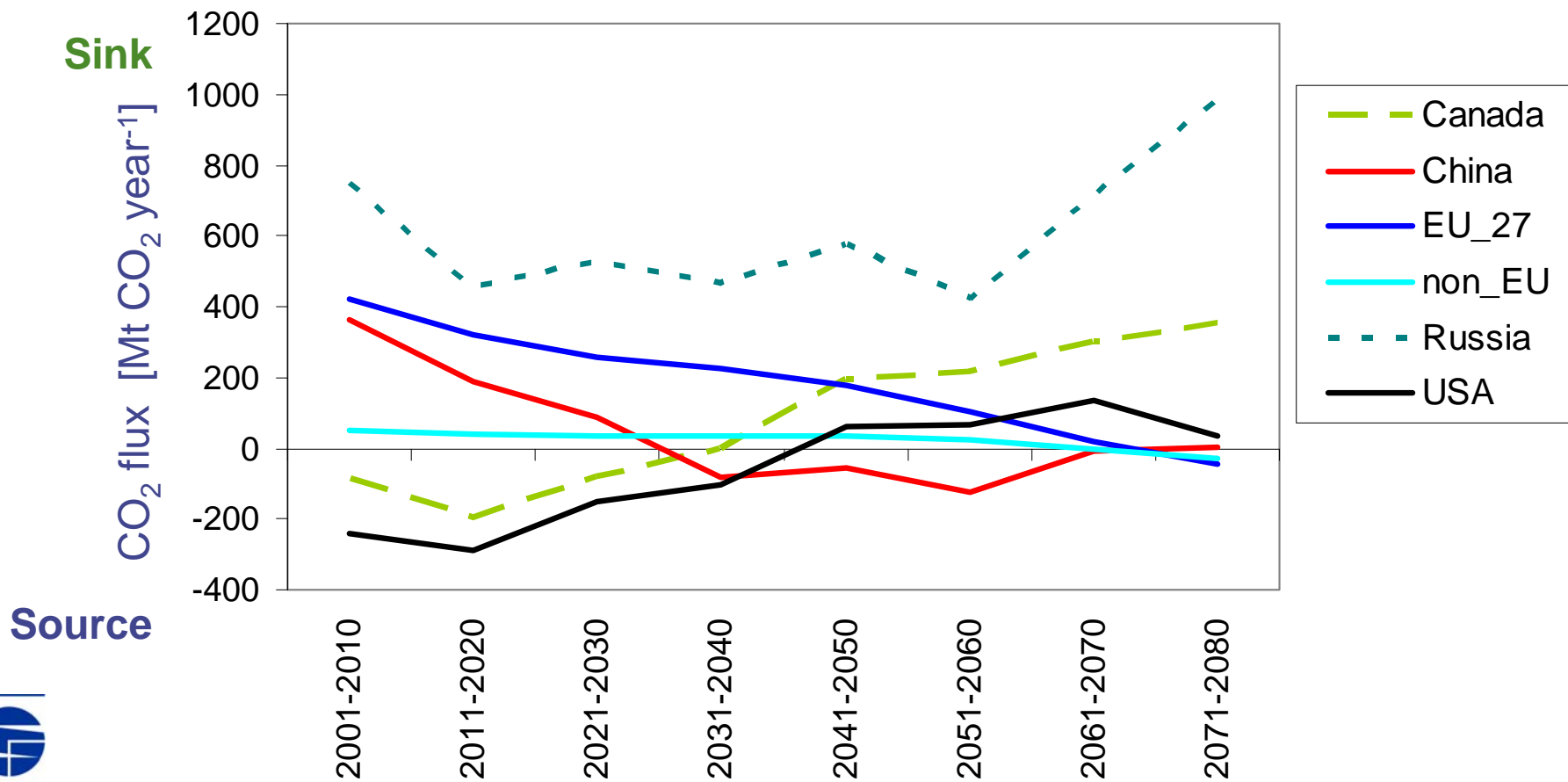


Scenarios of forest management

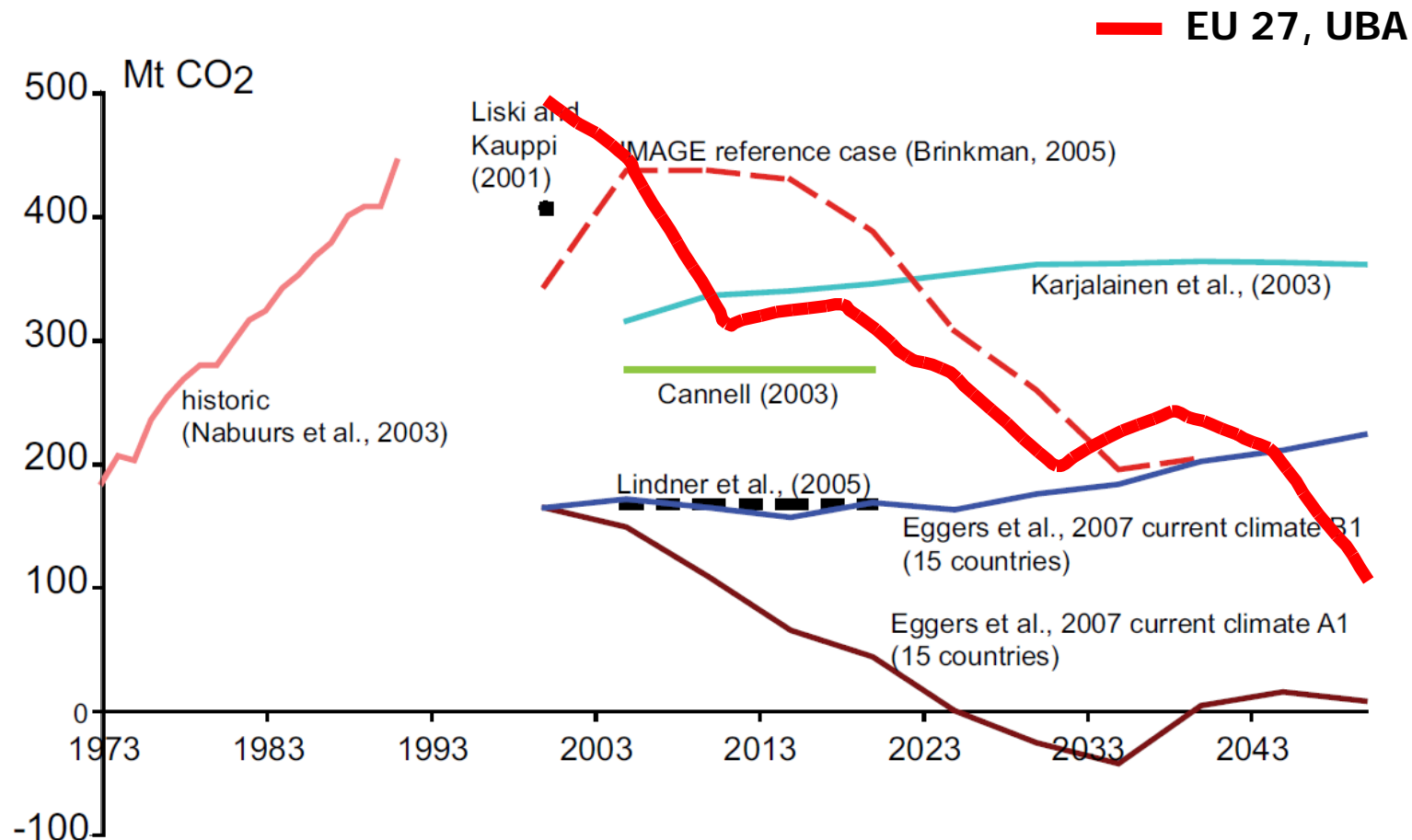
Scenario	Description
Business as usual	Management according to FAO country description, average rotation length derived from inventory, allocation of products according to reports (FAO, UNECE)
Longer rotation	Rotation prolonged by 20%, age class structure as in Business as usual
Shift in product allocation	Harvested material enters 100% pool of longest average residence time (ca. 25 years MRT), management and age classes as in Business as usual

Business as usual: countries

- ◆ Forest sector: biomass, soil, litter, products
- ◆ North America: intensive management
- ◆ Regeneration in Russia, China and Europe

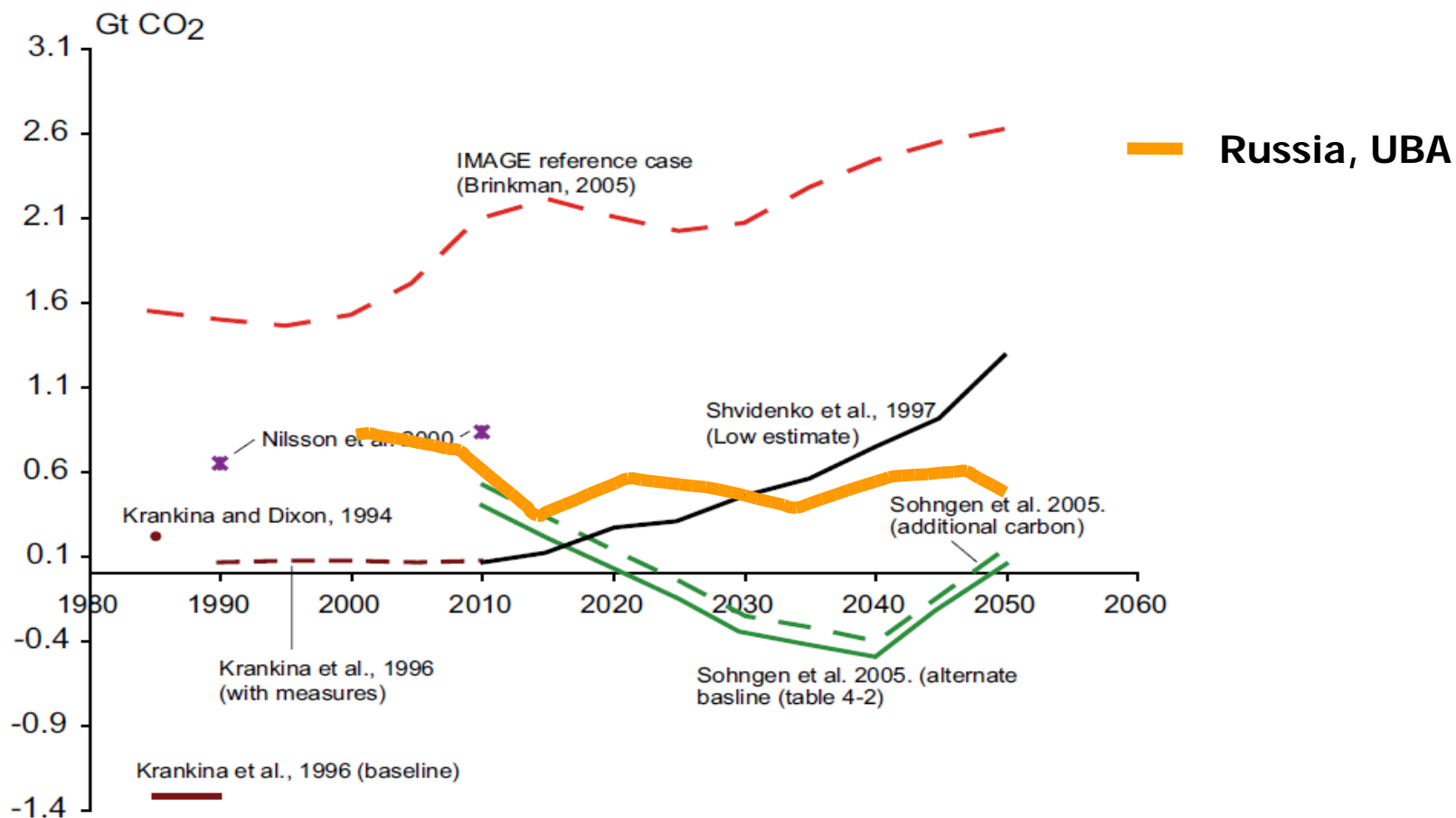


Comparison to other projections - Europe



European forest sector carbon sink projections from IPCC AR4 2007

Comparison to other projections - Russia



Sinks and sources under business as usual

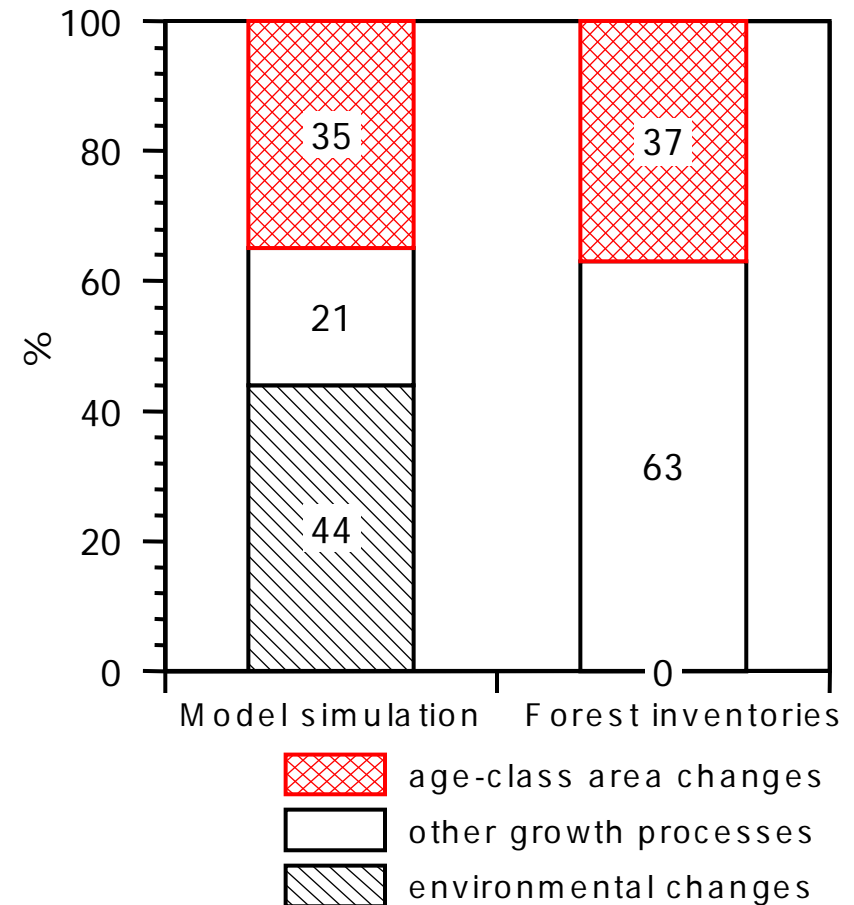
	Canada	China	EU 27	non EU	Russia	USA
Biomass						
until 2020	-135	299	414	51	652	-273
until 2050	-45	124	316	44	581	-158
Full sector						
until 2020	-172	182	324	39	481	-301
until 2050	-70	94	285	40	589	-179
National Cap (MA)	44		45	8	121	

Origin of forest carbon sink

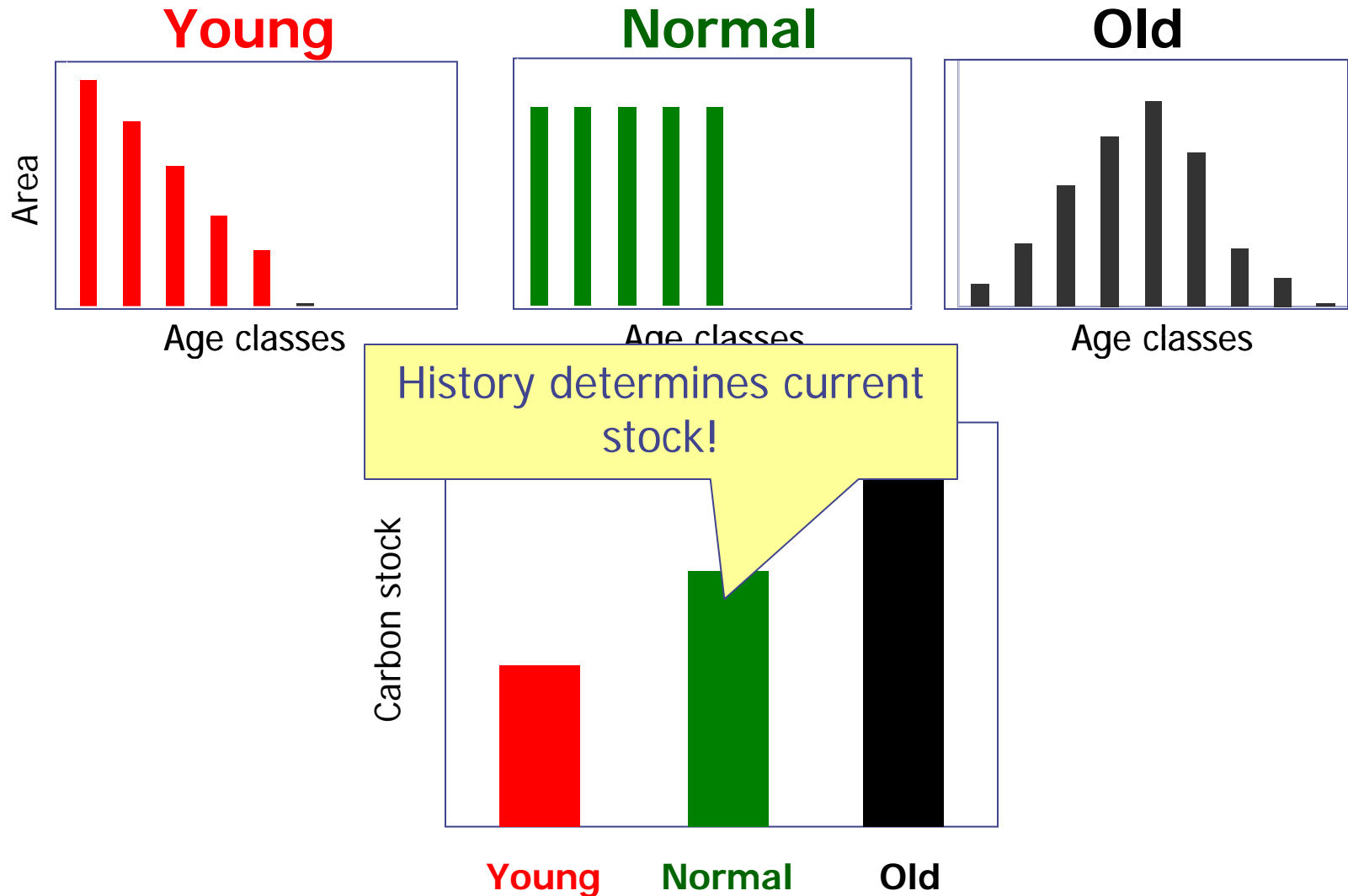
Forest carbon sink in Thuringia between 1982 and 2001

Causes regionally different:

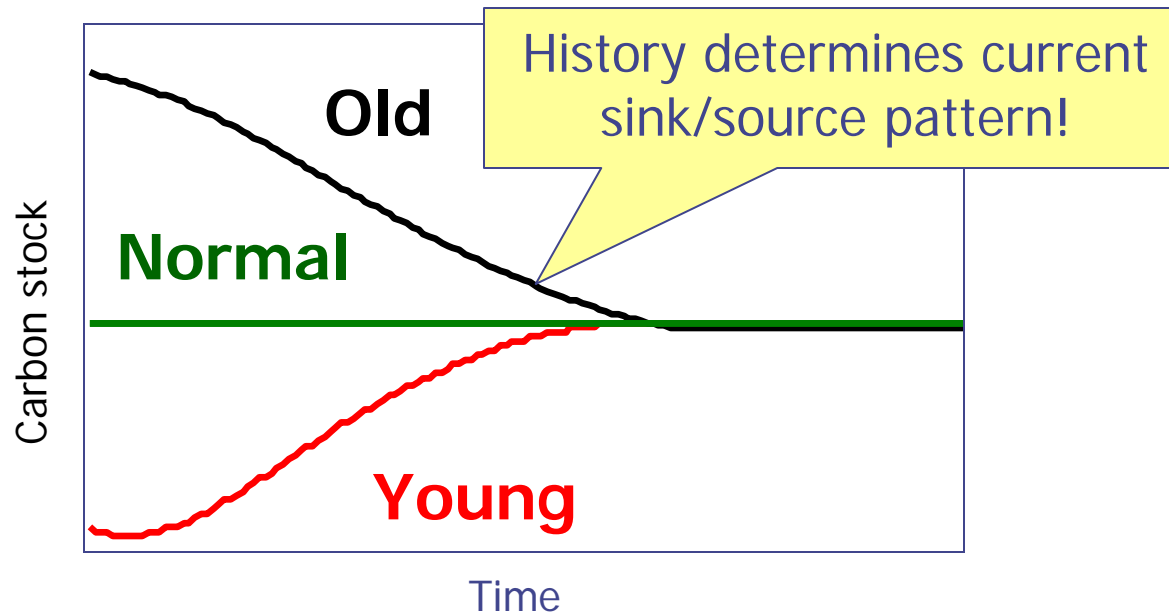
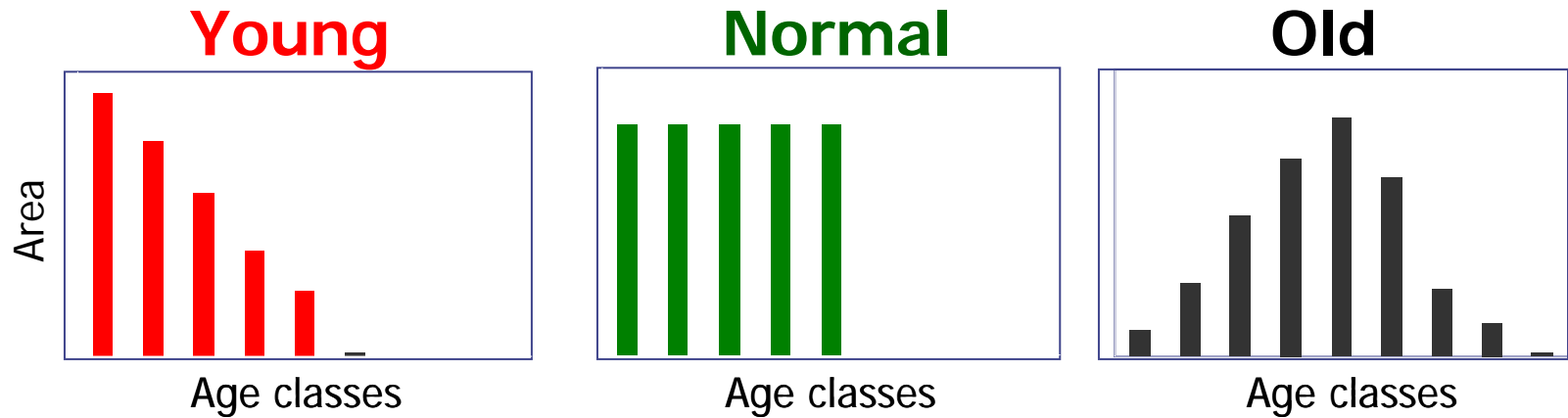
- ◆ Tropics: enhanced CO₂-concentration
- ◆ Siberia: higher temperatures
- ◆ Europe: N deposition
- ◆ Managed forests general: age class effects!
- ◆ In Central Europe about one third of sink due to aging!



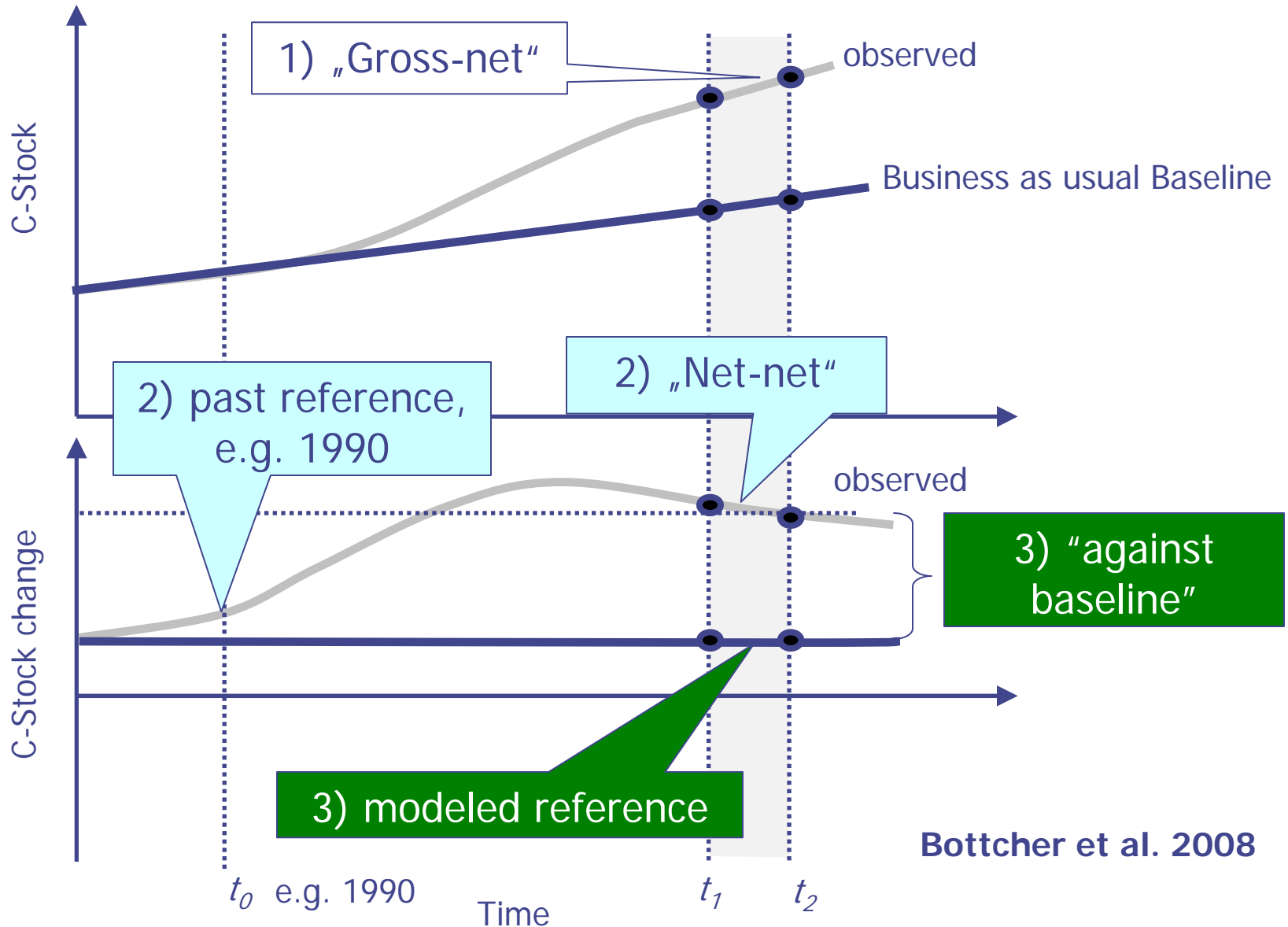
It matters where you come from



It matters where you come from



Overview of accounting schemes



Comparison of accounting rules

Method	Indirect effects excluded?	Applicability	Incentive for e.g.	
			Italy "young" forest landscapes	Finland "old"
„Gross-net“ (current rule for FM)	no	simple: comparison of inventory values	high	low
„Net-net“	no	simple: comparison of inventory values	low	high
Against baseline	yes	medium: model application	high	high

- ◆ Accounting against baseline sets incentives for improved management
- ◆ Despite decreasing trend of sink or even source (e.g. Canada)

Sink extension by longer rotations

	Canada	China	EU 27	non EU	Russia	USA
Biomass						
until 2020	304	189	99	23	554	139
until 2050	195	179	50	16	489	108
Full sector						
until 2020	283	163	81	23	525	124
until 2050	195	166	48	16	473	93
National Cap (MA)	44		45	8	121	

Conclusions 1

- ◆ Prolongation of rotation length in 25 Annex I countries could reach a biologic-technical potential (additional sink) of annual 1.1 Gt CO₂ until 2020
- ◆ Temporal dynamic: additional sink diminishes after 2030
- ◆ Impact of ‚past practices‘ evident and to a certain degree quantifiable/excludable
- ◆ Accounting against forward looking baseline projections derived with the help of forestry models

Conclusions 2

- ◆ Technical potential only – market will have a strong influence on realization of potential
- ◆ Overall forest management mitigation options rather limited due to
 - past practice effects
 - competition for land/forest resources
 - disturbances, climate change feedbacks
- ◆ A land-only view of GHG mitigation is not effective

Questions?
bottcher@iiasa.ac.at

