



# **FOREST EUROPE – Expert Group on Valuation of Forest Ecosystem Services**

## **Sub-working group 1: A functional classification and list of forest ecosystem services**

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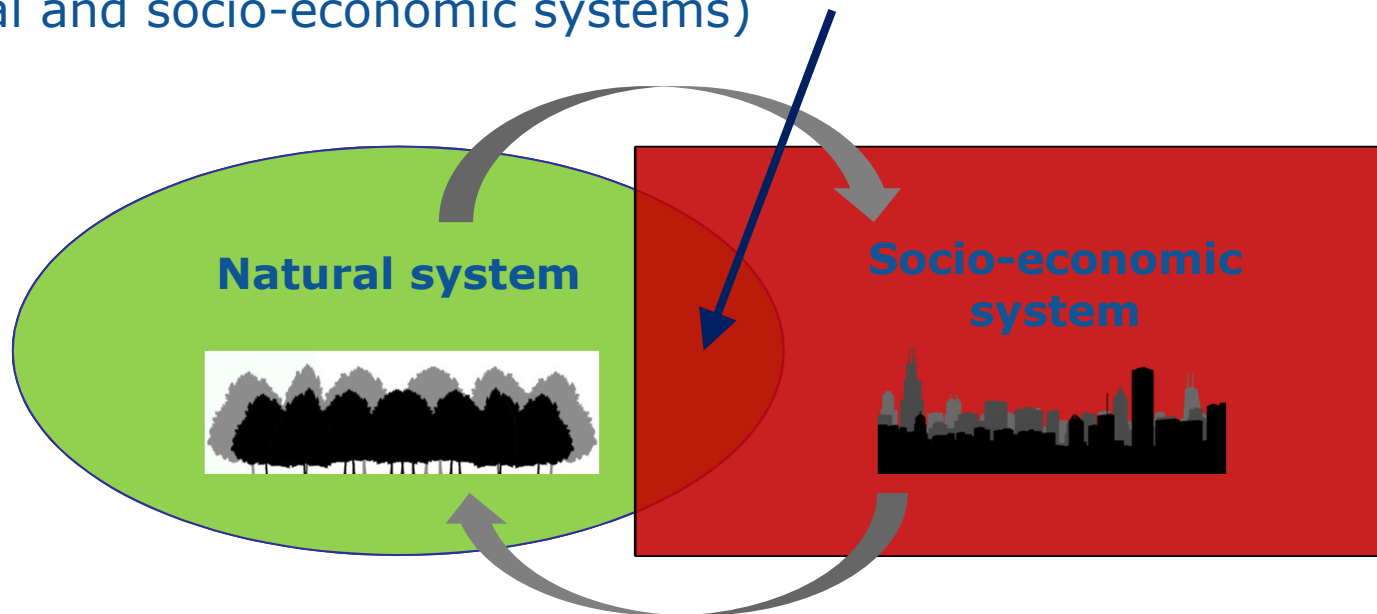
## Expert Group on Valuation of Forest Ecosystem Services

### Sub-working group 1: A functional classification and list of forest ecosystem services

- The **aim** of sub-working group 1 was to elucidate a classification of forest ecosystem services (FES) that can be applied in the pan-European region
- The classification will actuate as the **basis for valuation** steps identified in SWG 2 and SWG 3
- **Assessing** the state of art of FES classifications from literature review
- **Adoption** of a comprehensive, operational and widely accepted classification of FES applicable at the pan-European level

## Forest ecosystems - Introduction

- Forests are very complex biological laboratories (ecosystems)
- Therefore, their analysis from a human-centred perspective is challenging
- Even more challenging when studying forests and their services from an economic perspective (monetary interphase between natural and socio-economic systems)

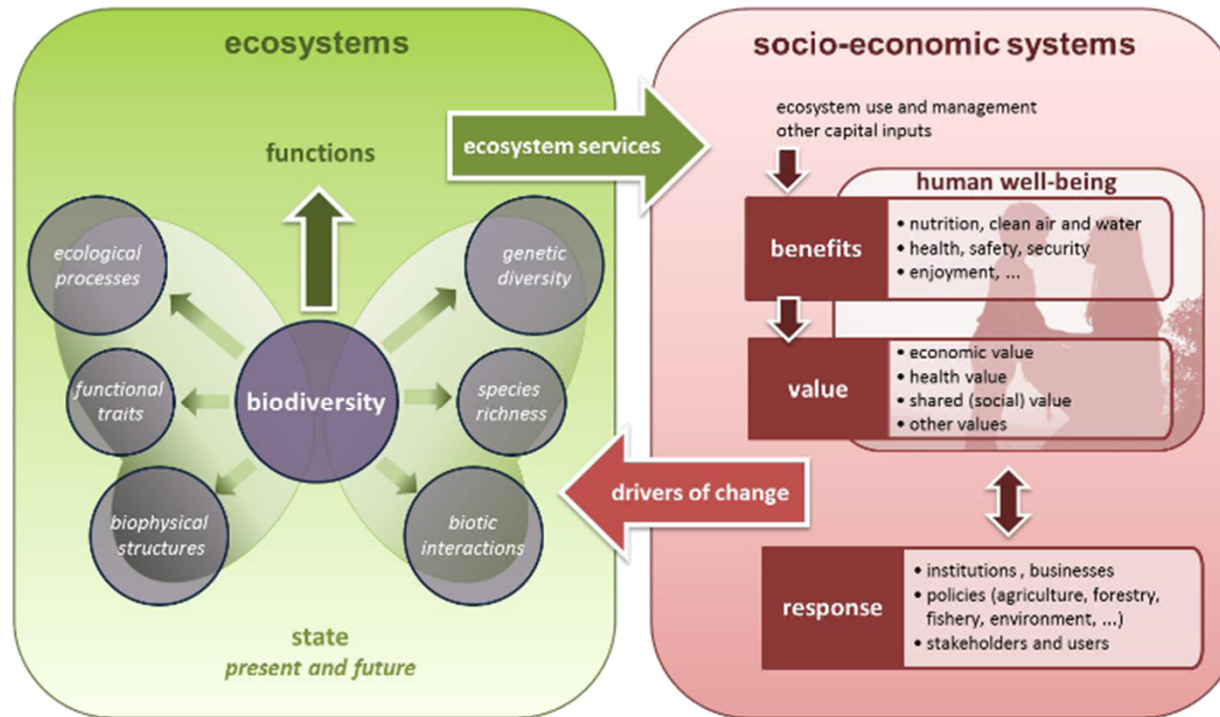


# Forest ecosystems and their services

Three interlinked concepts...

- 1) Ecosystem process:** is any change or reaction which occurs within ecosystems, physical, chemical or biological. Ecosystem processes include decomposition, production, nutrient cycling, and fluxes of nutrients and energy
- 2) Ecosystem function:** is a subset of the interactions between biophysical structures, biodiversity and ecosystem processes that underpin the capacity of an ecosystem to provide ecosystem services
- 3) Ecosystem services:** are the benefits that people obtain from ecosystems

# Forest ecosystems and their services



ESS classification...

Figure 2. Conceptual framework for EU wide ecosystem assessments.

Source: [http://ec.europa.eu/environment/nature/knowledge/ecosystem\\_assessment/pdf/MAESWorkingPaper2013.pdf](http://ec.europa.eu/environment/nature/knowledge/ecosystem_assessment/pdf/MAESWorkingPaper2013.pdf)



## Classification of ecosystem services

Subsequently to the pioneer work of Costanza et al. (1997) on the valuation of ESS at the global level, three main international classification systems have been implemented:

- **Millennium Ecosystem Assessment** (MA, 2005)
- **Economics of Ecosystems and Biodiversity** (TEEB, 2010)
- **Common International Classification of Ecosystem Services** (CICES, 2013)

# Classification of ecosystem services

## Main groups of ESS

MA (2005)	TEEB (2010)	CICES (2013)
PROVISIONING	PROVISIONING	PROVISIONING
REGULATION	REGULATING	REGULATION AND MAINTENANCE
--	HABITAT**	--
CULTURAL	CULTURAL & AMENITY	CULTURAL
SUPPORTING*	--	--

\* Supporting services necessary for the production of all other ESS, in TEEB are considered as a subset of ecosystem processes

\*\* Habitat services were included in CICES in Regulation and Maintenance

# Classification of ecosystem services

## Example: Provisioning ESS

MA	TEEB	CICES (Division / Group)
PROVISIONING	PROVISIONING	PROVISIONING
Industrial wood	Raw materials	Materials / Biomass, fibre
Fuelwood		Energy / Biomass-based energy
Non-wood forest products	Food / Raw materials	Nutrition / Biomass
		Materials / Biomass, fibre
Fresh water (water purification) (also Regulation service)	Water supply	Materials / Water
		Nutrition / Water
Genetic resources	Genetic resources	Materials / Biomass, fibre (genetic resources)





# Classification of ecosystem services MA, TEEB and CICES

- MA, TEEB and CICES classifications show many similarities and have been built following an evolutionary process considering the findings (and limitations) of its predecessors
- Each has its own advantages and disadvantages due to the specific context, view and scope for which they were developed
- We are studying ecosystems from a human-centred perspective and this is **challenging !!!**
- There is **no one-fits-all** perfect classification of ESS:
  - It depends on the purpose



# Classification of ecosystem services

## CICES

- CICES has been implemented for supporting the work of the European Environment Agency (EEA) on environmental accounting
- CICES supports EEA's contribution to the System of Environmental-Economic Accounting (SEEA) which is currently being led by the United Nations Statistical Division (UNSD)
- CICES is a common international standardised classification of ESS. Useful for ecosystem accounting methods and comparisons
- CICES was adopted in the MAES process at EU level

[http://cices.eu/wp-content/uploads/2012/07/CICES-V43\\_Revised-Final\\_Report\\_29012013.pdf](http://cices.eu/wp-content/uploads/2012/07/CICES-V43_Revised-Final_Report_29012013.pdf)



## Classifications of forest ecosystem services

- The aim was to identify, characterise and assess FES classifications from literature review
- Forest ecosystems provide a multiplicity of services to humans. FES are the direct and indirect contributions of forest ecosystems to human wellbeing
- This conceptual view of forest ecosystems is in line with the **multifunctional role of forest** for delivering multiple services in a balanced way and ensuring forest protection (New EU Forest Strategy)



## Classifications of forest ecosystem services

- **Total Economic Value** (TEV) classification (e.g. Pearce & Moran, 1994; Merlo & Croitoru, 2005)
- **Millennium Assessment** functional classification of FES (MA, 2005)
- **Holistic** classification (Mantau et al., 2007)
- **FORVALUE** study classification (Mavsar et al., 2008)
- **MAES-CICES** classification (MAES, 2014)

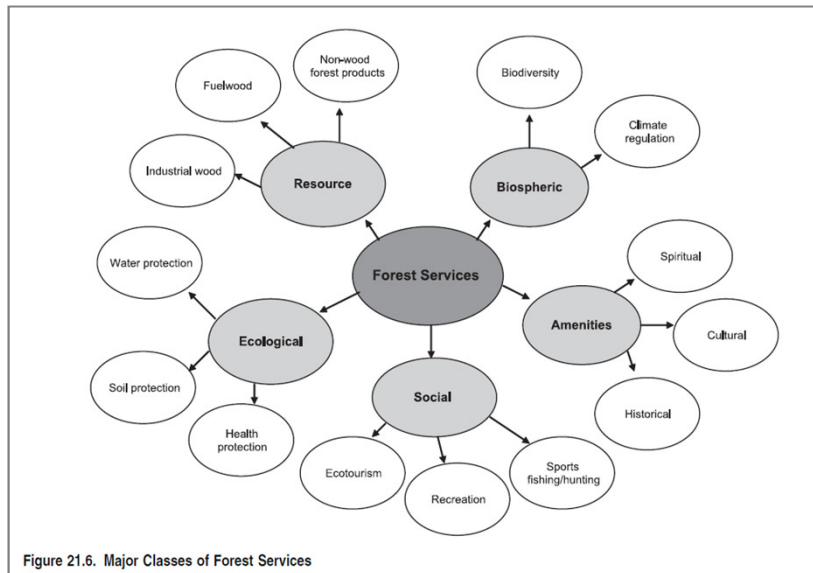


## Classifications of forest ecosystem services

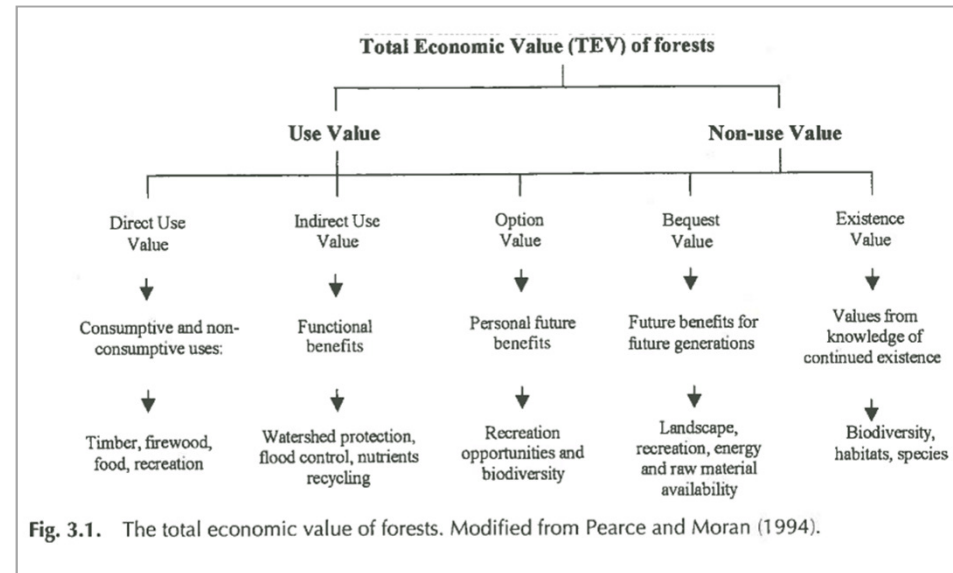
- Several approaches have been proposed pursuing **different aims**, however there is no consensus on a unique universal framework
- Each framework responds to specific requirements and scope
- The classifications are hardly comparable because they have been elaborated for different purposes
- All classifications present **advantages** and **disadvantages** depending of the application context and scope
- Examples:

## Forest ecosystem services:

- Millennium Assessment (MA, 2005)
- Merlo & Croitoru (2005). Modified from Pearce & Moran (1994)



Source: <http://www.unep.org/maweb/documents/document.290.aspx.pdf>



Source: Merlo & Croitoru (2005). Modified from Pearce & Moran (1994)



## Forest ecosystem services MAES-CICES (MAES, 2014)

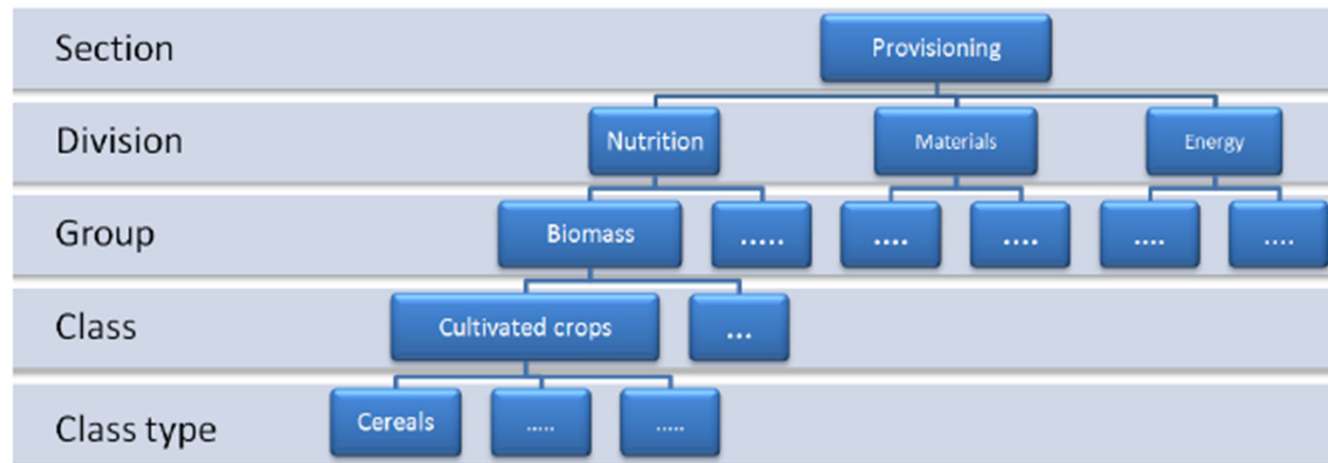
- **Provisioning** includes forest services related to (supply of) biomass, water and energy
- **Regulation and maintenance** services includes all the ways in which forest ecosystems can mediate or moderate the environment that affects human performance.

It covers the degradation of wastes and toxic substances, the mediation of flows, as well as the ways in which ecosystems can regulate the physico-chemical and biological environment of people

- **Cultural services** include the non-material outputs of forest ecosystems. These services are seen as the physical settings, locations or situations that produce benefits in the physical, intellectual or spiritual state of people

# Forest ecosystem services MAES-CICES (MAES, 2014)

**Figure 1:** Illustration of proposed hierarchical structure of CICES V4.3



**MAES-CICES** is a flexible and hierarchical classification that can be adapted to specific requirements and needs

Five hierarchical levels provide a flexible framework

Source: [http://cices.eu/wp-content/uploads/2012/07/CICES-V43\\_Revised-Final\\_Report\\_29012013.pdf](http://cices.eu/wp-content/uploads/2012/07/CICES-V43_Revised-Final_Report_29012013.pdf)



## Forest ecosystem services MAES-CICES (MAES, 2014) – Provisioning

Section	Division	Group	Class
<b>Provisioning</b>	Nutrition	Biomass	Reared animals and their outputs
			Wild plants, algae and their outputs
			Wild animals and their outputs
		Water	Surface water for drinking
	Ground water for drinking		
	Materials	Biomass	Fibres and other materials from plants, algae and animals for direct use or processing
			Materials from plants, algae and animals for agricultural use
			Genetic materials from all biota
		Water	Surface water for non-drinking purposes
			Ground water for non-drinking purposes
Energy	Biomass-based energy sources	Plant-based resources	

Source: [http://ec.europa.eu/environment/nature/knowledge/ecosystem\\_assessment/pdf/MAESWorkingPaper2013.pdf](http://ec.europa.eu/environment/nature/knowledge/ecosystem_assessment/pdf/MAESWorkingPaper2013.pdf)



# Forest ecosystem services MAES-CICES (MAES, 2014) – Regulation and Maintenance

Section	Division	Group	Class
<b>Regulation &amp; Maintenance</b>	Mediation of waste, toxics and other nuisances	Mediation by ecosystems	Filtration / sequestration / storage / accumulation by ecosystems
	Mediation of flows	Mass flows	Mass stabilisation and control of erosion rates
			Buffering and attenuation of mass flows
		Liquid flows	Hydrological cycle and water flow maintenance
			Flood protection
			Storm protection
	Maintenance of physical, chemical, biological conditions	Gaseous / air flows	Ventilation and transpiration
			Pollination and seed dispersal
		Lifecycle maintenance, habitat and gene pool protection	Maintaining nursery populations and habitats
			Pest and disease control
		Pest and disease control	Pest control
			Disease control
		Soil formation and composition	Weathering processes
			Decomposition and fixing processes
	Water conditions	Chemical condition of freshwaters	
Atmospheric composition and climate regulation		Global climate regulation by reduction of greenhouse gas concentrations	
	Micro and regional climate regulation		

Source: [http://ec.europa.eu/environment/nature/knowledge/ecosystem\\_assessment/pdf/MAESWorkingPaper2013.pdf](http://ec.europa.eu/environment/nature/knowledge/ecosystem_assessment/pdf/MAESWorkingPaper2013.pdf)



# Forest ecosystem services MAES-CICES (MAES, 2014) – Cultural

Section	Division	Group	Class
<b>Cultural</b>	Physical and intellectual interactions with biota, ecosystems, and landscapes	Physical and experiential interactions	Experiential use of plants, animals and landscapes in different environmental settings. And physical use of landscapes in different environmental settings
		Intellectual and representative interactions	Scientific, educational, heritage, cultural, entertainment and aesthetic
	Spiritual, symbolic and other interactions with biota, ecosystems, and landscapes	Spiritual and/or emblematic	Symbolic and sacred and/or religious
		Other cultural outputs	Existence and bequest

Source: [http://ec.europa.eu/environment/nature/knowledge/ecosystem\\_assessment/pdf/MAESWorkingPaper2013.pdf](http://ec.europa.eu/environment/nature/knowledge/ecosystem_assessment/pdf/MAESWorkingPaper2013.pdf)



# Challenges of forest ecosystem services valuation studies

Applying valuation results

Overcoming difficulties in Valuation of FES

# Challenges of forest ecosystem services valuation studies

## Dimensions of uncertainty:

- Baseline datasets (stats/georeferenced): observed vs. modelled data
- Modelling tools (assumptions, validation, ground data, etc...)
- **Valuation method** (environmental economics !!!)
- Communicating uncertainty to final users (policy makers)

# Challenges of forest ecosystem services valuation studies

## Uncertainty:

- : the quality or state of being uncertain
- : something that is doubtful or unknown: something that is uncertain

## Uncertain:

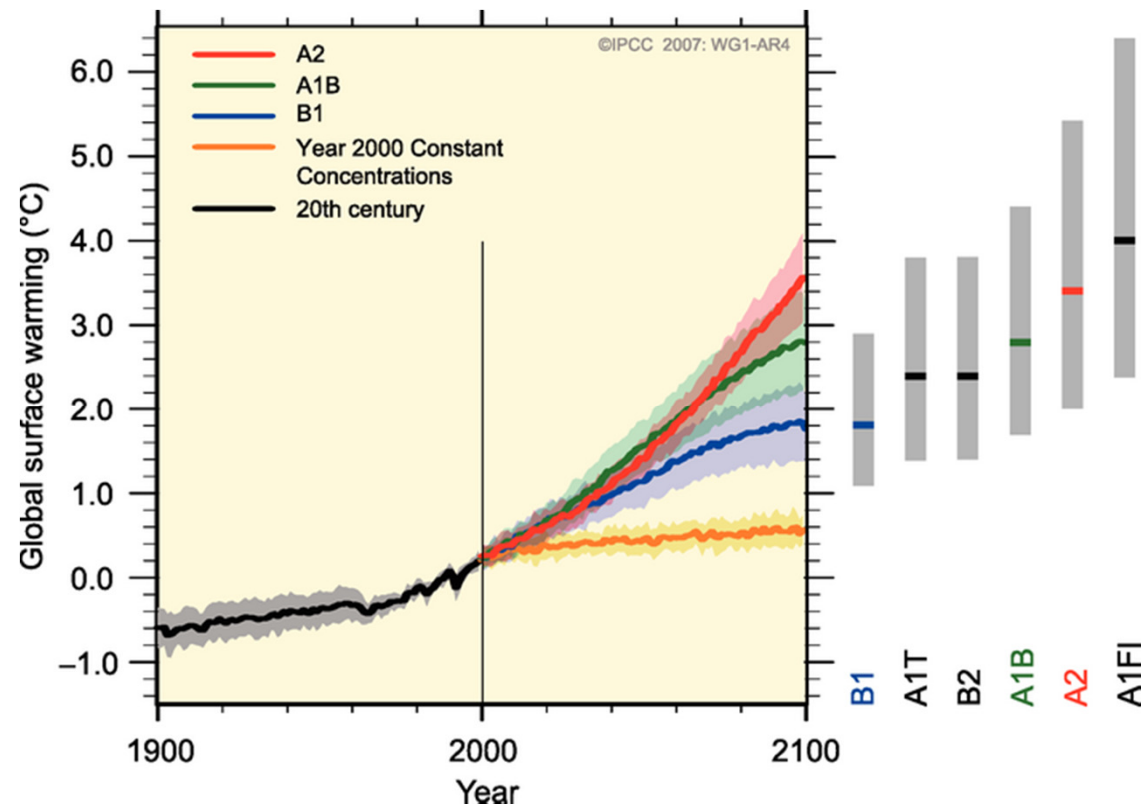
- : not exactly known or decided: not definite or fixed
- : not sure: having some doubt about something



## Challenges of forest ecosystem services valuation studies

- The monetary value of ecosystems depends on the potential payers as well as several other factors, including the long-term sustainability of the service
- (...) defining the 'true' value of ecosystem services is a **major challenge**. There is no accepted universal method but instead a range of approaches (FAO, 2014)
- Different valuation methods might produce different results !!!
- The same applies to different baseline indicators/datasets

FAO (2014): <http://www.unece.org/fileadmin/DAM/timber/publications/SP-34Xsmall.pdf>



The assessment of the best estimate and likely ranges in the grey bars includes the AOGCMs in the left part of the figure, as well as results from a hierarchy of independent models and observational constraints

Source: [http://www.ipcc.ch/publications\\_and\\_data/ar4/wg1/en/figure-spm-5.html](http://www.ipcc.ch/publications_and_data/ar4/wg1/en/figure-spm-5.html)



## Challenges of forest ecosystem services valuation studies

- Different valuation methods producing different results should be seen as an **opportunity**
- Important methodological resource
- Different outputs from different valuation methods are useful for **informing uncertainty** to users/policy makers
- Ensemble approach for valuation, range of values: min/max, SD, etc.
- In some cases **spatially explicit uncertainty** measures: e.g. territorial decision making



# Thank you

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