

15th Meeting of the London Group on
Environmental Accounting
Wiesbaden, 30 November – 4 December 2009

Ecosystem Capital Accounting: *towards a fast track implementation in Europe*

Jean-Louis Weber

Senior adviser economic-environmental accounting
European Environment Agency
30 November 2009

“ Because National Accounts are based on financial transactions, they account for nothing Nature, to which we don’t owe anything in terms of payments but to which we owe everything in terms of livelihood.” **Bertrand de Jouvenel 1968**

“The same rule of self-destructive financial calculation governs every walk of life. We destroy the beauty of the countryside because the unappropriated splendours of nature have no economic value. We are capable of shutting off the sun and the stars because they do not pay a dividend.” **John Maynard Keynes 1933**



Recurrent policy demands

Environmental performance of the economy

Decoupling from resource use and generation of residuals

Decoupling from impacts

Cost of meeting targets

Water Framework Directive → “full recovery of costs”

EU Climate change programme → carbon emission offset costs

Environmental Liability Directive → remediation costs of impacts

Natura2000 (as application of ELD 2004): restoration or replacement of degraded sites → costs

Supplement GDP

“GDP and Beyond” → dashboard of pressure indicators + basket of impact indicators

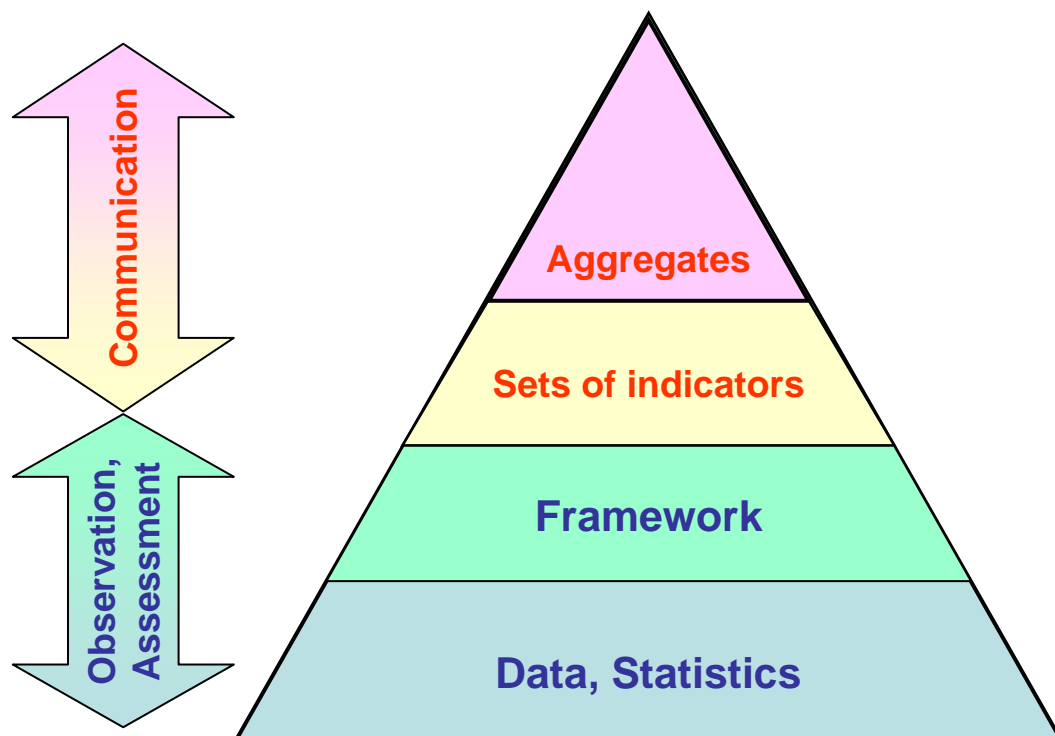
“Stiglitz/Sen/Fitoussi” report → focus on Income (underinvestment) and Consumption (overconsumption)

TEEB (G8+5 initiative, UNEP, CBD) → benefits from ES + ecosystem capital accounting

These policy demands address both SNA and the SEEA which has been created to help in that respect when coming to environmental and SD issues

Future of National Accounts - from Data and Statistics to Aggregates and Communication

Core SNA Accounts



Not so easy to move things regarding data collection and the framework.

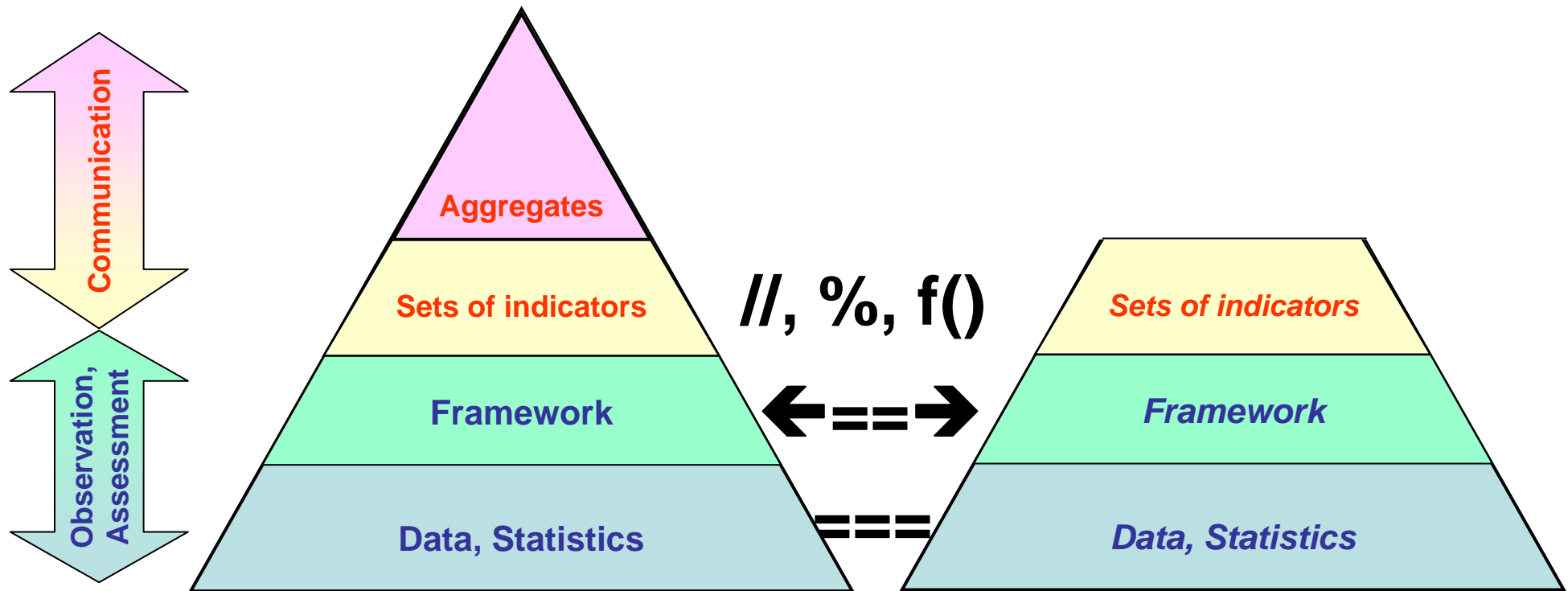
What matters for policy people is the top...

JLW from W. Radermacher's presentation at Eurostat National Accounts Conference 2009 "Reading the Present to Prepare the Future", Brussels, 16 September 2009

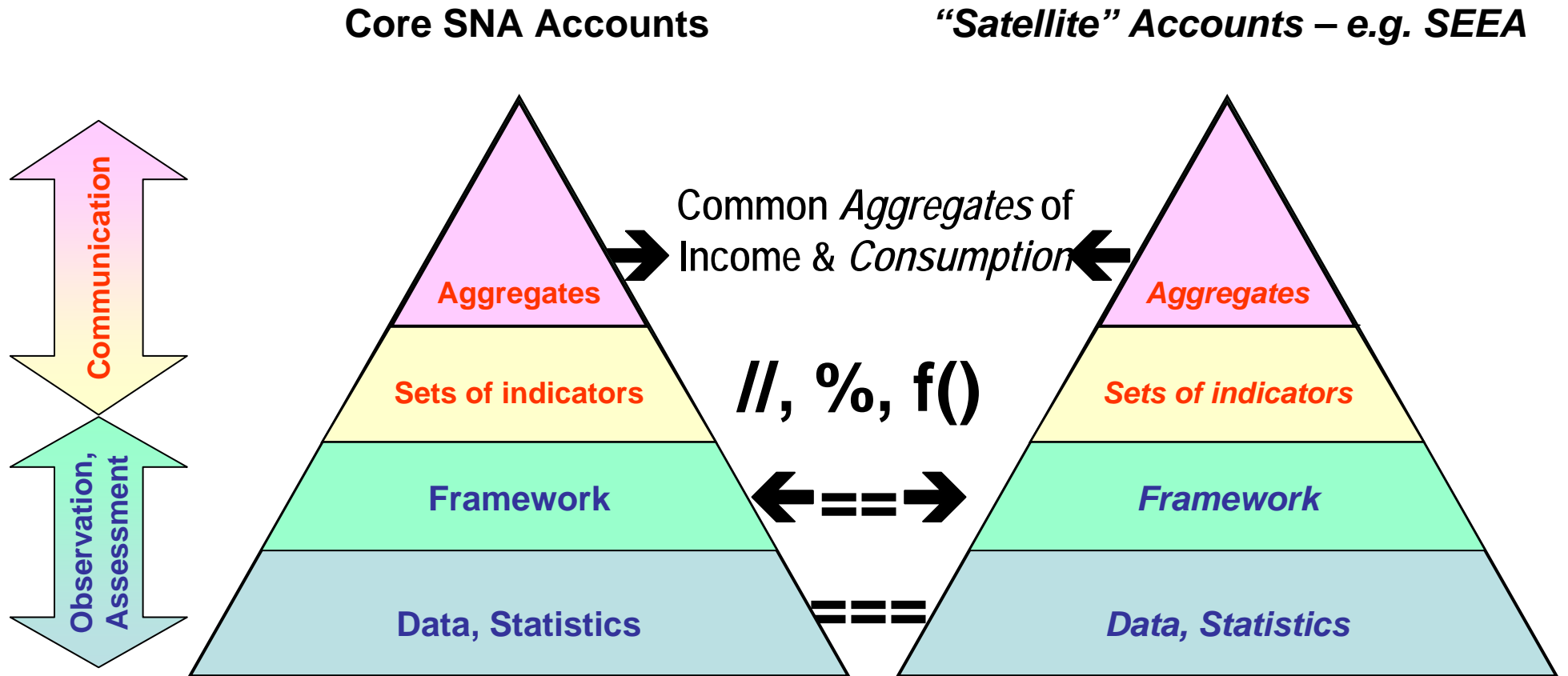
National Accounts “deficit”:
Core and “Satellite” Accounts at the Same Level

Core SNA Accounts

“Satellite” Accounts – e.g. SEEA



National Accounts “deficit”:
Core and “Satellite” Accounts at the Same Level



Make it happen?

Be outcome oriented

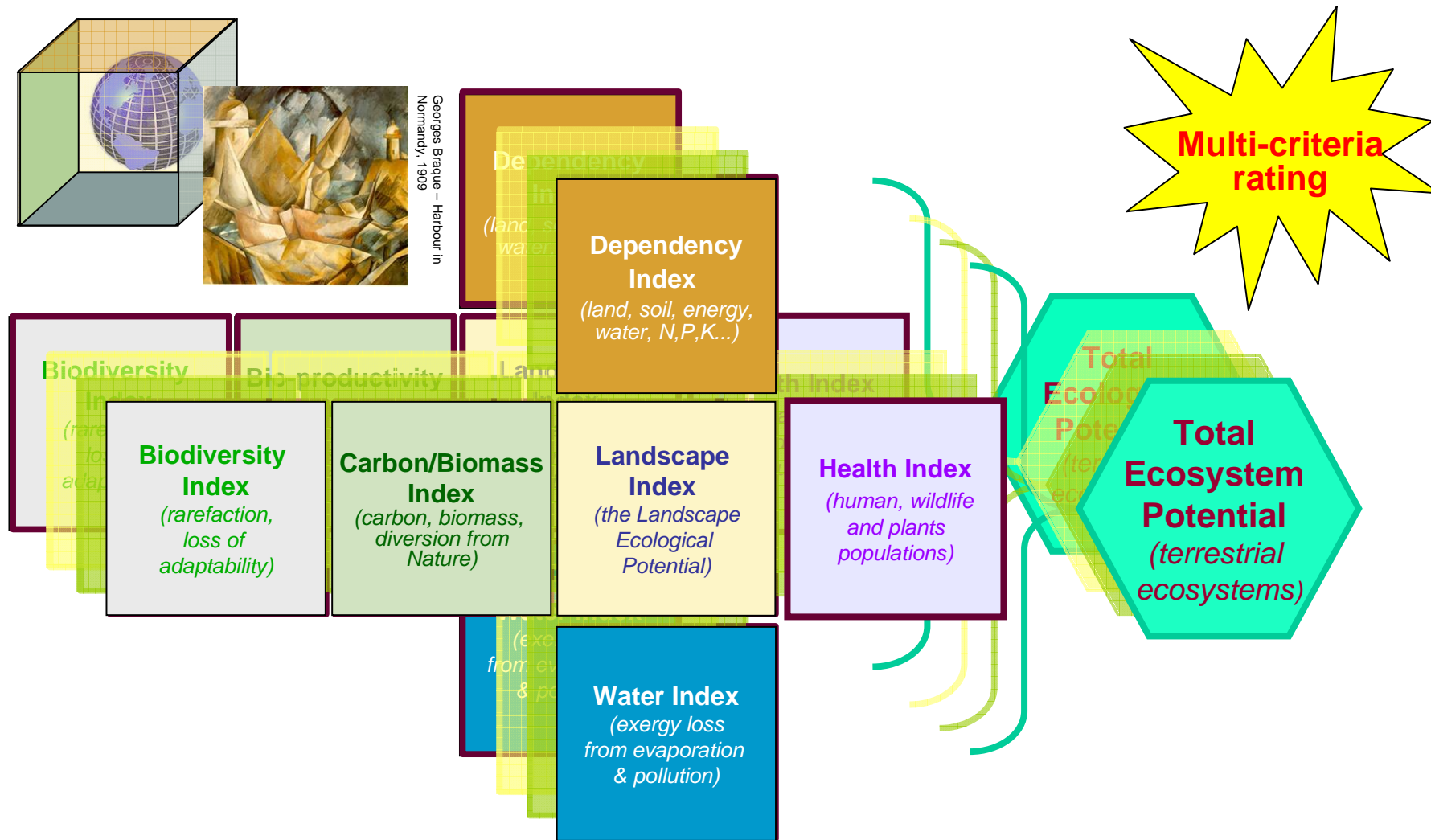
Working with existing data and statistics

Time matters

Space matters

Simplified framework

Make it happen? Make it simple! : a "Cubist" Approach



Depreciation of Ecosystem Capital = Change in TEP * €

No valuation of ecosystem services or assets is needed

European Environment Agency



In the tool box: innovative methodologies

Multi-criteria rating

Energy	Washing machine
Manufacturer Model	
More efficient Less efficient	B
Energy consumption kWh/cycle <small>(based on standard test results for 60°C cotton cycle) Actual energy consumption will depend on how the appliance is used</small>	1.75
Washing performance <small>A: higher G: lower</small>	A B C D E F G
Spin drying performance <small>A: higher G: lower Spin speed (rpm)</small>	A B C D E F G 1400
Capacity (cotton) kg	5.0
Water consumption	5.5
Noise (dB(A) re 1 pW)	Washing: 5.2 Spinning: 7.6
Further information contained in product brochure	



Mean statistics:
unitary
remediation costs extracted
from statistics on
environmental protection and
management expenditure

Traceability of products



Implementation priorities

Expenditure accounts	Sectors	Land protection & management	Water protection & management	Carbon/ biomass Protection & management	Biodiversity protection	Health protection	Agriculture & fishery subsidies
	Basic physical balances	Sectors	Land Use (surfaces & commodities)	Water resource, supply & use	Carbon/ biomass resource, supply & use	<i>Fishing, hunting, harvesting of wild species (non cultivated)</i>	<i>LCA: impacts of chemical,, on human and wildlife health</i>
Services		Land functions & ecosystem services	Water functions & ecosystem services	Carbon/ biomass functions & ecosystem services	<i>Biodiversity related ecosystem services</i>	<i>Human morbidity/ environment & food security</i>	<i>Dependency from regulating ecosystem services</i>
Spatial Units		Land cover stocks & change	Water bodies resource & abstraction	Carbon/ biomass resource and extraction/ harvesting	Natural and semi-natural habitats & species distribution	<i>Distribution of critical areas for health</i>	<i>Water, C, energy, NPK, subsidies</i>
Health counts	Spatial Units	Landscape patterns	Water quantity & quality	Carbon/ Biomass, productivity	Biodiversity factors	<i>Ecosystem health factors</i>	<i>Net external balances by socio-ecosystems</i>
Indexes	Spatial Units	Landscape Index <i>(the Landscape Ecological Potential)</i>	Water Index <i>(exergy loss from evaporation & pollution)</i>	Carbon/ biomass Index <i>(carbon, biomass, diversion from Nature)</i>	Biodiversity Index <i>(rarefaction, loss of adaptability)</i>	Health Index <i>(human, wildlife and plants populations)</i>	Dependency Index <i>(land, soil, energy, water, N,P,K...)</i>

Maintenance/ Restoration Costs

mean
€

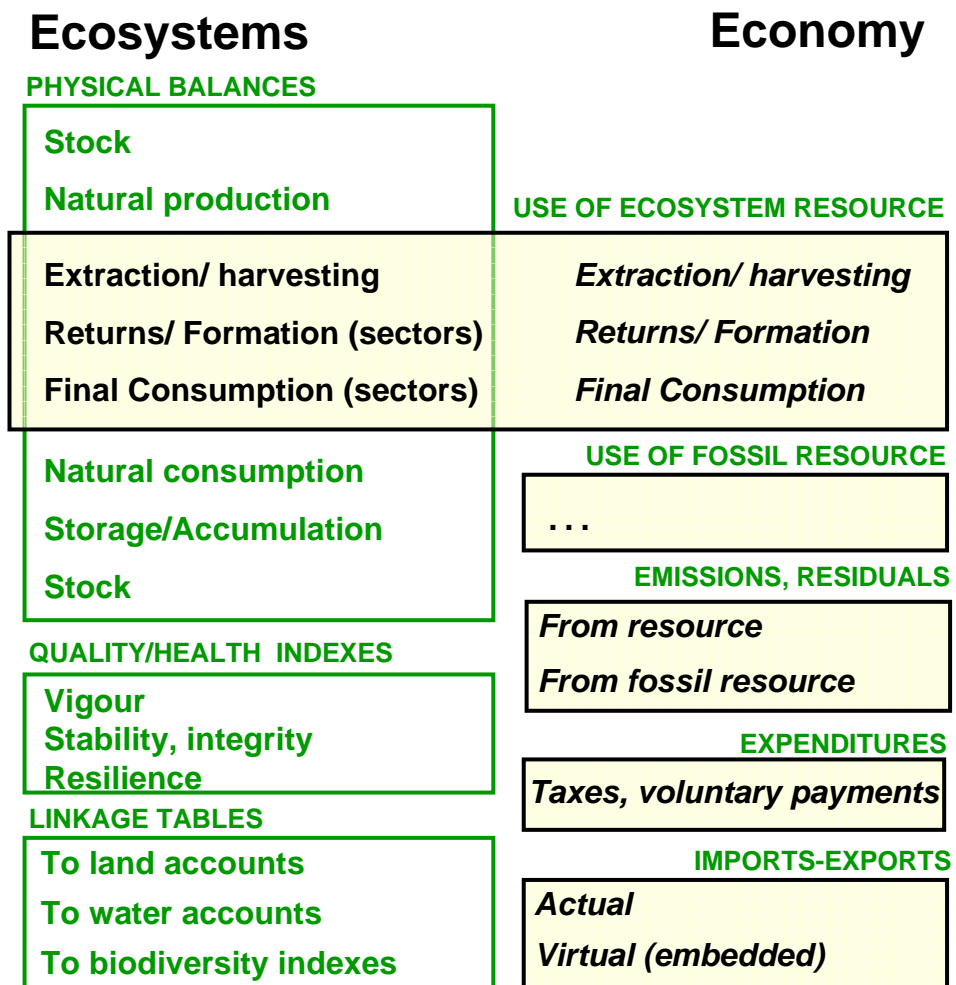
Ecosystem capital depreciation

Φ
degradation

Change in Total Ecosystem Potential



Integration of carbon accounts



Accounts & Indexes :
Carbon/Biomass Ecosystem Accounts

Ecosystem Asset Account

Bio-C balance

Opening stocks by ecosystems

- Formation of bio-C (Net Ecosystem Production)

- Withdrawals by activities
- Net transfers between ecosystems
- Returns from activities
- Imports/Exports
- Storage in the user system
- Consumption/combustion of bio-C

- Changes due to natural & multiple causes
 - In situ bio-C storage
- Final stocks by ecosystems

Ecosystem C-Productivity Counts

- NPP trends
- NPP perturbation
- Change in NPP profiles

Linkage table

- Landscape ecological potential
- Water availability (quantity*quality)

Sector Accounts

(Supply & Use, MFA, NAMEA, Expenditures)

- Withdrawal of bio-C
- Input-Output between sectors
- Returns of bio-C
- Imports/Exports
- Storage in the user system
- Consumption/combustion of bio-C

Consumption of C / Emissions of CO₂ CH₄

- Consumption/combustion of bio-C
- Combustion of fossil fuel
- CO₂/CH₄ emissions

Net Carbon Offset Expenditures

- C taxes and subsidies
- Net purchase of C permits

Virtual C embodied in Import-Export

- Virtual C by products



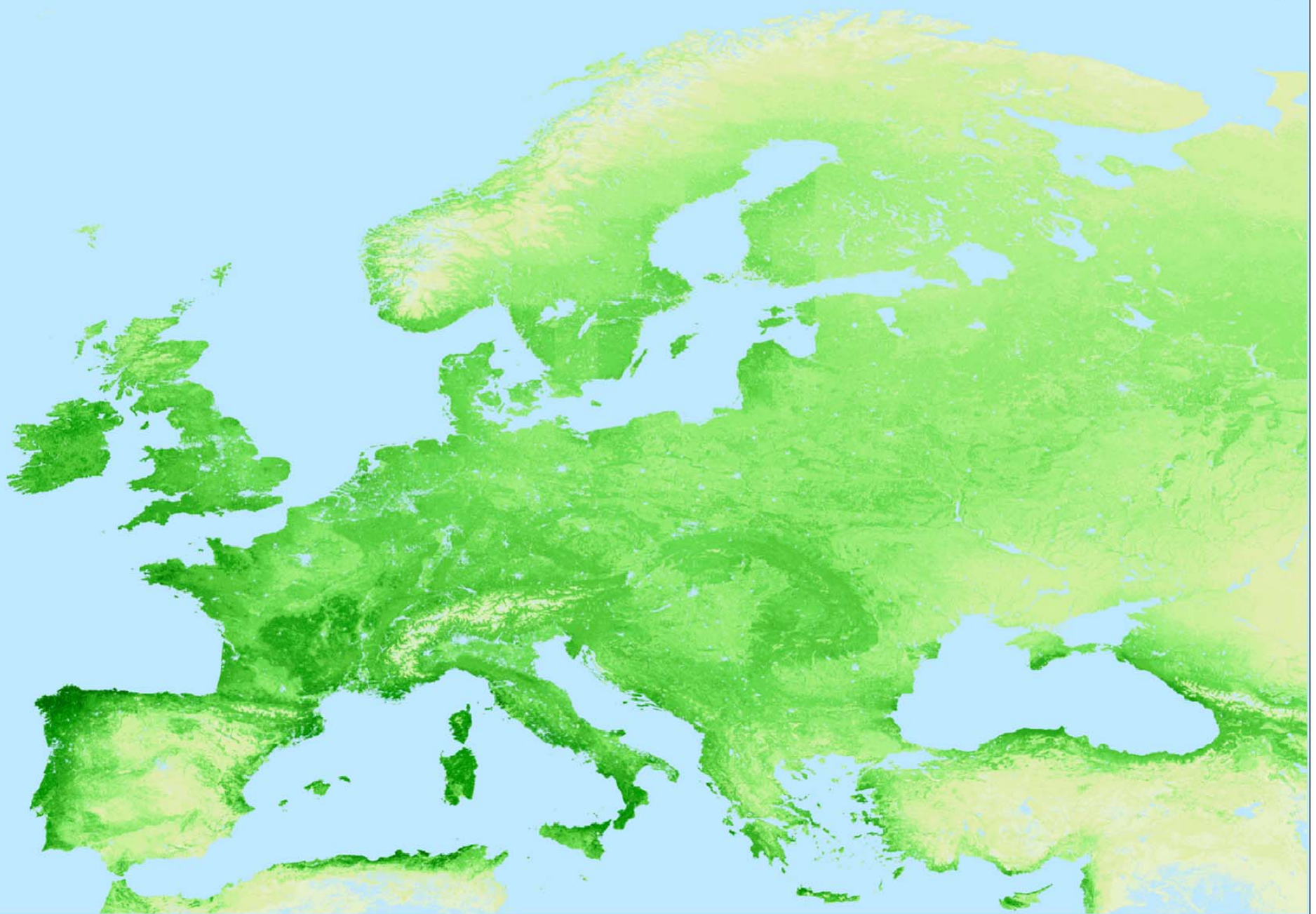
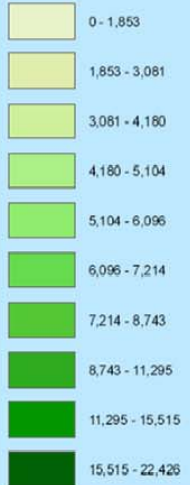
Mean NPP of vegetation (2000 - 2008)



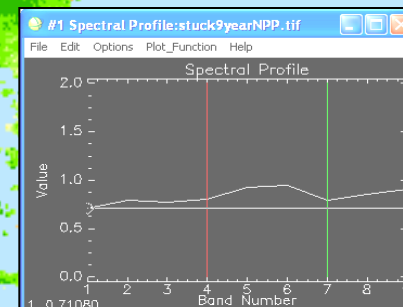
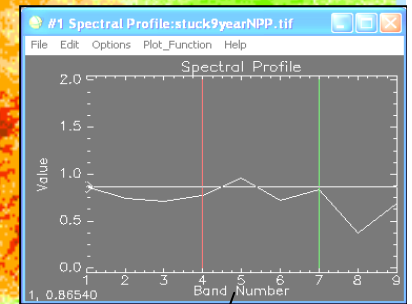
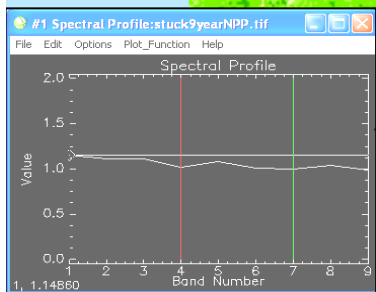
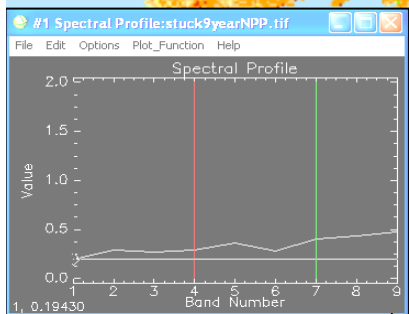
Legend

Mean NPP

VALUE



Trends in NPP and cumulated annual change 2000-2008 (2008-2007)+(2007-2006)+(2006-2005) ... (2001-2000)



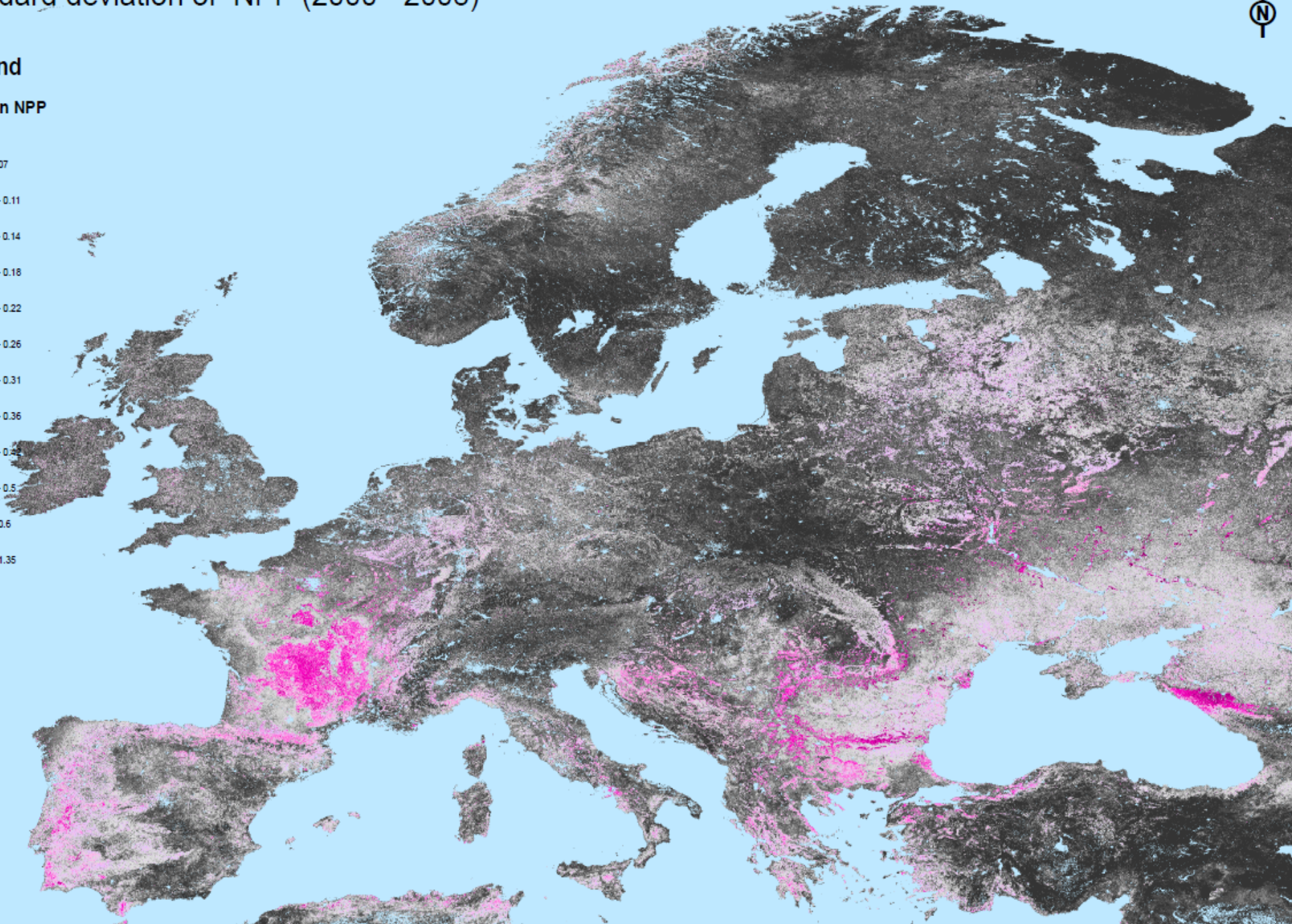
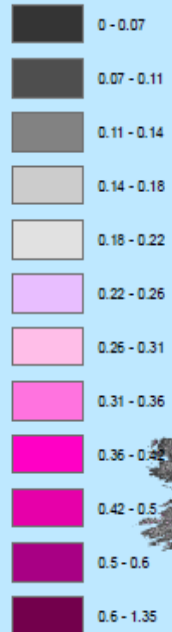
Standard deviation of NPP (2000 - 2008)



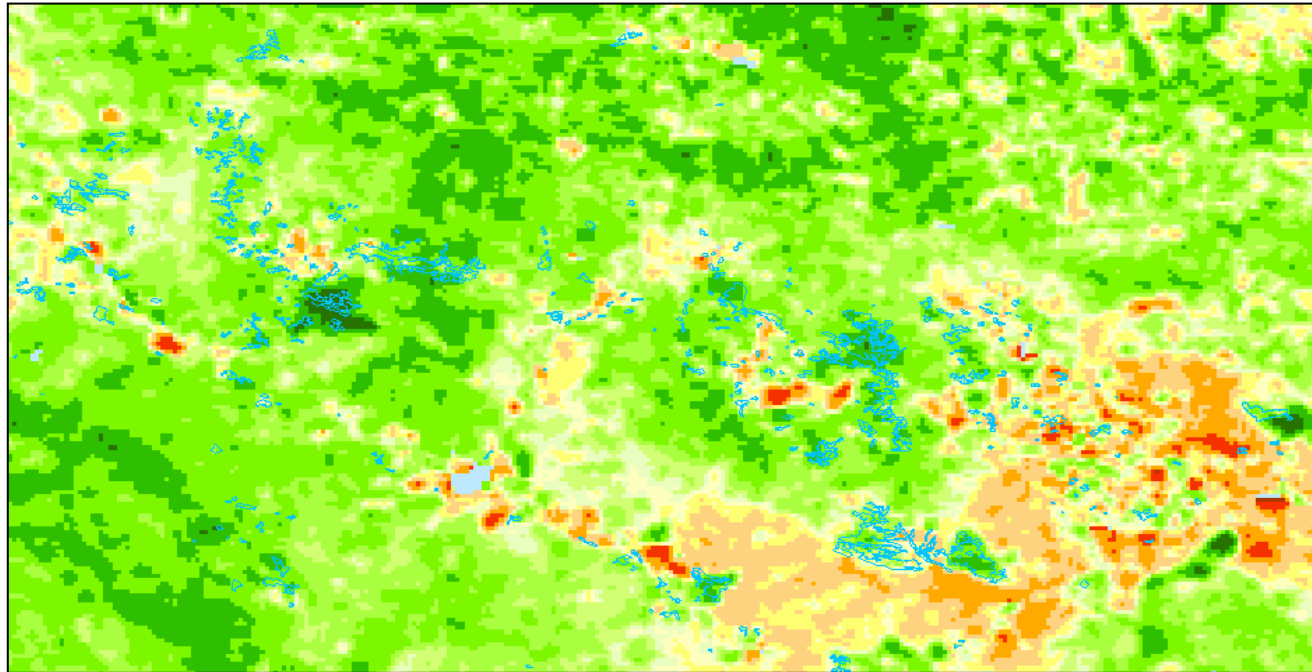
Legend

StDeviation NPP

gC/m²/yr



Need for thematic integration of bio-carbon accounts with land, water & biodiversity

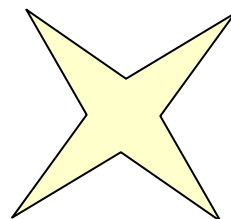
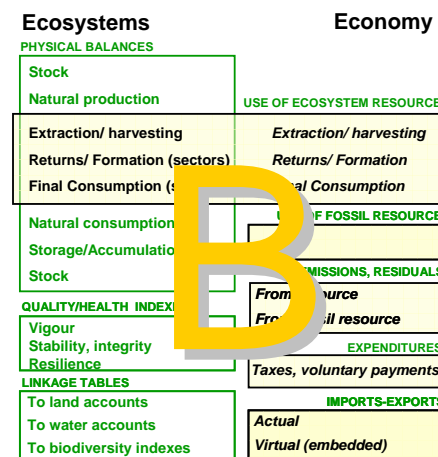
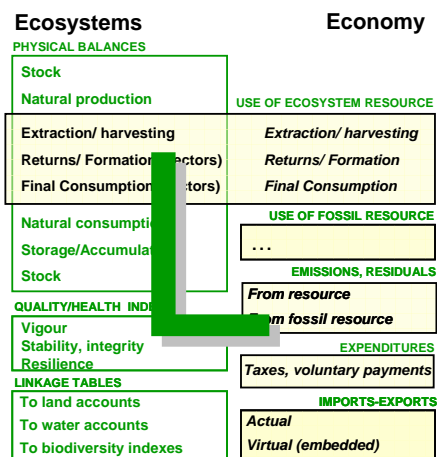
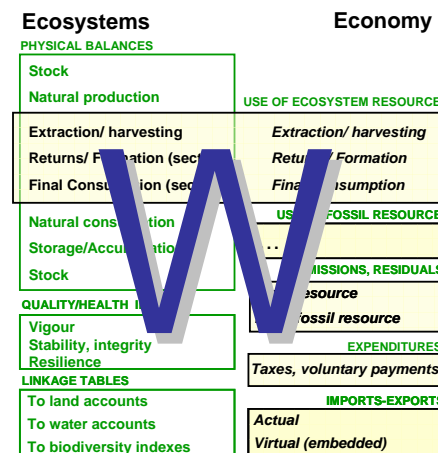
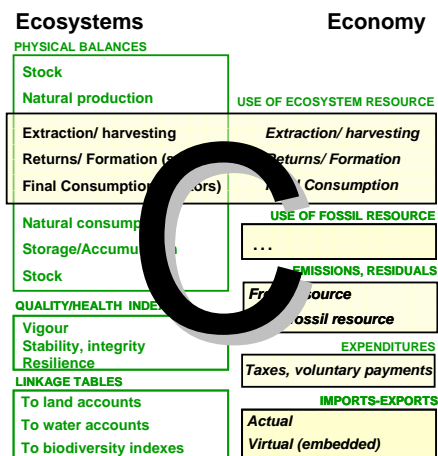


Example from southern Spain: NPP increase in dry region

- Much of the increased NPP in semi-arid Spain is due to new irrigations (water taken from fossil reservoirs or directly taken from nature/rivers ...)
- And so more NPP brings also some functional simplification of the ecosystem
- If such causal relations exist they should be reflected in some “biodiversity account” (but the species responses are usually delayed due to nature’s buffering capacity) (from Emil D. Ivanov, EEA-ETC LUSI)

Fast track implementation of ecosystem accounts in Europe by 2011

- Dual accounts of Ecosystems (EEA) and Economy (Eurostat)
- 4 priority areas: Carbon [C], Land [L], Water [W] & Biodiversity [B]
- Deadline 2011 with intermediate delivery by Sept. 2010 (Post-Copenhagen, Biodiversity Year, CBD COP10)



Accounts & Indexes : Land Ecosystem Accounts

Ecosystem Asset Account

Land cover balance

Opening land cover stocks by ecosystems

- LCF1 Urban land management
- LCF2 Urban residential sprawl
- LCF3 Sprawl of economic sites and infrastructures
- LCF4 Agriculture internal conversions
- LCF5 Conversion from other land cover to agriculture
- LCF6 Withdrawal of farming
- LCF7 Forests creation and management
- LCF8 Water bodies creation and management

- LCF9 Changes of Land Cover due to natural and multiple causes
- Change in land cover (formation - consumption)

Final land cover stocks by ecosystems

Landscape Ecological Potential

- Green Landscape Index
- Landscape nature value
- Landscape fragmentation

Linkage table

- Carbon/Biomass productivity & storage
- Water availability (quantity*quality)

Sector Accounts

(Supply & Use, MFA, NAMEA, Expenditures)

- LCF1 Urban land management
- LCF2 Urban residential sprawl
- LCF3 Sprawl of economic sites and infrastructures
- LCF4 Agriculture internal conversions
- LCF5 Conversion from other land cover to agriculture
- LCF6 Withdrawal of farming
- LCF7 Forests creation and management
- LCF8 Water bodies creation and management

Land use (main use, ha + tons + number of units)

- Agriculture (by crop types)
- Forestry
- Infrastructure, transport
- Economic activities
- Residential

Landscape Protection and Management Expenditures

- Taxes and subsidies
- Investments

Virtual land embodied in Import-Export

- Virtual land by products

LCF = Land Cover Flows, as in EEA Land Cover Accounts 2006 report

European Environment Agency



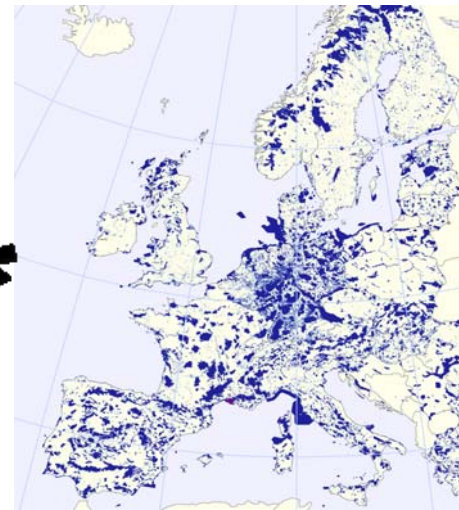
Land Ecosystem Account: Landscape Ecological Potential



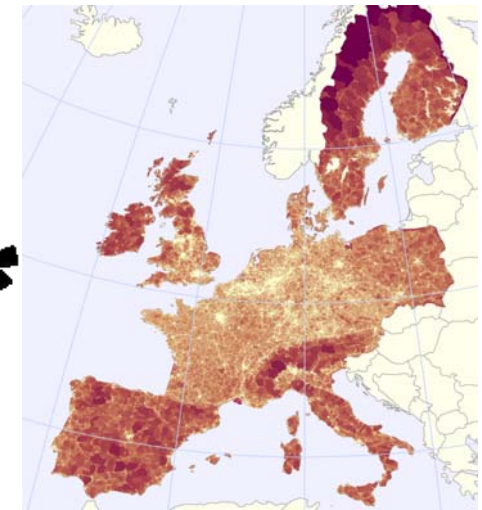
Corine land cover map (CLC is derived from satellite images)



Green Landscape Index (derived from CLC)



Nature Value (*Naturilis*, derived from Natura2000 designated areas)

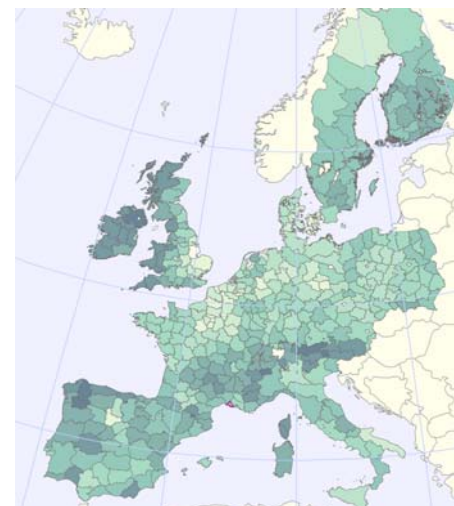


Fragmentation (*Effective Mesh Size (MEFF)* derived from TeleAtlas Roads and CLC)



Landscape Ecological Potential (LEP) 2000, by 1km² grid cell

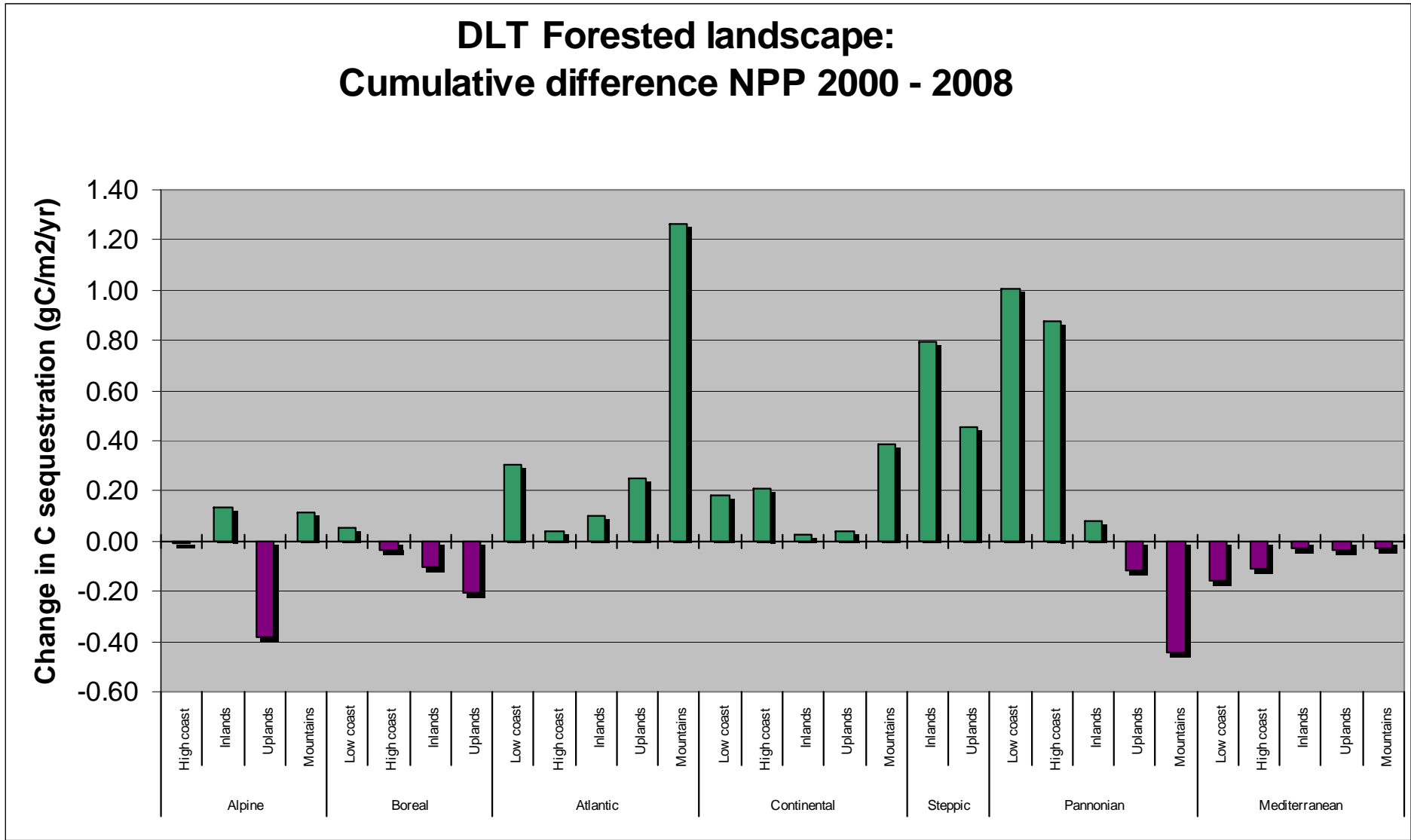
and



LEP 2000 by NUTS 2/3

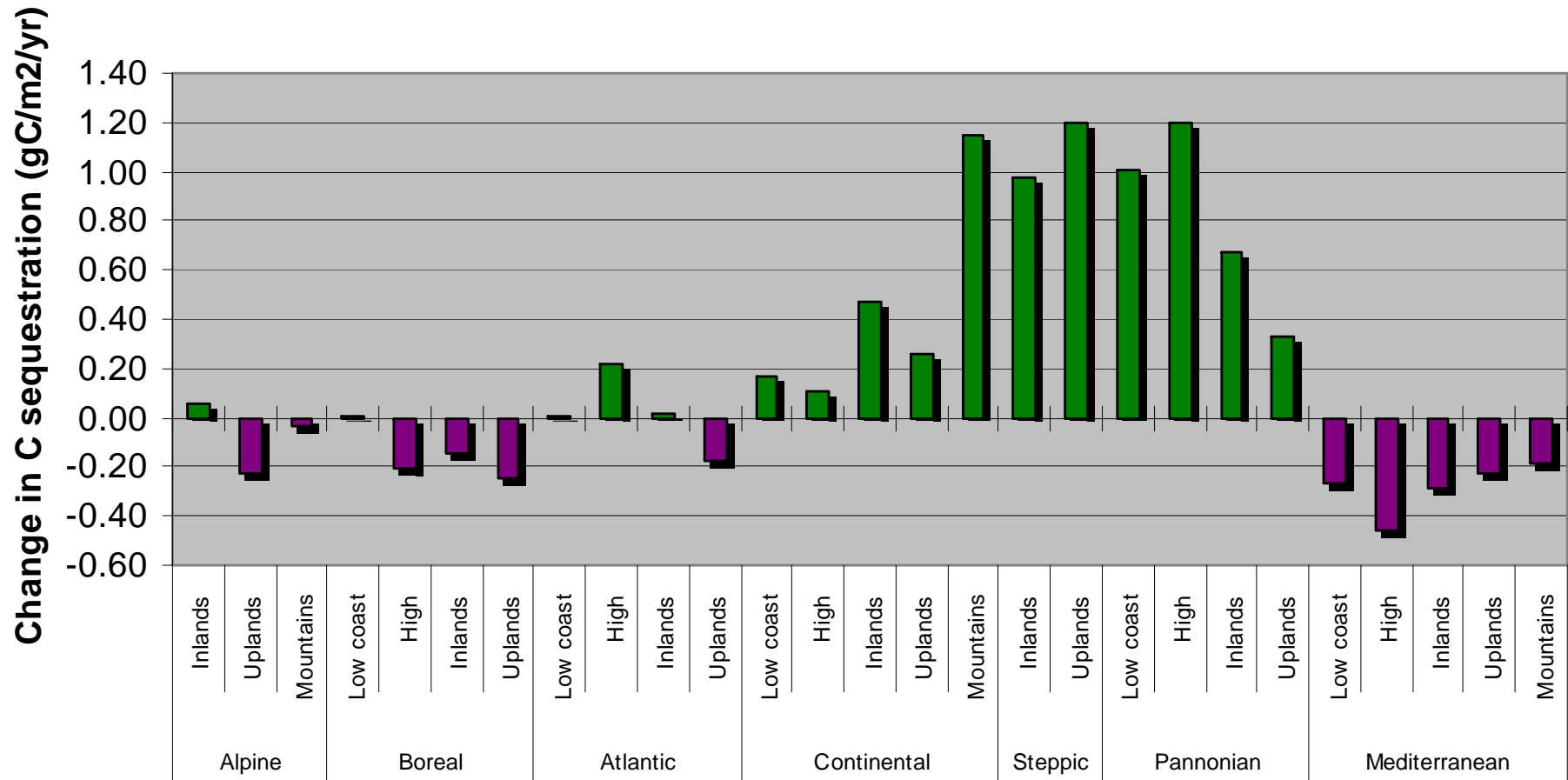
NPP * Forests * Bio-geographic regions

**DLT Forested landscape:
Cumulative difference NPP 2000 - 2008**



NPP * Intensive agriculture * Bio-geographic regions

**DLT Broad pattern intensive agriculture:
Cumulative difference NPP 2000 - 2008**



Accounts & Indexes : Water Ecosystem Accounts

Ecosystem Asset Account

Water balance

Opening stocks by ecosystems/water bodies

- Precipitations
- Natural Inflows

- Withdrawals by activities
- Net transfers between ecosystems/water bodies
- Returns to the water system from activities
- Imports/Exports and return to the sea
- Storage in the user system
- Consumption/evaporation in the use system

- Real evapotranspiration
- Changes due to natural & multiple causes
- Natural outflows

Final stocks by ecosystems/water bodies

Ecosystem Water Quality Accounts

- Water net availability
- Water bio-chemical quality
- Ecological quality of river basins

Linkage table

- Landscape ecological potential
- Carbon/Biomass productivity & storage

Sector Accounts

(Supply & Use, MFA, NAMEA, Expenditures)

- Withdrawals by activities
- Net transfers between ecosystems/water bodies
- Returns to the water system from activities
- Imports/Exports and return to the sea
- Storage in the user system
- Consumption/evaporation in the use system

In situ water usage

- Returns of waste water
- Storage in dams
- Rainfed agriculture
- Evapotranspiration by irrigation

Water Protection and Management Expenditures

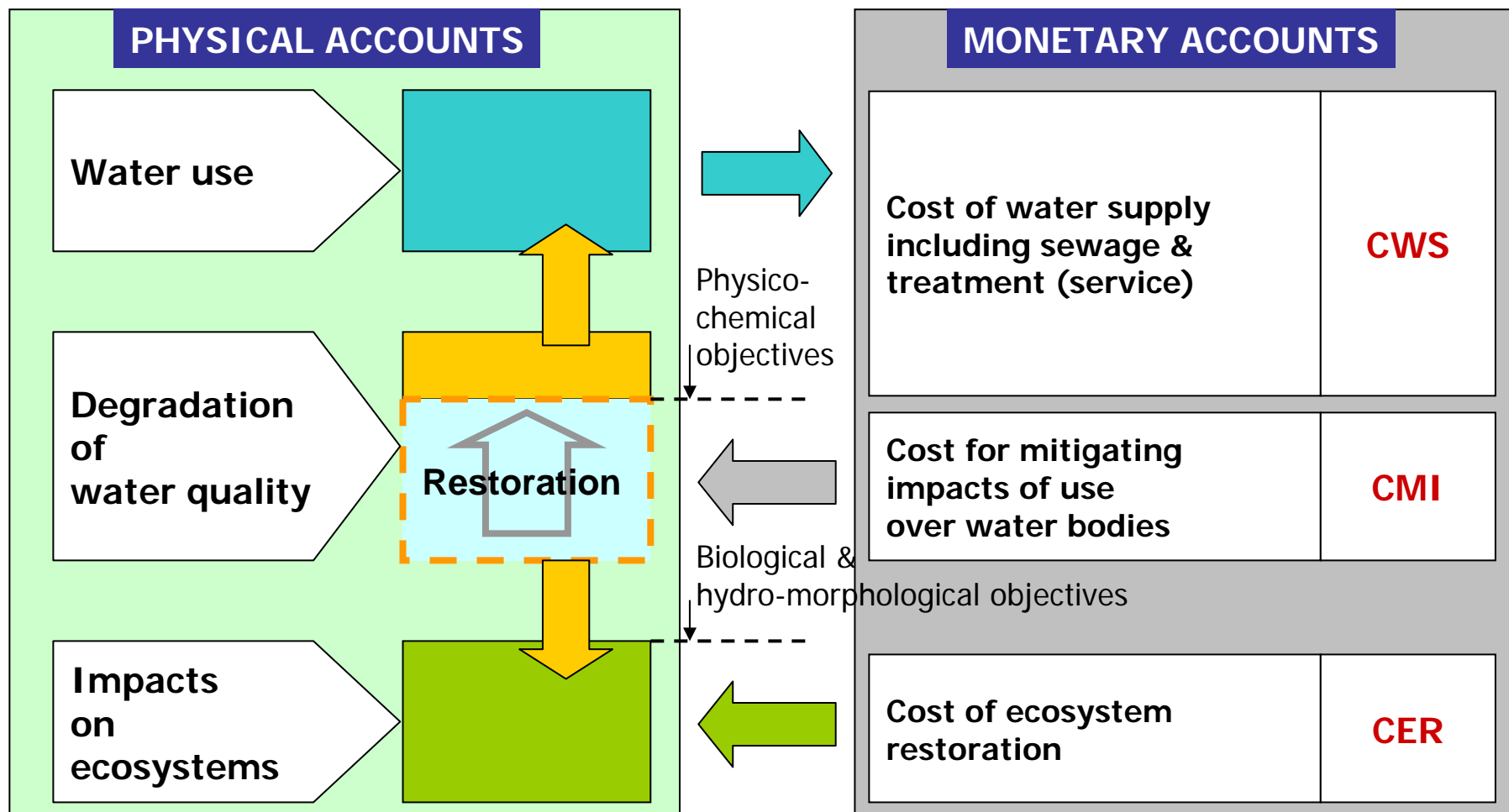
- Taxes and subsidies
- Purchase of water
- Investments

Virtual water embodied in Import-Export

- Virtual water by products



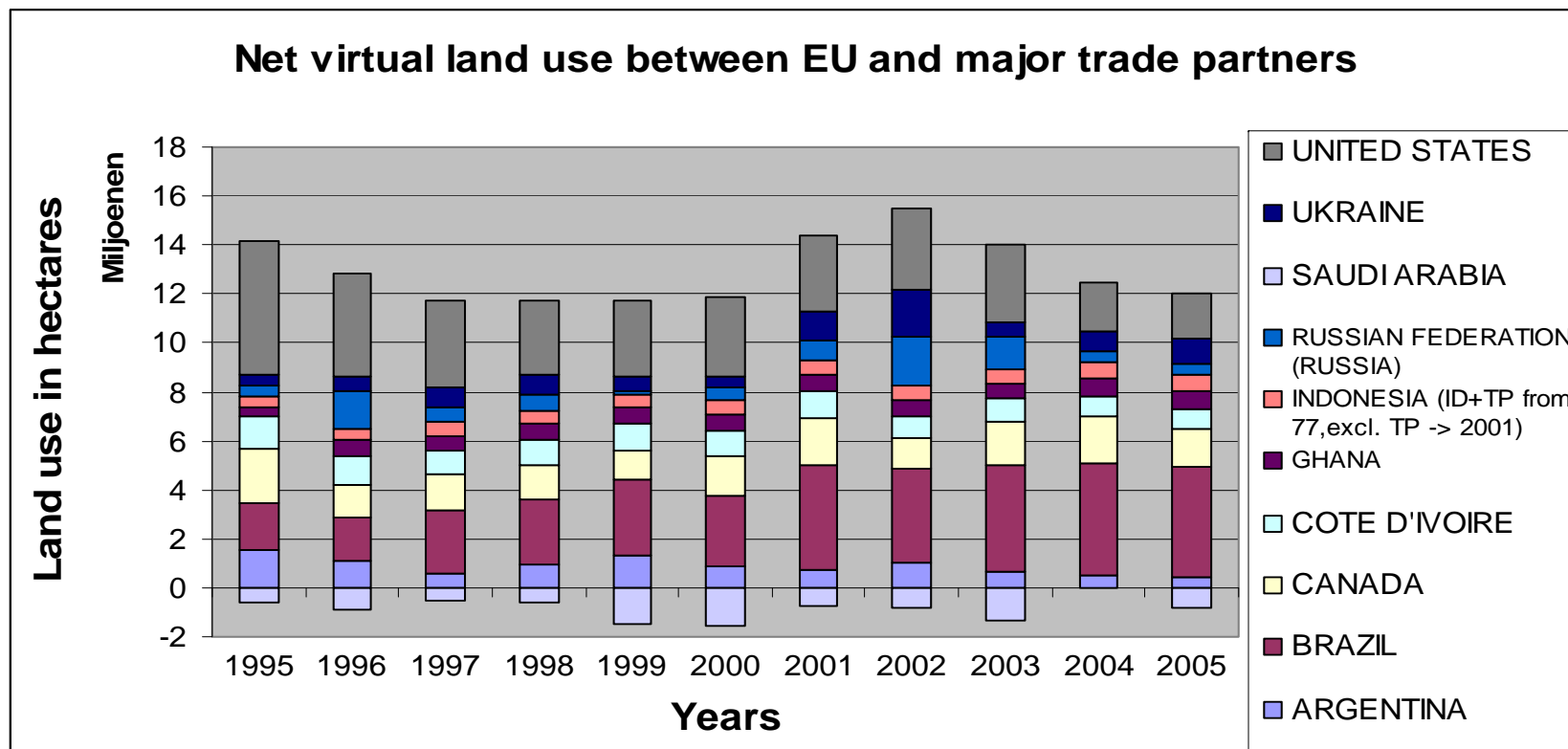
Water accounts meeting WFD requirements



Full recovery of water costs of the WFD = CWS + CMI + CER
Cost of the "effective measures" for meeting the objective of the WFD considered in the Program me of Measures of River Basin Management Plan



Virtual Land Use & Agriculture Footprints in Imports-Exports



Trends in EU virtual land flows: EU agricultural land use through international trade between 1995-2005. Manel van der Sleen, EEA 2009

Ecosystem services

Physical accounts at the macro and micro levels

Valuation on a case by case basis

Work on CICES



CICES
Towards a Common International
Classification of Ecosystem Services

European Environment Agency 
Discussion hosted on behalf of the EEA

www.cices.eu

Summary of Discussion up to 1st December 2009
Roy Haines-Young and Marion Potschin (e-forum moderators)

Fast track implementation: as simple as possible, as accurate as necessary

Based on QA/QC existing monitoring data and statistics

- Mine/sample monitoring networks (space, in situ...)
- Verification, counter-expertise to be considered from the start because of foreseen use in policy making, legal cases, money allotment
- Joint use with National Accounts
- Extensive use of statistics: agriculture, demography, transport, energy, trade...

Spatially explicit

- Hot issues not concealed within national average values
- Acceptability of global messages by local stakeholders
- Relevant geographical units: countries, regions + catchments, socio-ecological systems
- Standard EU 1 km² grid as a tool for geographical integration
- Consider EU within the Global Environment

Time relevant

- Hot issues not concealed within annual average values: work from frequent monitoring when necessary
- Results delivered in time for policy making: at least for annual budgetary debates
- Nowcasting is part of the quick start package (e.g. EEA “QuickScan” tool)



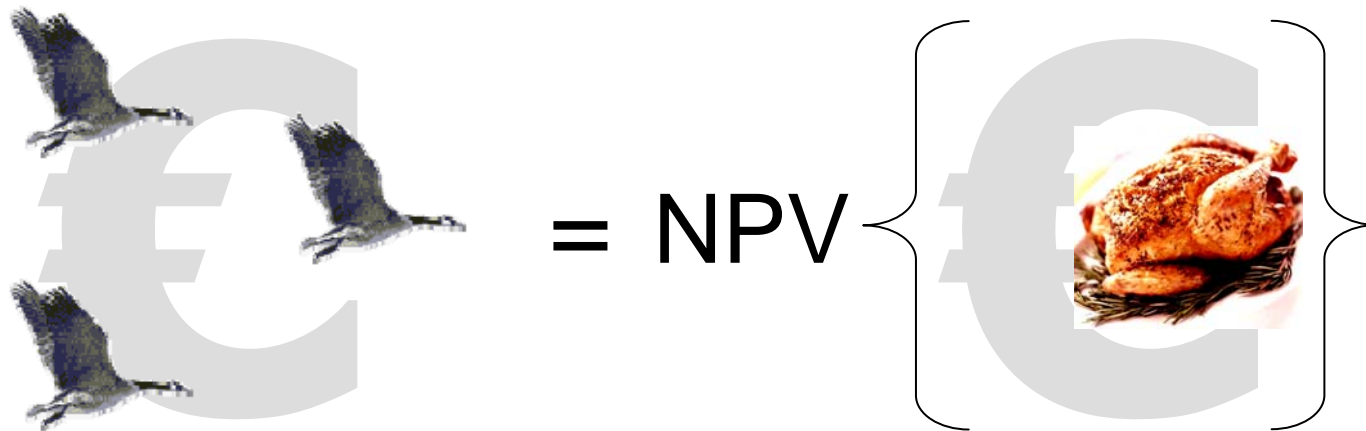
2 approaches to ecosystem economics:
*maximisation of benefits (the **financial value of nature**)*
vs. maintenance of options (the **quantity*quality of nature**)

- **Maximisation of benefits from nature** → measurement of benefits & losses (e.g. TEEB's COPI study) or of ecosystem services value entangled into commodities or real estates (WB current proposal for SEEA revision). Requires measurement and **valuation of ecosystem services & ecosystem assets**. Ecosystem depreciation calculated as the difference in ecosystem asset values at two dates. Accounting prices: depends on services and purposes (market prices, production functions, contingent values, assets as NPV of future benefits = financial approach) → *relevant for planning, project impacts assessments (CBA)*.
- **Maintenance of options (ecosystems potential of delivering services)** → measurement of ecosystem capital degradation in physical units (quantity*quality) & **valuation limited to (non-paid) remediation costs**. Equivalent to the calculation of capital maintenance cost (Consumption of Fixed Capital). **No valuation of ecosystem services nor of ecosystem assets**. Accounting prices: derived from observed remediation costs (statistics) → *relevant for National Accounts, as well as for business accounting (options and risks)... and for CBA in addition.*



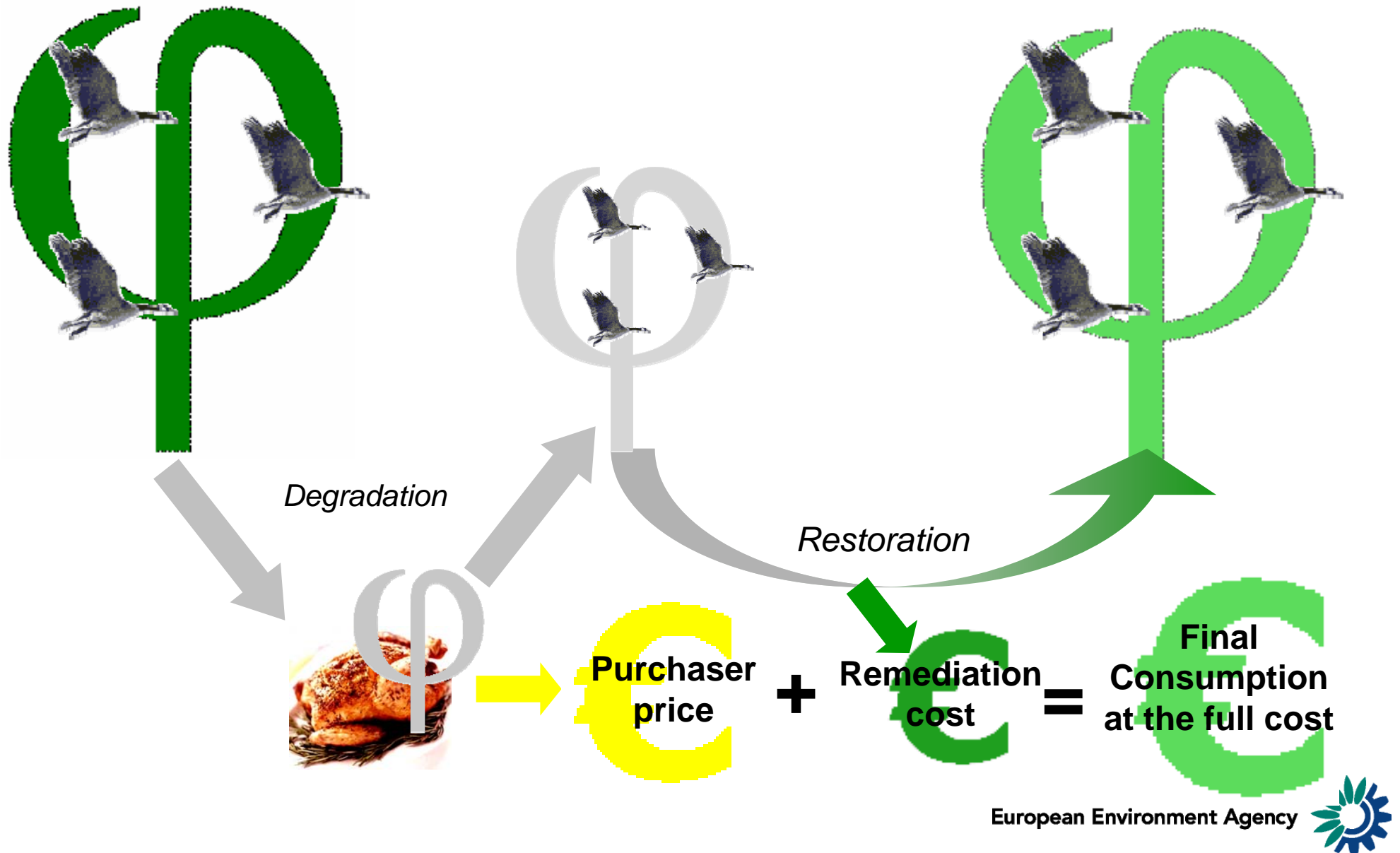
“Economic Theory”: asset value = financial value =
NPV of expected future benefits

Financial value of natural assets = “Net Present Value” of expected future benefits



If surveys or econometric models tell how much homo economicus is willing to pay for ecosystem services, there is no need to monitor Nature!

Ecosystem capital account: asset "quantity*quality"



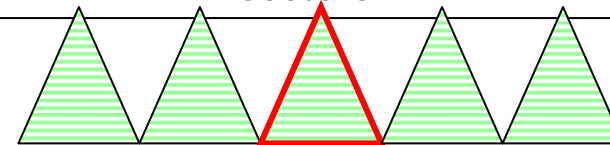
Ecosystem Accounting: Green National Accounts and Costs-Benefits Analysis

National Accounts =
the macro-economic picture
adjusted for natural capital depreciation

Benefits & Costs Assessments =
extended accounts for projects,
sectors...

Maintenance/restoration costs

Top-Down, Collective preferences, Multi-criteria decision (economic benefits, costs, social values, long term targets...), Consumption of Ecosystem Capital



Ecosystem public good protection (all services)	
Ecosystem Stocks & Flows	Ecosystem Health
Land cover Biomass/Carbon Soil Species/populations Water catchments Sea Atmosphere	Vigour Organisation Resilience Autonomy Support to healthy populations
Service n	Service n value ??
Service 5: e.g. existence	Service 5 value ?
Service 4: e.g. water regulation	Service 4 value
Service 3: e.g. eco-tourism	Service 3 value
Service 2: e.g. fish provision	Service 2 value
Service 1: e.g. timber provision	Service 1 value

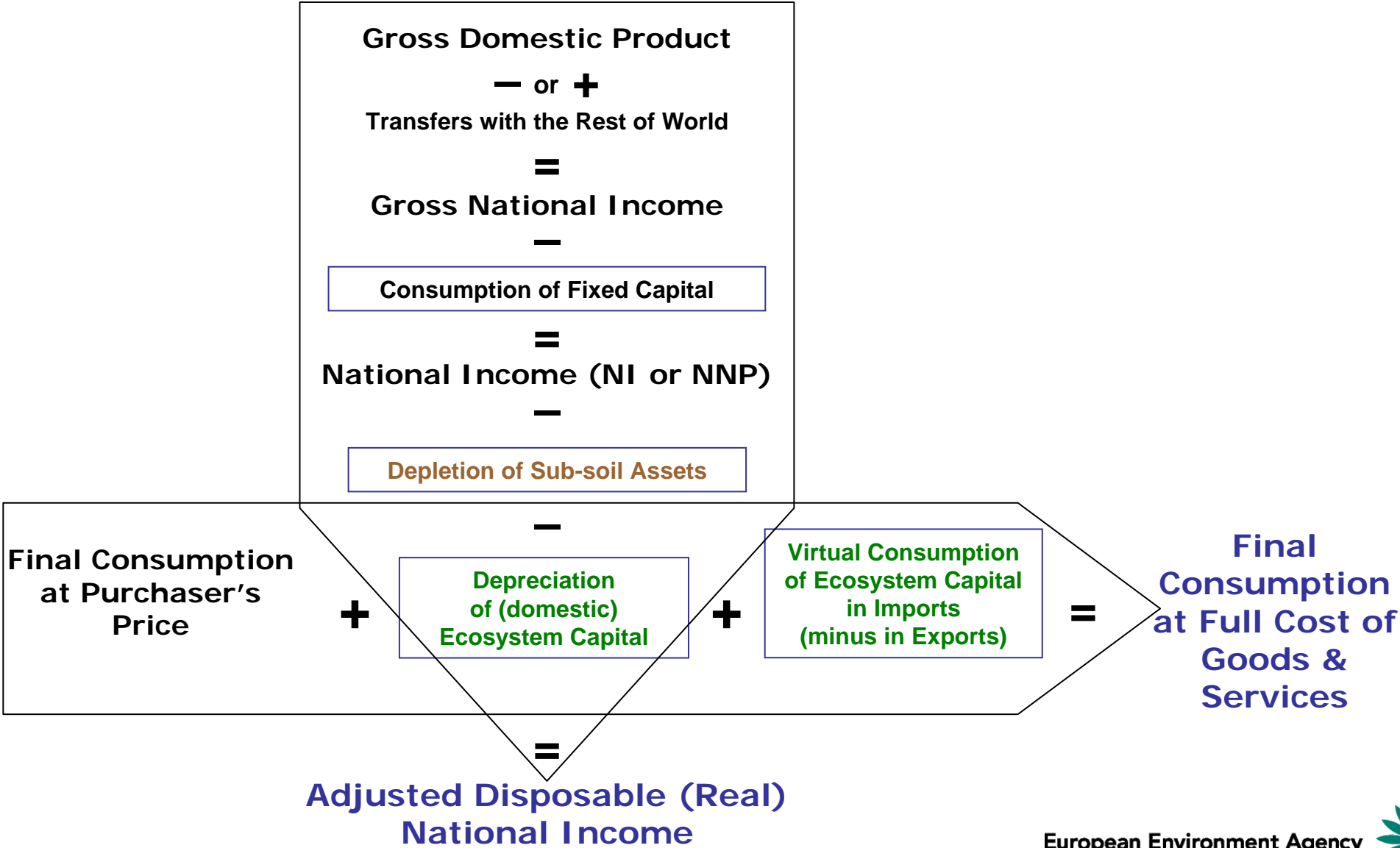
Ecological Tax
or/
and
Tradable Offset
Certificates
(fair use of
ecosystem public
good)



- Operation costs E.S n
- Operation costs E.S 5
- Operation costs E.S 4
- Operation costs E.S 3
- Operation costs E.S 2
- Operation costs E.S 1

Ecosystem Services values
Bottom-Up, Individual preferences, Costs-Benefits Analysis,
Market and Shadow prices, General equilibrium modelling

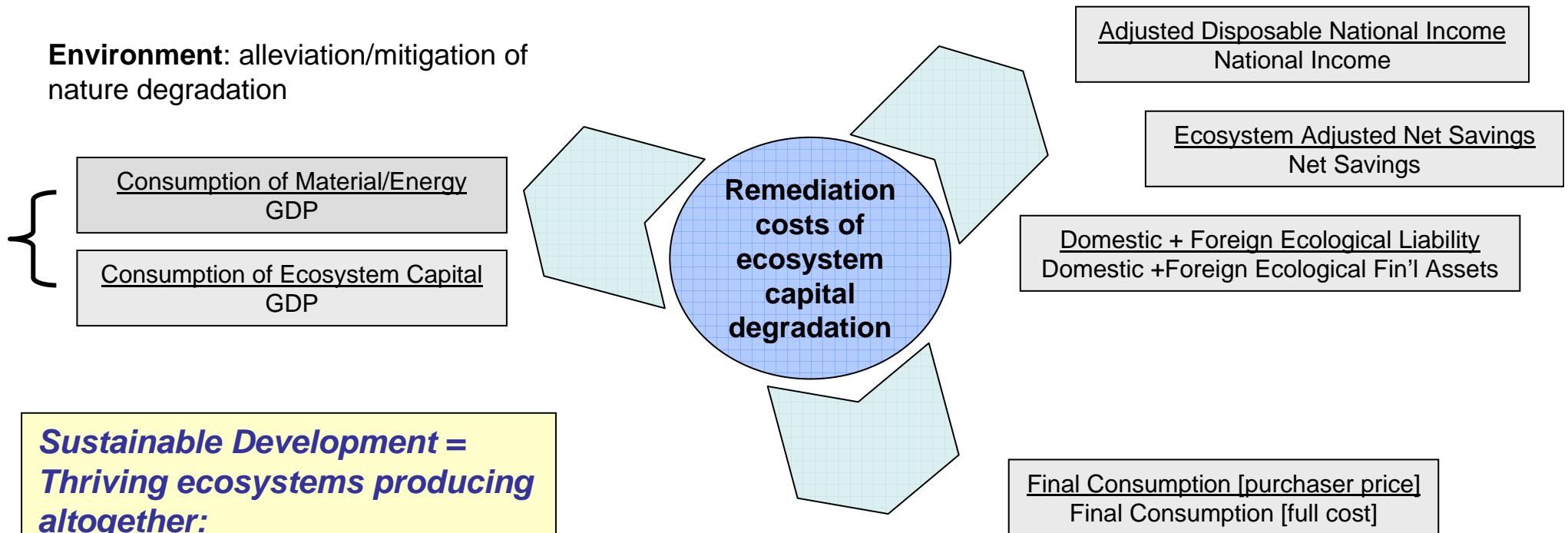
Consumption of Natural Capital & Adjustment of National Accounts for “under-investment” ↓ and “over-consumption” →



[future] Integration with National Accounts aggregates

Economy: capital maintenance

Environment: alleviation/mitigation of nature degradation



Sustainable Development = Thriving ecosystems producing altogether:

- *economic resources*
- *carbon*
- *biodiversity*
- *clean air, clean water*
- *options for the future (“development as freedom” – A. Sen)*

Social: sustainable consumption, new skills and jobs



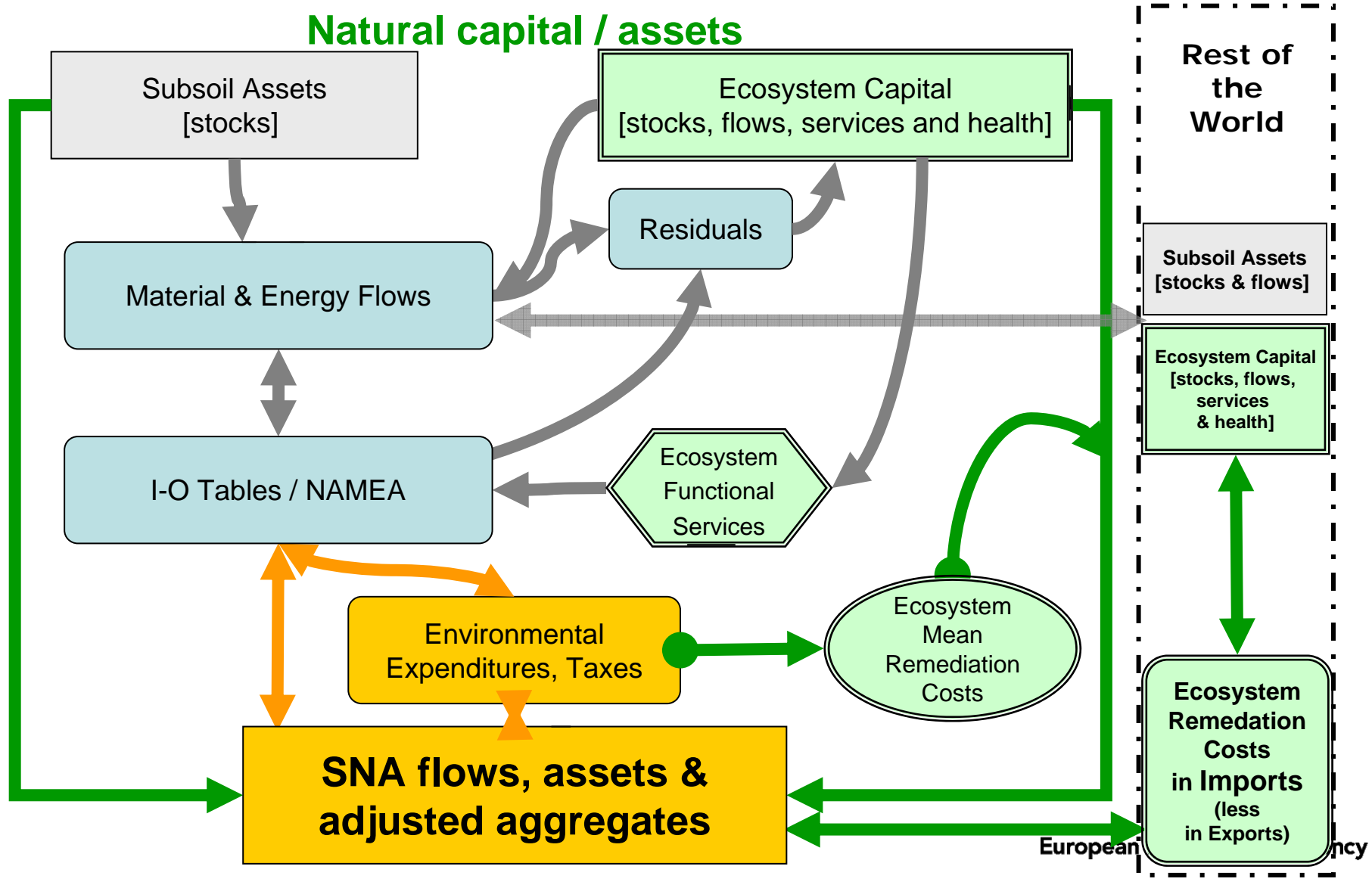
Integration within SNA/SEEA framework

Physical flows

Monetary flows

Natural Capital Depreciation

Natural capital / assets



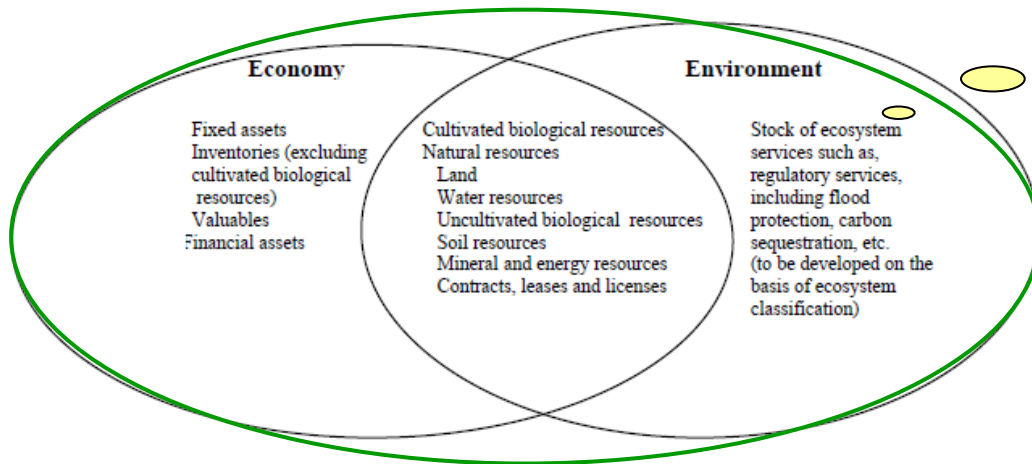
SNA extension vs. interacting systems

G. Questions to the London Group

Q1: Do you agree that the classification of assets presented in Volume 1 should take the economy as the system of reference and thus structure the classification as an extension to the 2008 SNA asset classification?

Current proposal

Figure 2. Schematic presentation of the coverage of the classification



No

What is a stock of services in physical units ???

Complete environment asset accounts exist **only in money**
SNA asset classification revamped

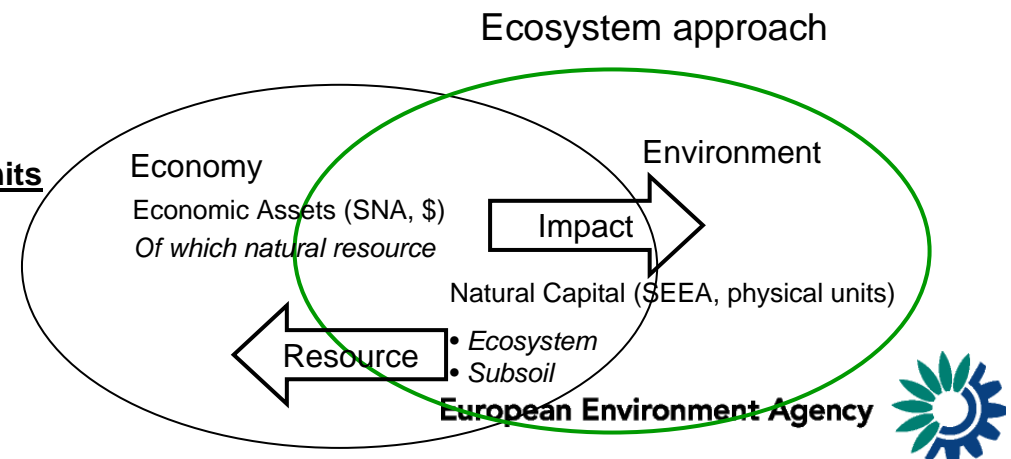
Valuation: Depletion + "Stocks of ecosystem services" to be surveyed (WTP) or disentangled within market prices (commodities, real estates...)

Complete environment asset accounts **only in physical units**

SNA asset classification untouched

Valuation:

- ecosystem: only (non-paid) remediation costs
- subsoil: income maintenance cost



Ecosystems: why resource depletion should not be separated from degradation...

Extract from a paper in Financial Times of 26 Nov. 2009 explaining why banks should get inspiration from ecosystems...

FT .com
FINANCIAL TIMES

COMMENT
ANALYSIS

Organic mechanics

By Clive Cookson, Gillian Tett and Chris Cook
Published: November 26 2009 21:43 | Last updated: November 26 2009 21:43



“Fisheries management has interesting parallels with financial regulation, says Lord May. For the past 50 years fish stocks have been managed on a species-by-species basis that aims to maximise the “sustainable yield” of individual fish such as cod or herring – an approach analogous to regulatory risk analysis that focuses on individual banks. But with the collapse of some important fishing grounds, marine scientists are coming to recognise that what really matters is the wider ecosystem and environmental context. You cannot protect cod, for example, without considering the sand eels, whiting, haddock, squid and other species on which cod feed.”