Overview of forest accounting

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Turkey, March 10, 2015

Outline

1. The policy agendas at national and global levels
2. Forest accounts in the context of NCA.
3. The accounting framework
4. Filling the tables
5. Where do we get the data from?
6. Valuation
7. A comment on data challenges

The forest policy agendas

National agendas

- Enhance revenues from forests managed as forests (REDD+)
- Include forest-based income in national income accounts
- Value forests for food security. Recognize forest-based ecosystem services as input to agriculture.
- Increase forest productivity (green infrastructure)
- Increase forest related activities productivity
- Value forests for adaptation
- Ensure that appropriation of forest resources is legal
- Ensure equitable distribution of forest resources
- Community forest management

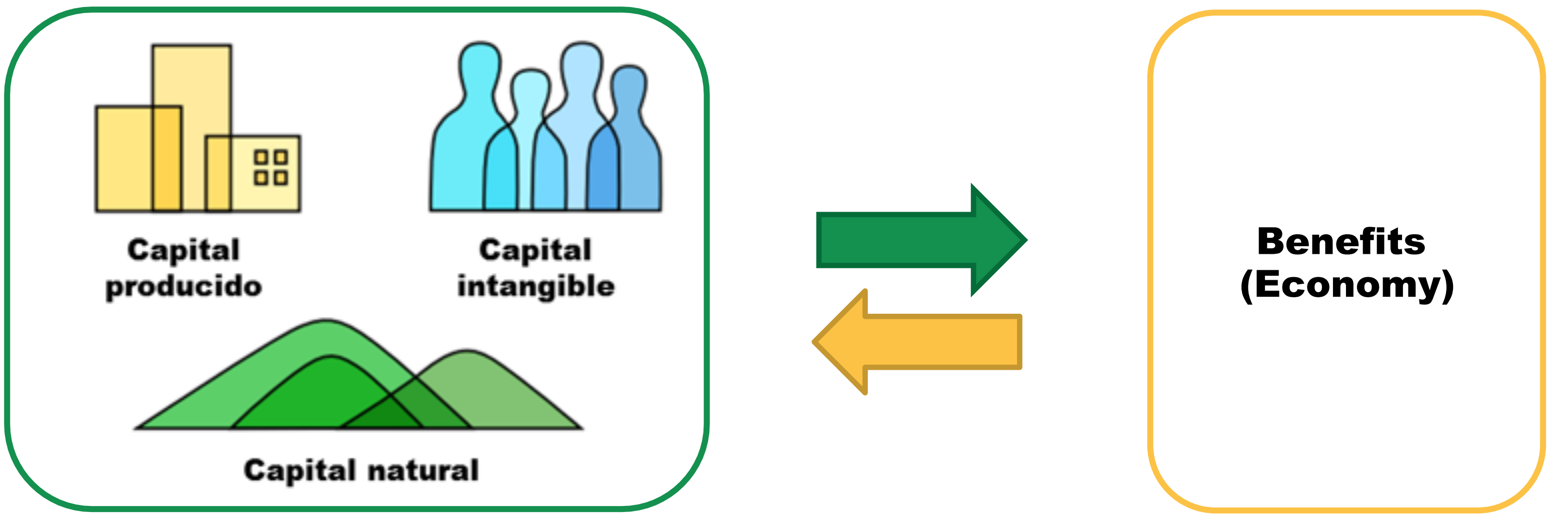
Global agendas

- Mobilize finance for REDD+ and adaptation
- Support voluntary private sector commitments to responsible sourcing
- Remove subsidies for unsustainable biofuels
- Implement other demand-side policies to provide incentives for legal and sustainable production
- Legality assurance initiatives
- Green procurement programs

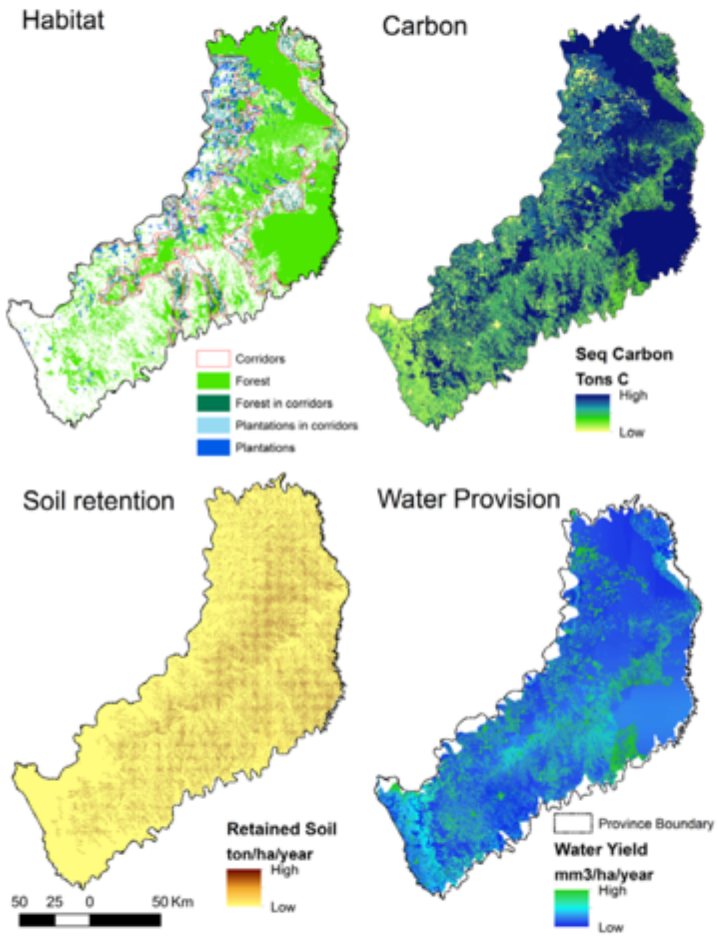
Forests in the context of NCA

Why NCA?

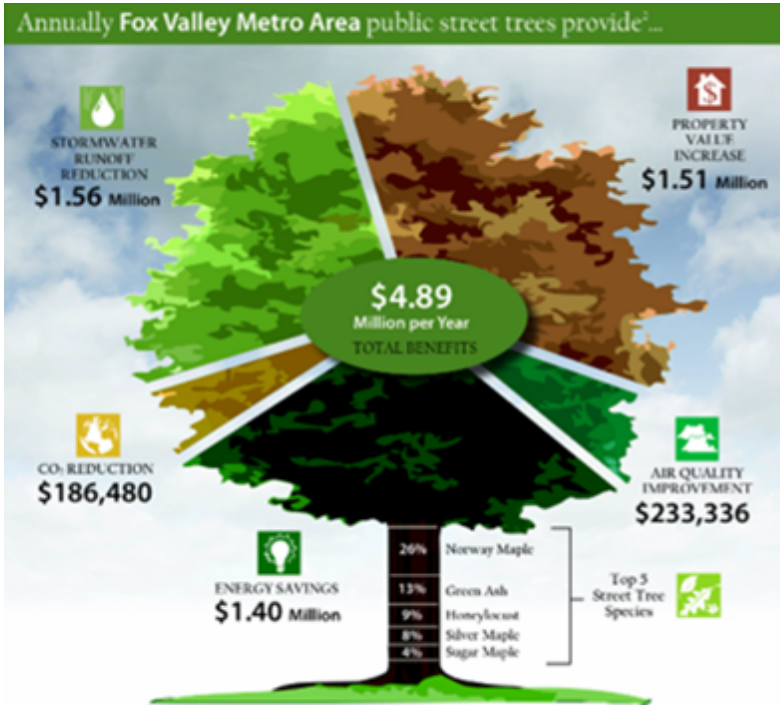
Total wealth **Flows of capital**



Why forests? Why trees?



Misiones, Argentina and
Fox Valley Metro Area, USA



What do we want to measure and how?

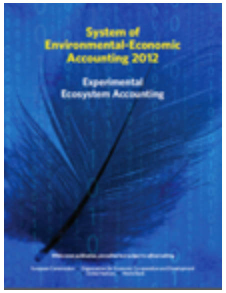
SEEA Central Framework

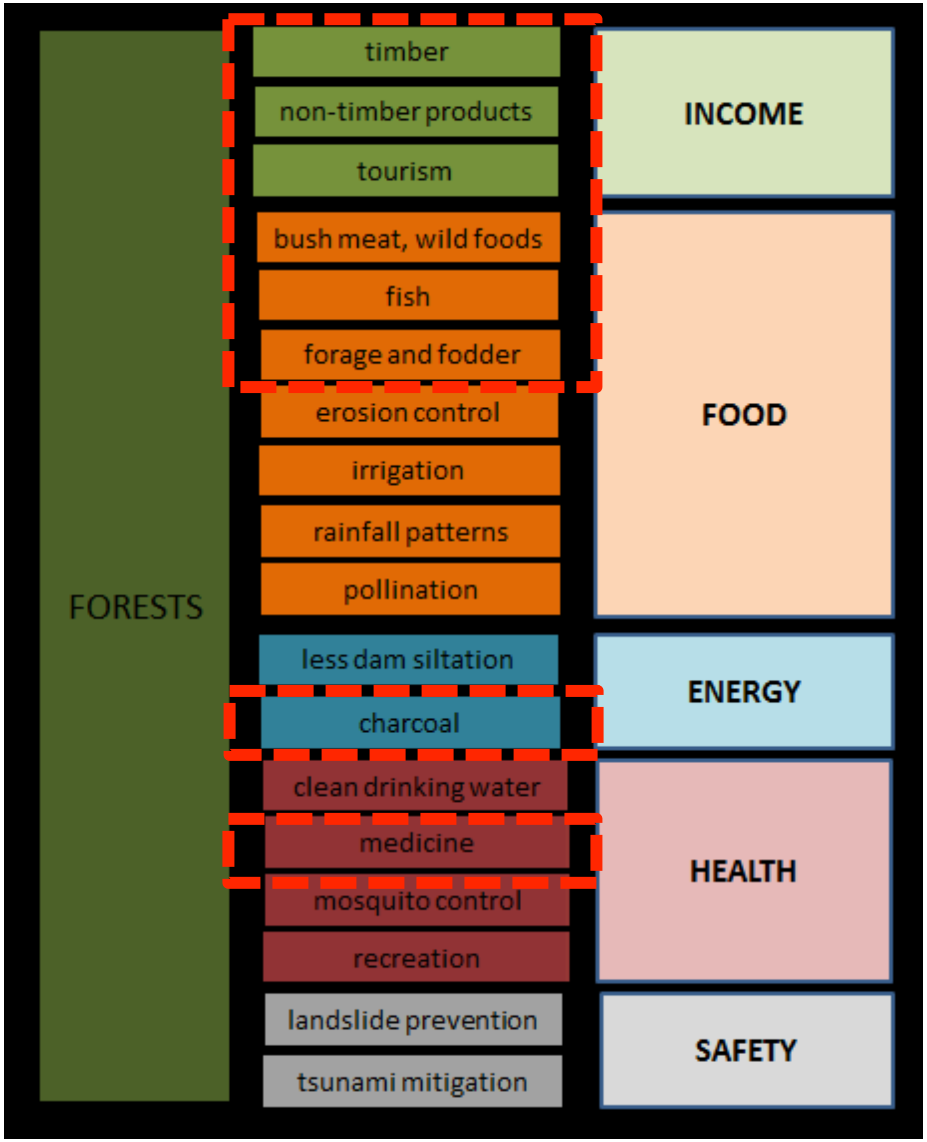
More consensus

Two complementary perspectives

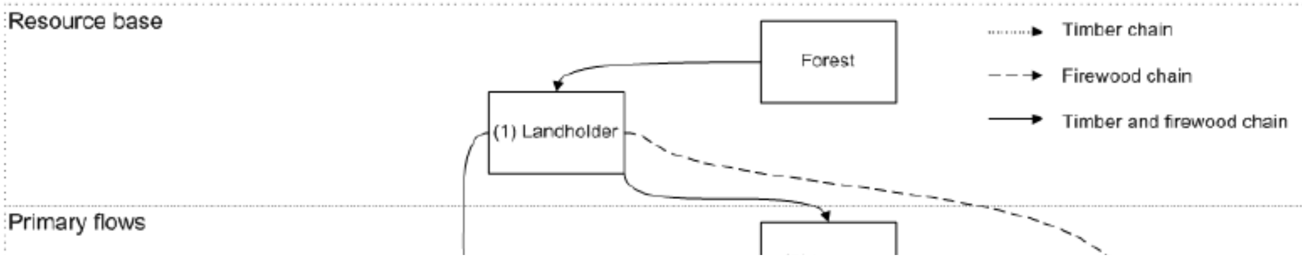
Less consensus

SEEA Ecosystem Accounting





The accounting framework



Type of logging and primary extraction	Control type, variables, data type and sources Controlled (c)			Non-controlled (n)			Total logging (t) variables, data types and sources		
Clearcutting									
Firewood	FCc	D	INAB data	FCn	R	INAB reports ratio	FC	E	Sum of the parts

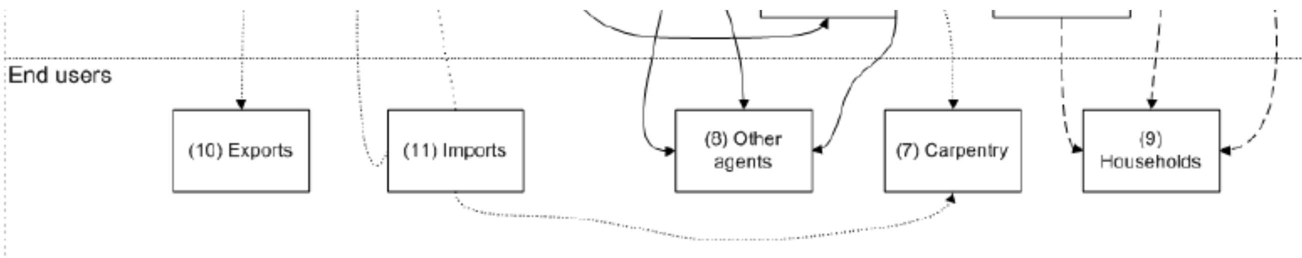
$$\mathbf{Ln = L - Lc} \quad \text{(a)}$$

$$\mathbf{(Cn + Sn) = (Ct + St) - (Cc + Sc)} \quad \text{(b)}$$

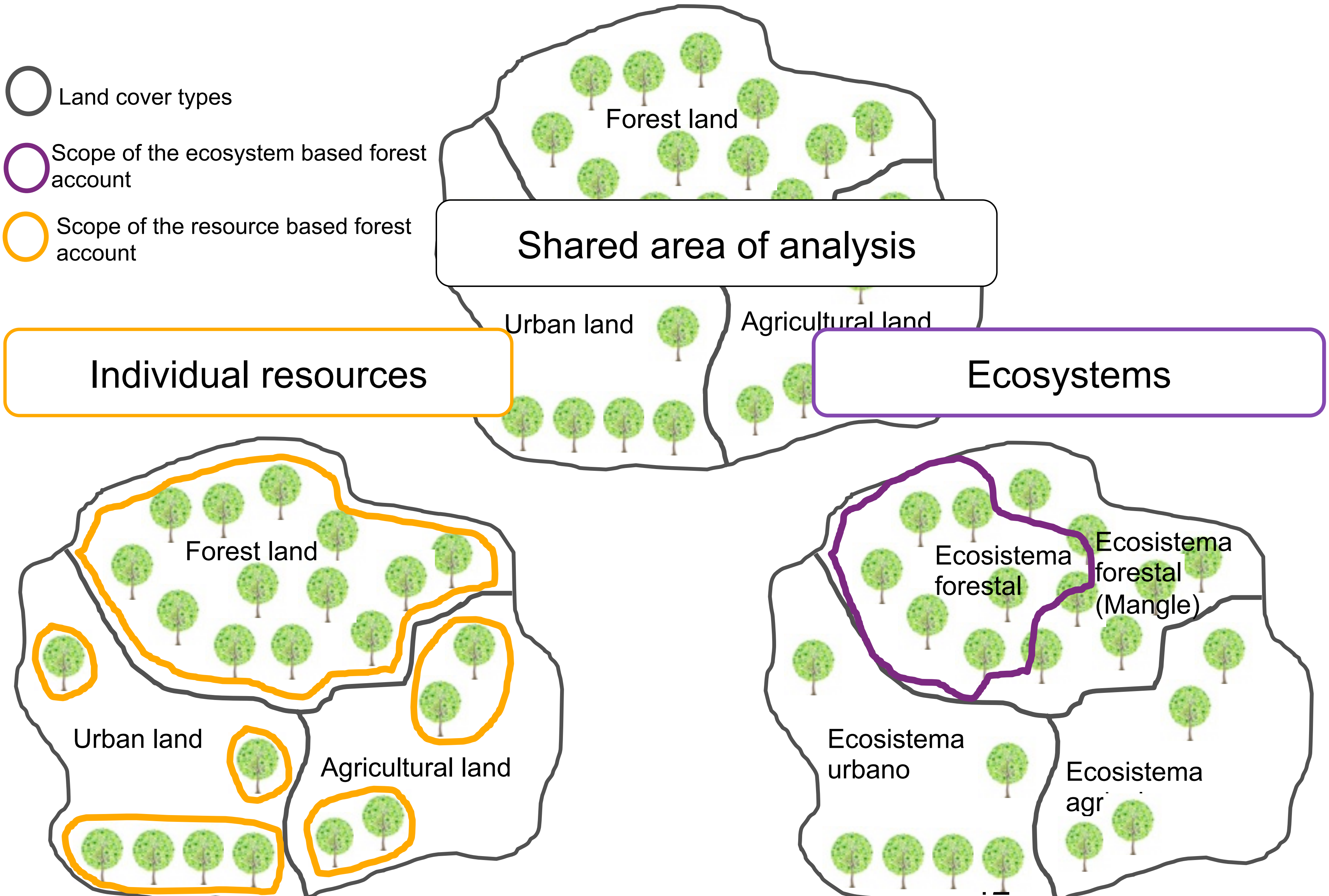
$$\mathbf{[(FCn + TCn) + (FSn + TSn)] = [(FCt + TCt) + (FSt + TSt)] - [(FCc + TCc) + (FSc + TSc)]} \quad \text{(c)}$$

$$\mathbf{Fn + Tn = Ft + Tt - Fc + Tc} \quad \text{(d)}$$

D = Direct source, O = Own estimations (survey, enterview or gis), E = Estimated as residual from identity or as the sum of the parts, R = Ratios obtained from direct sources



The framework



General structure of the forest accounts – ASSET ACCOUNTS

❖ resource by resource

	Type of timber resource		
		Natural timber resources	
	Cultivated timber resources	Available for wood supply	Not available for wood supply
Opening stock of timber resources			
Additions to stock			
Natural growth			
Reclassifications			
Total additions to stock			
Reductions in stock			
Removals			
Natural losses			
Catastrophic losses			
Reclassifications			
Total reductions in stock			
Closing stock of timber resources			

Monetary units

Type of timber resources	
Cultivated timber resources	Natural timber resources Available for wood supply

❖ Cultivated: management practices constitute a process of economic production

❖ Natural: where the previous doesn't apply.

❖ Not AFWS: due to physical, economic or regulatory reasons

❖ forest asset (forest ecosystem unit)

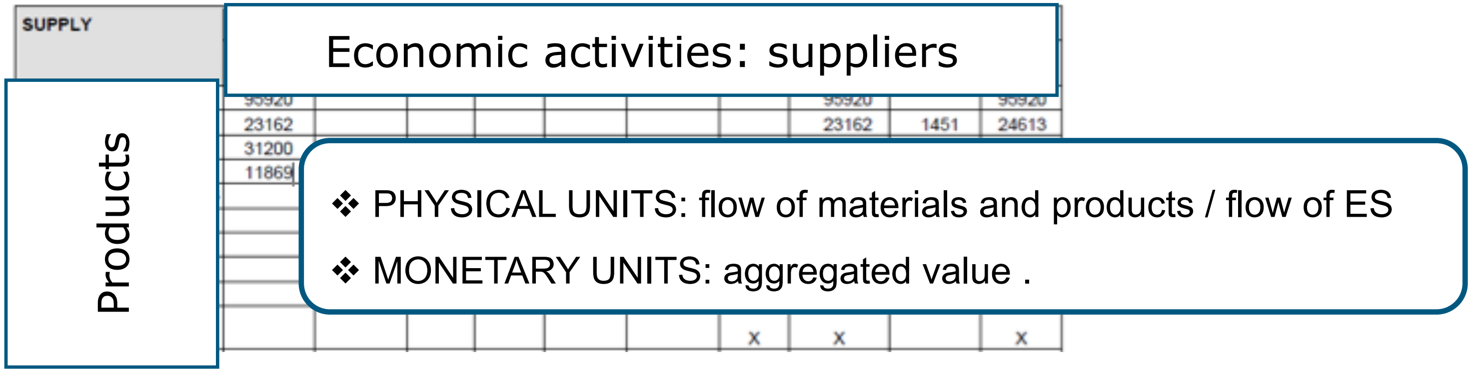
	Changes of ecosystem condition				
	Vegetation	Biodiversity	Soil	Water	Carbon
Opening condition					
Improvements in conditions					
Reduction in condition					
Closing condition					

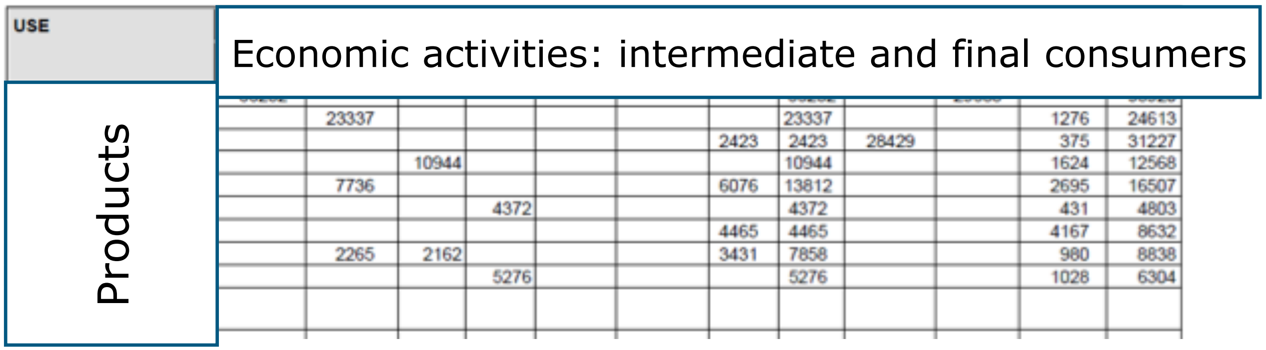
Monetary units

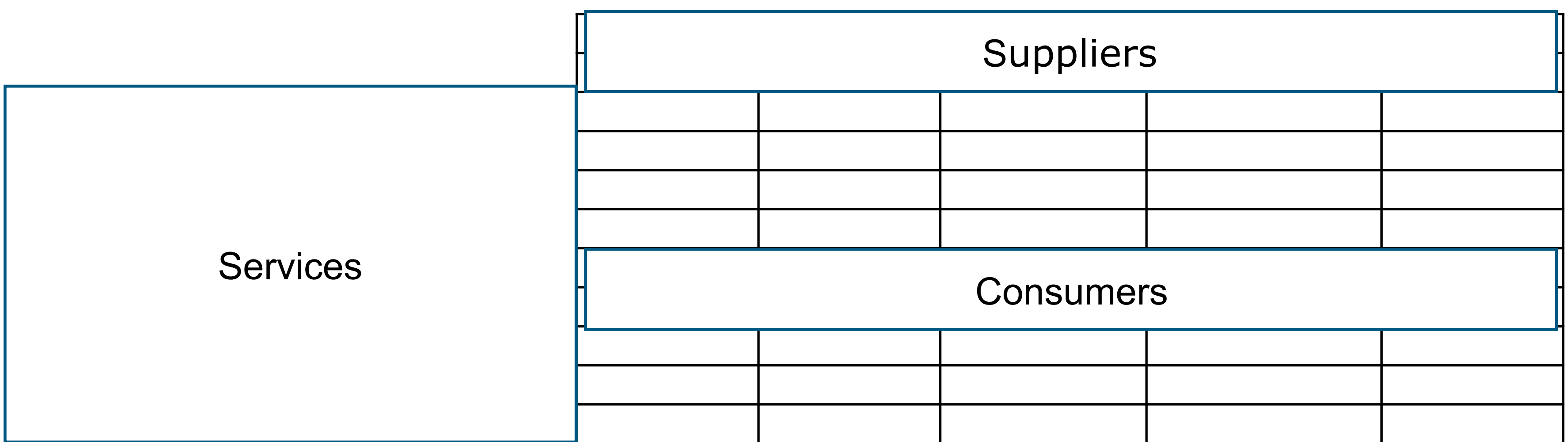
	EAU or LCEU
Opening stock	
Additions to stock	
Regeneration-natural	
Regeneration. human	
Total additions to stock	
Reductions in stock	
Extraction and harvest	
Catastrophic losses	
Total reductions in stock	
Revaluations	
Closing stock of ecosystem assets	

General structure of the forest accounts – FLOW ACCOUNTS

Table 6.9: Physical supply and use table for wood products, France, 1999
(timber, logs and wood in 1000 cubic metres; pulp, paper and waste in 1000 tons)

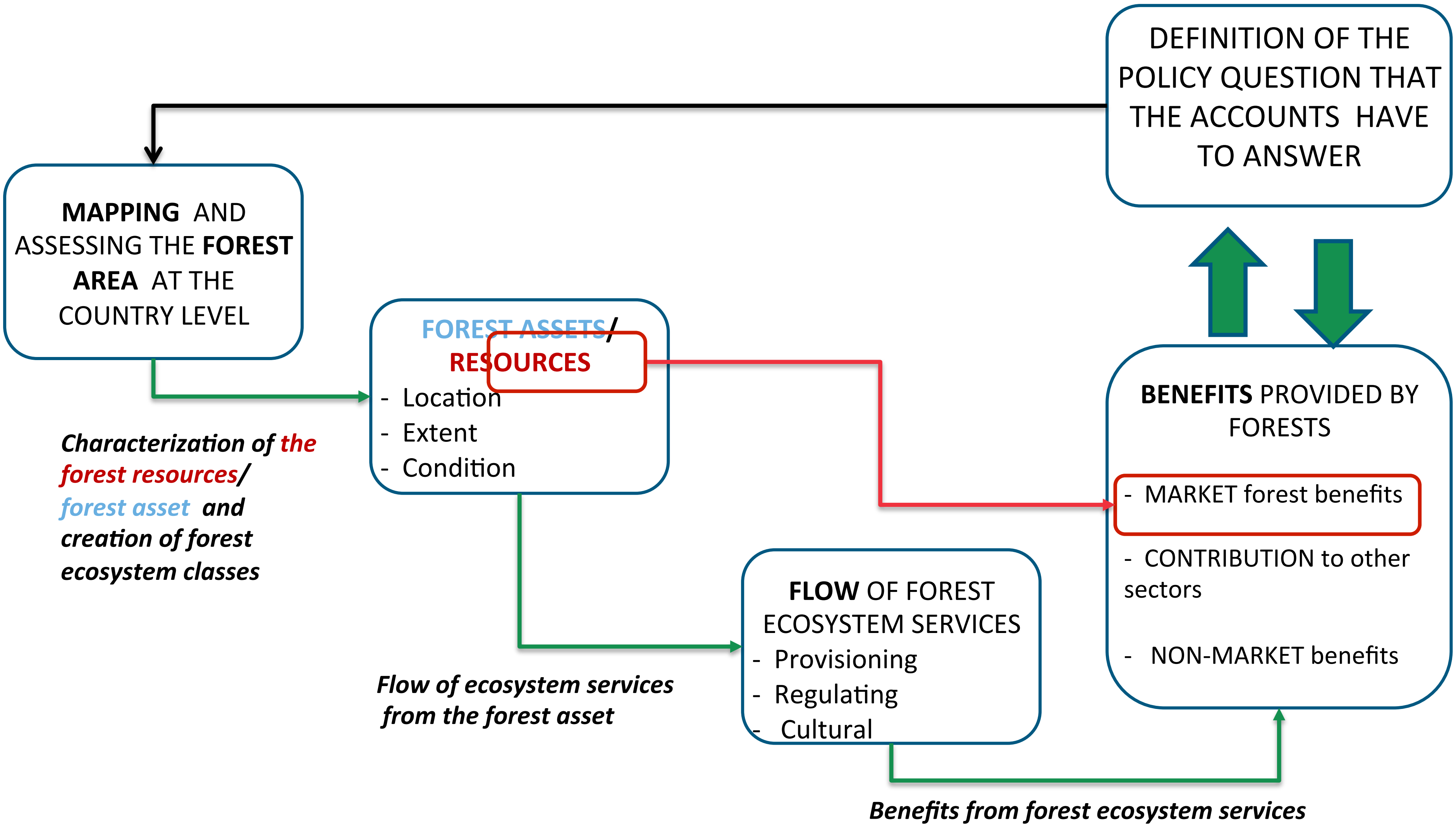






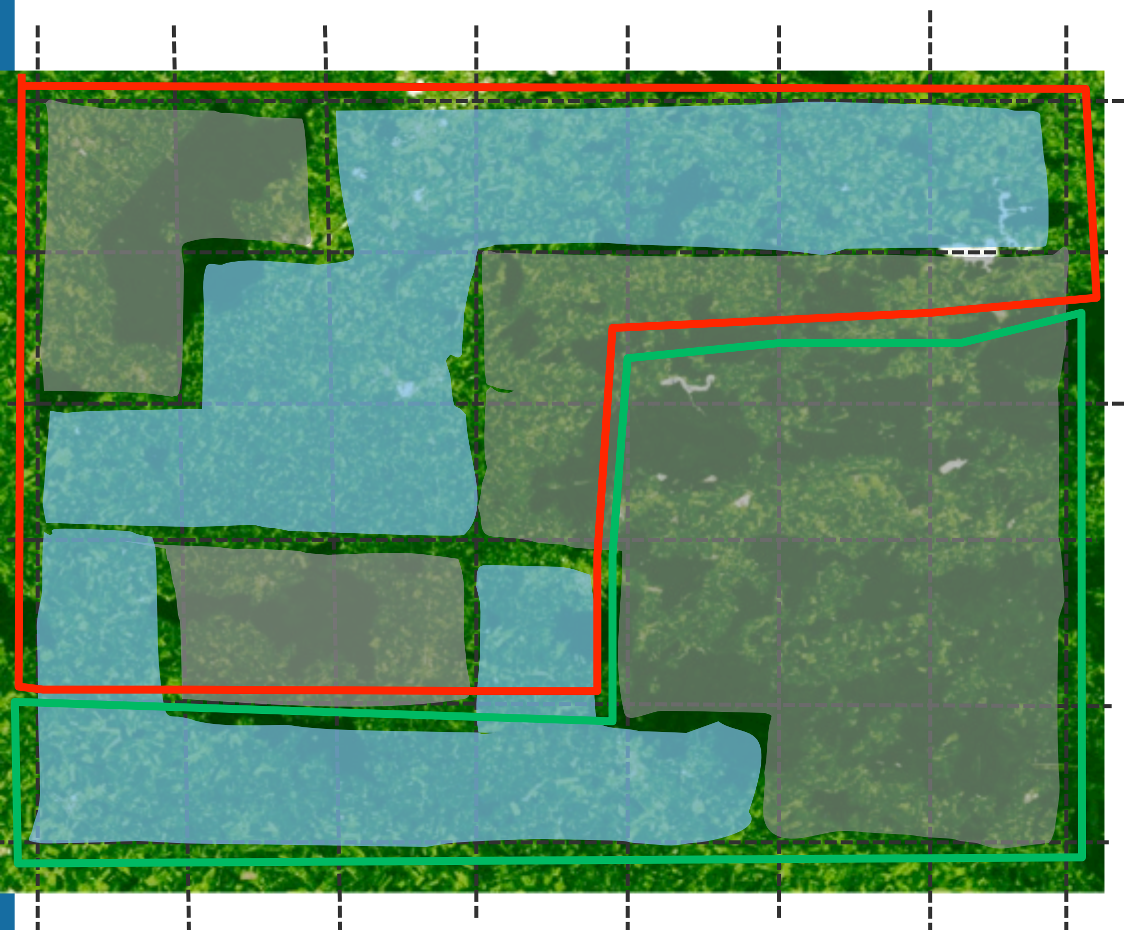
Filling the tables

General steps to compile the accounts



Mapping of the forest area & ecosystems

Steps proposed by the EEA to define units to account for forest assets
- Basic Statistical Units



BSUs: Basic Statistical Units
Min grid resolution info

LCEUs Closest to ecosystems

Broadleaved primary forest

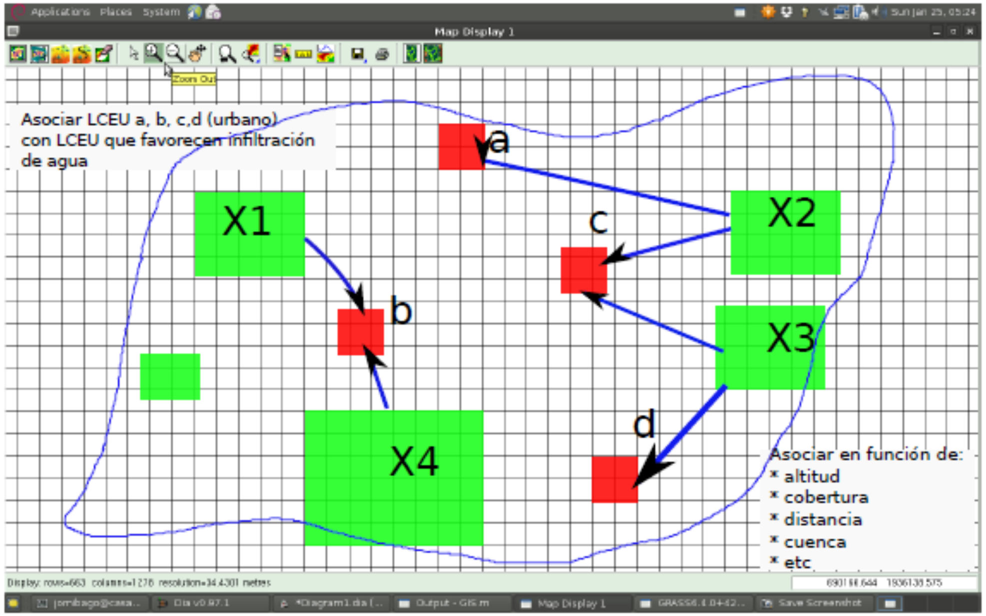
Broadleaved secondary forest

EAUs Long-term monitoring

Not protected forest

Natural park (protected forest)

Spatial relationships between BSU



hacia	desde	flujo
a	X2	f1
b	X1	f2
b	X4	f3
c	X2	f4
c	X3	f5
...	...	...

Flujo total $= \sum$ *flujo*
Flujo hacia a = *select sum(flujo) from table where hacia=a*

Flujo desde X1 = *select sum(flujo) from table where desde=X1*

Indicators to characterize the forest ASSET

Forest land

Opening stock of forest and other wooded land	
Additions to stock	
• Afforestation	• Afforested area (m^2) • Density (trees/ha)
• Natural expansion	• Area (m^2)
• Reforestation	• Reforested area (m^2) • Density (trees/ha)
Reductions in stock	
• Deforestation	• Deforested area (m^2)
• Natural regression	• Area (m^2)
Closing stock of forest and other wooded land	

Standing timber

Additions to stock	
• Growth	• Natural growth of timber volume (m^3)
• Timber in young trees (not considered in previous accounting period)	• Volume in trees recently classified as timber (m^3)
Reductions to stock	
• Tree harvest	• Havested timber during the period (m^3)
• Tree losses	• Losses in timber volume due to fires, disease, catastrophic events, etc (m^3)
Closing stock of standing timber	

Condition of forest ecosystems

Defoliation	• Litter fall measurements (kg) • LAI-based indicator
Forest health	• Presence of pathogens and plagues • Status of bark • Mortality rate
Forest fires	• Burnt area
Fragmentation	• % of forest area in categories (core, interior, connected, patchy) • Effective mesh size • Size of forest fragments • Length of fragment edge
Aerosol pollutants	• Ozone concentration • Nitrogen deposition • Sulfur deposition

Indicators to characterize the forest FLOWS

Provisioning services

Timber	• Harvested timber (m^3; m^3/ha)
Firewood/charcoal	• Volume (m^3)
NTFP	• Volume (m^3); Weight (kg; ton); Number of units
Genetic material	• Composition • Diversity
Grazing	• Number of animals in silvo-pastoral system • Weight units of produced animal product • Energy uptake

Regulating services

Atmospheric/climate regulation	• Net carbon storage (gains-losses)
Water flow regulation	• Canopy cover fraction in recharge areas • Average daily and annual water flow in rivers • Cover in strategic locations (floodplains, steep slopes, wetlands, etc)
Water cycle regulation	• BOD • Turbidity in waterways
Pollination	• Abundance and variety of pollinator species
Soil retention and formation	• Erosion rates • Cover (or bare soil) fraction in vulnerable areas • Turbidity in waterways

Cultural services

Division	Group	Class	Indicators
Physical and intellectual interactions with biota, ecosystems, and land-/seascapes	Physical and experiential interactions	Experiential use of plants, animals and land-/seascapes in different environmental settings. And physical use of land-/seascapes in different environmental settings	• Distribution of wildlife/emblematic species associated with forest • Important bird areas associated with forest • Area of forest accessible for recreation • Number of visitors • Number of hunters • Ecotourism operators • Area of forests accessible for hunting
	Intellectual and representative interactions	Scientific, educational, heritage, cultural, entertainment and aesthetic	• Citations, distribution of research projects, educational projects, number of historic records • Number/value of publications sold
Spiritual, symbolic and other interactions with biota, ecosystems, and land-/seascapes	Spiritual and/or emblematic	Symbolic and sacred and/or religious	• Distribution of sites of emblematic plants/forest • Number of sites with recognised cultural & spiritual value • Number of visitors
	Other cultural outputs	Existence and bequest	• Distribution of important areas for forest biodiversity and their conservation status • Condition of forest-associated priority species on habitat and birds directives • Distribution of sites with forest designated as having cultural values • Number of visitors

Where do we get the data from?

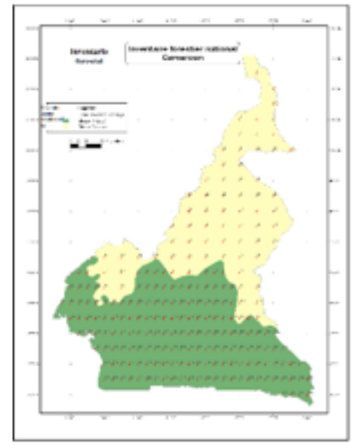
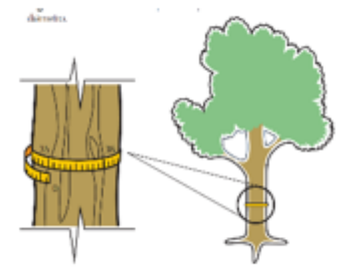
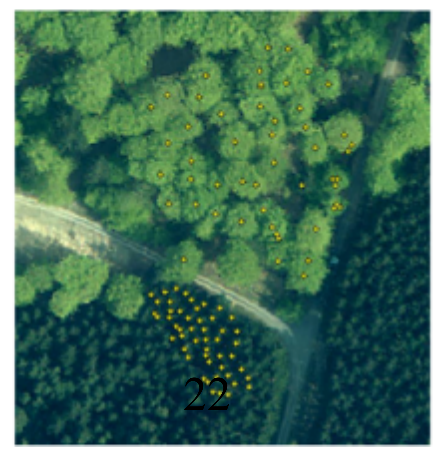
Where do we get the data from?

Forest inventories/forest statistics

Main features:

- The primary source of quantitative information on forest resources
- Based on statistical sampling
- Based on field surveying techniques
- Basis for planning and assessments at country, regional or global level (e.g. Forest Resources Assessment – FRA)

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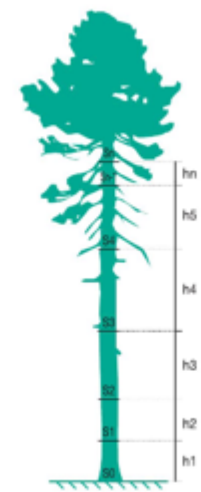
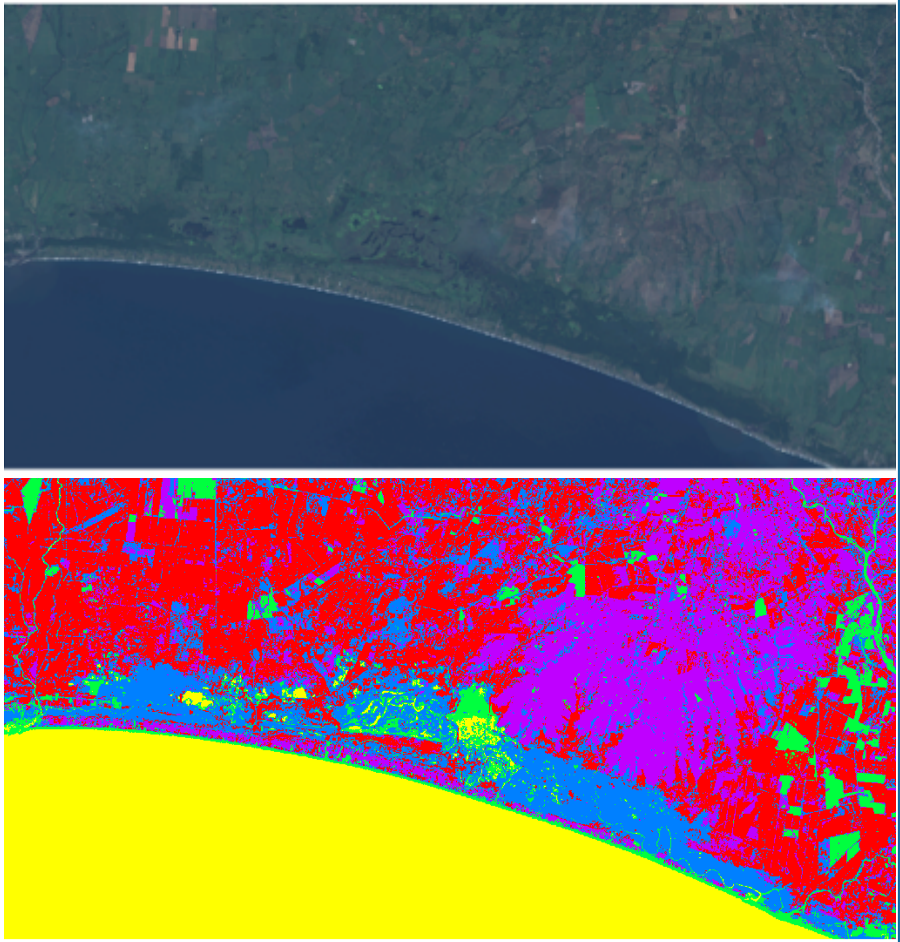


Where do we get the data from?

Spaceborne remote sensing

Why remote sensing?

- Dynamic data source of area covered by vegetation
- Identification of different vegetation types
- Upgrade forest inventories
- Information forest condition
- Geographical reference
- Constant technological development



Example: Land cover classification based on Landsat 8 imagery. Pacific coast; Guatemala

Forest Modeling

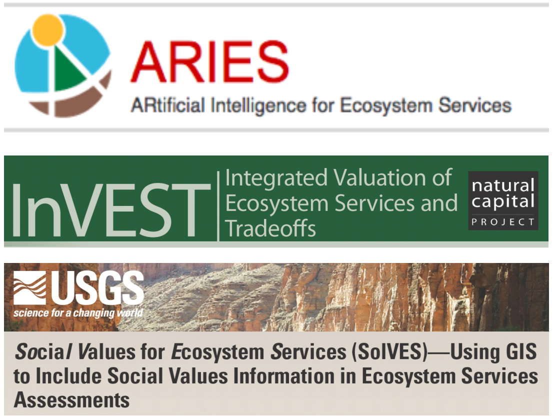
Why modeling ?

❖ Various indicators of forest assets and flows can not be measured directly.

❖ Particularly useful for deriving indicators of environmental services.

❖ Some examples are:

- Wild fauna population
- Erosion protection
- Surface discharge
- Carbon sequestration
- Green area deficit in urban areas



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Other sources

- Livelihood surveys
- Population census
- Other statistics, reports, spatial databases
- etc.
- SNA → validate
- Global forest

watch (?)

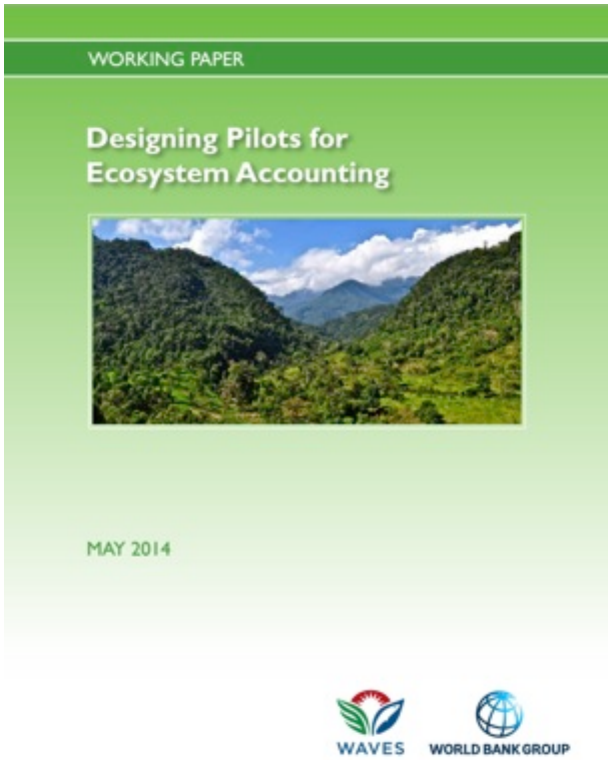
Table 6. Number of households in survey consuming each type of renewable energy.

Village class	Sample size	Fire-wood	Char-coal	Plant residues	Animal dung	Biogas	Solar panel
LOA	406	395	35	250	40	0	0
LOF	276	275	29	192	10	0	1
RAF	29	29	5	25	1	0	0
UPA	37	37	7	22	0	0	0
LOG	162	147	83	115	5	1	0
UG	351	202	248	324	3	0	0
National total	1261	1085	407	928	59	1	1

Source: Mustonen, S.; Raiko, R.; Luukkanen, J. Bionergy consumption and biogas potential in Cambodian households. Sustainability. 2013 (5) 1875-1892 doi:10.3390/su5051875 25

Valuation

What type of valuation?



https://www.wavespartnership.org/sites/waves/files/documents/PTEC2%20-%20Ecosystem.pdf

Type of Ecosystem Service	Valuation Method	Short Description
Provisioning services	Unit resource rent	Producer's surplus is calculated net of labor and man-made capital inputs and adjusted for taxes and subsidies. The value will vary depending on the associated structure of property rights. In the case of open access, it is important to include calculations for different institutional settings, to understand the potential value of the service.
Regulating services	Production function method	The contribution of ecosystem services to production processes are valued by estimating their contribution to the value of the final product when sold on the market (i.e., net of labor and capital costs).
	Damage costs	The value of production losses or damages due to degradation or loss of ecosystem services can be used as estimates of the value of these services.
Cultural services	Travel cost method	The amount that consumers are willing to pay for goods and services related to visits to recreational sites can be used as a proxy for the value of the ecosystem and its attributes.
	Hedonic pricing	This involves disentangling the part of the price that people pay for marketed products or assets that can be attributed to the local ecosystem services.
	Production function	Similar to regulating services, the value of cultural services can be disentangled from the value of marketed products. An example is to estimate the part of the value added of the tourism sector that can be attributed to the ecosystem.

Main principles

Not to include consumer surplus in the valuation of ecosystem services. However, it is appropriate to use the change in consumer surplus (=price) times quantity, since this will provide a marginal price. The production function approach or damage costs avoided approach are suitable methods to use.

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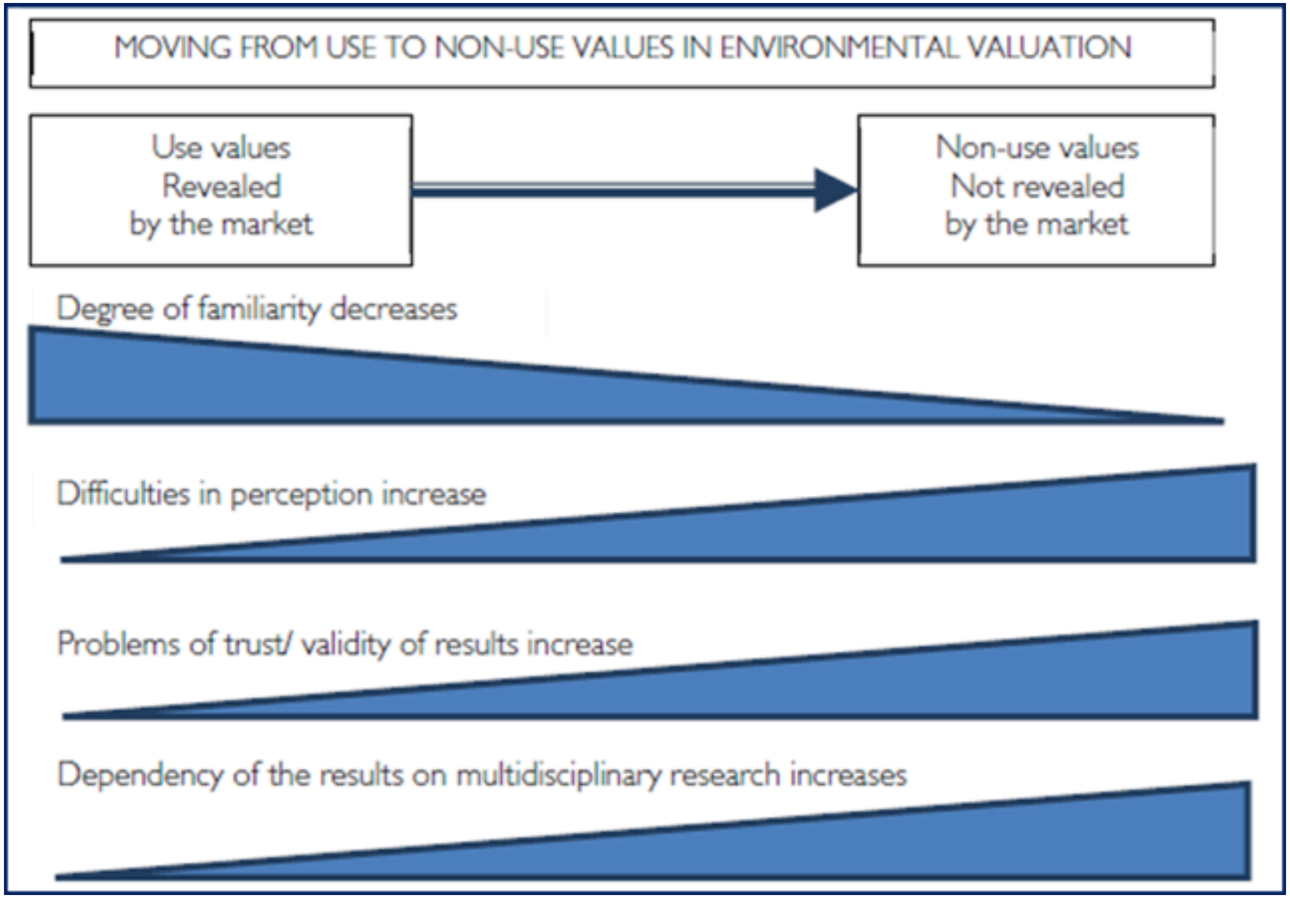
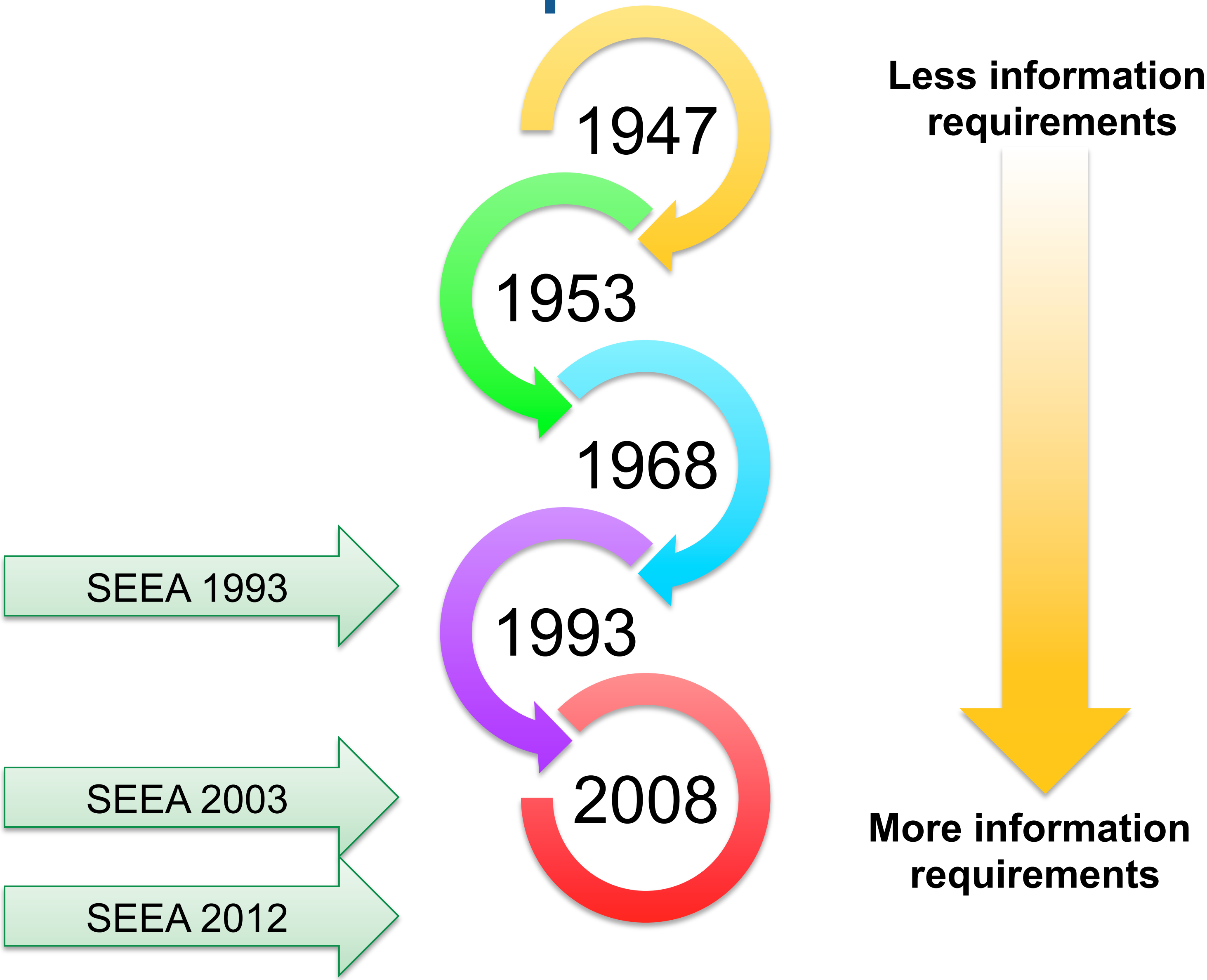
Credibility is the key to valuation?



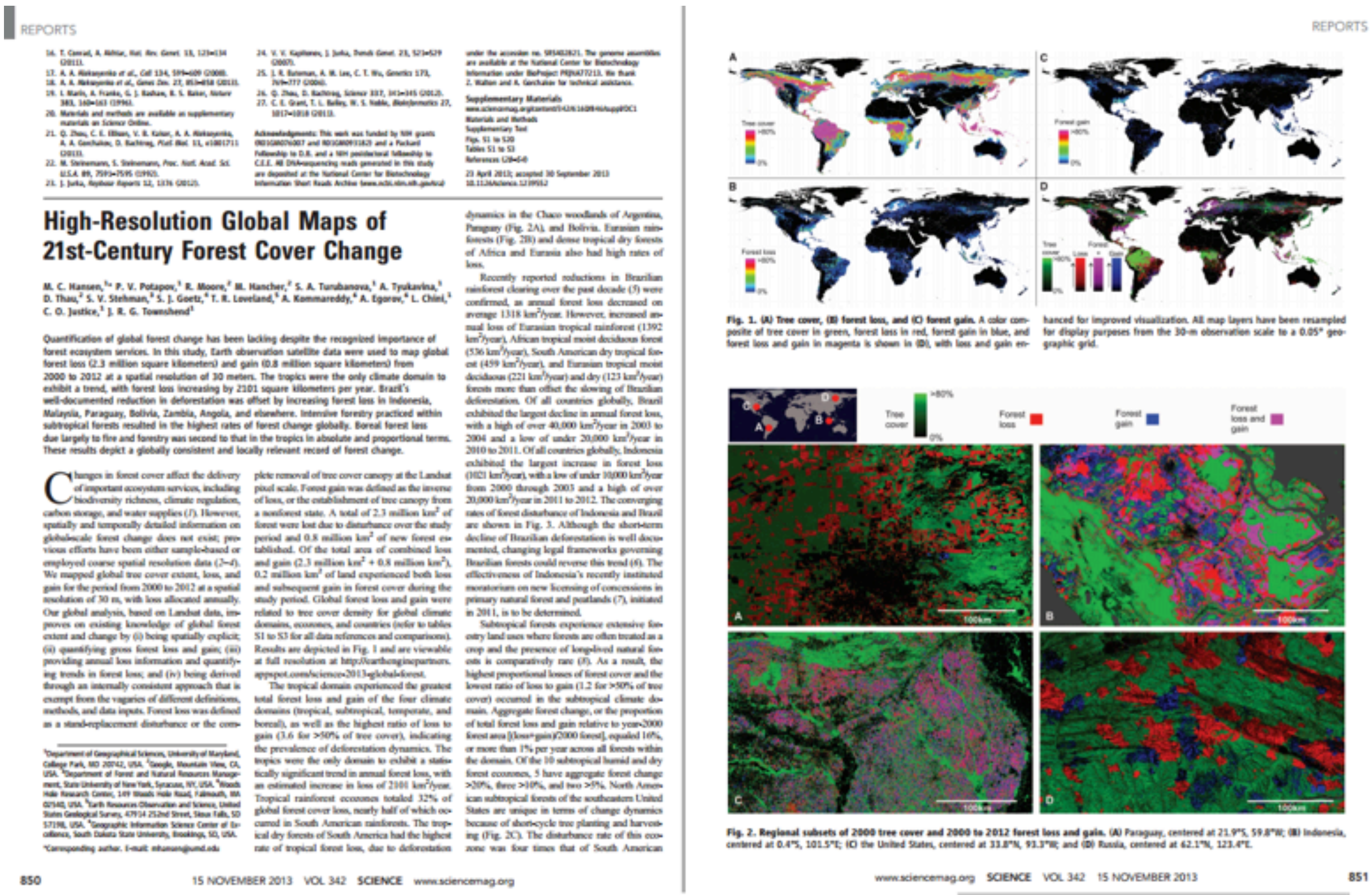
A comment on data challenges

Based on Seymour, 2014

Give time to development…



Information on forests has never been better…



High-Resolution Global Maps of 21st-Century Forest Cover Change

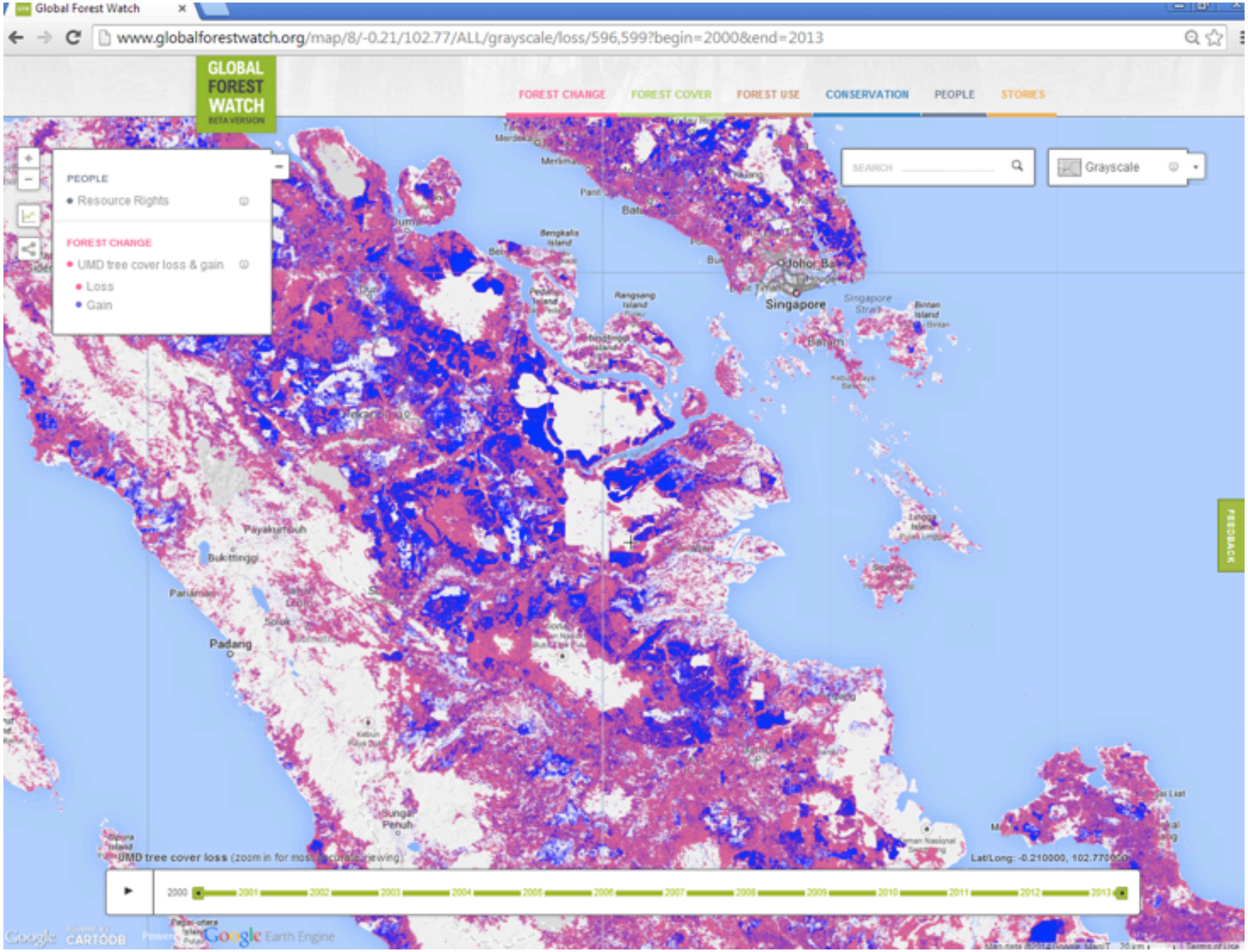
M. C. Hansen,[1*] P. V. Potapov,[1] R. Moore,[2] M. Hancher,[2] S. A. Turubanova,[1] A. Tyukavina,[1] D. Thau,[2] S. V. Stehman,[3] S. J. Goetz,[4] T. R. Loveland,[5] A. Kommareddy,[6] A. Egorov,[6] L. Chini,[1] C. O. Justice,[1] J. R. G. Townshend[1]

Quantification of global forest change has been lacking despite the recognized importance of forest ecosystem services. In this study, Earth observation satellite data were used to map global forest loss (2.3 million square kilometers) and gain (0.8 million square kilometers) from 2000 to 2012 at a spatial resolution of 30 meters. The tropics were the only climate domain to exhibit a trend, with forest loss increasing by 2101 square kilometers per year. Brazil's well-documented reduction in deforestation was offset by increasing forest loss in Indonesia, Malaysia, Paraguay, Bolivia, Zambia, Angola, and elsewhere. Intensive forestry practiced within subtropical forests resulted in the highest rates of forest change globally. Boreal forest loss due largely to fire and forestry was second to that in the tropics in absolute and proportional terms. These results depict a globally consistent and locally relevant record of forest change.

Fig. 1. (A) Tree cover, (B) forest loss, and (C) forest gain. A color composite of tree cover in green, forest loss in red, forest gain in blue, and forest loss and gain in magenta is shown in (D), with loss and gain enhanced for improved visualization. All map layers have been resampled for display purposes from the 30-m observation scale to a 0.05° geographic grid.

Fig. 2. Regional subsets of 2000 tree cover and 2000 to 2012 forest loss and gain. (A) Paraguay, centered at 21.9°S, 59.8°W; (B) Indonesia, centered at 0.4°S, 101.5°E; (C) the United States, centered at 33.8°N, 93.3°W; and (D) Russia, centered at 62.1°N, 123.4°E.

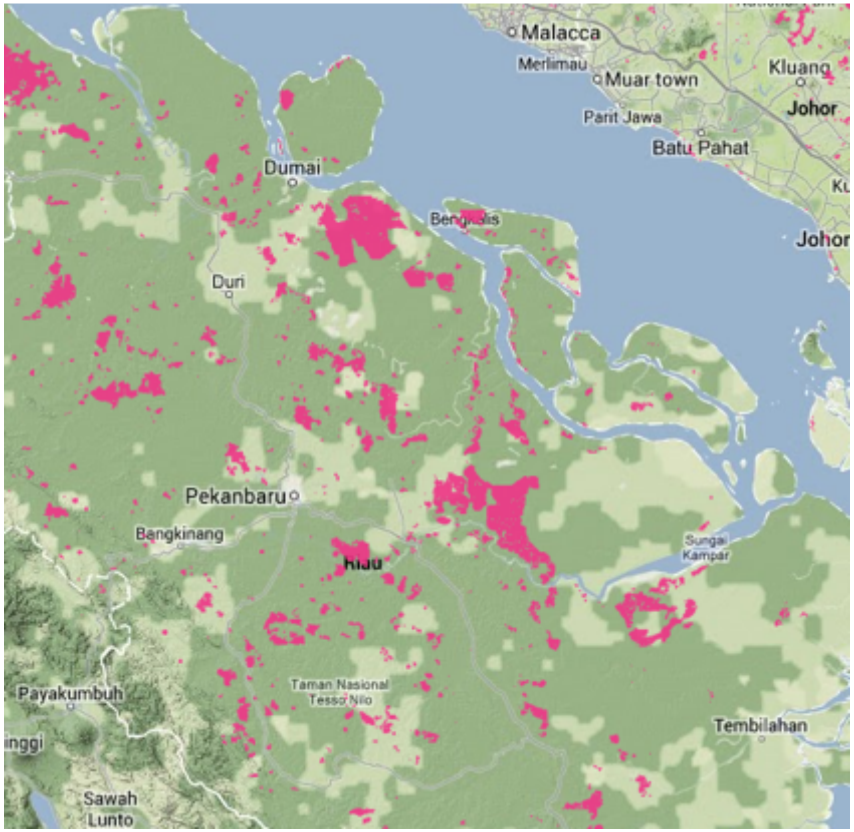
…or more accessible

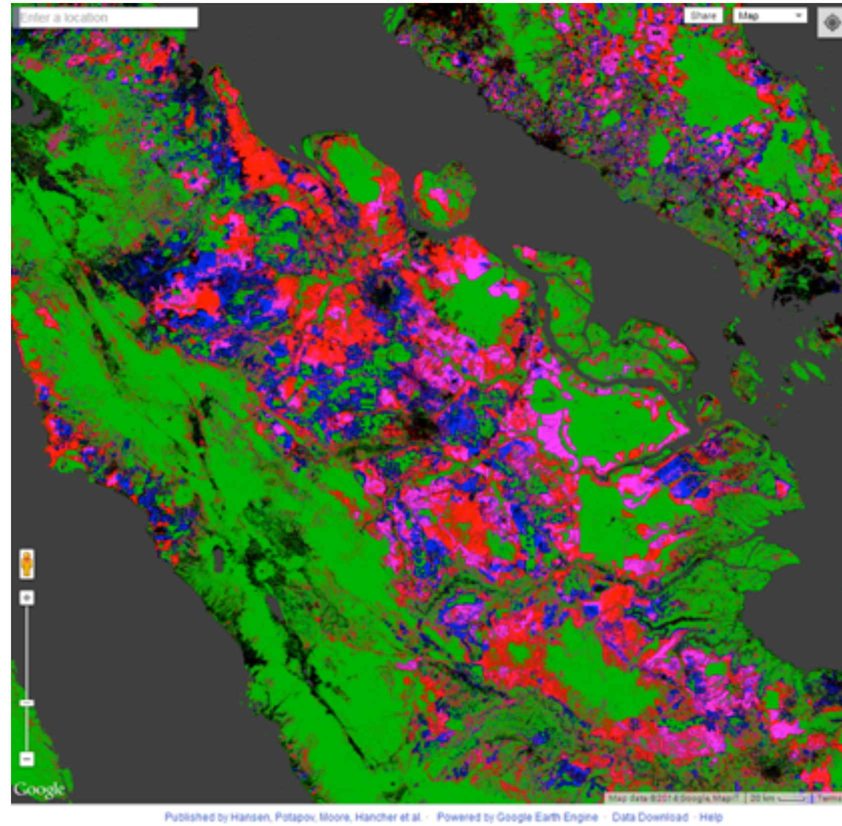


We know what drives forest change…

Ratio of regression coefficients showing significant negative association with deforestation to regression coefficients showing significant positive association with deforestation, based on 5605 regression coefficients in 117 spatially explicit econometric studies.
Source: Ferretti-Gallon and Busch. CGD Working Paper #361 (2014)

…and can track and respond to change





High temporal resolution
for near real-time monitoring and response

High spatial resolution
for accurate measurement of annual deforestation

Thank you!