SUSTAINABLE FLOWS

Improving Financial & Ecosystem Service Flows

Improving Corporate Performance with Final Ecosystem Services

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with

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INTRODUCTION: Key points

- Ecosystem Services (**ES**) not fully incorporated into business decision making
- Use of Ecosystem Services Classification System(s) (**ES-CS**) such as NESCS or CICES helps to:
  - coordinate and standardize the identification and measurement of ES to bring into formal quantification
  - reduce double counting
  - improve stakeholder engagement
  - enable data interoperability
- Case applications demonstrate efficacy of ES-CS use

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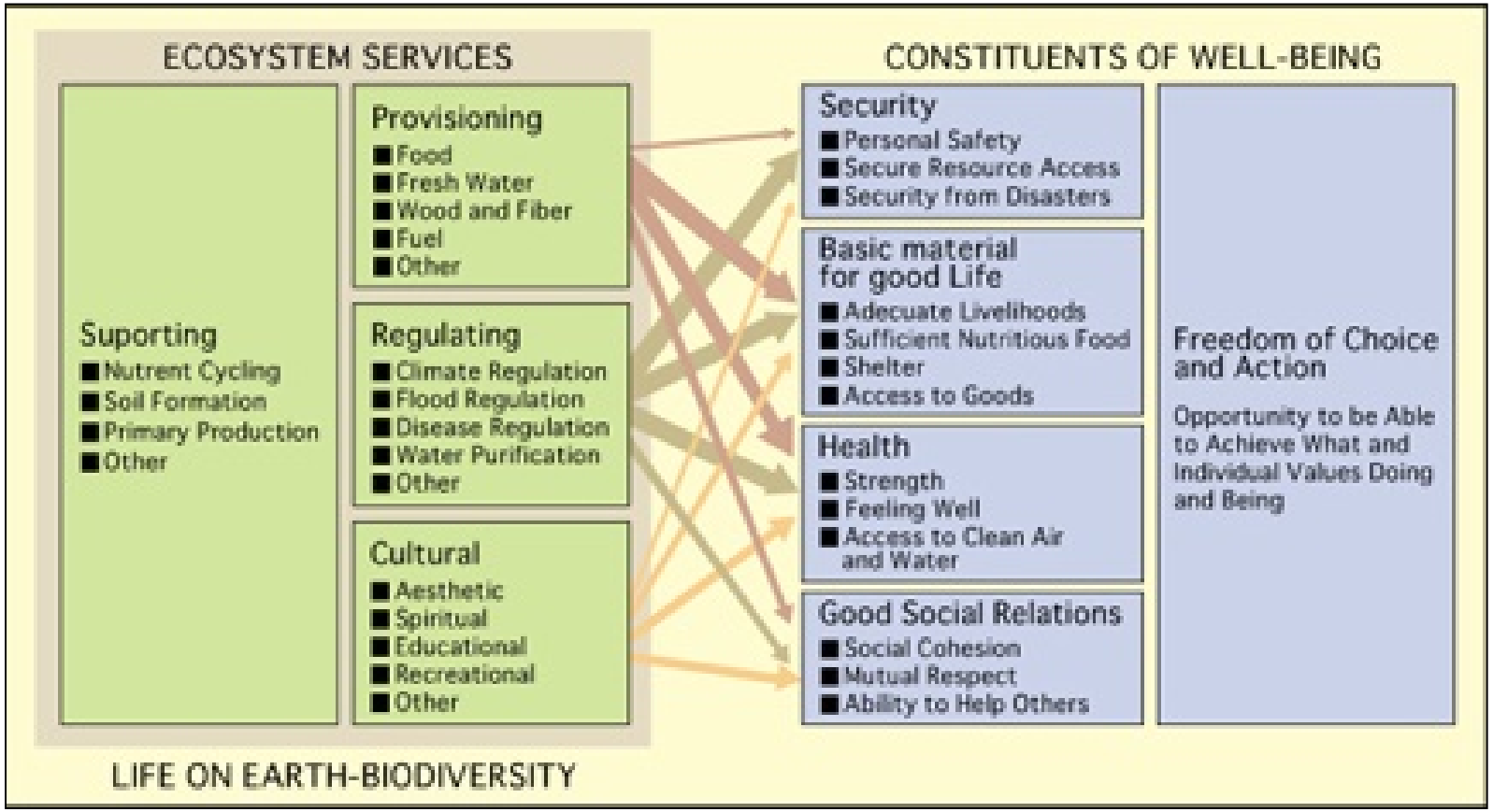
INTRODUCTION – History: Origins of present "grouping standard"



"These categories overlap extensively, and the purpose is not to establish a taxonomy but rather to ensure that the analysis addresses the entire range of services." (MA, 2003, page 38)

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Introduction – History: Several groupings and Classifications emerged

Millennium Ecosystem Assessment (MA) – Four Groups

The Economics of Ecosystems and Biodiversity (TEEB) – ES are not Benefits

Common International Classification of Ecosystem Services (CICES, v 5.1) – Hierarchy

Final Ecosystem Services Classification System (FEGS-CS) *and* National Ecosystem Services Classification System (NESCS) – conscious break from MA-based approach

- **Ecological conditions and functions** (e.g. habitat)
- **Ecological end-products** (e.g., biophysical elements)
- **Economic activity/Use of ES** (e.g., hunting)
- **Benefits** (e.g., lower insurance premiums)

UK National Capital Accounting (NCA) – final ES elements

China National Capital Accounting (NCA) – final ES elements

Nature's Contribution to People (NCP)

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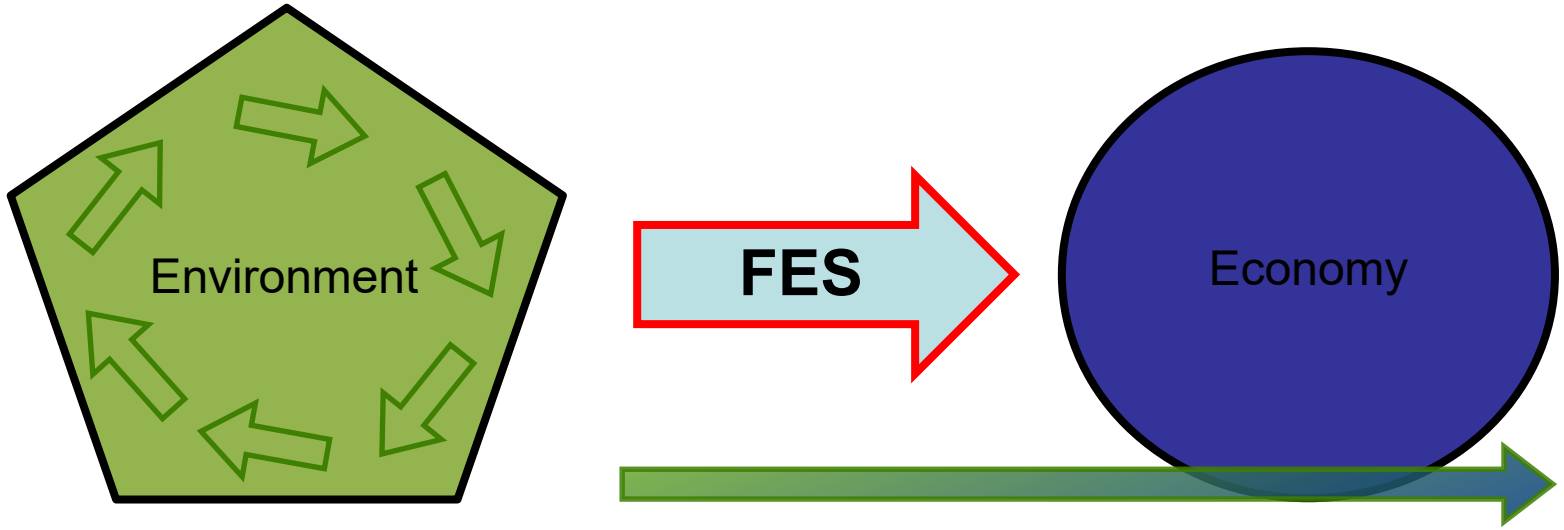
INTRODUCTION – History: Final Ecosystem Services



- **Transition point** from being predominately ecological to being predominately economic
- Defined **ecological end-products** (like Boyd and Banzhaf "end-points" for accounting)
- **Only systems** that define ES within a hierarchy/classification are appropriate for standard

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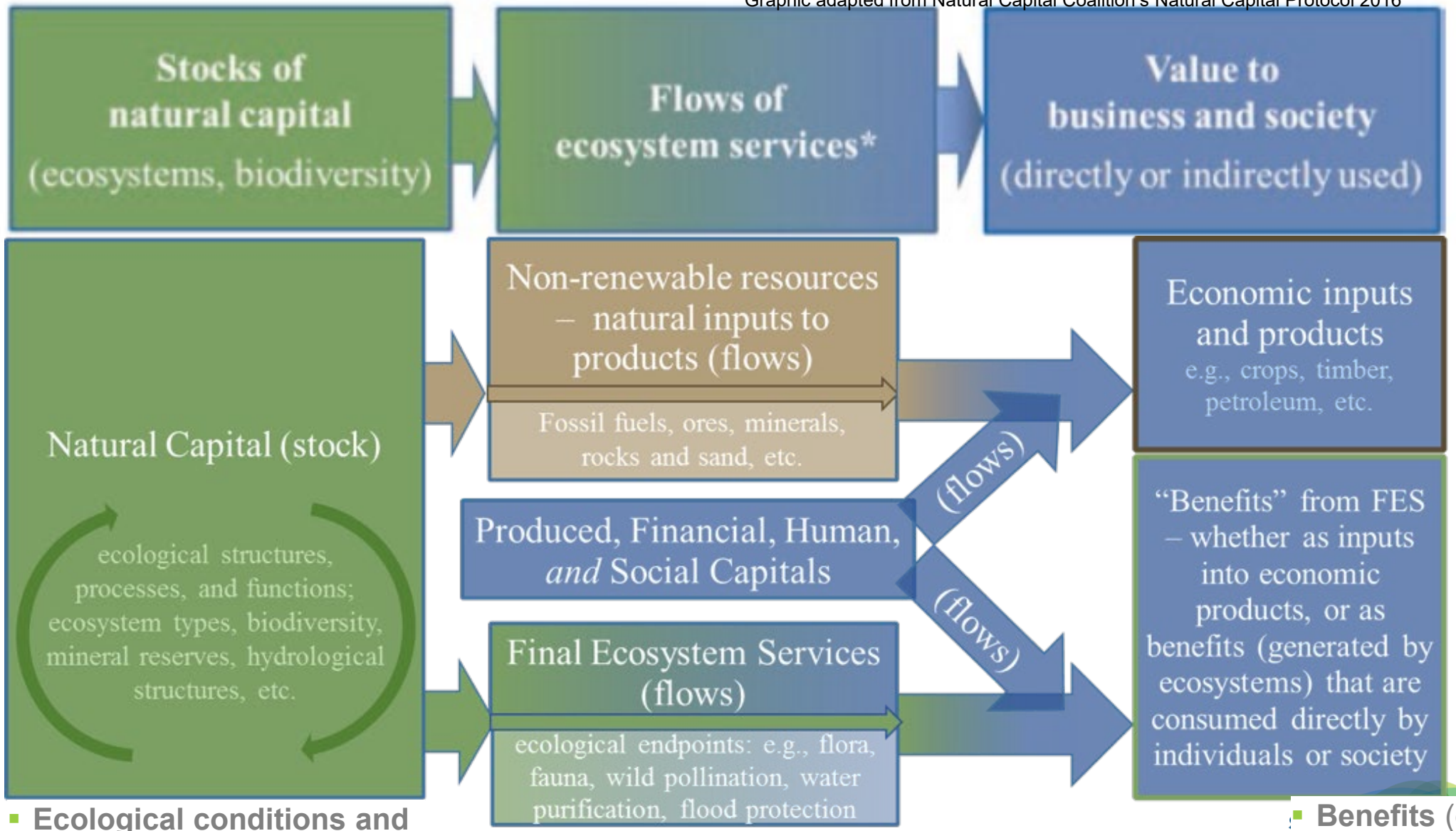
Current application of natural capital

Graphic adapted from Natural Capital Coalition's Natural Capital Protocol 2016



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INTRODUCTION: Ecosystem Services Paradigm

an overarching analytical model for discussing ways humans draw well-being from ecological processes

Analytical Process	• disciplinary training and perspectives (ecol, econ, geog, stat, acctg, etc.) • terms of analysis (embed and channel perspectives) • qualitative and quantitative choices • scoping (reacting to research constraints) • Input and Output choices by research purpose and constraints
Analysis Inputs	• choice of metrics (balance between ad-hoc and formal) • choice of measures (constraints, optimal vs available) • data (actual measures, or more likely, proxies) • databases (currently almost all external, not built to ES purposes)
Analysis Outputs	*Publications* (including combos of these) – • Maps • Assessments • Policy Analysis (scenario, CBA) • Recording / Accounting (national, corporate)
	Tool and Resource Development – • Methodologies relating to Analytical Processes and data generation • Create Databases *and* call to upgrade Input Databases to purpose • New tools and networking, standardizations

Corporate POV: Ecosystem-Services-based opportunities and risks

(adapted from Hanson et al. 2012)

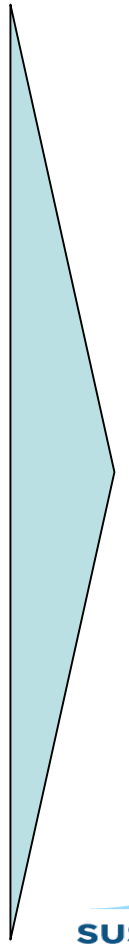
Type	Opportunity	Risk
Operational	• Increased efficiency and savings	• Increase in scarcity and cost of inputs • Disruption to operations
Regulatory and legal	• Improved licensing processes • Services and products that meet new regulations • Opportunities to influence public policies	• Extraction restrictions • Fines, fees, and lawsuits • Permitting and quota challenges
Reputational	• Brand differentiation	• Harm to brand or image • Difficulty with "license to operate"
Market and product	• Product and service innovations • Market opportunities from certification • Markets for ecosystem services	• Changes in customer preferences
Financing	• Investment from progressive leaders and socially responsible funds	• Steeper lending requirements and capital costs

Improved identification of elements, metrics, and analytical techniques

- Using ES-CS helps to avoid common mistakes:
  1. Not having a direct user
  2. Mistaking a joint product of ecological and economic processes for an FES
  3. Misidentifying an ecosystem characteristic, process or function as an ecological end-product
  4. Failing to distinguish between a use and a user
  5. Not beginning from stocks and flows approach

While helping to:

  6. Not identifying metrics with each FES
  7. Not proactively reducing the risk of double counting



All from use of ES-CS

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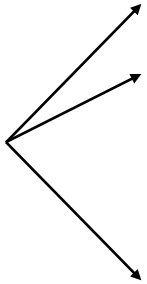
ES values on land for crop production and views

Double counting



MA based classification system

Land for crops	
Crops	$120
Pollination	$20
Soil	$30
Rainwater	$15
Pumped groundwater	$20
Presence of farm for views by residents	$50
Total	**$ 255**

FES based classification system

Land for crops	
-	-
Non hired pollination	$5
Soil for farming	$30
Rainwater for farming	$15
-	-
Presence of farm for views by residents	$50
Total	**$100**

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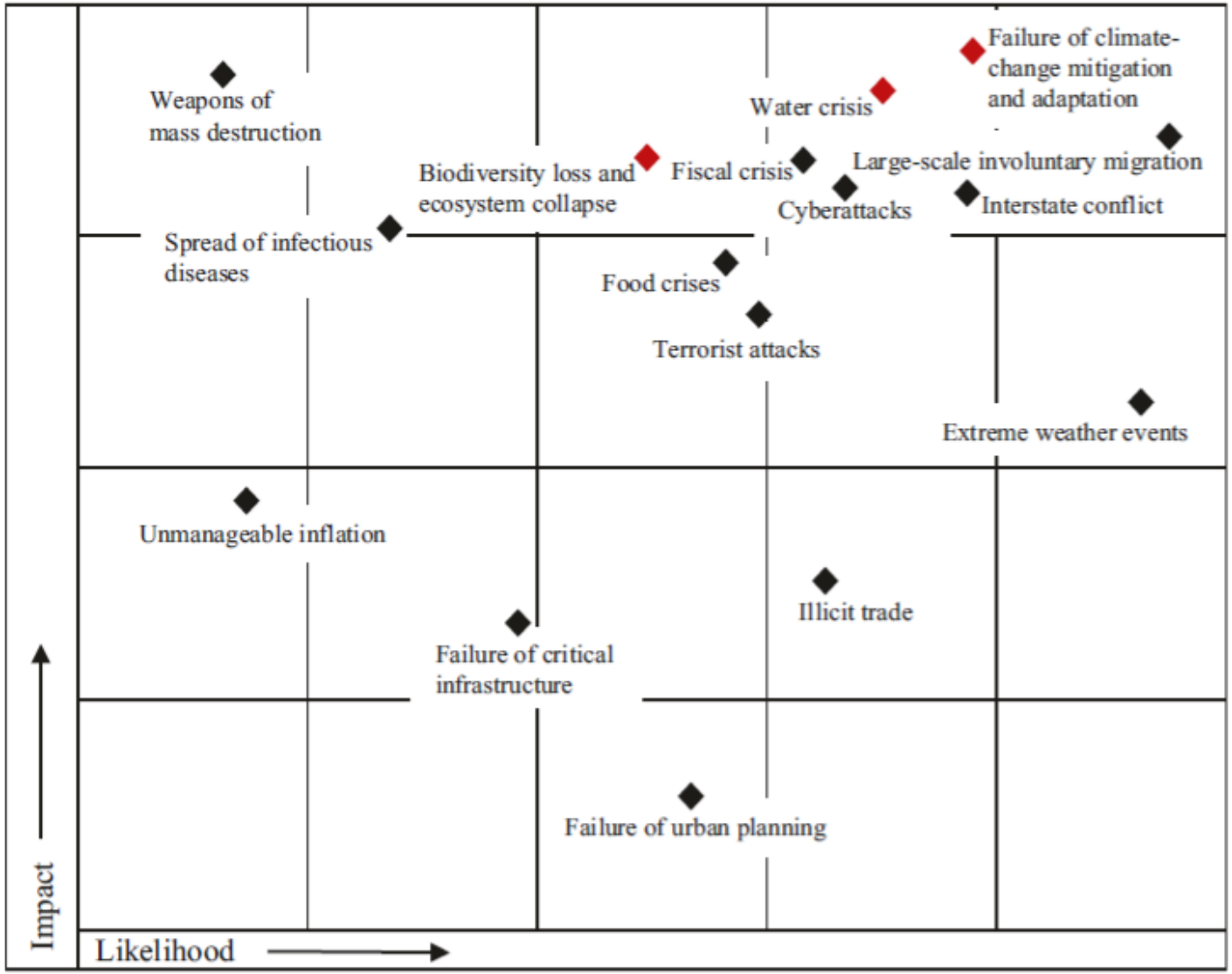
WEF risk matrix, double counts



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Restricted Case Example – Indonesian Palm Oil

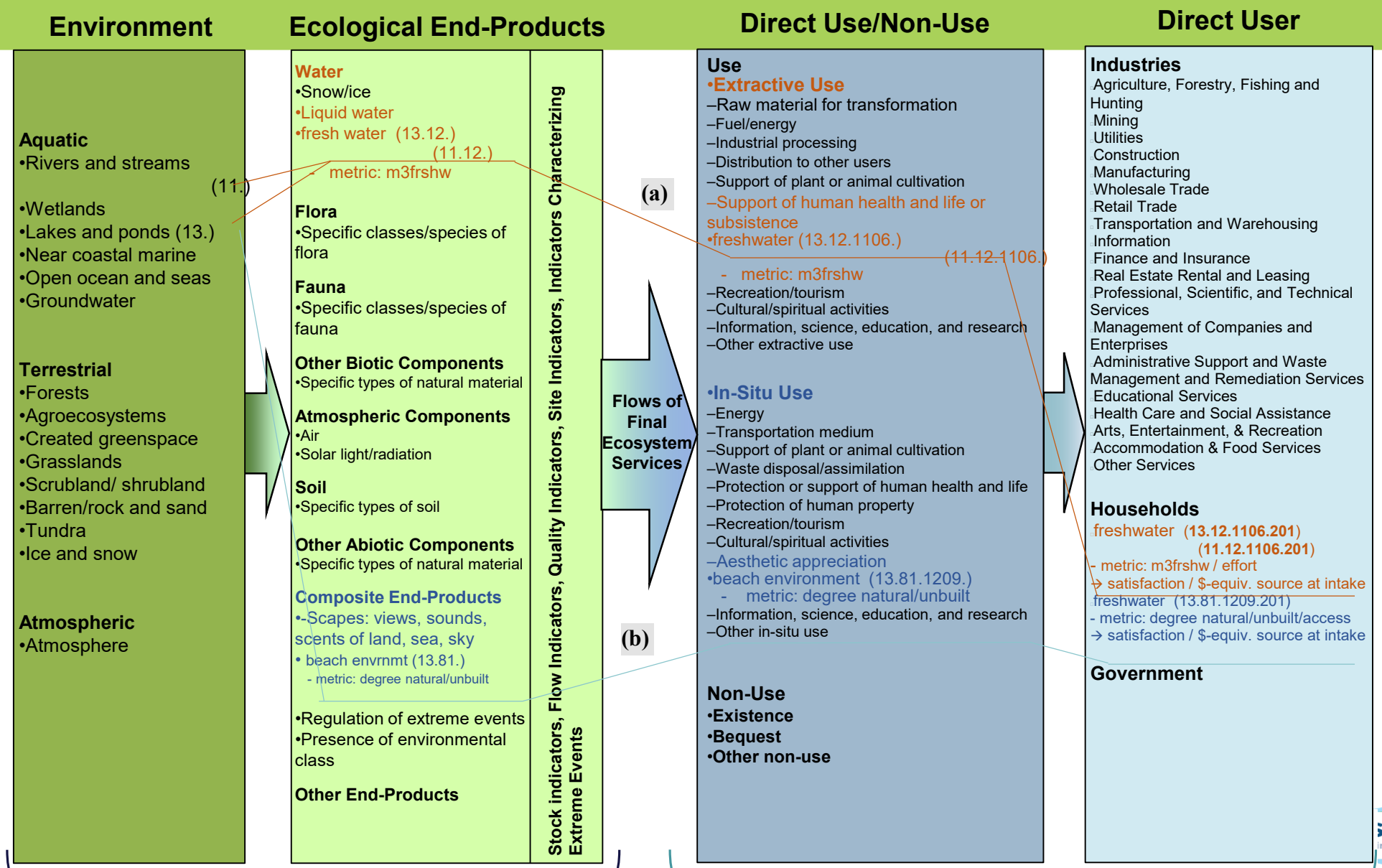
- large firm considers conversion of new large tracts of peatland forest in affect on flows of ES; consider only:
  - the oil palm crop itself (and *not* loss of existing peat and plants)
  - reduced regulation of drought and flood ('*final ES*' only!)
  - threat to orangutans (FES approach embeds 'habitat,' not as an FES)

CICES	FEGS-CS	NESCS
FES-oriented MA-based hierarchy	FES-based Environment + Beneficiary	FES-based Envt + EEP + Use + User
Section–Division–Group–Class–ClassType (code)	Environment Class–Subclass Beneficiary Class–Subclass (code)	Envt/EEP/Use/User Class–Subclass–Infraclass (code)

CICES 5.1, NESCS or NESCS Plus – oil palm, drought/flood, orangutans

CICES – **oil palm itself**	Provisioning – Cultivated terrestrial plants for nutrition, materials or energy – [Class](1)"nutrition"(2)energy – [Class Type]"Crop by type"	Division.Group.Class.ClassType 1.1.1.2 (nutrition), 1.1.1.3 (energy)
CICES – **reduced regulation of drought and flood**	Regulating – Water Regulation – Regulation of Water Flows (1) and Moderation of Extreme Events (2) – Mediation of liquid flows	Division.Group.Class.ClassType 1.1.1.2 , 1.1.1.
CICES – **threat to orangutans**	Cultural – (1)Recreation and ecotourism – Recreation and tourism–physical and experiential interactions([Class]"non-consumptive experiential uses" – [Class Type]"…of…animals…or locations; and (2)[Class] "Knowledge systems and educational values – Information for cognitive development" – Intellectual and representational interactions ("other cultural outputs" – [Class Type]"Existence"	Division.Group.Class.ClassType 3.1.1.2 (Recrtn or eco-tourism); 3.2.2.1 (Existence) 3.2.2.1 (Bequest)
NESCS – **oil palm itself**	Agroecosystems –EEP=Water(12),Soil(6),AtmosphericComponents(52), CombinedEnd-Products(83) – In-Situ Use – Agric.Industry (N.B.: *no crop*)	Environment.EEP.Use.User partial: 22.**12**.1105.111, 22.**6**.1203.111, 22.**52**.1203.111, and 22.**83**.1203.111
NESCS – **reduced regulation of drought and flood**	Agroecosystems – Combined End-Product Regulation of extreme events – Use=Supports plant cultivation(1203),protect life(1205),protect property(1206),tourism(1207) – Agric.Industry(111),Household(201)	Environment.EEP.Use.User partial: 22.82.**1203**.111 (cultivation by palm oil farmer), 21.82.**1206**.201 (protect household property) (N.B.: ≧8!)
NESCS – **threat to orangutans**	Forests – Fauna – [Use+User]=recreation by tourists(1207.201), state or national park revenues(**1207**.**203**), domestic or foreign university research of orangutans (**1210**.**161**), traveling to native habitat using tour services(1207.**171**) …	Environment.EEP.Use.User partial: 21.3.1207.201, 21.3.**1207**.301, 21.3.1210.**161**, 21.3.1207.171, ...

Reference for NESCS codes (as necessary)



NESCS Plus (FEGS-CS & NESCS) should prove more applicable than the alternatives

- Fits better into business processes
  - regulations
  - strategic planning
  - impacts of operations and sustainability programs on risk and human well-being
- Easier to understand
- Focuses on valuation
- NESCS "Four Groups" (Envt + EEP + Use + User) can fit naturally well with accounting rows and columns in Environmental-Economic-Accounting-style tables (US NCA)

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		Generic Benefits		
		Defining data	Discovering data	Avoiding recreating CS
Functional Benefits	1. Unifying language			
	2. How interrelate			
	3. Improved elements, metrics techniques			
	4. Knowledge transfer			
	5. Knowledge management			

About Sustainable Flows

Sustainable Flows helps organizations improve financial and ecosystem services flows through ecosystem modeling, valuation and risk assessment that improve strategies for managing risks related to the natural environment.

We work globally with the public and private sectors to advance methods and approaches, while providing clients practical strategies for risk reduction.

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Appendix

4. Improved knowledge transfer

Semantic web:
- FAIR principles
- Linked Open Data
- Graph databases

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 Graphic source: http://sites.linkeddata.center/blog/_/rsrc/1471794942816/archive/1-2-3linkedopendataarehere/Social_Network_Analysis_Visualization.png

Impact assessments

General Factor	Biodiversity	Ecosystem Services	AVOID if...
Landscape-level BES Goals	Options to protect/mitigate target species or habitats, or services within servicesheds		Few
	Multiple values overlap for BES		Yes
Irreplaceability (uniqueness)	Intact, undisturbed or critical habitat [1]		Yes
	Endemic, rare, unique species or habitats		Yes
	Protected areas		Yes
	Support for ecological connectivity or evolutionary processes		Strong
		ES link to specific place, habitat, or species	Strong
		Beneficiary dependence on ES	Strong
		Size of serviceshed area	Small
Vulnerability (threat)	Current rate and extent of loss from other drivers		High
	Rate and likelihood of recovery from disturbance		Low
	Highly threatened species or habitats		Yes
		Beneficiary access to alternatives	Few
		Expected future ES demand	High

Graphic source: H. Tallis, et. AL. Mitigation for one & all: An integrated framework for mitigation of development impacts on biodiversity and ecosystem services. Environmental Impact Assessment Review 55 (2015) 21–34. http://dx.doi.org/10.1016/j.eiar.2015.06.005

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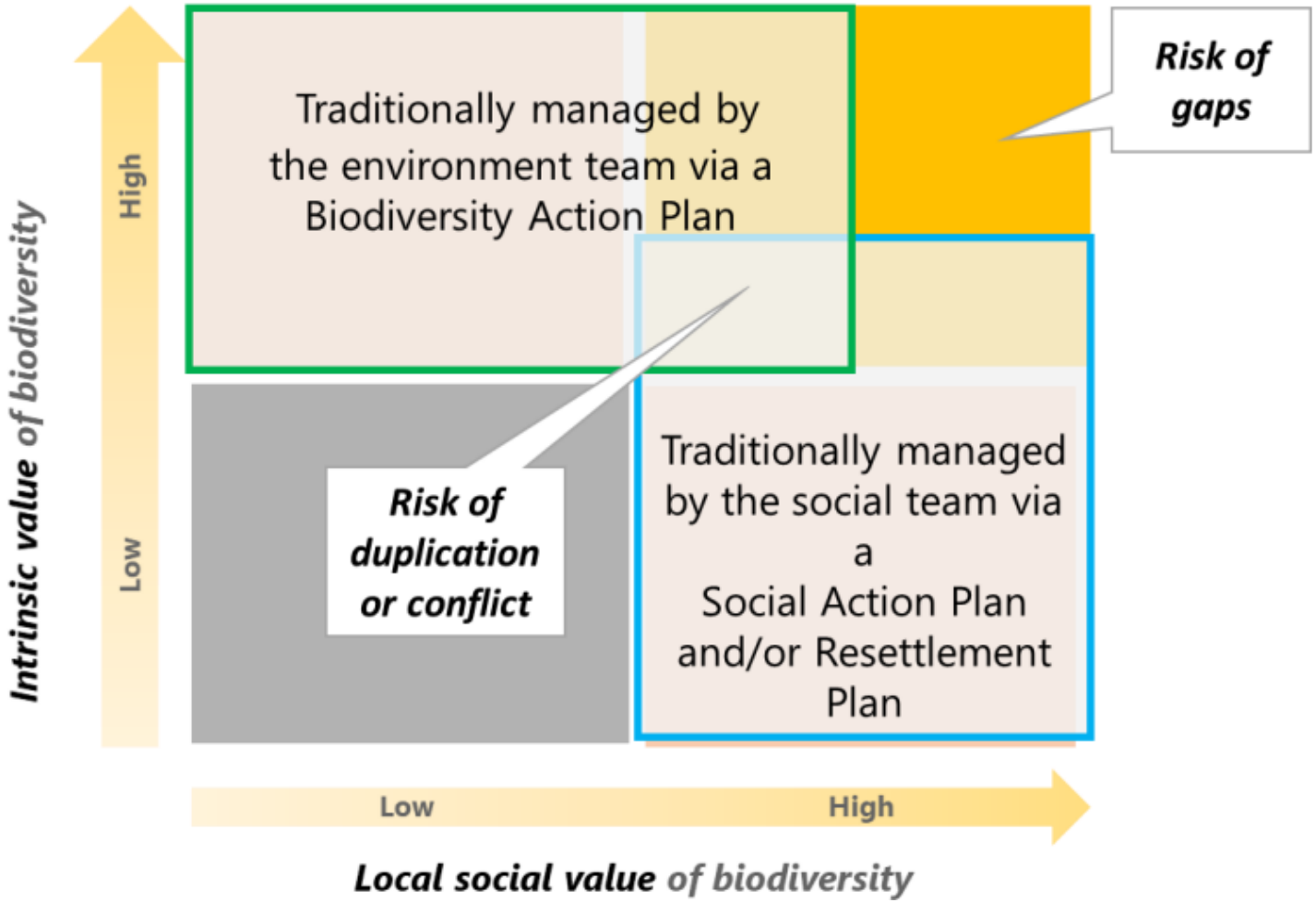
Impact assessments



Graphic source: The Biodiversity Consultancy

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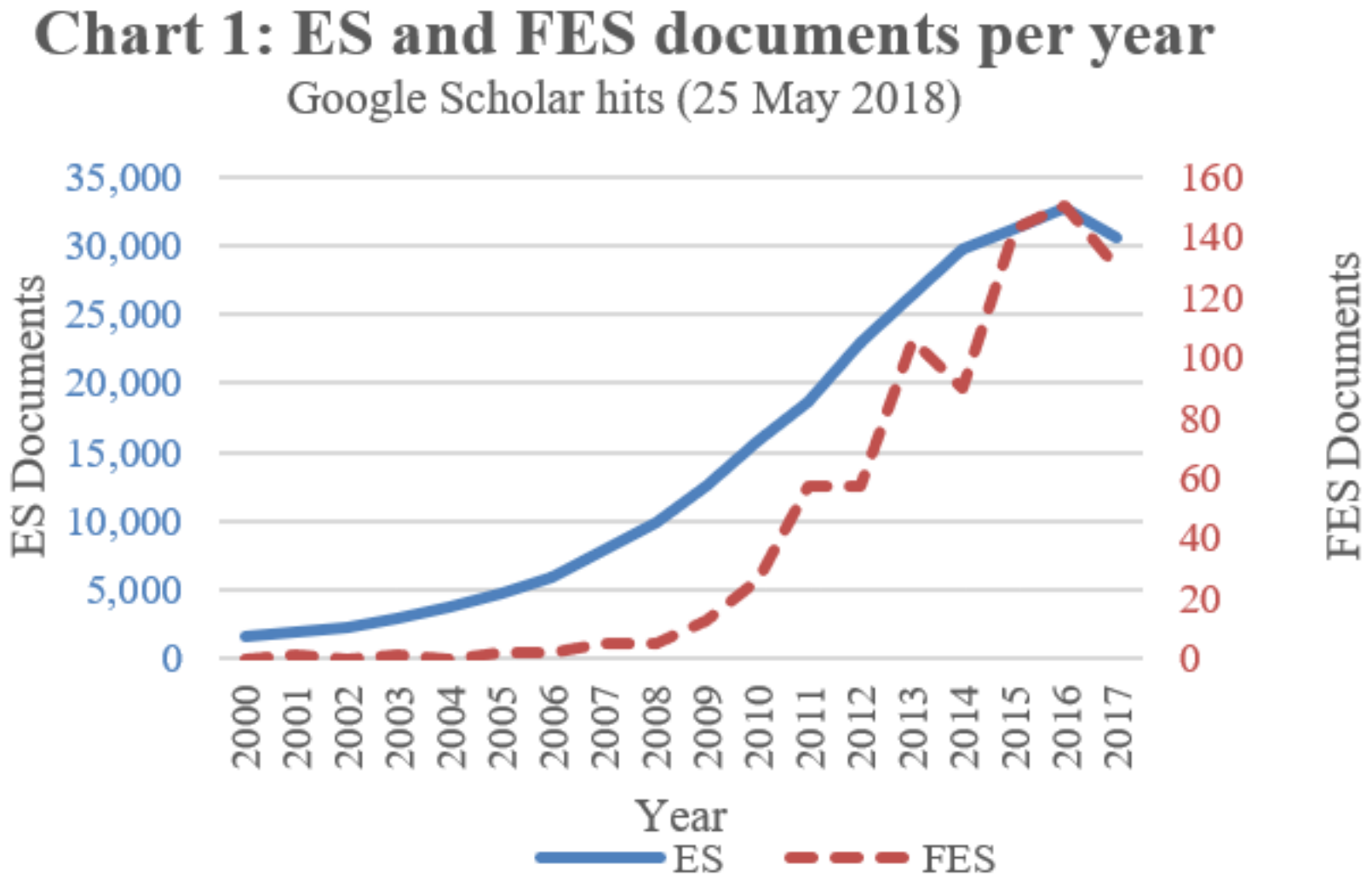
FES research is growing



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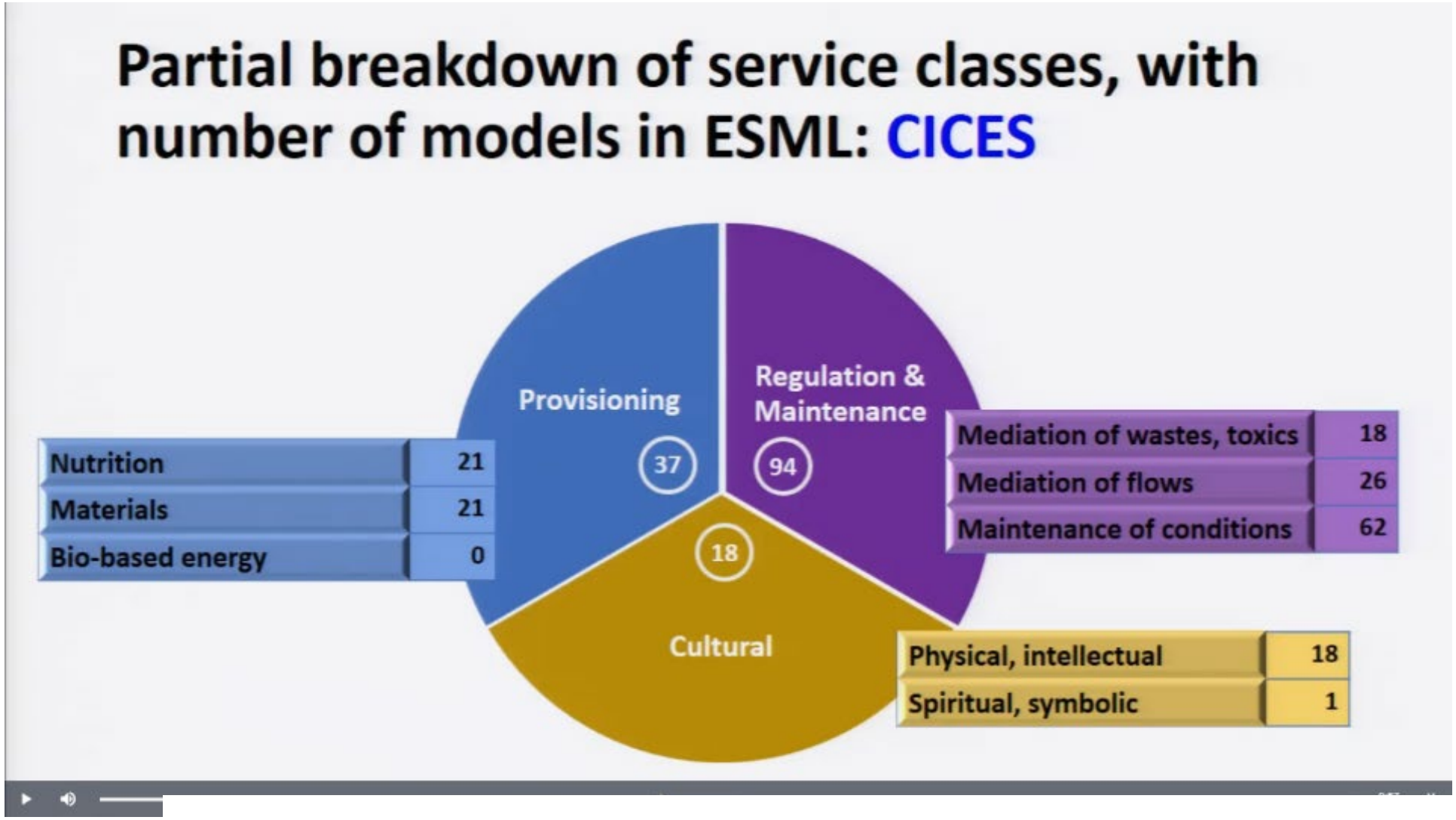
Defining data: f. Quicker identification of research needs



Graph Source: T. Canfield. Aligning ecological models and ecosystems services endpoints. SETAC North America 38th Annual Meeting. November 14, 2017. Available at http://setac.sclivelearningcenter.com/index.aspx?PID=9484&SID=232867. Accessed: May 21,

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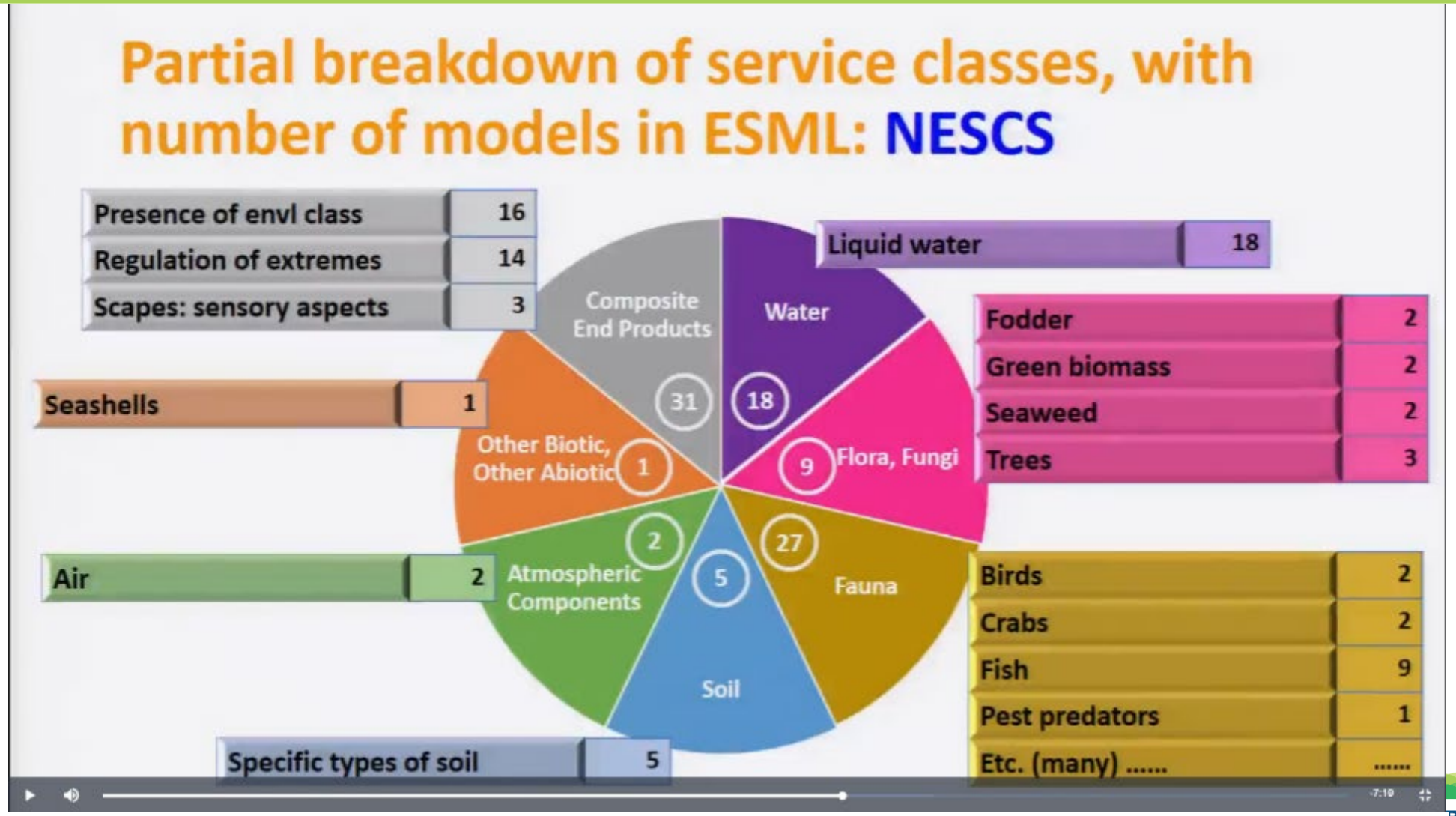

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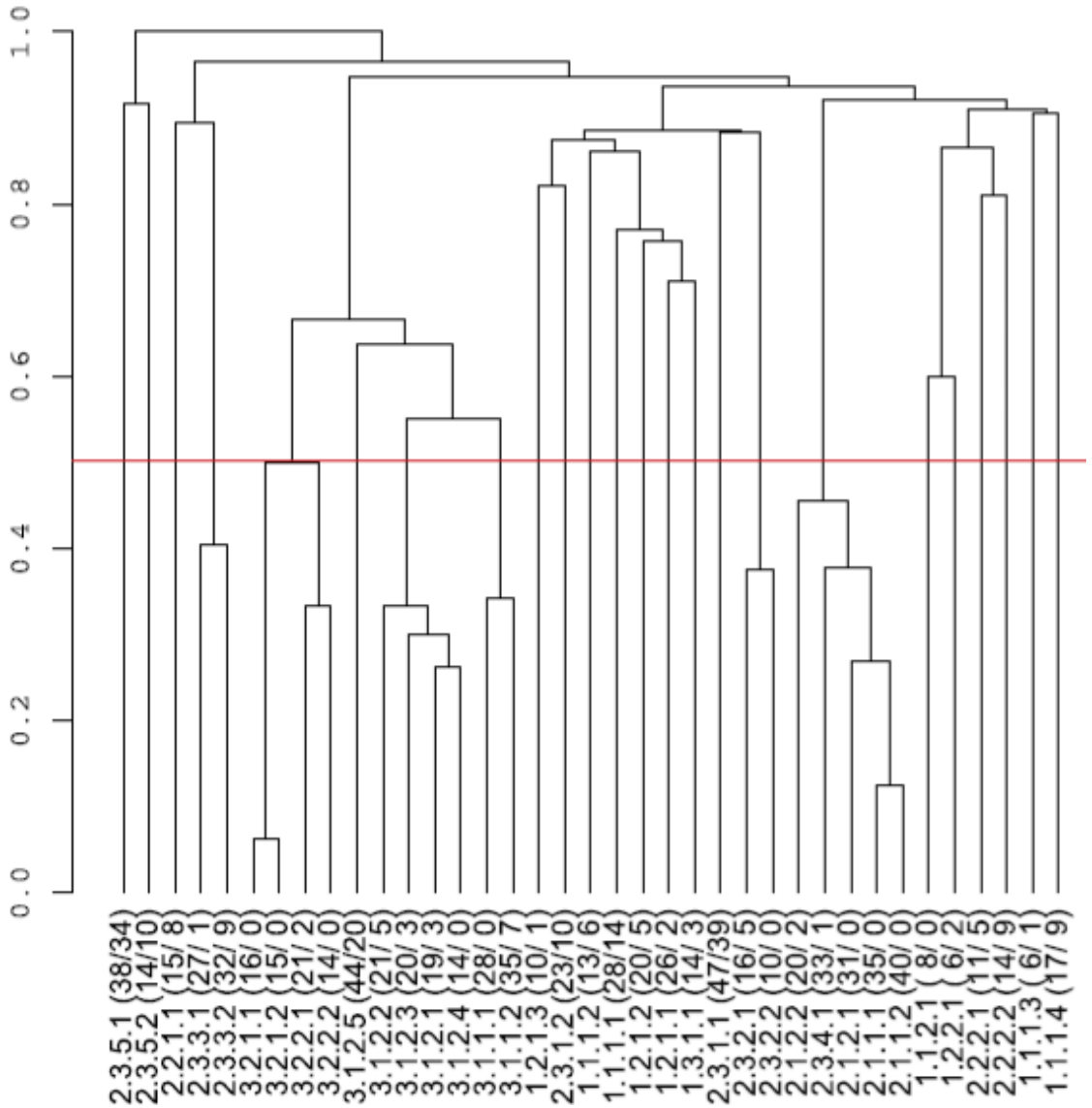
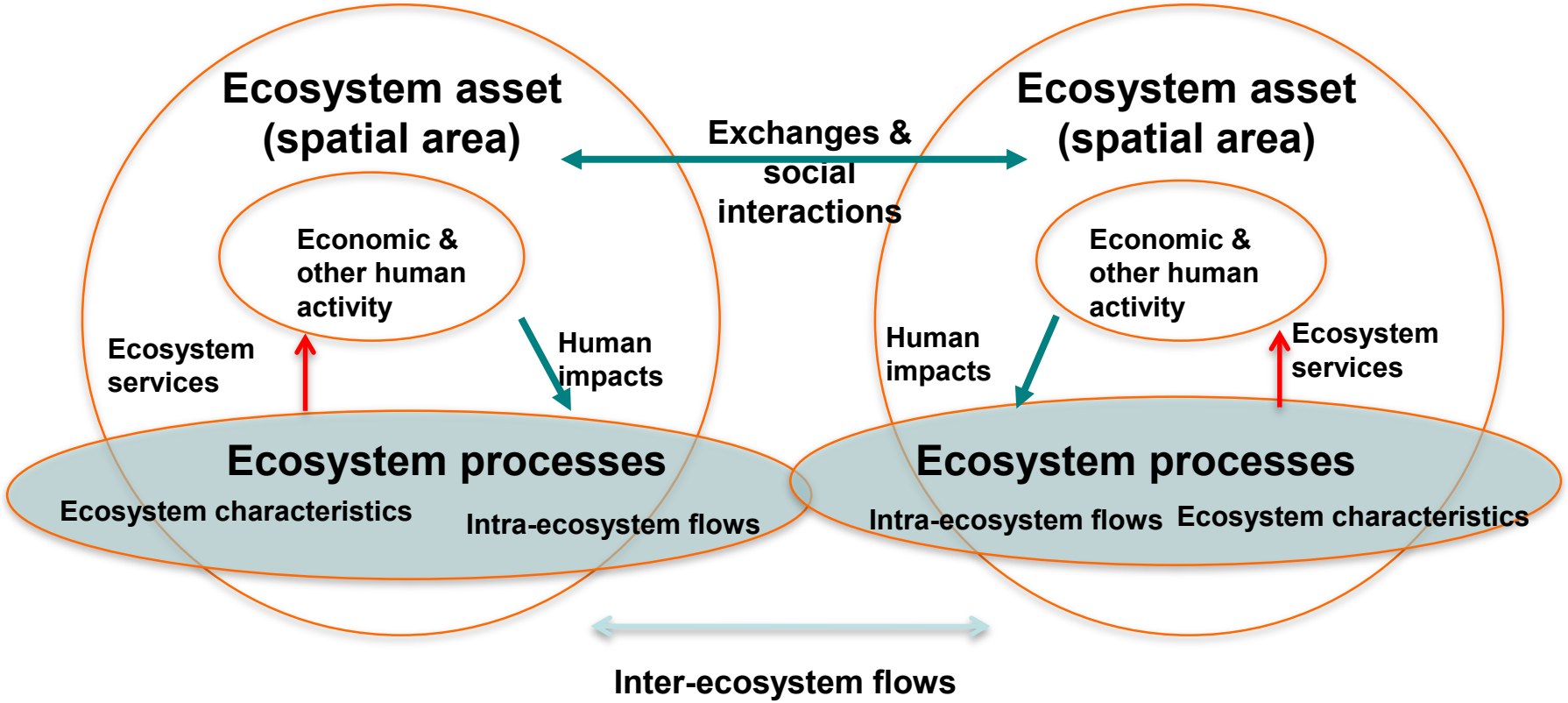
Clustering of CICES classes based on use fraction of shared indicators in published studies



Graph Source: B. Czúcz, I. Arany, M. Potschin, K. Bereczki, M. Kertész, M. Kiss, R. Aszalós, and R. Haines-Young, 2018. Where concepts meet the real world: A systematic review of ecosystem service indicators and their classification using CICES. Ecosystem Services, 29, pp.145-157.

Basic UN-SEEA accounting model



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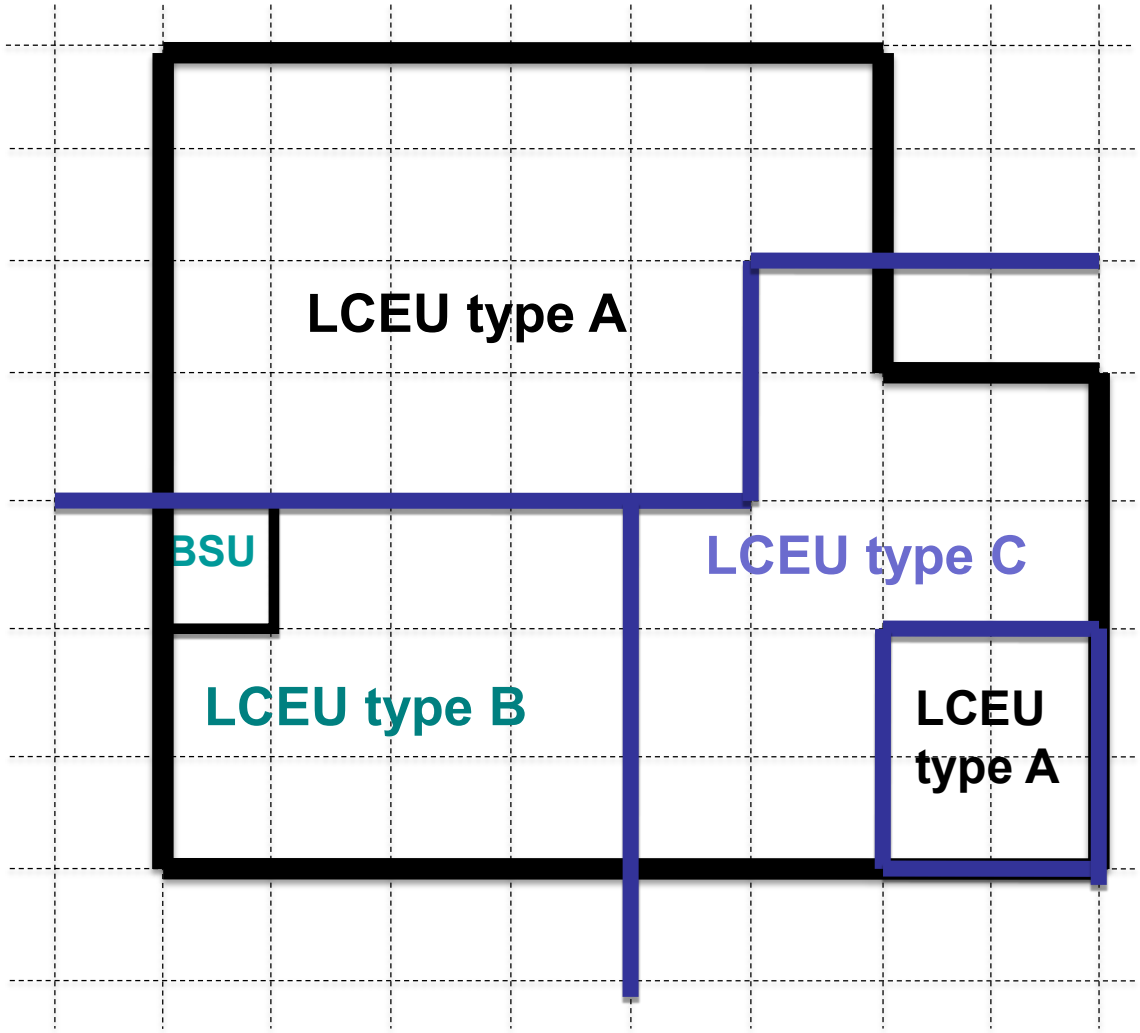
Ecosystem Accounting Unit



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1. Unifying language

	Specific ES-CS terms and examples		
Term used in this paper	**CICES**	**FEGS-CS** (to be retired)	**NESCS** (to be retired) **and NESCS Plus** (from FEGS-CS and NESCS)
Hierarchical level*	Section, Division, Group, Class, Class Type	Environmental Class, Environmental Sub-Class, Beneficiary Class, Beneficiary Sub-Class	Environment, Ecological End-Products, Direct Use/Non-Use, Direct User
Example elements of the FES (element)**	Provisioning, Biomass, Wild Animals, Terrestrial, Nutrition	Terrestrial, Forest, Recreational, Hunting	Forest, Fauna, Hunting for Consumption, Households
Code	1.1.6.2	21.0604	21.3.1106.2
Example of the FES the system names	Food from wild animals	Recreational forest hunting	Animals in forests hunted for household consumption

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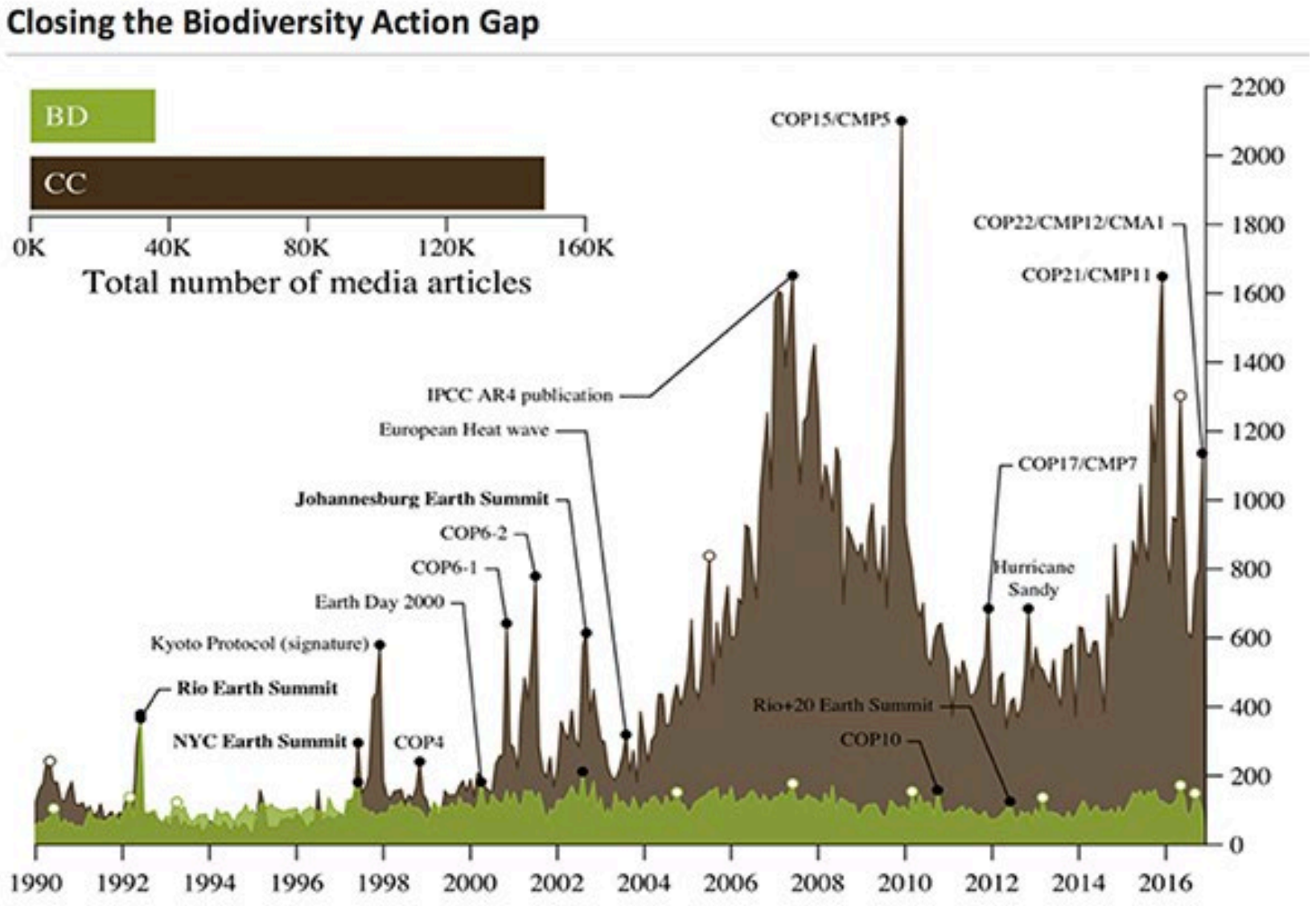
1. Unifying language



Graph Source: Legagneux , P., N. Casajus, K. Cazelles, C. Chevallier, M. Chevrinais, L. Guéry, C. Jacquet, M. Jaffré, M. Naud, F. Noisette, P. Ropars, S. Vissault, P. Archambault, J. Bêty, D. Berteaux, and D. Gravel. 2018. Our House Is Burning: Discrepancy in Climate Change vs. Biodiversity Coverage in the Media as Compared to Scientific Literature . Front. Ecol. Evol. https://doi.org/10.3389/fevo.2017.00175

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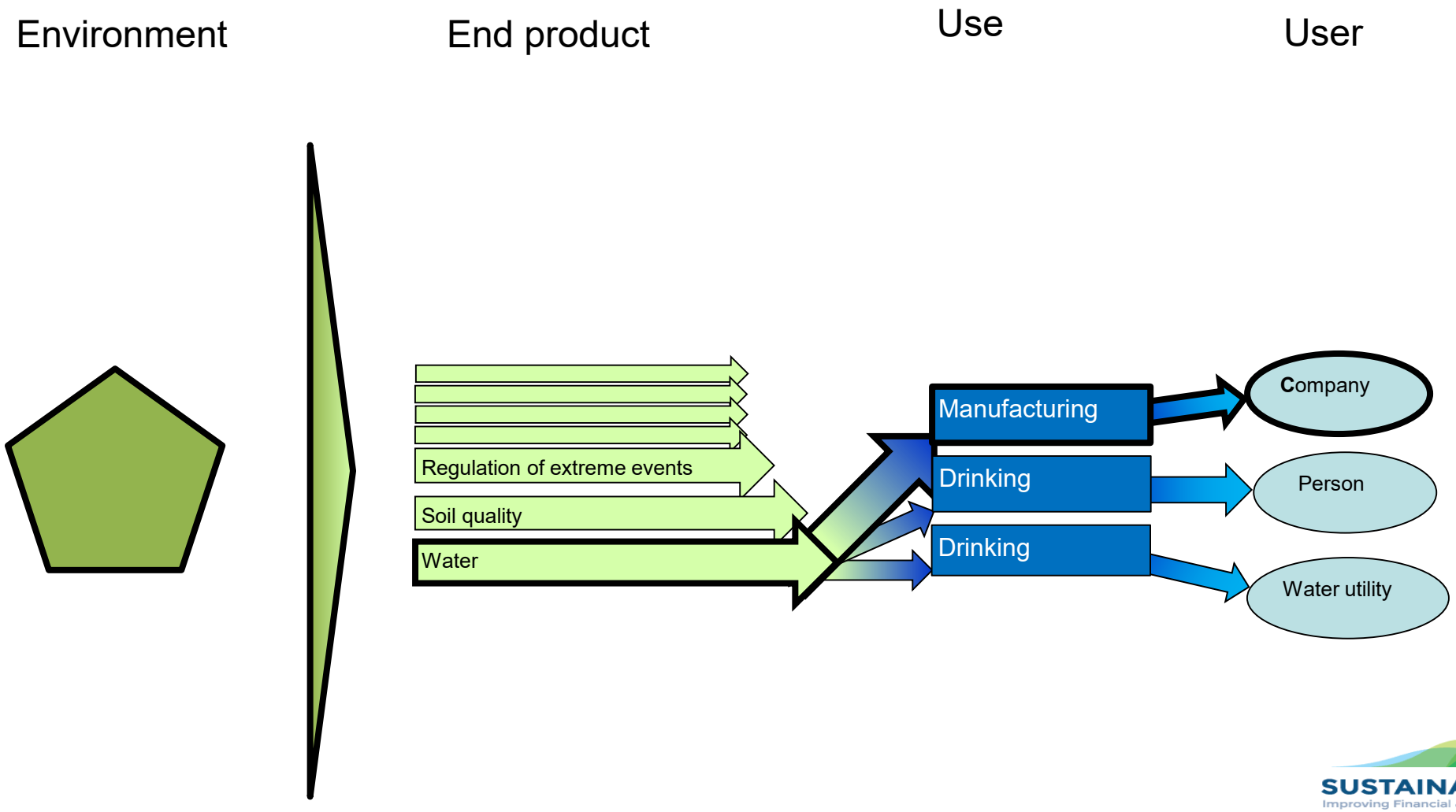
2. Understand how all the elements interrelate



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4. Improved knowledge transfer

- Benefit transfers
  - More precise elements and metrics

- Scaling
  A. Driving greater accuracy in scaling analysis
  B. Informing the selection of scales
  C. Encouraging greater consistency in defining scales
  D. Helping ensure that FES are not “lost” in scaling
  E. Improving communications with decision makers and stakeholders

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5. Improved knowledge management

- Employee turnover less costly for employee and employer

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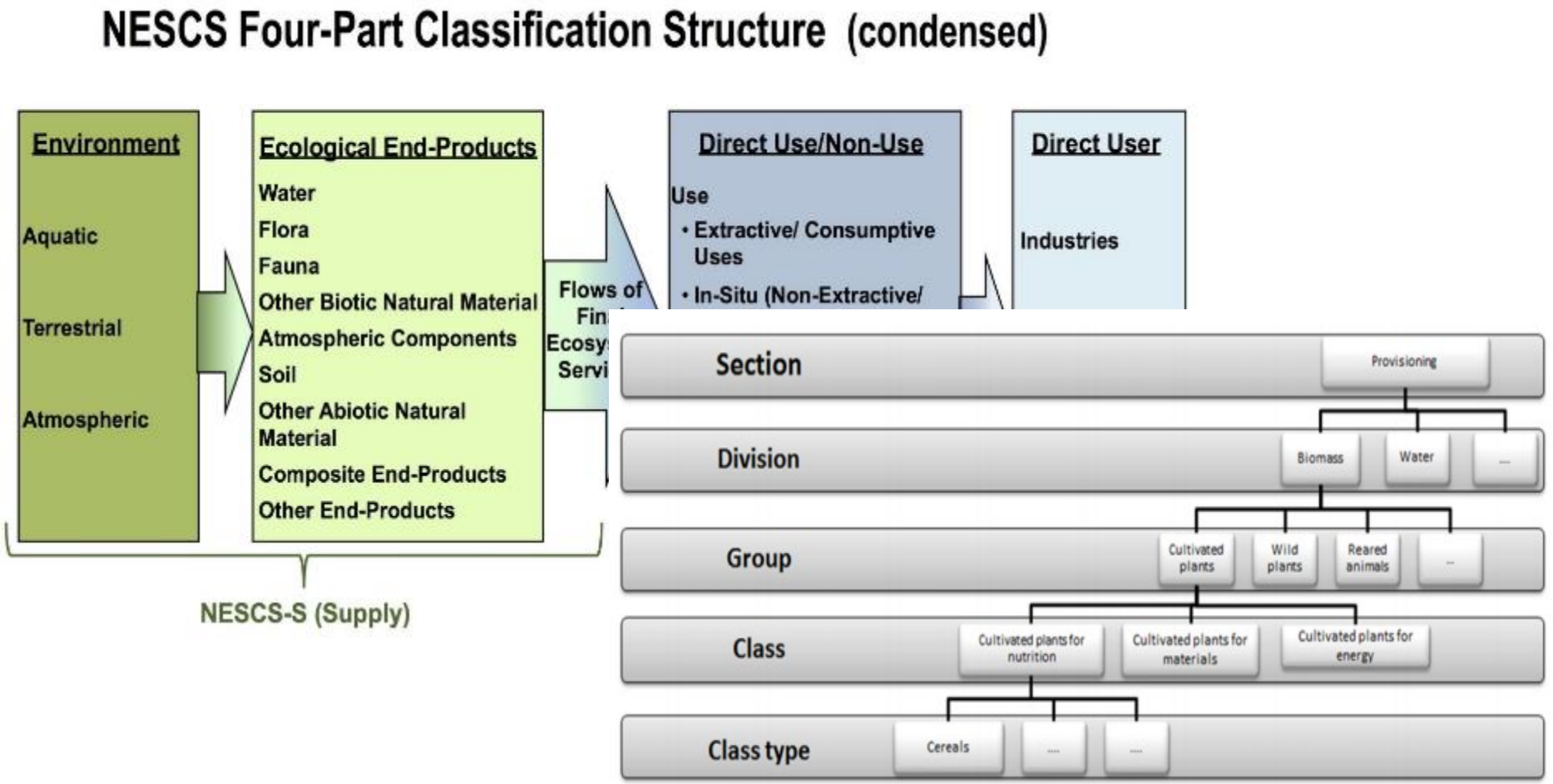
ES-CS hierarchies



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