Expanding the field of ES practitioners—
18 benefits from using classification systems

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with

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Imagine

- No definition for schizophrenia
- No list of symptoms for HIV
- 10 definitions for “fast food restaurant”
- A species being placed in 4 families
Outline

- Introduction
- History of ES classification systems
- 18 benefits of ES classification systems (ES-CS)
- Costs benefit analysis
- Transition
Introduction
Classification systems have proven value

- Knowledge workers spend 20-35% of their time searching for data, with a 50% success rate
- Data collection and preparation is 60% of the time needed for environmental modeling
- Reuters saved $90 million with a CS
- One poor CS costs 10,000 organizations $10 million annually
ES-CS likely to spur 18 benefits, including:

- Unified language
- More appropriate metrics
- Improved knowledge sharing
  - Benefit transfer, scaling, regional assessments
  - Data interoperability
- More precise ES efforts
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).
Several groupings and classifications emerged

MA
4 groups

TEEB
• ES are not benefits
• supporting habitat

CICES (v 5.1)
• Hierarchy

FEGS-CS and NESCS
Conscious break from MA

UK NCA
• FES elements

China NCA
• FES based

Nature’s contribution to people
Final ecosystem services

- **Transition point** from being predominately ecological to being predominately economic
- Defined ecological **end points**
- Only system discovered that can place ES into a hierarchy/classification system
Classification systems have a

- **Hierarchy** that nests sub-groups in a way that is:
  - Complete
  - Mutually exclusive
  - Consistent
  - Relevant
  - Balanced
  - Flexible
  - Stable
  - Comparable

- **Thesaurus** that lists all the terms related to the classification system
- **Vocabulary** that can be used to search the data

CICES (v 5.1)  
FEGS-CS, NESC, NESC Plus
ES-CS hierarchies

NESC Four-Part Classification Structure (condensed)

CICES structure

Section
- Provisioning

Division
- Biomass
- Water
- 

Group
- Cultivated plants
- Wild plants
- Reared animals

Class
- Cultivated plants for nutrition
- Cultivated plants for materials
- Cultivated plants for energy

Class type
- Cereals
- 
- 

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18 Benefits of ES-CS
<table>
<thead>
<tr>
<th>Functional Benefits</th>
<th>Defining data</th>
<th>Discovering data</th>
<th>Avoiding recreating CS</th>
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</thead>
<tbody>
<tr>
<td>1. Unifying language</td>
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<tr>
<td>2. How interrelate</td>
<td></td>
<td></td>
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<td>3. Improved elements, metrics, and analytical techniques</td>
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<td>4. Knowledge transfer</td>
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<td>5. Knowledge management</td>
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</table>
# 1. Unifying language

<table>
<thead>
<tr>
<th>Term used in this paper</th>
<th>CICES</th>
<th>FEGS-CS (to be retired)</th>
<th>NESCS and NESCS Plus (to be retired)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hierarchical level</strong></td>
<td>Section, Division, Group, Class, Class Type</td>
<td>Environmental Class, Environmental Sub-Class, Beneficiary Class, Beneficiary Sub-Class</td>
<td>Environment, Ecological End-Products, Direct Use/Non-Use, Direct User</td>
</tr>
<tr>
<td>(each has nested sublevels)</td>
<td></td>
<td></td>
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</tr>
<tr>
<td><strong>Example elements of the FES (element)</strong></td>
<td>Provisioning, Biomass, Wild Animals, Terrestrial, Nutrition</td>
<td>Terrestrial, Forest, Recreational, Hunting</td>
<td>Forest, Fauna, Hunting for Consumption, Households</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Code</strong></td>
<td>1.1.6.2</td>
<td>21.0604</td>
<td>21.3.1106.2</td>
</tr>
<tr>
<td><strong>Example of the FES the system names</strong></td>
<td>Food from wild animals</td>
<td>Recreational forest hunting</td>
<td>Animals in forests, hunting for household consumption</td>
</tr>
</tbody>
</table>
2. Understand how all the elements interrelate

Environment

Ecological end product

Use

User

FES

Manufacturing

Drinking

Drinking

Company

Community

Water utility

Water

Regulation of extreme events

Soil quality
3. Improved identification of elements, metrics, and analytical techniques

Avoid common mistakes, including:
1. Not having a direct user
2. Mistaking an economic input 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. Choose an FES without identified metrics

While helping to:
6. Reduce the risk of double counting
7. Simplify natural capital accounting
4. Improved knowledge transfer

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

Graphic source: http://sites.linkeddata.center/blog/_/rsrc/1471794942816/archive/1-2-3linkedopendataarehere/Social_Network_Analysis_Visualization.png
Cost benefit analysis
Benefits likely far exceed costs

<table>
<thead>
<tr>
<th>Costs</th>
<th>Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Promotion of ES-CS (ongoing)</td>
<td>• 18 benefits</td>
</tr>
<tr>
<td>• Updating ongoing research, tools &amp; DBs</td>
<td>• ES easier to teach</td>
</tr>
<tr>
<td>• Building search systems (ongoing)</td>
<td></td>
</tr>
<tr>
<td>• Managing biases (e.g. ISO process)</td>
<td></td>
</tr>
<tr>
<td>• Updating ES-CS</td>
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</tbody>
</table>
Transition
Transition to using ES-CS

ES practitioners should:

1. Integrate stakeholders’ understanding of the “benefits of nature” with ES-CS
2. When not using an ES-CS, clearly define the ecosystem, ecological end-product (or CICES equivalent), use, and users
3. Where practical, use an ES-CS
4. Promote the adoption of ES-CS
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
1. Unifying language

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
5. Improved knowledge management

- Employee turnover less costly for employee and employer
2. Understand how all the elements interrelate

Environment
- Aquatic
  - Rivers and streams
  - Wetlands
  - Lakes and ponds
  - Near coastal marine
  - Open ocean and seas
  - Groundwater
- Terrestrial
  - Forests
  - Agroecosystems
  - Created greenspace
  - Grasslands
  - Scrubland/shrubland
  - Barren/rock and sand
  - Tundra
  - Ice and snow
- Atmospheric
  - Atmosphere

End-Products
- Water
  - Snow/ice
  - Liquid water
- Flora
  - Specific classes/species of flora
- Fauna
  - Specific classes/species of fauna
- Other Biotic Components
  - Specific types of natural material
- Atmospheric Components
  - Air
  - Solar light/radiation
- Soil
  - Specific types of soil
- Other Abiotic Components
  - Specific types of natural material

Composite End-Products
- *Scapes: views, sounds, scents of land, sea, sky
- Beach environment (13.81.1209)
  - Metric: degree natural/unbuilt
- Regulation of extreme events
- Presence of environmental class

Other End-Products

Use
- Extractive Use
  - Raw material for transformation
  - Fuel/energy
  - Industrial processing
  - Distribution to other users
  - Support of plant or animal cultivation
  - Support of human health and life or subsistence
- Freshwater (13.12.1106)
  - Recreation/tourism
  - Cultural/spiritual activities
  - Information, science, education, and research
  - Other extractive use

- In-Situ Use
  - Energy
  - Transportation medium
  - Support of plant or animal cultivation
  - Waste disposal/assimilation
  - Protection or support of human health and life
  - Protection of human property
  - Recreation/tourism
  - Cultural/spiritual activities
  - Aesthetic appreciation
  - Beach environment (13.81.1209)
  - Metric: degree natural/unbuilt
  - Information, science, education, and research
  - Other in-situ use

Non-Use
- Existence
- Bequest
- Other non-use

Flows of Final Ecosystem Services

Flow Indicators, Quality Indicators, Site Indicators, Indicators Characterizing Extreme Events

Direct Use/Non-Use

Stock indicators

Direct User
- Industries
  - Agriculture, Forestry, Fishing and Hunting
  - Mining
  - Utilities
  - Construction
  - Manufacturing
  - Wholesale Trade
  - Retail Trade
  - Transportation and Warehousing
  - Information
  - Finance and Insurance
  - Real Estate Rental and Leasing
  - Professional, Scientific, and Technical Services
  - Management of Companies and Enterprises
  - Administrative Support and Waste Management and Remediation Services
  - Educational Services
  - Health Care and Social Assistance
  - Arts, Entertainment, & Recreation
  - Accommodation & Food Services
  - Other Services

Households
- Freshwater (13.12.1106.201)
  - Metric: m³ freshwater
  - Satisfaction / $-equiv. source at intake

Government
- fresh water (13.12.1106.201)
  - Metric: m³ freshwater
FES research is growing
Defining data: f. Quicker identification of research needs

Partial breakdown of service classes, with number of models in ESML: CICES

 Provisioning
- Nutrition: 21
- Materials: 21
- Bio-based energy: 0

 Regulation & Maintenance
- Mediation of wastes, toxics: 18
- Mediation of flows: 26
- Maintenance of conditions: 62

 Cultural
- Physical, intellectual: 18
- Spiritual, symbolic: 1

Defining data: f. Quicker identification of research needs

Partial breakdown of service classes, with number of models in ESML: NESCS

- Presence of envl class: 16
- Regulation of extremes: 14
- Scapes: sensory aspects: 3
- Composite End Products
  - Water: 18
  - Flora, Fungi: 9
  - Other Biotic, Other Abiotic: 31
- Atmospheric Components
  - Seashells: 1
  - Air: 2
  - Specific types of soil: 5
- Liquid water: 18
- Seaweed: 2
- Trees: 3
- Fodder: 2
- Green biomass: 2
- Birds: 2
- Crabs: 2
- Fish: 9
- Pest predators: 1
- Etc. (many)......
Basic UN-SEEA accounting model
Clustering of CICES classes based on use fraction of shared indicators in published studies