Vision, Structure, Scope, and Applicability of the National Ecosystem Services Classification System (NESCS) For UNSD SEEA-EEA

UNSD Expert Group Meeting
Towards a standard international classification on ecosystem services
June 20, 2016

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Expert Group Meeting Agenda proposed Six elements:

- **Purpose** and nature of the classification
- **Scope and coverage** of the classification
- **Principles** used in constructing the classification
- **Concepts** of “ecosystem services” used in the classification
- **Structure** of the classification
- **Applicability** for ecosystem accounting
Actual Outline Elements

The proposed Six elements will find address here in this order:

1. **Concepts** of “ecosystem services” used in the classification
   - *ecosystem services classification system* (ES-CS)

2. **Principles** used in constructing the classification/ES-CS

3. **Purpose** and nature of the classification/ES-CS

4. **Structure** of the classification/ES-CS

5. **Scope and coverage** of the classification/ES-CS
   - Including how NESCS and FEGS-CS differ

6. **Applicability** of the ES-CS for ecosystem accounting
Growing ES literature since Daily et al. (1997), as ecologists, researchers, and policy makers try to apply ES concept:

- De Groot et al (2002); MA (2005); Boyd and Banzhaf (2007);
- Wallace (2007); Fisher and Turner (2009); Staub et al (2011);
- Haines-Young and Potschin (2012); Landers and Nahlik (2013) ...

Where and what ecosystem services occur along the continuum between ecosystems and human well-being?

How should we distinguish ecosystem services relevant to any focused analysis?

Millennium Ecosystem Assessment (MA, 2005)

Supporting Services, Provisioning Services, Regulating Services, Cultural Services
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” (p. 38, emphasis added).

- Porous categories
- Double Counting


1. Concept of ES

US EPA

• Benefit-Cost Analyses (BCA)
• Adding more ES *cannot* be allowed to bring poorly identified metrics or double counting into BCA or policy analyses

EPA’s ORD, OW, OAR: within constraints of MA’s four groups, can researchers derive a set of clear, unique, unduplicated ecological and economic *measures for ES that matter to people and policy?*

*Boyd and Banzhaf (2007)* indicate a potential way forward: count only those ES that directly enter the human economy, at the point they do – *Final Ecosystem Services*

*Final Ecosystem Services*

At the point they enter human systems “ecological endpoints” have no price – no human pays nature for birdsong, seashells, or soil productivity
Ecosystem Services Perspective and Economics

Final ES are *defined* as not having prices:

- A key information signal between providers (supply) and consumers (demand) in markets is *missing*.
- The ES perspective *may*, and Environmental Economic Accounts *do* attempt to model/mimic/approximate a Price-Quantity relationship (equilibrium) for ES.

2. Principles for ES-CS

*Knowing* this:

1) careful identification of supply- and demand-*like* elements becomes critical to “modeling success”
2) data may be judged relevant as it informs identified supply- and demand-*like* elements

“Supply” *from* a specific environment  “Demand” *from* specific humans
## Approaches to definition and identification of ES

Approaches to definition and identification of ES seem to split between:

### Those seeking formalization and standardization of ES definitions and identification

- bound to formal analysis
  - marginal/scenario/cost-benefit analyses
- seek long-term tool development
  - “full-spectrum” identification
  - precise, reproducible, and specific field *metrics*
  - precise final ES for known users/beneficiaries to *value*
  - common tracking of relevant ES metrics with the goal of “allowable” benefits transfer

### Ad-hoc pragmatists

- frustrated with slowness of adoption of ES perspective
- focused on limitations of full-scale ES assessment for very few ES
  - 1 to 6 “ecosystem services”
- question the efficacy of formalizing classification
2. Principles for ES-CS

Core Features for a Desirable *Final* Ecosystem Services Classification System

- **Exhaustive and Mutually Exclusive**
  uniquely identifies all structures, processes, functions, and products of natural systems (separate from human-driven systems) that humans use or appreciate

- **Non-Duplicative**
  focuses attention and measurement on those ecosystem services that humans use or appreciate directly (*final* versus intermediate *ecosystem services*), to avoid double-counting

- **Practical for Users**
  groups or separates candidate elements in a way easy to conceive and use, with clear definitions, and rules for classifying that appeal across disciplines and users – avoiding overwhelming complexity, confusion, fuzzy classification boundaries, and thus avoiding divergent choices for similar cases by similar users

- **Helpful for Selecting Appropriate Metrics**
  uniquely identifying the environment, the precise flows of ecosystem services, the users, and how they use the ES, all help to determine what ecologists and economists should measure

- **Modular**
  a “bonus” for practical use, if system interfaces with other standard classification systems or ecosystem service tools without extensive exceptions and patching

- **Appropriate to be a Standard**
  a “bonus” for practical use, if system is stable, its rules for use are well-explained, and it is practical enough to serve as the standard for many types of applications
3. Purpose and Nature of ES-CS (NESCES)

Pathway Linking Policy Changes to Human Well-Being

- Policy Change
  - Environmental Class
    - (Intermediate) Ecological Processes
      - Ecological End-Products
        - Changes in Flows of Final ES
          - Changes in Direct Uses
            - Direct Users
              - Changes in Human Welfare

NESCS “FFES” (4-15) digit codes

FEGS-CS

Environment – 21.

Beneficiary - .0406

21.0406
3. Purpose and Nature of NESCS

The National Ecosystem Services Classification System (NESCS)

- Identification/Classification
- Quantification and Measures
- Valuation and Monetization


http://www.epa.gov/eco-research/ecosystems-services

NESCS Report generated under contract with RTI, International
3. Purpose and Nature of NESCS → 4. Structure of NESCS

The NESCS Conceptual Framework – The “Blue-Green Diagram”

Ecosystem Services Supply Side

<table>
<thead>
<tr>
<th>Physical Capital and Labor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intermediate Economic Production Function</td>
</tr>
<tr>
<td>Final Economic Production Function</td>
</tr>
<tr>
<td>Household Utility Function</td>
</tr>
</tbody>
</table>

Economic Goods & Services Supply-Side

<table>
<thead>
<tr>
<th>Economic Goods &amp; Services Supply-Side</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical Capital and Labor</td>
</tr>
<tr>
<td>Intermediate Economic Production Function</td>
</tr>
<tr>
<td>Final Economic Production Function</td>
</tr>
</tbody>
</table>

Economic Goods & Services Demand-Side

<table>
<thead>
<tr>
<th>Economic Goods &amp; Services Demand-Side</th>
</tr>
</thead>
<tbody>
<tr>
<td>Household Utility Function</td>
</tr>
</tbody>
</table>

Flows of Final Ecosystem Services

Natural Capital

Ecological Production Function

Ecological End-Products

(EPFs) “Stocks of FEGS” is a good proxy for these
4. Structure of NESCS

**NESCS Four-Group Classification Structure (condensed)**

- **Environment**
  - Aquatic
  - Terrestrial
  - Atmospheric

- **End-Products of Nature (Types of Final ES)**
  - Water
  - Flora
  - Fauna
  - Other Biotic Natural Material
  - Atmospheric Components
  - Soil
  - Other Abiotic Natural Material
  - Composite End-Products
  - Other End-Products

- **Flows of Final Ecosystem Services**
- **Direct Use/Non-Use**
  - Use
    - Extractive/Consumptive Uses
    - In-Situ (Non-Extractive/Non-Consumptive) Uses
  - Non-Use
    - Existence
    - Bequest

- **Direct User**
  - Industries
  - Households
  - Government

- **NESCS-S (Supply)**
- **NESCS-D (Demand)**
4. Structure of NESCS

National Ecosystem Services Classification System, Four-Group Structure

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 species of flora

Fauna
- Specific species of fauna

Other Biotic Natural Material
- Specific types of natural material

Atmospheric Components
- Air
- Solar light/radiation

Soil
- Specific types of soil

Other Abiotic Natural Material
- Specific types of natural material

Combined End-Products
- -Scapes: views, sounds and scents of land, sea, sky
- Regulation of extreme events
- Natural phenomena
- Presence of environmental class

Other End-Products

Direct Use/Non-Use

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
  - 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
  - Information, science, education, and research
  - Other in-situ use

Non-Use
- Existence
- Bequest

Direct User

Industries
- Agriculture, forestry, fishing and hunting
- Mining
- Utilities
- Construction
- Manufacturing
- Wholesale and 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, and recreation
- Accommodation and food services
- Other services

Households

Government

NESCS-S

NESCS-D
# 4. Structure of NESCS

## NESCS Classification Structure and Hierarchical Coding System

<table>
<thead>
<tr>
<th>Group</th>
<th>Environment</th>
<th>End-product</th>
<th>Direct Use/Non-use</th>
<th>Direct User</th>
</tr>
</thead>
<tbody>
<tr>
<td>Definition</td>
<td>Ecosystems where end-products spatially occur, or producers of “end-products”</td>
<td>Biophysical components of nature that are directly used or appreciated by humans</td>
<td>Different ways in which end-products are used or appreciated by humans</td>
<td>Sectors that directly use or appreciate the end-products</td>
</tr>
</tbody>
</table>

| Hierarchy and Coding System NESCS Category Representation*:  
WW.XX.YYYY.ZZZZZZZZ |
|----------------------|

<table>
<thead>
<tr>
<th>Class</th>
<th>WW.XX.1202.1483111</th>
</tr>
</thead>
</table>

### Example 1 – ocean water used as a medium to haul freight

**NESCS Code = 15.12.1202.1483111**

<table>
<thead>
<tr>
<th>Class</th>
<th>Aquatic: 1 Water: 1 Direct Use: 1 Industry: 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sub-Class</td>
<td>Open Ocean and Seas: 15 Liquid Water: 12 In-Situ Use: 12 Transportation and Warehousing: 148</td>
</tr>
<tr>
<td>Detail</td>
<td>Transportation medium: 1202 Deep Sea Freight Transportation: 1483111</td>
</tr>
</tbody>
</table>

### Example 2 – direct fresh water intake used for home gardening

**NESCS Code = 11.12.1105.201**

<table>
<thead>
<tr>
<th>Class</th>
<th>Aquatic: 1 Water: 1 Direct Use: 1 Households: 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sub-Class</td>
<td>Rivers and Streams: 11 Liquid Water: 12 Extractive Use: 11 Households: 201</td>
</tr>
<tr>
<td>Detail</td>
<td>Support of plant or animal cultivation: 1105</td>
</tr>
</tbody>
</table>

Note that this 15-digit code is the most disaggregated level of representation. Different levels of aggregation can be used depending on the context.
Proposed 4-Group NESCS Structure – “Wiring Diagram” with Proposed Metrics By Group

Example: (a) lake, river, or stream water for drinking – m³ fresh water (m³frshw)
(b) same water in composite viewing environment – degree natural/unbuilt

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
  - fresh water (13.12.)
- 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.)
  - metric: degree natural/unbuilt
- Stock indicators, Flow Indicators, Quality Indicators, Site Indicators, Indicators Characterizing Extreme Events

Direct Use/Non-Use
- Use
  - Extractive Use
    - Raw material for transformation
    - Fuel/energy
    - Industrial processing
    - Support of plant or animal cultivation
    - Support of human health and life or subsistence
  - freshwater (13.12.1106.)
- 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.)
- Other in-situ use

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

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: m³frshw
- satisfaction / $-equiv. source at intake

Government
- freshwater (13.12.1106.201)
- metric: degree natural/unbuilt
- satisfaction / $-equiv. source at intake
### 4. Structure of NESCS

**FEGS-CS – NESCS Pass-Through Example:**

7 times “wild mussels”, 1 times “beach-scape” at the wild mussel site

<table>
<thead>
<tr>
<th>Envrm Sub-Class</th>
<th>Examples of FEGS</th>
<th>Beneficiary Category</th>
<th>Beneficiary Sub-Category</th>
<th>FEGS-CS 6-Digit Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aquatic</td>
<td>wild mussels: “type 10” of 21 types of FEGS is “fish,” but thousands of FEGS, so no #</td>
<td>Commercial/Industrial</td>
<td>Food Extractors</td>
<td>XX.XXXX 14.0201</td>
</tr>
</tbody>
</table>

*beneficiaries are a “use-user” combination →* Internal transformation →

**Examples:**

1. **Aquatic**

   - **FEGS**
     - Use/Non-Use Class: Use
     - Use/Non-Use Sub-Class: extractn/consump
     - Use/Non-Use Detail (Example): raw material
     - User Class: Indus
     - User Sub-Class/Detail: Food Manuf
     - User Detail Example: Seafood Prod. Prep & Packgg
     - Example Code: 14.3.1101.1311710

   - **FEGS**
     - Use/Non-Use Class: distrib to others
     - Use/Non-Use Sub-Class: Fishing Trapping
     - Use/Non-Use Detail (Example): Shellfish fishing
     - User Class: Shellfish fishing
     - User Sub-Class/Detail: (UseClass+NAICS)
     - User Detail Example: Seafood Prod. Prep & Packgg
     - Example Code: 14.3.1104.1114112

2. **Aquatic**

   - **FEGS**
     - Use/Non-Use Class: info/educ/research
     - Use/Non-Use Sub-Class: educ
     - Use/Non-Use Detail (Example): non-extractn/consump
     - User Class: Industries
     - User Sub-Class/Detail: Food Extractors
     - User Detail Example: Fish, Seafood and Aquatic Resource Products
     - Example Code: 14.3.1109.1611310

3. **Aquatic**

   - **FEGS**
     - Use/Non-Use Class: extractn/consump
     - Use/Non-Use Sub-Class: support human health subsistence
     - Use/Non-Use Detail (Example): Households
     - User Class: Households
     - User Sub-Class/Detail: Food Extractors
     - User Detail Example: Seafood Prod. Prep & Packgg
     - Example Code: 14.3.1102.1611310

4. **Aquatic**

   - **FEGS**
     - Cultural/spiritual activities
     - Example Code: 14.3.1105.1611310

5. **Aquatic**

   - **FEGS**
     - Recreation/tourism
     - Example Code: 14.3.1106.1611310

6. **Aquatic**

   - **FEGS**
     - Combined end-products: -scapes, views, sounds, scents
     - Example Code: 14.3.1107.1611310

7. **Aquatic**

   - **FEGS**
     - OR also…if tourist tries hand at mussel-ing
     - Example Code: 14.3.1108.1611310

8. **Aquatic**

   - **FEGS**
     - AND if “beach experience” is part of “ES” of mussel harvest, then a separate Non-Use ES “use” for any User, “combined end-product” here, not “fauna”
     - Example Code: 14.3.1109.1611310

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*Note: The table above is an example of how FEGS and NESCS can be used to classify and manage the use of wild mussels and beach-scape activities in aquaculture environments.*

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5. Scope and Coverage / 6. Applicability of NESCS for Env.l Accounting

The NESCS Conceptual Framework – Specialized to a Terrestrial Acidification Example

- **Ecosystem Services Supply Side**
  - Physical Capital and Labor
  - Natural Capital
    - Forests
  - Ecological Production Function
    - Tree Growth, Health and Regeneration
  - FEGS Stocks / End-Products
    - Trees
  - Policy Change to Atmosphere

- **Economic Goods & Services Supply Side**
  - Intermediate Economic Production Function
    - Lumber Production
  - Final Economic Production Function
    - Furniture Manufacturing

- **Economic Goods & Services Demand Side**
  - Final Economic Goods & Services / Products
    - Furniture
  - Household Utility Function
    - HUMAN WELL-BEING

**Flows of Final Ecosystem Services**

- Tree Volumes Contributing to Timber Production
- Tree Volumes Contributing to Aesthetics
- Tree Volumes Contributing to Aesthetics
### Applying NESCS: Policies Impacting Terrestrial Acidification – Two-species example table, with NESCS numeric coding pieces

<table>
<thead>
<tr>
<th>NESCS-S</th>
<th>NESCS-D</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Env. Class</strong></td>
<td><strong>Direct Use/Non-Use Class</strong></td>
</tr>
<tr>
<td>Sugar maple trees</td>
<td>1. Direct Use</td>
</tr>
<tr>
<td></td>
<td>12. In-situ Use</td>
</tr>
<tr>
<td></td>
<td>2. Non-Use</td>
</tr>
<tr>
<td></td>
<td>22. Bequest</td>
</tr>
</tbody>
</table>
### Inland (Freshwater) Wetland

<table>
<thead>
<tr>
<th>General Wetland Characteristics for “Common List”</th>
<th>Examples</th>
<th>NESCS 4-Group Designation relevant combinations: environment—end-product—use—user</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Wildlife</strong></td>
<td>Birds, fish, insects for harvest, catch-and-release, research, or viewing</td>
<td>Wetland-fauna-extractive/in-situ-households</td>
</tr>
<tr>
<td><strong>Vegetation</strong></td>
<td>Wetland plants for harvest, research, or viewing</td>
<td>Wetland-flora-extractive/in-situ-households</td>
</tr>
<tr>
<td><strong>Characteristic Open Space/“-scape”</strong></td>
<td>Wetland as enjoyable or inspirational landscape</td>
<td>Wetland-compositeendproduct-extractive/in-situ-households</td>
</tr>
<tr>
<td><strong>Water quality</strong></td>
<td>Extraction, distribution, scenic amenity</td>
<td>Wetland-liquidwater-extractive/in-situ-(any)</td>
</tr>
<tr>
<td><strong>Flood surge (reduction)</strong></td>
<td>Protect or support human health or life (1205), protect human property (1206)</td>
<td>Wetland-compositeendproduct-extractive/in-situ-(any)</td>
</tr>
<tr>
<td><strong>Groundwater (quantity)</strong></td>
<td>recharge/flow from wetland absorption is intermediate ecological process</td>
<td>Groundwater-liquidwater-extractiveraw material-(any)</td>
</tr>
<tr>
<td><strong>Freshwater (surface flow volume)</strong></td>
<td>recharge/flow from wetland absorption is intermediate ecological process</td>
<td>River/stream-liquidwater-extractiveraw material-(any)</td>
</tr>
<tr>
<td><strong>Existence/bequest for each of previous two</strong></td>
<td></td>
<td>Groundwater-liquidwater-nonuse-households, River/stream-liquidwater-nonuse-households</td>
</tr>
</tbody>
</table>
### Formal List of Potential Wetland FFES

<table>
<thead>
<tr>
<th>NESCS 4-Group Designation relevant combinations: environment—end-product—use—user</th>
<th>NESCS User Codes and Combinations ww.xx.yyy.zzzzzzz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wetland-fauna-extractive/in-situ-households</td>
<td>12.31.1yyy.201, 12.31.1yyy.1zzzzzz</td>
</tr>
<tr>
<td>Wetland-flora-extractive/in-situ-households</td>
<td>12.21.1yyy.201, 12.21.1yyy.1zzzzzz</td>
</tr>
<tr>
<td>Wetland-composite-endproduct-in-situ-households</td>
<td>12.81.1207(/08/09).201</td>
</tr>
<tr>
<td>Wetland-liquid-water-extractive/in-situ-(any)</td>
<td>12.12.1yyy.1zzzzzz, 12.12.1yyy.201</td>
</tr>
<tr>
<td>Wetland-composite-endproduct-in-situ-(any)</td>
<td>12.82.1205(/6).1zzzzzz</td>
</tr>
</tbody>
</table>

**Context**
- geographic, uniqueness/substitutability, social-individual valuation

**Define**
- relevant environment–end-product–use–user combinations

**Quantify**
- defined end-products and relevant paths to value

**Prioritize**
- defined Flows of Final Ecosystem Services (FFES)

**Monetize**
- some prioritized and defined FFES

*Not all defined, quantified, and prioritized elements can be monetized*

*Including economic and non-economic methods, not all defined or quantified elements can be ranked, and criteria or ranking may vary*

*Not all defined elements can be quantified*

*Not all context can translate to definitions useful for FFES*

**Careful definition identifies exactly what we seek to (or cannot yet) quantify, prioritize, or monetize**

*Relative scarcity or abundance, absolute and at geographic scale of production and accessibility; degree to which characteristics are unique or substitutable; economic use of characteristics; cultural and individual influences on how contextual value is assigned*
Context geographic, uniqueness/substitutability, economic use, social-individual valuation

Define relevant environment–end-product–use–user combinations

Quantify defined end-products and relevant paths to value

Prioritize defined Flows of Final Ecosystem Services (FFES)

Monetize some prioritized and defined FFES

Identified-Defined (Qualified)


- Identified-Defined (Qualified)
- Quantified
- Prioritized
- Monetized

**Identified-Defined (Qualified)**

- Wetland-fauna extractive/in-situ-households, (any)
- Wetland-flora extractive/in-situ-households, (any)
- Wetland-compositeendproduct in-situ-households

**Quantified**

(best metrics achieved to fill identified FFES and NESCS codes)

**Prioritized**

**Monetized** (value estimates)
### Identified-Defined (Qualified)

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Use Type</th>
<th>Possible Metrics</th>
</tr>
</thead>
<tbody>
<tr>
<td>12.81.1207/08/09.201</td>
<td>Wetland-compositeendproduct-in-situ-households</td>
<td>Pictures or plants taken for school project</td>
<td># of visits to purpose /yr.</td>
</tr>
<tr>
<td>12.81.1207.561520</td>
<td>Wetland-liquidwater-extractive/in-situ-(any)</td>
<td>gathering forest products for commercial use</td>
<td>Quantity (/Input value) to garden/landscaping/nursery operations</td>
</tr>
<tr>
<td>16.12.11yy.1zzzzzz</td>
<td>Wetland-compositeendproduct-in-situ-(any)</td>
<td>Groundwater % purified through wetlands, extracted for industrial use or public treatment</td>
<td>Quantity (at quality level?) of groundwater purified by wetlands used commercially or in public water treatment</td>
</tr>
<tr>
<td>12.31.21/(2).201, 12.21.21/(2).201, 12.81.21/(2).201, 12.82.21/(2).201</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>16.12.11yy.1zzzzzz</td>
<td>Groundwater-liquidwater-extractorawmaterial-(any)</td>
<td></td>
<td></td>
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<tr>
<td>12.31.1yy.201, 12.21.1yy.201, 12.21.1yy.1zzzzzz, 12.21.1yy.301, 12.31.1106.201</td>
<td>River/stream-liquidwater-extractorawmaterial-(any)</td>
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<td></td>
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<tr>
<td>12.31.1106.201, 12.31.1209.201, 12.21.1109.201, 12.21.1104.11321, 12.81.1207.561520, 16.12.11yy.1zzzzzz</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Quantified (best metrics achieved to fill identified FFES and NESCS codes)

- 12.31.1yy.201, 12.21.1yy.201, 12.21.1yy.1zzzzzz, 12.31.1106.201

### Prioritized

- 12.31.1106.201, 12.31.1209.201, 12.21.1109.201, 12.21.1104.11321, 12.81.1207.561520, 16.12.11yy.1zzzzzz

### Monetized (value estimates)
6. Applicability of NESC for Environmental Accounting

Comparing FEGS-CS and NESC

Metrics or indicators “populate” NESC cells

Needs:
- EPFs
- Data

Tool developers and practitioners within EPA expect FEGS-CS to be used to vet appropriate metrics for final ES, and the EcoService Models Library to aid in identifying ecological production functions.

ORD Contact for FES Metrics and Indicators: Dr. Paul Ringold/Ringold.paul@epa.gov; 541-754-4565

ORD Contact for EcoService Models Library: Randy Bruins/bruins.randy@epa.gov

https://esml.epa.gov/epf_l/public/signup
6. Applicability of NESCS for Environmental Accounting

The NESCS focuses users on the final ES of interest:

- By demanding identification of environment and user, it helps users discover which metrics best may best match ecosystem supply with human demand.
- It embeds ecosystem structures processes and functions within the EPFs that characterize dynamics affecting the supply of ecological endpoints.
- Modular structure offers appeal to non-US users, and standardized definitions should accommodate “results” database construction and use.
The NESCS is a conceptual framework and a structure, with guidelines for use:

- applies at fine or coarse levels of numeric coding
- offers great flexibility in geographic and temporal scale of application
- does not provide metrics or conduct valuation, but should assist by identifying elements directly relevant to both later steps in ESA work
- will use EPFs, when applied in a sophisticated way
- is an accessible ES classification tool that offers a path to standardization of terms and many metrics
6. Applicability of NESCS for Environmental Accounting

<table>
<thead>
<tr>
<th>Environment</th>
<th>End-Products</th>
<th>Use or/and Non-Use</th>
<th>Direct User</th>
<th>Examples of Direct Users/Non-Use Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aquatic</td>
<td>-</td>
<td></td>
<td></td>
<td>-</td>
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<td>Terrestrial</td>
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<tr>
<td>Atmospheric</td>
<td>-</td>
<td></td>
<td></td>
<td>-</td>
</tr>
</tbody>
</table>

**Proposed 4-Group NESCS Structure** with FEGS-Metric Pass-Through

**Example (a): mussels – m²/mussels/km of beach (m²m/kmb)**

**DRAFT (EPA internal)**

One “trace,” or table row, is a potential FFES. Existence, Magnitude, and Value of the FFES are empirical questions.
6. Applicability of NESCS for Environmental Accounting

National Ecosystem Services Classification System, Four-Group Structure

Environment

Water
- Snow/ice
- Liquid water

Flora
- Specific species of flora

Fauna
- Specific species of fauna

Other Biotic Natural Material
- Specific types of natural material

Atmospheric Components
- Air
- Solar light/radiation

Soil
- Specific types of soil

Other Abiotic Natural Material
- Specific types of natural material

Combined End-Products
- -Scapes: views, sounds and scents of land, sea, sky
- Regulation of extreme events
- Natural phenomena
- 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
  - 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
  - Information, science, education, and research
  - Other in-situ use

Non-Use
- Existence
- Bequest

Flows of Final Ecosystem Services

Direct Use/Non-Use

Direct User

Industries
- Agriculture, forestry, hunting
- Mining
- Utilities
- Construction
- Manufacturing
- Wholesale and 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, and recreation
- Accommodation and food services
- Other services
- Households
- Government

May substitute out NAICS for ISIC or other system, so long as exhaustive, exclusive, and easy-to-use

UNSD-selected ENVIRONMENT classes must be exhaustive, exclusive, and easy-to-use

Challenge Slide!!

Can you suggest a flow of “final” ES that we cannot trace from left to right?!
6. Applicability of NESCS for Environmental Accounting

Understanding NESCS in contrast to other Tools and Approaches

- **The NESCS is NOT a list** –
  - the 4-Group Structure and Guidelines for Use (under construction) provide a framework, operators, and general rules
  - can be used to make a list for any application, but there is little use for a comprehensive list (which could include *thousands* of potential FFES)

- **Final ES are NOT in any of the 4-Group Structure columns or tables**

- **The NESCS does NOT – do any economic valuation**
6. Applicability of NESCS for Environmental Accounting

Understanding NESCS in contrast to other Tools and Approaches

- **The NESCS is a modular (final) ES identification tool**
- **The NESCS looks outside of its own framework, structure, and rules for:**
  - *Ecological Production Functions* – to describe/project dynamics of FFES from an area, over time, and in response to exogenous influences
  - *all final selection of metrics, indicators, and qualitative or quantitative measures*; proper use of NESCS can guide choices, not make them
  - *stakeholders vet the appropriate set of identifiable FFES* and the appropriate subsets for environmental measurement and for valuation
  - *choosing which research and methodology gaps* – to improve future ES assessment efforts