1. Biodiversity in the SEEA-EEA
2. Developing Thematic Species Accounts
3. Opportunities for Sustainable Development
“Biological diversity means the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems” (CBD, 1992)
Biodiversity and ecosystem services

- Total stock of Natural Capital, comprised of biotic and abiotic features
- Ecosystems (functional ‘units’ in which biotic and abiotic aspects of natural capital interact)
- Species (biotic elements of natural capital)
- Genes

Flow of Ecosystem Services

- Other capital inputs
- Other benefits from abiotic natural capital

Flow of benefits to people from combination of natural and other capitals
Areas of ecosystems – reveals ecosystem diversity at landscape / country scale

**Species diversity** characteristic of ecosystem condition

**Ability to deliver ecosystem services**

**Ecosystem thematic accounts:** E.g., Biodiversity, Carbon, Water, Land

**Supporting information:** Socio-economic conditions and activities, ecological production functions

**Tools:** classifications, spatial units, scaling, aggregation, biophysical modelling
THEMATIC SPECIES ACCOUNTS?

Information in Ecosystem Extent Accounts

Testing on how to communicate ecosystem-level biodiversity and linking to ecosystem services

Important for ecosystem function - Species provide an indicator of ecosystem condition

Perform functional roles

Methodological gap - planning for species may differ from planning for ecosystems

Important but for the future!
SPECIES AND THE SEEA-EEA

Benefits of Species

Exchange of material

Functional traits

SNA and non-SNA

Individual & societal well-being

Ecosystem services

Other ecosystem assets

Ecosystem characteristics

Intra-ecosystem flows

Inter-ecosystem flows

ECOSYSTEM ASSET

Human inputs (e.g., labour, produced assets)
Towards a global map of natural capital: key ecosystem assets

Experimental Biodiversity Accounting as a component of the System of Environmental-Economic Accounting Experimental Ecosystem Accounting (SEEA-EEA)

Exploring approaches for constructing species accounts in the context of the SEEA-EEA

2014

http://wcmc.io/Global_Nat_Cap

2015

http://wcmc.io/SEEA_EEA_Bio_Accounting

2016

http://wcmc.io/Species_Accounting
DEVELOPING THEMATIC SPECIES ACCOUNTS
PRIORITISING SPECIES FOR ACCOUNTING

Reflects species are an important element of ecosystem condition and service supply and a consideration for ecosystem management in itself *

Conservation Concern:
- Threatened species
- Endemic species
- Migratory species
- Evolutionary distinct species

Ecosystem Condition Concern:
- Umbrella species
- Specialist species
- Generalist species

Ecosystem Condition & Functioning Concern:
- Keystone species
- Trophic groups
- Taxonomic groups
- Functional groups
- Structural classes

Direct Ecosystem Service Concern:
- Charismatic species
- Wild food species

Thematic concerns

*Remme et al., (2016) Exploring spatial indicators for biodiversity accounting
## Biodiversity Accounts in 2016

### Table 9.3a. Change over time in the numbers of species listed under the IUCN Red List of threatened species categories in the Central Highlands study area

<table>
<thead>
<tr>
<th></th>
<th>Extinct</th>
<th>Critically</th>
<th>Endangered</th>
<th>Vulnerable</th>
<th>Near Threatened</th>
<th>Least Concern</th>
<th>Lower Risk</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1990</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>12</td>
<td>16</td>
</tr>
<tr>
<td>1995</td>
<td>1</td>
<td>0</td>
<td>6</td>
<td>10</td>
<td>0</td>
<td>10</td>
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<tr>
<td>2000</td>
<td>1</td>
<td>1</td>
<td>7</td>
<td>15</td>
<td>1</td>
<td>1</td>
<td>14</td>
<td>40</td>
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<tr>
<td>2005</td>
<td>1</td>
<td>3</td>
<td>8</td>
<td>13</td>
<td>5</td>
<td>8</td>
<td>2</td>
<td>40</td>
</tr>
<tr>
<td>2010</td>
<td>1</td>
<td>4</td>
<td>7</td>
<td>10</td>
<td>11</td>
<td>8</td>
<td>0</td>
<td>42</td>
</tr>
<tr>
<td>2015</td>
<td>0</td>
<td>8</td>
<td>6</td>
<td>9</td>
<td>12</td>
<td>0</td>
<td>-12</td>
<td>28</td>
</tr>
</tbody>
</table>

Net change 1990 to 2015

<table>
<thead>
<tr>
<th></th>
<th>Extinct</th>
<th>Critically</th>
<th>Endangered</th>
<th>Vulnerable</th>
<th>Near Threatened</th>
<th>Least Concern</th>
<th>Lower Risk</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
<td>8</td>
<td>6</td>
<td>7</td>
<td>12</td>
<td>-12</td>
<td>28</td>
<td></td>
</tr>
</tbody>
</table>
1) Fits the accounting unit of an ‘Ecosystem Asset’
2) Only captures diversity within a location / ecosystem unit
3) Species-level biodiversity is not additive
4) Resource intensive – generally requires significant direct observation data

1) Capture diversity between locations (ecosystems interact)
2) Simplify accounting where species use multiple ecosystems
3) Less resources intensive – can employ modelling approaches to make use of sparse direct observation data

Interaction between the biodiversity and accounting community required to develop pragmatic solutions for scale and aggregation issues!
INTEGRATION CHALLENGES

Interaction between the biodiversity and accounting community required to develop pragmatic solutions for integration issues!
GENERAL CHALLENGES

1) Consideration of thresholds – need to establish safe operating spaces for species and ecosystems

2) Reference condition – need to establish appropriate common reference point / year to aggregate and compare across species data and (potentially) other ecosystem condition characteristics

3) Applying big data – can we effectively use satellite remote sensing data, in-situ monitoring and citizen science
OPPORTUNITIES FOR SUSTAINABLE DEVELOPMENT

03/10/2016
A HOLISTIC PICTURE

Identifying which ecosystems are being degraded and their resilience compromised.

Comparing current trends in species status with information on economic activities and other drivers of species loss.

Informing ecological return on investment analysis.

Identifying where trends in species status infer a risk to future ecosystem service provision.

Understanding the capacity of ecosystems to provide these services.
A THEMATIC PICTURE

The role of species in transferring matter and energy within and between ecosystems.

Maintaining biodiversity is an important part of ‘future-proofing’ ecosystems against climate change and other shocks.

In the wider SEEA-EEA this will be a subset of priority services – it will not be possible to robustly value all ecosystem services (e.g., climate regulation, water purification, pollination)

Conservation concerns of people (e.g., cultural benefits)

INTEGRATED DECISION MAKING

The drivers of biodiversity / species loss arise throughout the economy

Agriculture  Pollution  Climate Change  Forestry  Biofuel  Infrastructure

Biodiversity Protection / Enhancement Targets

Natural Hazard Protection

Climate Adaptation  Water Quality & Supply  Sustainable Development  Human Health  Rural Livelihoods  Food Security

Maintaining and investing in biodiversity will have benefits far beyond biodiversity and contribute to goals across our economies and societies
THANK YOU!

Images: Down to earth, Peter Hartl.; The production of Shea Butter, Carsten ten Brink, CC courtesy of Flickr; Prunus Africana (Hook.f.) Kalkman (ROSACEAE), Scamperdale; Cabrero (Spindalis zena, Thraupidae), Rodrigo Medel, all CC courtesy of Flickr. Remainder reproduced under license from Shuttershock.

03/10/2016
## Heterogeneity of Existing Data

<table>
<thead>
<tr>
<th>Example Species</th>
<th>Species or Species Group 1</th>
<th>Species or Species Group 2</th>
<th>Species or Species Group 3</th>
<th>Species or Species Group 4</th>
<th>Species or Species Group 5</th>
<th>Composite indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reference Measure for a common year</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Abundance measure at start of accounting period</td>
<td>No. of individuals</td>
<td>No. of individuals</td>
<td>Relative abundance based on population density</td>
<td>Hectares of suitable habitat</td>
<td>Proportion of original species complement</td>
<td>N/A</td>
</tr>
<tr>
<td>Additions and reductions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Should be stated if known</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Abundance measure at end of accounting period</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Net change in abundance over accounting period</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Relative Abundance measure at start of accounting period</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Relative Abundance measure at end of accounting period</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Net change in relative abundance over accounting period</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Change as % of the opening relative abundance</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Opening (1995)</td>
<td>2,000</td>
<td>100,000</td>
<td>Set to 1.0</td>
<td>1,000,000</td>
<td>85%</td>
<td>100%</td>
</tr>
<tr>
<td>Additions</td>
<td>1,500</td>
<td>60,000</td>
<td>0.70</td>
<td>100,000</td>
<td>80%</td>
<td>N/A</td>
</tr>
<tr>
<td>Reductions</td>
<td>100</td>
<td>N/A</td>
<td>N/A</td>
<td>10,000</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Closing (2010)</td>
<td>200</td>
<td>N/A</td>
<td>N/A</td>
<td>30,000</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Net Change</td>
<td>1,400</td>
<td>65,000</td>
<td>0.50</td>
<td>80,000</td>
<td>70%</td>
<td>N/A</td>
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<tr>
<td>Opening (% of reference, 2005)</td>
<td>-100</td>
<td>+5,000</td>
<td>-0.20</td>
<td>-20,000</td>
<td>-10%</td>
<td>N/A</td>
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<tr>
<td>Closing (% of reference, 2010)</td>
<td>75%</td>
<td>60%</td>
<td>70%</td>
<td>10%</td>
<td>94%</td>
<td>49%</td>
</tr>
<tr>
<td>Net change (% of reference)</td>
<td>70%</td>
<td>65%</td>
<td>50%</td>
<td>8%</td>
<td>82%</td>
<td>43%</td>
</tr>
<tr>
<td>Change (% of opening)</td>
<td>-5%</td>
<td>+5%</td>
<td>-20%</td>
<td>-2%</td>
<td>-12%</td>
<td>-6%</td>
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<tr>
<td>Change as % of the opening relative abundance</td>
<td>-6.7%</td>
<td>+8.3%</td>
<td>-29%</td>
<td>-20%</td>
<td>-13%</td>
<td>-13%</td>
</tr>
</tbody>
</table>
APPROACHES

1) Direct observations of species status
   i. Census counts, nest counts, population estimates from surveys
   ii. Requires significant investment

2) Habitat based modelling of species status
   i. Satellite-borne remote sensing data to model habitat condition for species and species groups
   ii. Maybe difficult to align with the ecosystem unit

3) Threat status categories
   i. IUCN Red List Data soon available at National Scale
   ii. Difficult to disaggregate spatially

4) Extent of important places for species
   i. Important Bird and Biodiversity Areas, Alliance for Zero Extinction sites, National Parks, Wilderness Areas
A PROPOSED TIERED APPROACH OF DATA NEEDS FOR BIODIVERSITY ACCOUNTS

Extent and Condition Account
Ecosystem extent, weighted by species indicators

Thematic Species Account
Species richness data and/or Threat Status Data

INCREASING INFORMATION REQUIREMENTS

Examples of information recorded for a Montane Coniferous Forest Ecosystem Unit (EU)

Extent and Condition Account
Montane Coniferous Forest EU extent, weighted by an input species condition indicator (e.g., Simpsons Index).

Thematic Species Account
Species richness of different taxonomic groups in Montane Coniferous Forest. Supplemented with information on species Red List stats.

Thematic Species Account
Species abundance monitoring data for Montane Coniferous Forest.