Outdoor recreation
Contributions of cultural services to the ecosystem services agenda

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“nonmaterial benefits people obtain from ecosystems,” and specifically lists “cultural diversity, spiritual and religious values, knowledge systems, educational values, inspiration, aesthetic values, social relations, sense of place, cultural heritage values, recreation and ecotourism”
1. Landscape aesthetics

• Emphasize visual scenic beauty
• Differences in aesthetics preferences

• Methods:
  – Monetary evaluation (e.g. property values)
  – More often as relative measure according to observers (e.g. ranking)
2. Cultural Heritage

- “the legacy of biophysical features, physical artifacts, and intangible attributes of a group or society that are inherited from past generations, maintained in the present, and bestowed for the benefit of future generations”
- Includes built environment and artifacts
- Tangible and intangibles (myths, legends and practices)
- Identity + livelihood + ecology:
  - E.g.1: Satoyama concept in Japan
  - E.g.2: Darjeeling region in India
  - E.g.3: wine regions...

Methods: expert knowledge elicitation
3. Recreation and Tourism

• In the field of conservation biology, recreation and tourism have been recognized mostly as a threat to ecosystems

• **Everyday short-term recreation** in nearby green spaces, **day tourism**, and **overnight tourism** are often lumped together

• Mental and physical health effects of outdoor recreation

• Role of infrastructure, accessibility and ecological conditions
  – Biodiversity → Ecotourism

• Methods: Visitor simulation models
4. Spiritual significance

- Religious conservation → Environmental stewardship
- E.g. Sacred groves as a long-term biodiversity pool preserved from short term interests
- Sacred sites and tourism
  - E.g. pilgrimage route to Santiago de Compostela

- Methods: qualitative analysis
Previous examples in ARIES

1. Sacred significance: an MCA to establish how sacred is each point of the landscape
   – based on distance from key natural and human made features

1. Recreation: a machine learning process to extract suitability of the landscape given known touristic places
   – links scenic beauty, religious activities, infrastructural elements and env. Conditions
Sacredness assessment
Tourist attractiveness
Beneficiaries
The Kailash Sacred Landscape example

- List of factors for assessing cultural value in KSL for three targeted stakeholders:
  - Pilgrims
  - Local people
  - Tourism related (hikers, tour operators)

- Distinguish between activities (hiking, skiing, pray,...) and features.

- Features can be:
  - Natural
  - Human made
Practical Part (workshop in Kathmandu)

• Participants are divided in groups representing stakeholders and the list with all criteria (using the excel file) is used for assigning marks to them (1-10) or pairwise.
• A facilitator assists each group
• Participants can give individual weights and then compute the average/mode or agree on a common weight.

• Excel files will be merged and radar-plots will be shown representing the different weights assigned to each criteria based on each stakeholder perspective.
• A final discussion on the results and on the possible methodologies/indicators to measure each criteria.
Results
Follow up: Data and behavioural models

• Simulate how human behavior and global environmental change interact to affect the travelling dynamics in the region and explore the effect of related policy interventions.

• Linked to activities

• Official data

• Crowdsourced: Flicker pictures – Twitter data
Tourism systems and main agent classes
References: model sources of inspiration

• Parrachini et al. 2014

Mapping cultural ecosystem services: A framework to assess the potential for outdoor recreation across the EU

Maria Luisa Parrachini, Graziella Zulian, Leena Kopparoinen, Joachim Maes, Jan Philipp Schängner, Mette Termansen, Marianne Zandbergen, Marta Perez-Soba, Paul A. Scholefield, Giovanni Biodio

• ESTIMAP

http://publications.jrc.ec.europa.eu/repo
Main Concepts of Supply

1. Hemeroby, often associated to naturalness as the complementary term, with a high degree of hemeroby equating to a high **human influence** on a natural environment.

2. Environmental features of attractiveness for outdoor recreation (**potential value of outdoor recreation**):
   - Protected areas
   - Rivers (**waterways**) and lakes (**water bodies**)
   - Coastline
   - Mountain Peaks
Main Concepts of Demand

1. Distance to Human Settlements

2. Travel time: a proxy of accessibility of a site
   - These two can be combined into Impedance:
     ➢ the probability of traveling to a site

3. Population that wants to recreate (population density factor)
Scalability of concepts
Connected to Collective Knowledge

• Waterways

```plaintext
@color(blue)
model each earth:Waterway
  "Automatically scales to find the types of settlements most relevant to each scale of observation."
using
gis.osm.query(
  feature-type="line",
  equal=(["waterway", "river"])
  if [space.scale <= 11],
gis.osm.query(
  feature-type="line",
  equal=(["waterway", (["river", "stream"))
  if [space.scale > 11];
```

• Human Settlements

```plaintext
model each infrastructure:HumanSettlement
  "Automatically scales to find the types of settlements most relevant to each scale of observation."
using
gis.osm.query(
  feature-type="point",
  equal=(["place", "city"])
  if [space.scale <= 5],
gis.osm.query(
  feature-type="point",
  equal=(["place", (["city", "town"))
  if [space.scale > 5 && space.scale < 9],
gis.osm.query(
  feature-type="point",
  equal=(["place", (["city", "town", "village"))
  if [space.scale >= 9];
```
The baseline model
```java
@documented(hemorby_table)
define HEMORBY_TABLE as {

<table>
<thead>
<tr>
<th>landcover</th>
<th>hemorby</th>
</tr>
</thead>
<tbody>
<tr>
<td>landcover:ArtificialSurface</td>
<td>7</td>
</tr>
<tr>
<td>landcover:ArableLand</td>
<td>6</td>
</tr>
<tr>
<td>landcover:NonIrrigatedArableLand</td>
<td>5, 4b-5a-5b</td>
</tr>
<tr>
<td>landcover:PermanentlyIrrigatedArableLand</td>
<td>4b-5a-5b</td>
</tr>
<tr>
<td>landcover:RiceField</td>
<td>4b-5a-5b</td>
</tr>
<tr>
<td>landcover:PermanentCropland</td>
<td>4, 4a-4b-5a //ADD</td>
</tr>
<tr>
<td>landcover:Vineyard</td>
<td>4, 4a-4b-5a</td>
</tr>
<tr>
<td>landcover:FruitAndBerryPlantation</td>
<td>4, 4a-4b-5a</td>
</tr>
<tr>
<td>landcover:OliveGrove</td>
<td>4, 4a-4b-5a</td>
</tr>
<tr>
<td>landcover:PastureLand</td>
<td>3, 3a-4a-4b</td>
</tr>
<tr>
<td>landcover:AnnualCroplandAssociatedWithPermanentlyIrrigatedArableLand</td>
<td>4a-4b-5a</td>
</tr>
<tr>
<td>landcover:ComplexCultivationPatternedLand</td>
<td>4a-4b-5a</td>
</tr>
<tr>
<td>landcover:AgriculturalLandWithNaturalVegetation</td>
<td>4a-4b-5a</td>
</tr>
<tr>
<td>landcover:AgroForestryLand</td>
<td>3, 3a-4a-4b</td>
</tr>
<tr>
<td>landcover:BroadLeafForest</td>
<td>3, 3a-4a-4b</td>
</tr>
<tr>
<td>landcover:ConiferousForest</td>
<td>3, 3a-4a-4b</td>
</tr>
<tr>
<td>landcover:MixedForest</td>
<td>3, 3a-4a-4b</td>
</tr>
<tr>
<td>landcover:NaturalGrassland</td>
<td>3, 3a-4a-4b</td>
</tr>
<tr>
<td>landcover:MoorAndHeathland</td>
<td>2</td>
</tr>
<tr>
<td>landcover:SclerophyllousVegetation</td>
<td>3</td>
</tr>
<tr>
<td>landcover:TransitionalWoodlandScrub</td>
<td>2</td>
</tr>
<tr>
<td>landcover:BeachDuneAndSand</td>
<td>2</td>
</tr>
<tr>
<td>landcover:BareArea</td>
<td>1, //ADD</td>
</tr>
<tr>
<td>landcover:BareRock</td>
<td>1</td>
</tr>
<tr>
<td>landcover:lichenMoss</td>
<td>1</td>
</tr>
<tr>
<td>landcover:SparseVegetation</td>
<td>1</td>
</tr>
<tr>
<td>landcover:BurnedLand</td>
<td>5</td>
</tr>
<tr>
<td>landcover:GlacierAndPerpetualSnow</td>
<td>1</td>
</tr>
<tr>
<td>landcover:NestLand</td>
<td>1</td>
</tr>
<tr>
<td>landcover:Mangrove</td>
<td>1</td>
</tr>
<tr>
<td>landcover:InlandMarsh</td>
<td>2</td>
</tr>
<tr>
<td>landcover:PeatBog</td>
<td>2</td>
</tr>
<tr>
<td>landcover:SaltMarsh</td>
<td>2</td>
</tr>
<tr>
<td>landcover:Saline</td>
<td>2</td>
</tr>
<tr>
<td>landcover:IntertidalFlat</td>
<td>1</td>
</tr>
<tr>
<td>landcover:WaterBody</td>
<td>1</td>
</tr>
</tbody>
</table>

}}
```
k.IM code (2)

```python
@documented(recreation.values.potential)
model im:Potential value of behavior:Outdoor behavior:Recreation
    observing
        magnitude of proportion of behavior:Outdoor in behavior:Recreation named human_influence,
        distance to conservation:ProtectedArea in m named distance_to_pristine_areas,
        distance to earth:Coastline in m named distance_to_coast,
        distance to earth:Waterway in m named distance_to_streams,
        distance to earth:WaterBody in m named distance_to_lakes,
        distance to earth:MountainPeak in m named distance_to_mountains
    set to
        human_influence "
            (nodata(distance_to_pristine_areas) ? 0 : distance_to_pristine_areas)
            + (nodata(distance_to_lakes) ? 0 : distance_to_lakes)
            + (nodata(distance_to_streams) ? 0 : distance_to_streams)
            + (nodata(distance_to_mountains) ? 0 : distance_to_mountains)
            + (nodata(distance_to_coast) ? 0 : distance_to_coast)
        ] then [ self.invert(); ]
```
@todo('semantics is tentative')

model in:Impedance of behavior:TravelConnection

observing
distance from infrastructure:HumanSettlement in m
   named distance_from_human_settlements,
   im:Duration of behavior:TravelConnection in day named travel_time

set to [
  travel_time < 0.02885
    ? (451/(450 + Math.exp(1.12 * (10**-.4) * distance_from_human_settlements)))
    : (451/(450 + Math.exp(1.12 * (10**-.4) * (distance_from_human_settlements + 30000))))
];

k.IM code (3)
Travel time in the baseline model


- An urban/rural population gradient around large cities of 50,000 or more people
- Global accessibility measures which combined with data on population density to create a much finer typology which is termed the Agglomeration Index (AI).
- The global map of travel time to major cities (cities of 50,000 or more people in year 2000) is a useful dataset in its own right, but it is also a component of the AI.

- This is described further in:
Towards globally customizable ecosystem service models

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Locations of the Basque Country
Results: Demand
Results: Supply
Results Surplus/Deficit
Results: Cobb-Douglass
Results: ROS
k.IM Code (4)

```ruby
@documented(recreation.tables.opportunity)

define RECREATION_OPPORTUNITY_TABLE as {

  remoteness | recreation_potential | score | description
  =<  0.25   | <  0.75                |   1   | 'low provision, easily accessible',
  0.25 to 0.5 | <  0.75                |   2   | 'low provision, accessible',
  >  0.5     | <  0.75                |   3   | 'low provision, not easily accessible',
  <=  0.25   |  0.75 to 0.88          |   4   | 'medium provision, easily accessible',
  0.25 to 0.5 |  0.75 to 0.88          |   5   | 'medium provision, accessible',
  >  0.5     |  0.75 to 0.88          |   6   | 'medium provision, not easily accessible',
  <=  0.25   | >   0.88               |   7   | 'high provision, easily accessible',
  0.25 to 0.5 | >   0.88               |   8   | 'high provision, accessible',
  >  0.5     | >   0.88               |   9   | 'high provision, not easily accessible'

```
Differences with ESTIMAP model

- We don’t use CAPRI agricultural model to differentiate attractiveness of different types of crops.
- European-derived, land cover-based estimates of naturalness and proximity thresholds, which may differ by ecoregion and socioeconomic setting, respectively.
- Both would be best informed by local parameterizations provided by region-specific experts.
Examples of model customization

- Local Land Cover and human influence
- Feature of attractiveness by activity (e.g. kayaking, surfing...)
- Cost-distance layer (travel time)
Conclusions

• baseline model of outdoor recreation
• not capturing touristic flows by only day trips

Homework:
• identify the weak points
• propose alternative solutions