Outdoor recreation

BASQUE CENTRE FOR CLIMATE CHANGE
Klima Aldaketa Ikergai

International Spring University on Ecosystem Services Modeling

Contributions of cultural services to the ecosystem services agenda

Terry C. Daniel[a,1], Andreas Muhar[b], Arne Arnberger[b], Olivier Aznar[c], James W. Boyd[d], Kai M. A. Chan[e], Robert Costanza[f], Thomas Elmqvist[g], Courtney G. Flint[h], Paul H. Gobster[i], Adrienne Grêt-Regamey[j], Rebecca Lave[k], Susanne Muhar[l], Marianne Penker[m], Robert G. Ribe[n], Thomas Schauppenlehner[b], Thomas Sikor[o], Ihor Soloviy[p], Marja Spierenburg[q], Karolina Taczanowska[b], Jordan Tam[e], and Andreas von der Dunk[j]

[a]School of Natural Resource and Environment, University of Arizona, Tucson, AZ 85721; [b]Department of Landscape, Spatial and Infrastructure Sciences, University of Natural Resources and Life Sciences, A-1190 Vienna, Austria; [c]Evolution des Usages, Intervention Publique et Développement des Espaces Ruraux, Irstea, Clermont-Ferrand, 63172 Aubière Cedex, France; [d]Resources for the Future, Washington, DC 20036; [e]Institute for Resources, Environment & Sustainability, University of British Columbia, Vancouver, BC, Canada V6T 1Z4; [f]Institute for Sustainable Solutions, Portland State University, Portland, OR 97201; [g]Department of Systems Ecology and Stockholm Resilience Centre, Stockholm University, SE-106 91 Stockholm, Sweden; [h]Natural Resources and Environmental Sciences, University of Illinois, Urbana, IL 61801; [i]Northern Research Station, US Department of Agriculture Forest Service, Evanston, IL 60201; [j]Department of Civil, Environmental and Geomatic Engineering, Swiss Federal Institute of Technology, 8093 Zurich, Switzerland; [k]Department of Geography, Indiana University, Bloomington, IN 47405; [l]Department of Water, Atmosphere and Environment, University of Natural Resources and Life Sciences, 1180 Vienna, Austria; [m]Department of Economics and Social Sciences, University of Natural Resources and Life Sciences, 1190 Vienna, Austria; [n]Institute for a Sustainable Environment, University of Oregon, Eugene, OR 97403; [o]School of International Development, University of East Anglia, Norwich NR4 7TJ, United Kingdom; [p]Institute of Ecological Economics, Ukrainian National Forestry University, Lviv 790057, Ukraine; and [q]FSW Department of Organisation Studies, Vrije Universiteit, 1081 HV Amsterdam, The Netherlands

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MEA, 2005

“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 simulations models

4. Spiritual significance

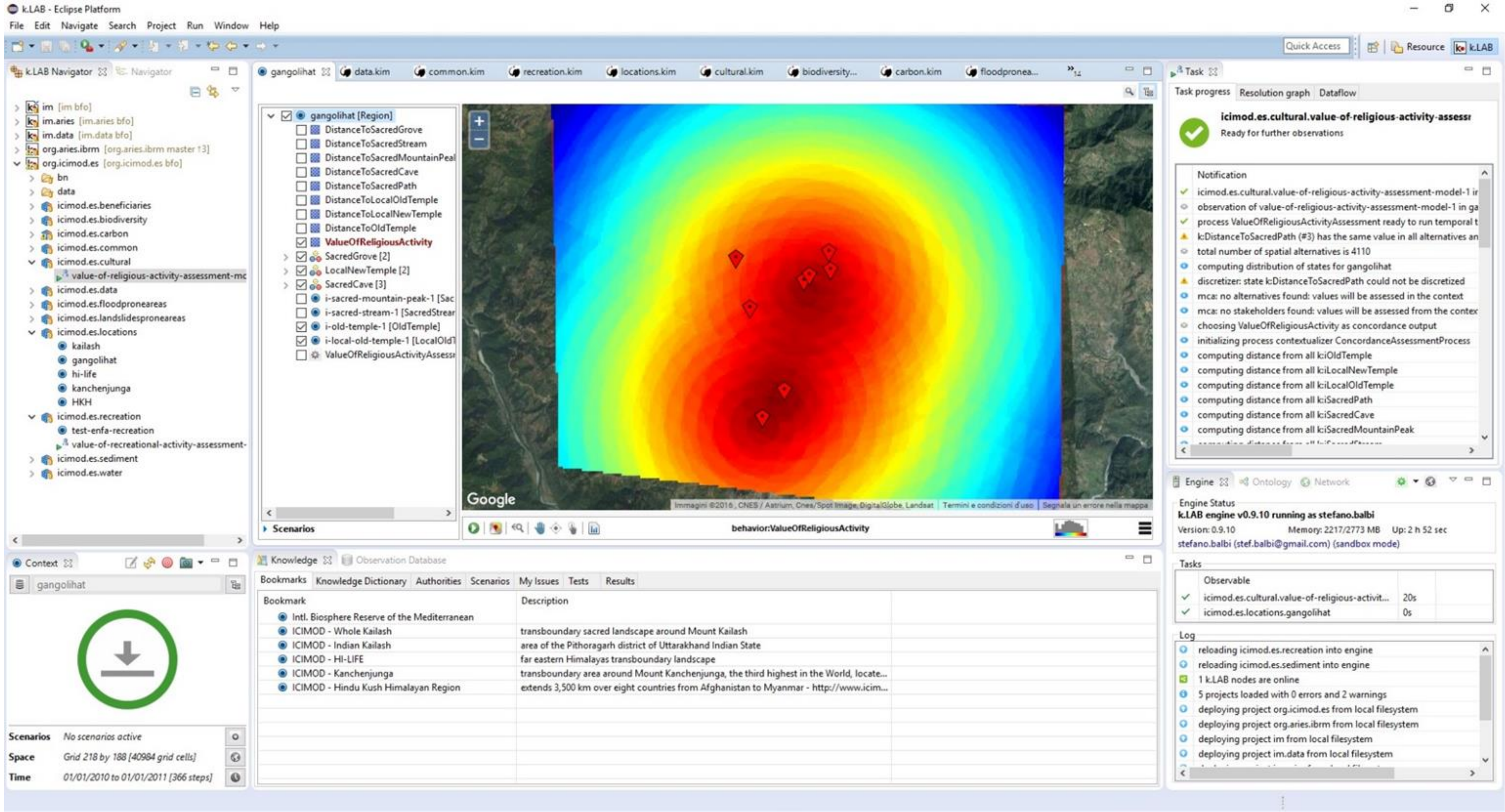
- Religious conservation → Environmental stewardship
- E.g. Sacred groves as a long-term biodiversity pool preserved from short term interests
- Sacred sites and tourism
  - E.g. pilgrimage route to Santiago de Compostela
- Methods: qualitative analysis

Previous examples in ARIES

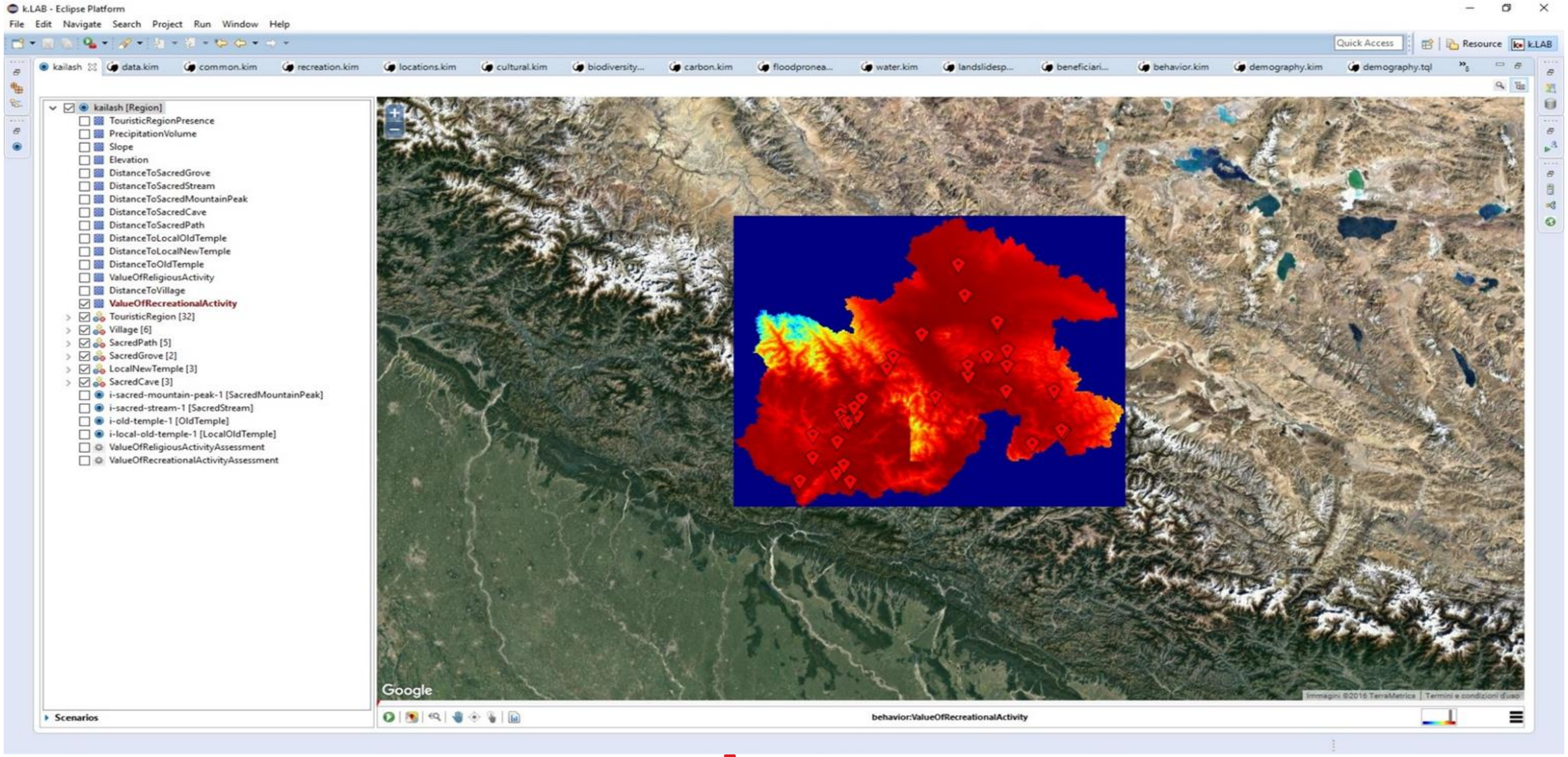
1. Sacred significance: an MCA to establish how sacred is each point of the landscape
   - based on distance from key natural and human made features

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

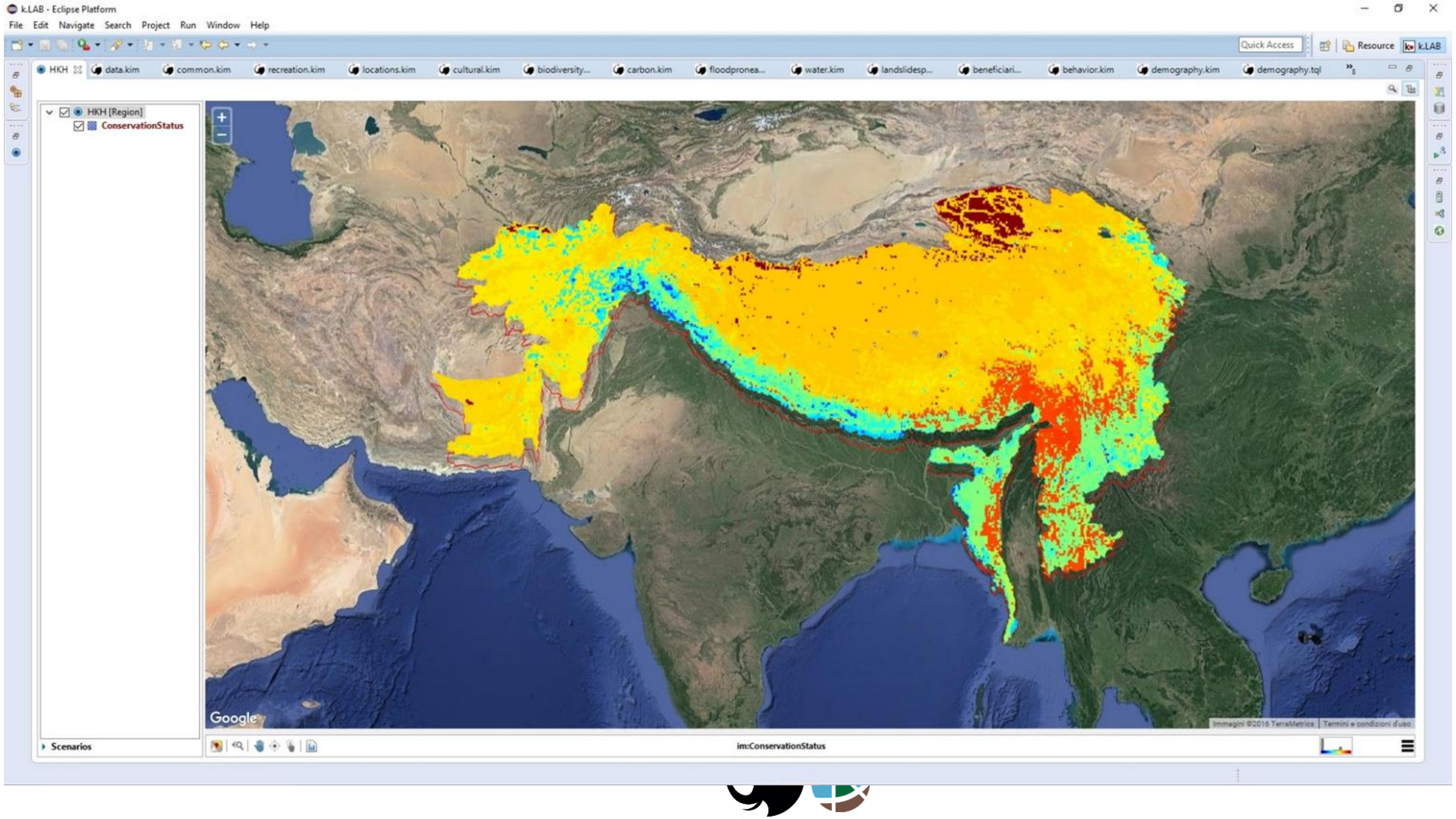
Sacredness assessment



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)

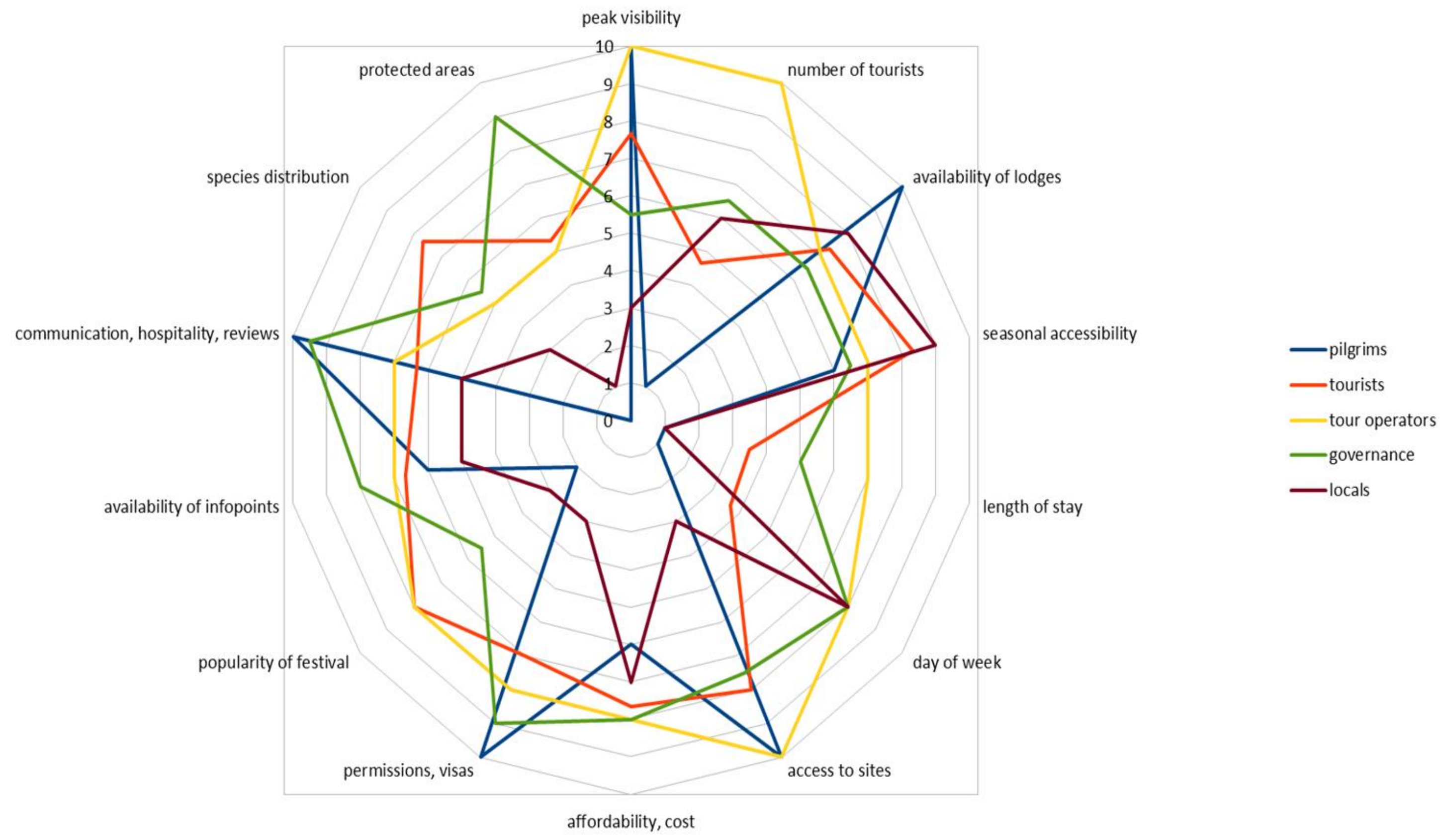
- Distinguish between **activities** (hiking, skiing, pray,...) and **features**.
- **Features** can be:
    - Natural
    - Human made

Practical Part (workshop in Kathmandu)

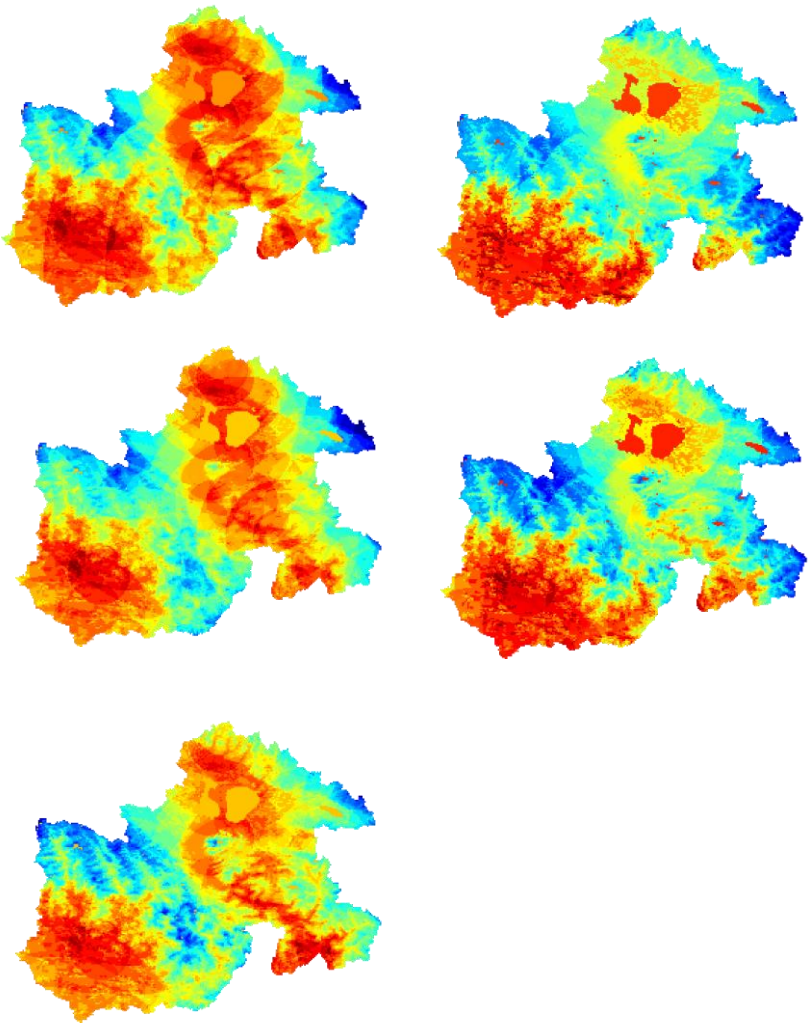
- Participants are divided in groups representing stakeholders and the list with all criteria (using the excel file) is used for assigning marks to them (1-10) or pairwise.
- A facilitator assists each group
- Participants can give individual weights and then compute the average/mode or agree on a common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



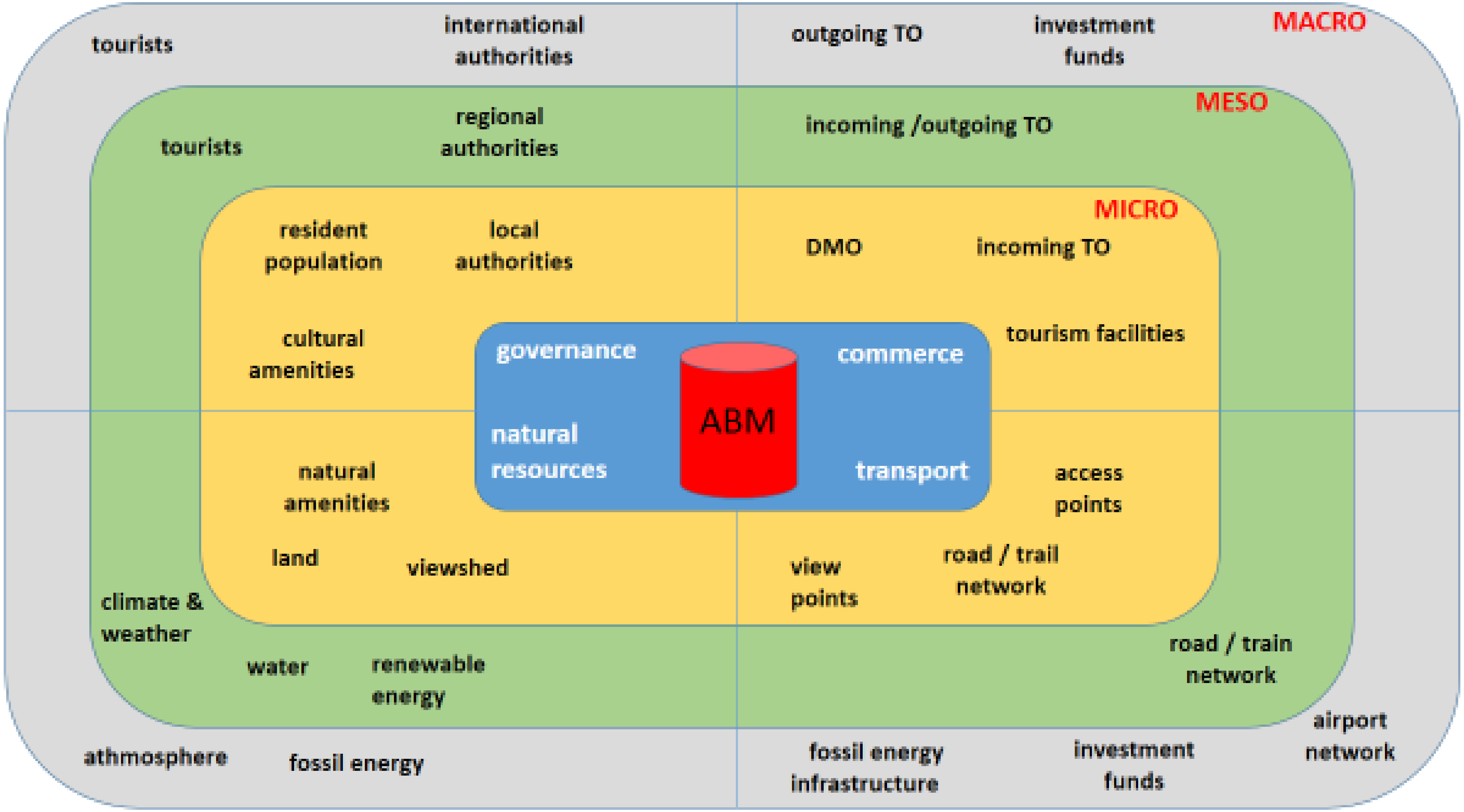
peak visibility
number of tourists
availability of lodges
seasonal accessibility
length of stay
day of week
access to sites
affordability, cost
permissions, visas
popularity of festival
availability of infopoints
communication, hospitality, reviews
species distribution
protected areas
10
9
8
7
6
5
4
3
2
1
0
pilgrims
tourists
tour operators
governance
locals



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


Ecological Indicators 45 (2014) 371–385

Contents lists available at ScienceDirect

Ecological Indicators

journal homepage: www.elsevier.com/locate/ecolind

ELSEVIER

CrossMark

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

Maria Luisa Paracchini[a,*], Grazia Zulian[a], Leena Kopperoinen[b], Joachim Maes[a], Jan Philipp Schägner[a], Mette Termansen[c], Marianne Zandersen[c], Marta Perez-Soba[d], Paul A. Scholefield[e], Giovanni Bidoglio[a]

[a] Joint Research Centre, Institute for Environment and Sustainability, Via E. Fermi 2749, 21027 Ispra, (VA), Italy
[b] Finnish Environment Institute SYKE, P.O. Box 140, FI-00251 Helsinki, Finland
[c] Aarhus University, Department of Environmental Science, Frederiksborgvej 399, 4000 Roskilde, Denmark
[d] ALTERRA, Wageningen University and Research Centre, P.O. Box 47, 6700 AA Wageningen, The Netherlands
[e] Centre for Ecology & Hydrology, Lancaster Environment Centre, Library Avenue, Lancaster, Lancashire LA1 4AP, United Kingdom

- ESTIMAP

http://publications.jrc.ec.europa.eu/r

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

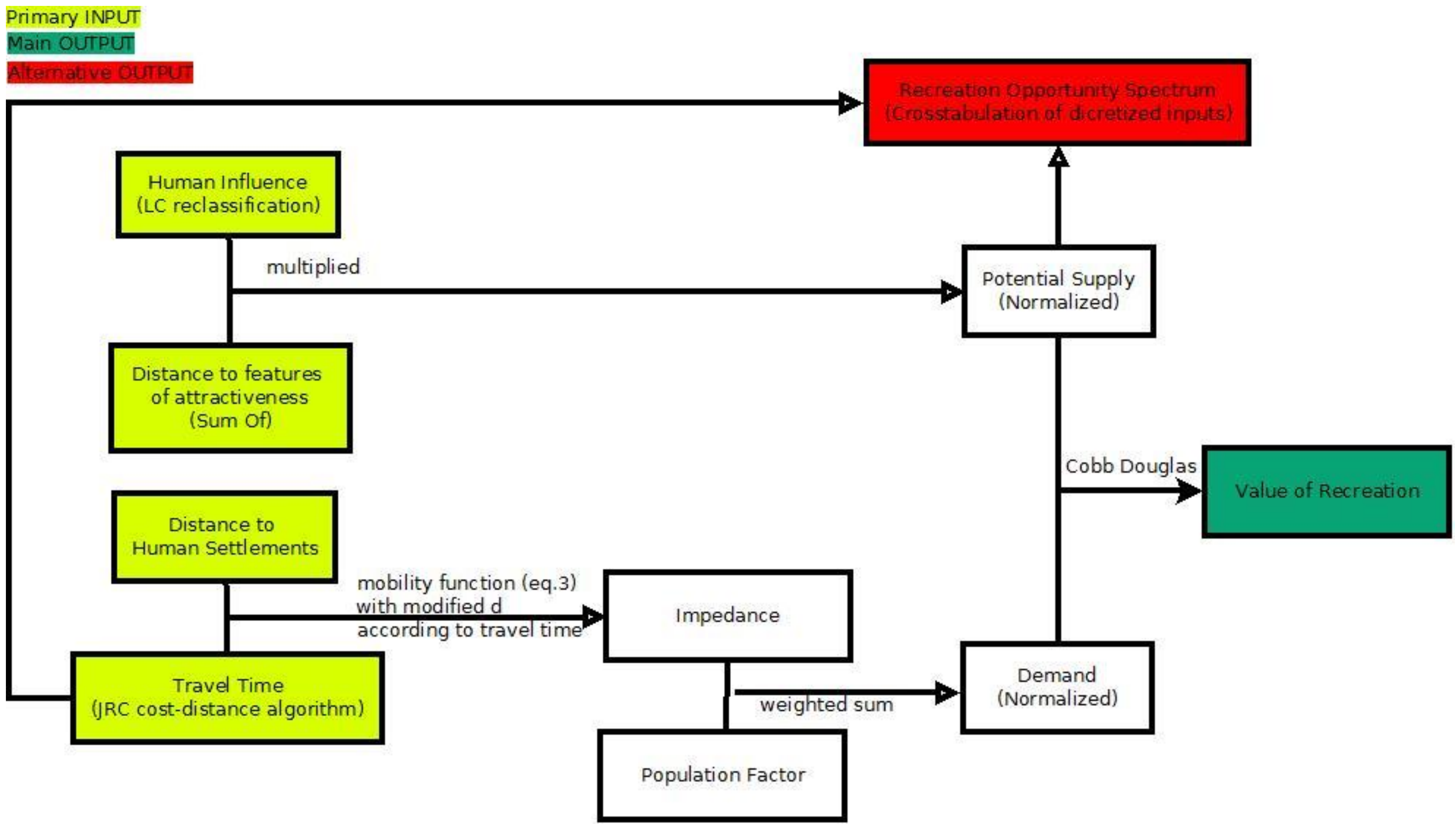
- Waterways

```
@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

```
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



k.IM code (1)

```
@documented(hemeroby_table)
define HEMEROBY_TABLE as {{

            landcover                                  | hemeroby
    -----------------------------------------------------------------
    landcover:ArtificialSurface                        | 7,
    landcover:ArableLand                               | 6,
    landcover:NonIrrigatedArableLand                   | 5, //4b-5a-5b
    landcover:PermanentlyIrrigatedArableLand           | 5, //4b-5a-5b
    landcover:RiceField                                | 5, //4b-5a-5b
    landcover:PermanentCropland                        | 4, //4a-4b-5a  //ADD
    landcover:Vineyard                                 | 4, //4a-4b-5a
    landcover:FruitAndBerryPlantation                  | 4, //4a-4b-5a
    landcover:OliveGrove                               | 4, //4a-4b-5a
    landcover:Pastureland                              | 4, //3-4a-4b
    landcover:AnnualCroplandAssociatedWithPermanent    | 4, //4a-4b-5a
    landcover:ComplexCultivationPatternedLand          | 4, //4a-4b-5a
    landcover:AgriculturalLandWithNaturalVegetation    | 4, //4a-4b-5a
    landcover:AgroForestryLand                         | 4, //3-4a-4b
    landcover:BroadleafForest                          | 3, //2-3-4a
    landcover:ConiferousForest                         | 3, //2-3-4a
    landcover:MixedForest                              | 3, //2-3-4a
    landcover:NaturalGrassland                         | 3, //2-3-4a
    landcover:MoorAndHeathland                         | 2,
    landcover:SclerophyllousVegetation                 | 2,
    landcover:TransitionalWoodlandScrub                | 2,
    landcover:BeachDuneAndSand                         | 2,
    landcover:BareArea                                 | 1, //ADD
    landcover:BareRock                                 | 1,
    landcover:LichenMoss                               | 1,
    landcover:SparseVegetation                         | 2,
    landcover:BurnedLand                               | 5,
    landcover:GlacierAndPerpetualSnow                  | 1,
    landcover:Wetland                                  | 1,
    landcover:Mangrove                                 | 1,
    landcover:InlandMarsh                              | 2,
    landcover:PeatBog                                  | 2,
    landcover:SaltMarsh                                | 2,
    landcover:Saline                                   | 5,
    landcover:IntertidalFlat                           | 1,
    landcover:WaterBody                                | 1
}};
```

k.IM code (2)

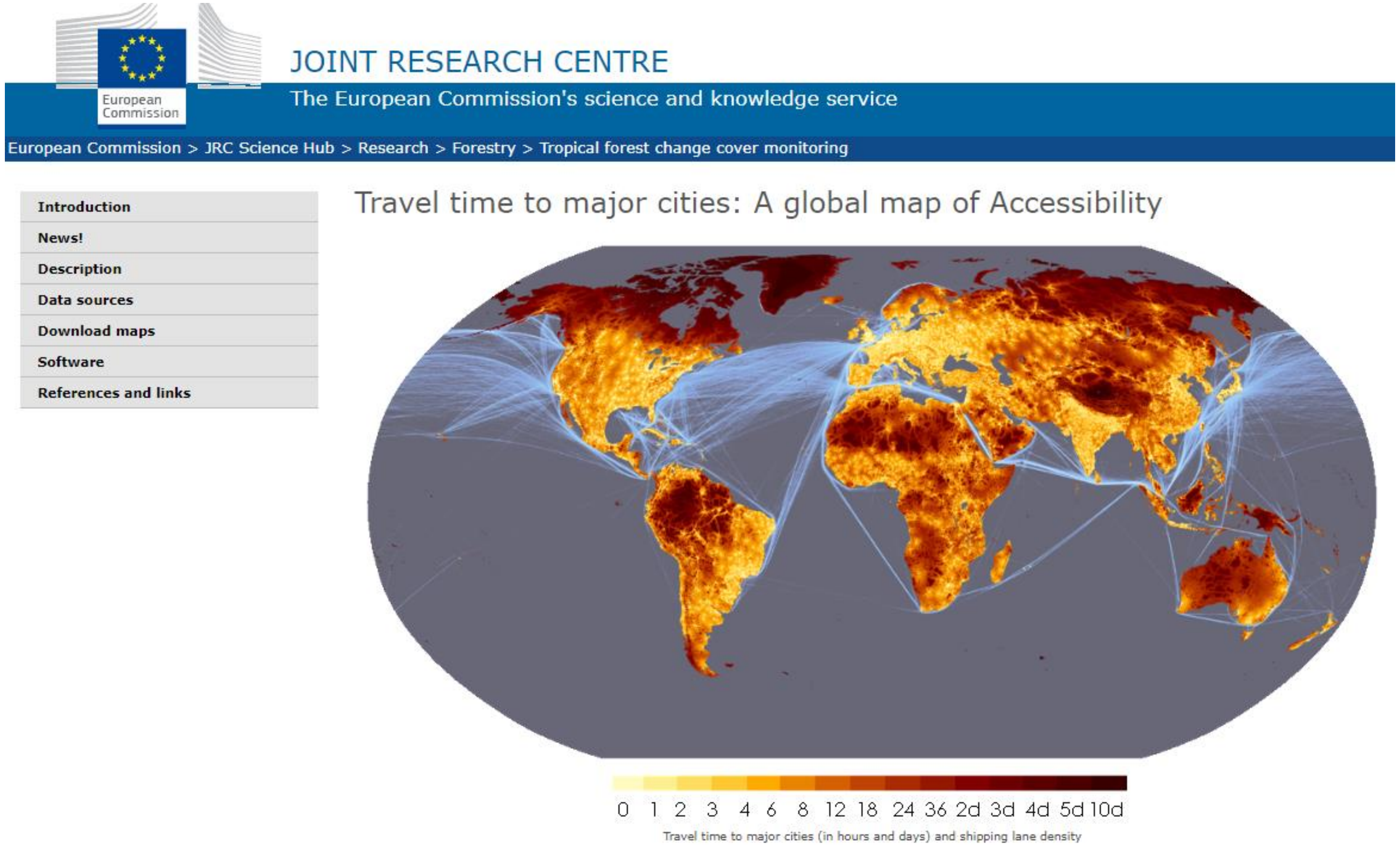
```
@documented(recreation.values.potential)
model im:Potential value of behavior:Outdoor behavior:Recreation
    observing
        magnitude of proportion of behavior:Outdoor in behavior:Recreation named human_influence,
        distance to conservation:ProtectedArea in m named distance_to_pristine_areas,
        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() ];
```

k.IM code (3)

```
@todo('semantics is tentative')
model im: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 < 0.02085
            ? (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))))
    ];
```

Travel time in the baseline model

- http://forobs.jrc.ec.europa.eu/products/gam/



- 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:

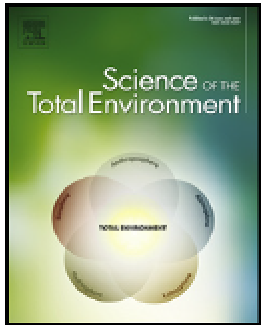
Uchida, H. and Nelson, A. Agglomeration Index: Towards a New Measure of Urban Concentration. Background paper for the World Bank's World Development Report 2009.

Results

Contents lists available at ScienceDirect

Science of the Total Environment

journal homepage: www.elsevier.com/locate/scitotenv



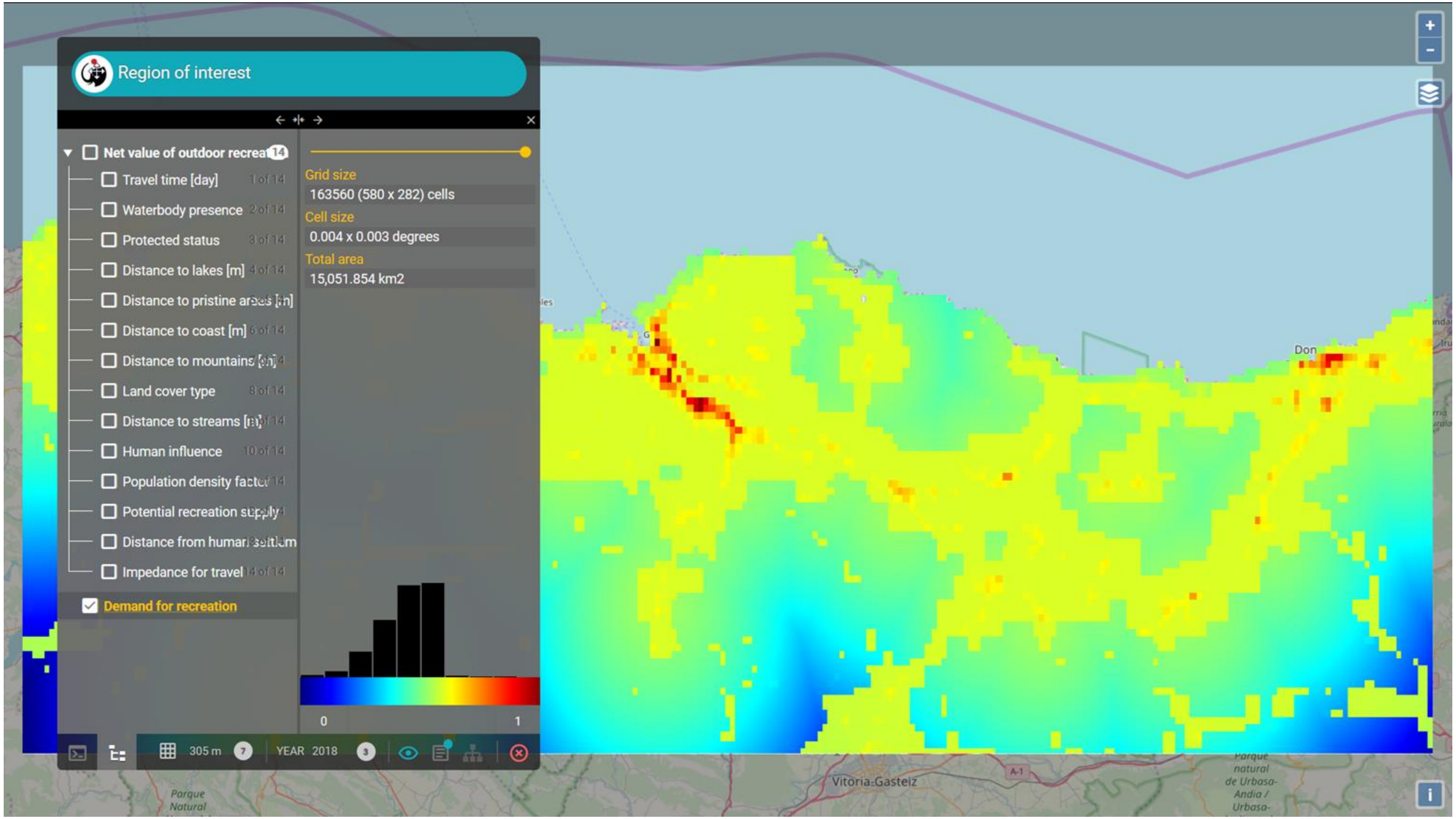
Towards globally customizable ecosystem service models

Javier Martínez-López [a,*], Kenneth J. Bagstad [b], Stefano Balbi [a], Ainhoa Magrach [a], Brian Voigt [c], Ioannis Athanasiadis [d], Marta Pascual [a], Simon Willcock [e], Ferdinando Villa [a,f]

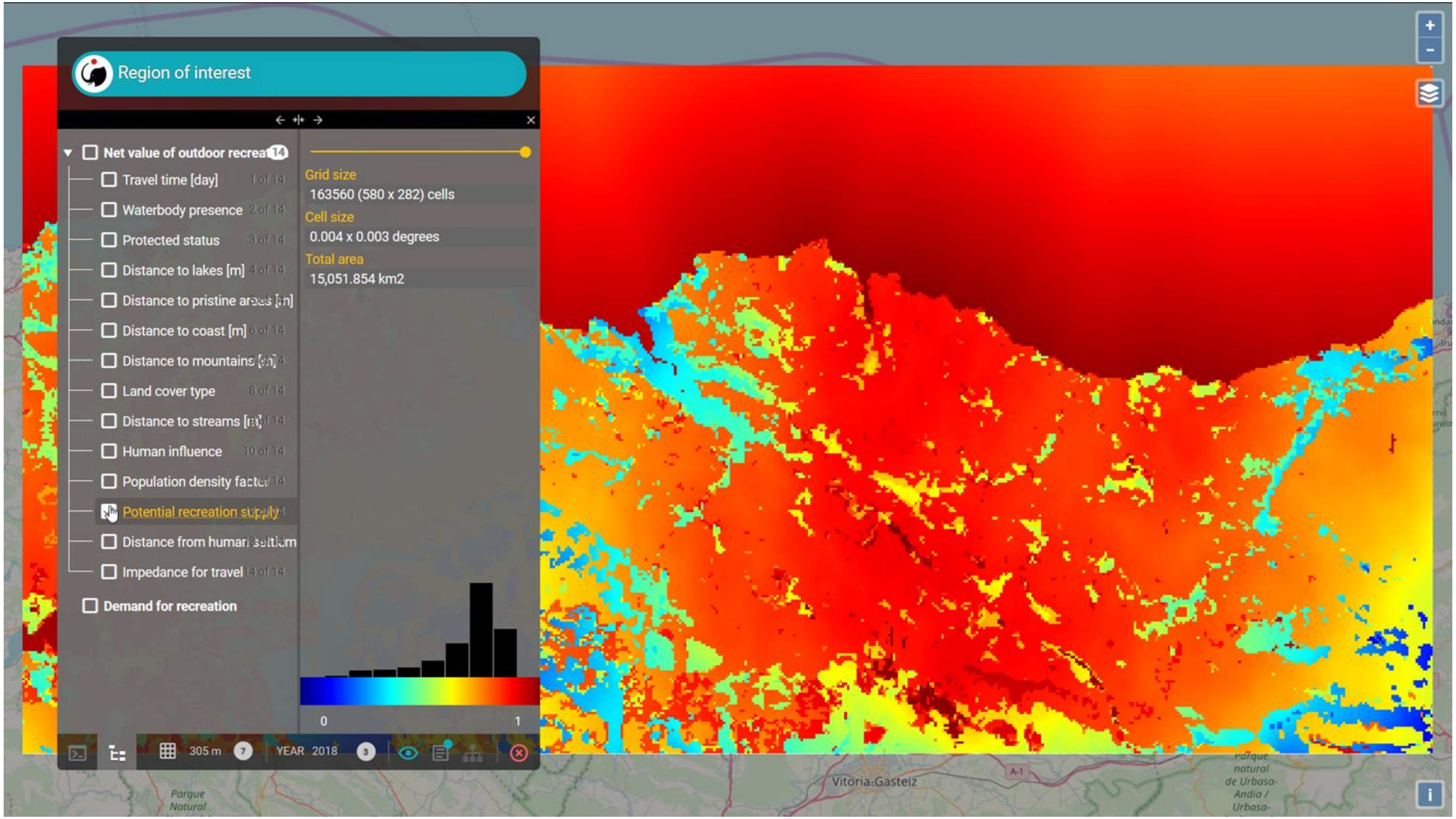
[a] BC3-Basque Centre for Climate Change, Sede Building 1, 1st floor, Scientific Campus of the University of the Basque Country, 48940 Leioa, Spain
[b] U.S. Geological Survey, Geosciences & Environmental Change Science Center, PO Box 25046, MS 980, Denver, CO 80225, USA
[c] University of Vermont, Gund Institute for the Environment, 617 Main Street, Burlington, VT 05405, USA
[d] Information Technology Group, Wageningen University, the Netherlands
[e] School of Environment, Natural Resources and Geography, Bangor University, United Kingdom
[f] IKERBASQUE, Basque Foundation for Science, Bilbao, Spain

Locations of the Basque Country

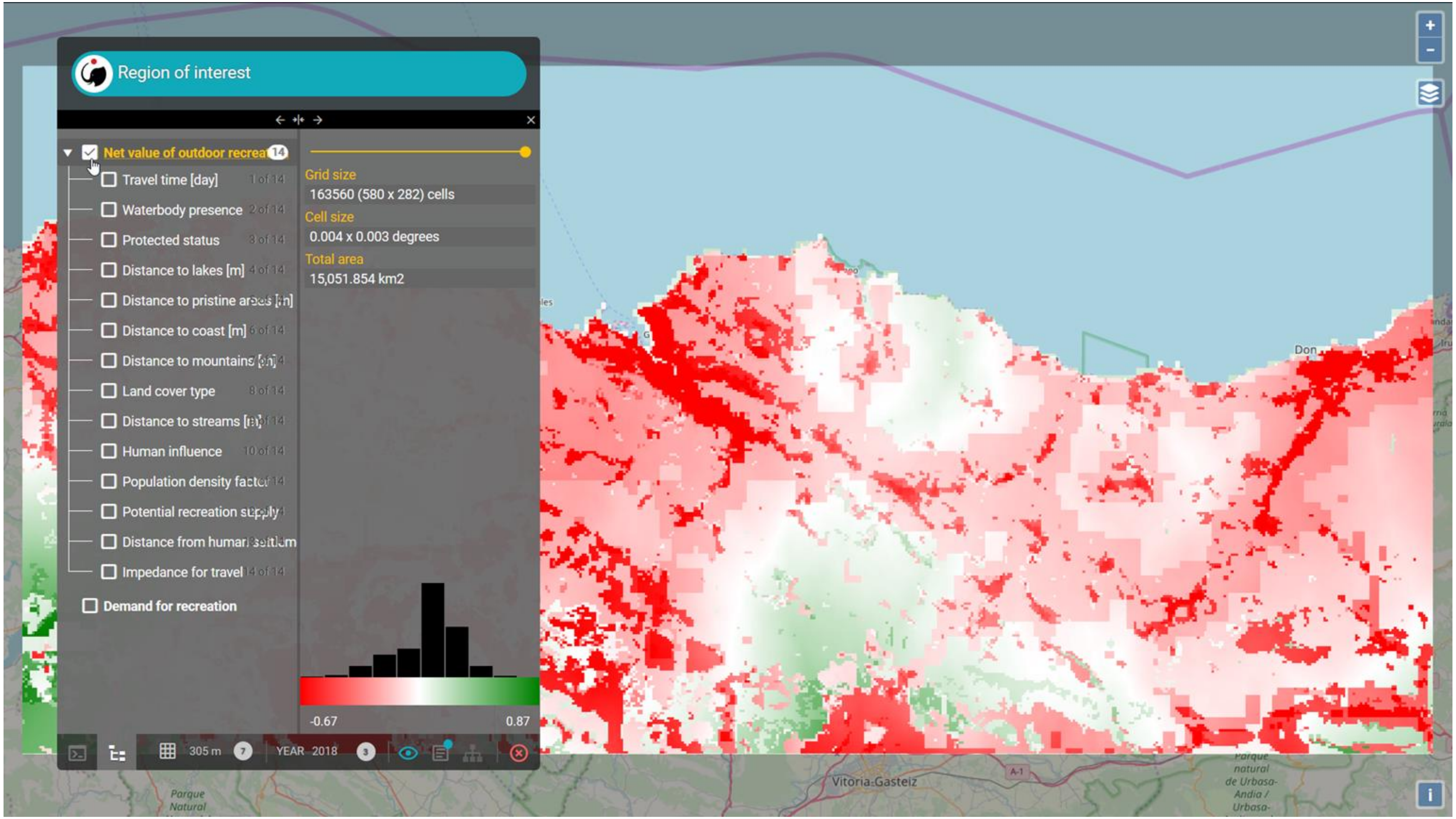
Results: Demand



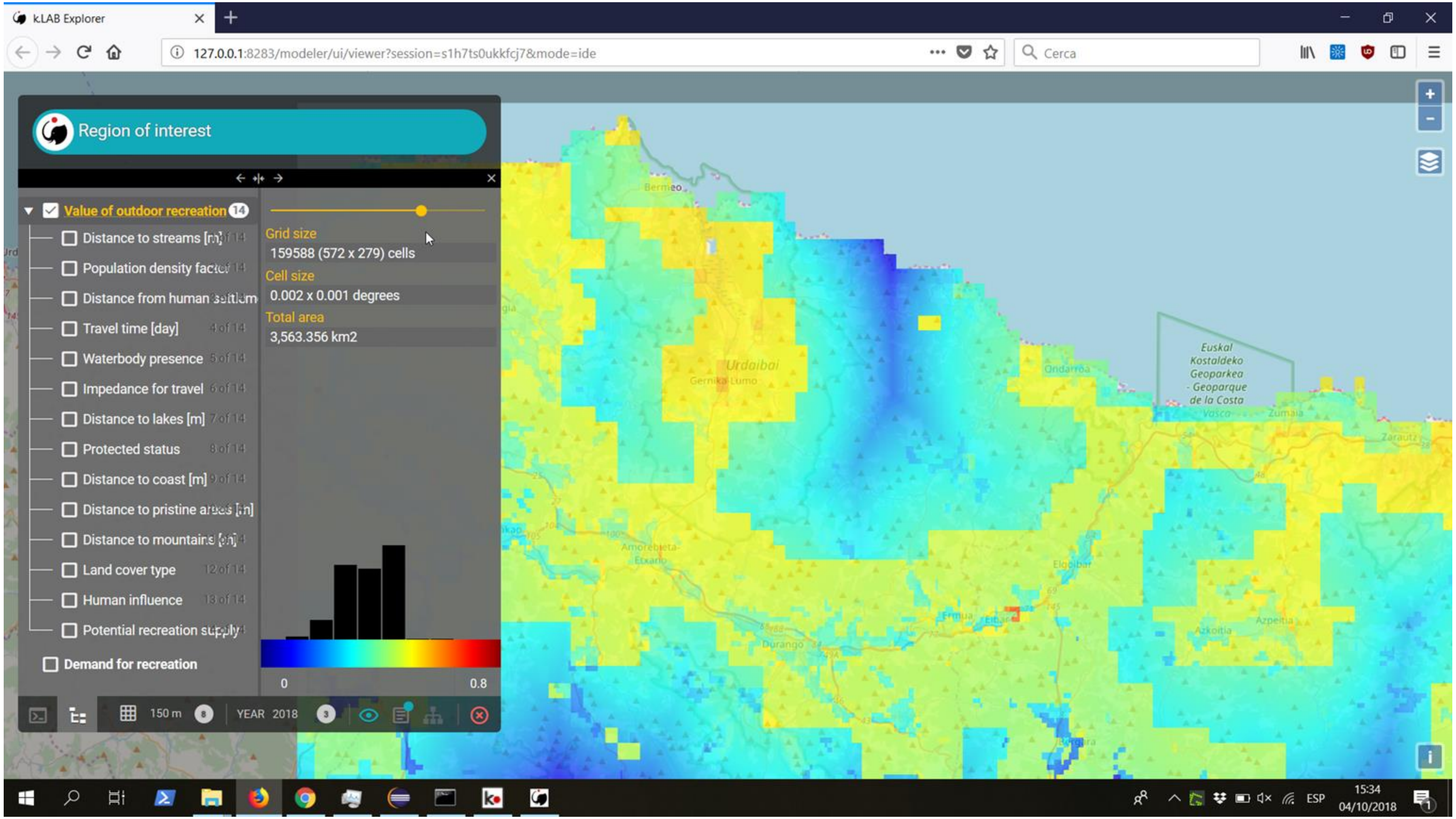
Results: Supply



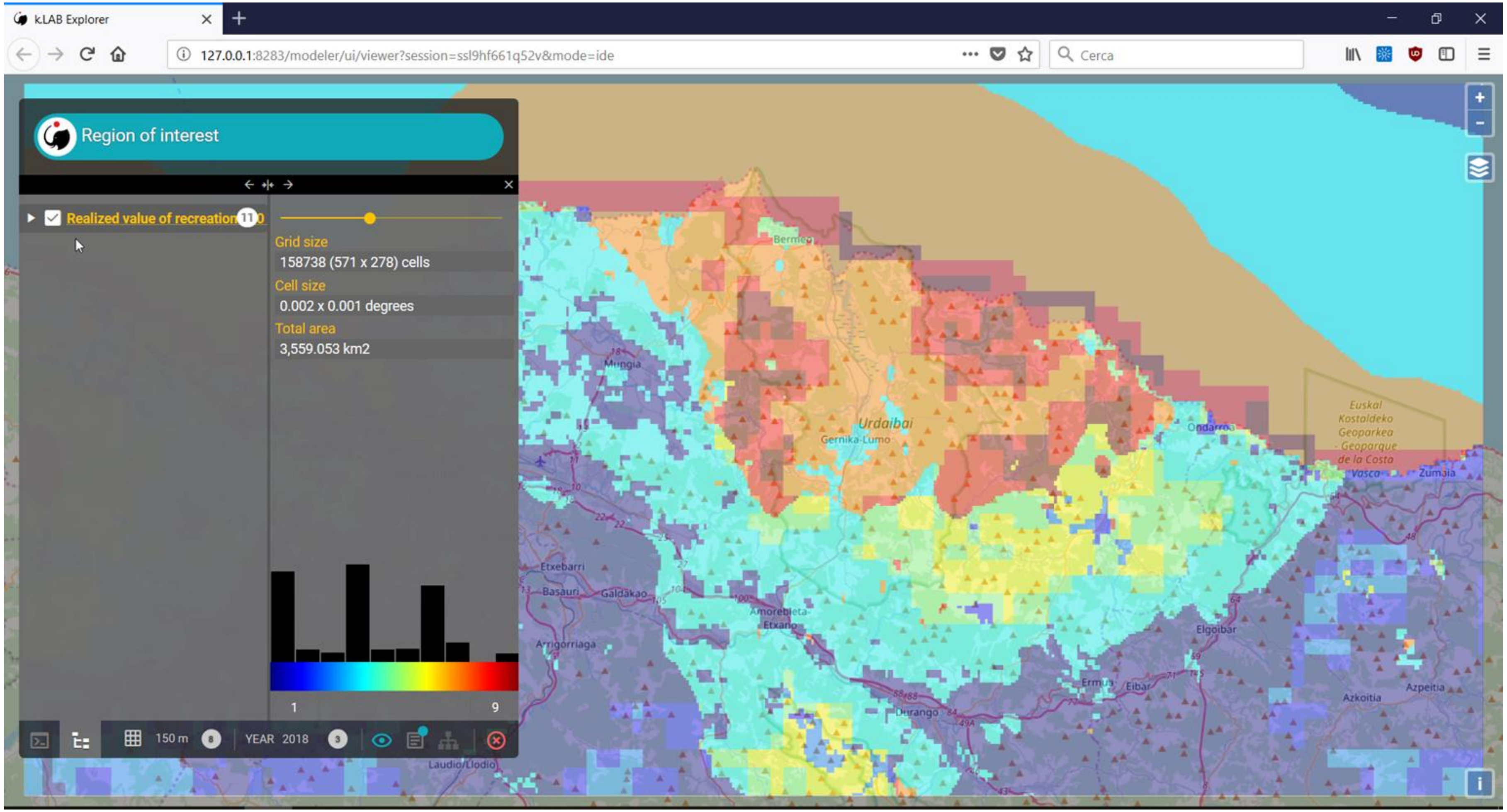
Results Surplus/Deficit



Results: Cobb-Douglass



Results: ROS



k.LAB Explorer
127.0.0.1:8283/modeler/ui/viewer?session=ssl9hf661q52v&mode=ide
Cerca
Region of interest
Realized value of recreation
Grid size
158738 (571 x 278) cells
Cell size
0.002 x 0.001 degrees
Total area
3,559.053 km2
1
9
150 m
YEAR 2018
Bermeo
Mungia
Urdaibai
Gernika-Lumo
Ondarroa
Euskal Kostaldeko Geoparkea - Geoparque de la Costa Vasca
Zumaia
Etxebarri
Basauri
Galdakao
Amorebieta-Etxano
Arrigorriaga
Elgoibar
Ermua
Eibar
Durango
Azkoitia
Azpeitia
Laudio/Llodio

k.IM Code (4)

```
@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

Land Use Policy
Volume 57, 30 November 2016, Pages 405-417

Regular research paper

Mapping ecosystem service capacity, flow and demand for landscape and urban planning: A case study in the Barcelona metropolitan region

Francesc Baró [a], Ignacio Palomo [b, c], Grazia Zulian [d], Pilar Vizcaino [d], Dagmar Haase [e, f], Erik Gómez-Baggethun [g, h]

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https://doi.org/10.1016/j.landusepol.2016.06.006

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Ecosystem Services
Volume 13, June 2015, Pages 108-118

Mapping recreation supply and demand using an ecological and a social evaluation approach

Lorena Peña, Izaskun Casado-Arzuaga, Miren Onaindia

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https://doi.org/10.1016/j.ecoser.2014.12.008

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- 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