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Organización de las Naciones Unidas para la Educación, la Ciencia y la Cultura · Hezkuntza, Zientzia eta Kulturarako Nazio Batuen Erakundea

Garapen Iraunkorra eta Ingurumen Hezkuntzari buruzko UPV/EHUko UNESCO Katedra · Cátedra UNESCO sobre Desarrollo Sostenible y Educación Ambiental de la UPV/EHU

Nature, basis of well-being

Ecosystem Services of the **Basque Country**

Ecosystem Services Assessment in the Basque Country

Prof. Miren Onaindia. UNESCO Chair on Sustainable Development and Environmental Education.University of the Basque Country

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Ecosystem Services Assessment in the Basque Country

1- Ecosystem services

2- An integrative approach

- Mapping ES
- People demand

3- Indicators of multifunctionality

4- Conclusions. Implementation in management strategies and politics

1- Ecosystem Services

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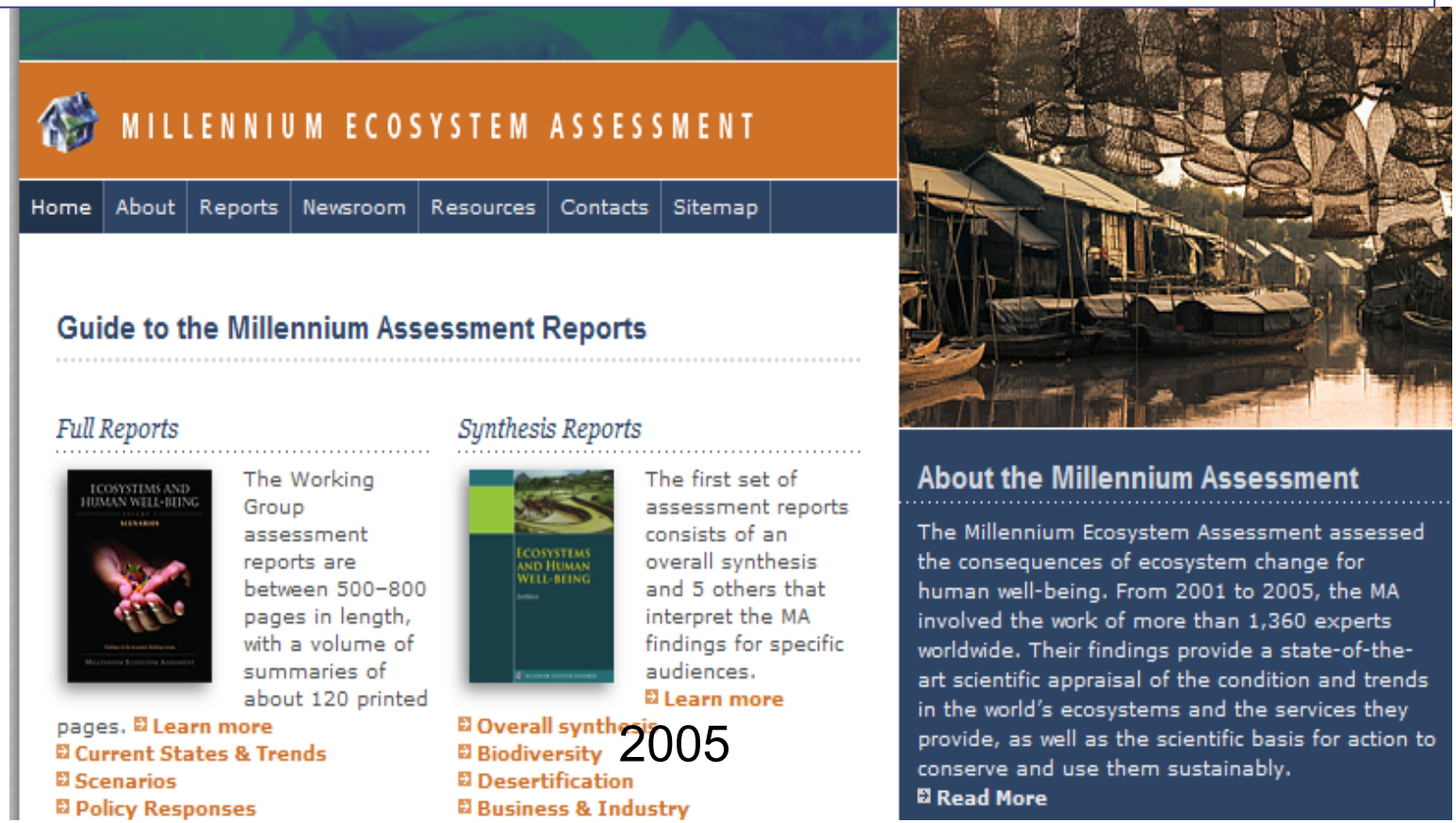
Ecosystem Services of the Basque Country

Benefits that ecosystems provide to society



2005

Millennium Ecosystem assessment: scientific basis for action

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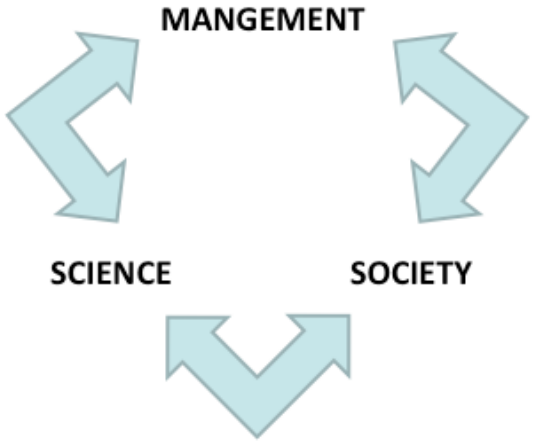
Millennium EcosystemAssessment in the **Basque Country**



A regional integrative approach to enhance the link between science, policy-making and society.

2- An integrative approach

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ECOSYSTEMS

BIODIVERSITY

FUNCTIONS

ECOSYSTEM SERVICES

biophysical value

SOCIAL SYSTEM

HUMAN WELL-BEING

VALUE

People perception

Total economical value (use, non use)

socio-cultural value

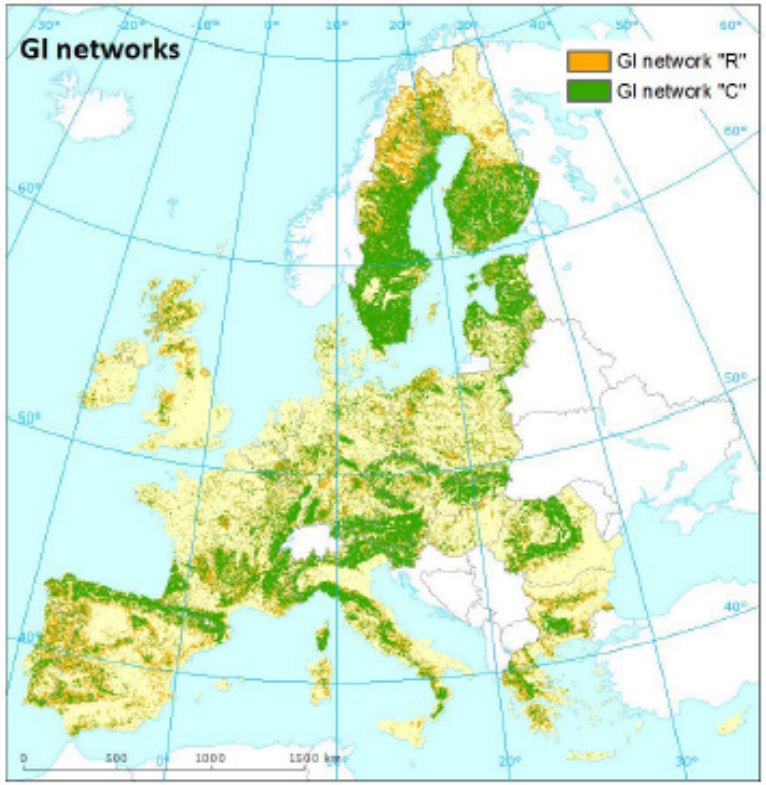
economical value

Decision level. Politics

- Mapping ecosystem services

Identifying hotspots or priority areas for multiple ecosystem services to enhance sustainable land management

Biodiversity, water delivery, flood control, carbon store , pollination, aesthetic value,



Green Infrastructure

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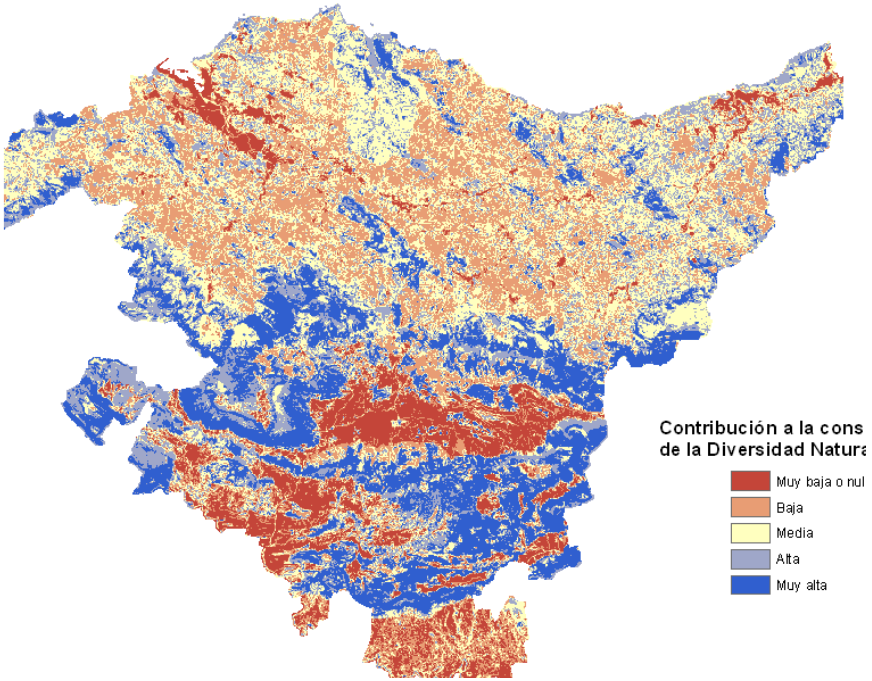
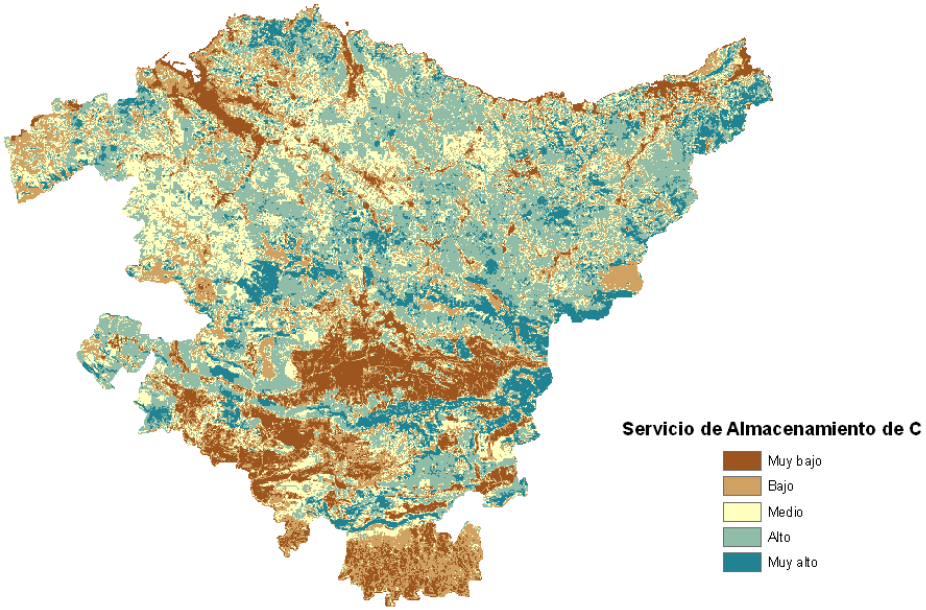
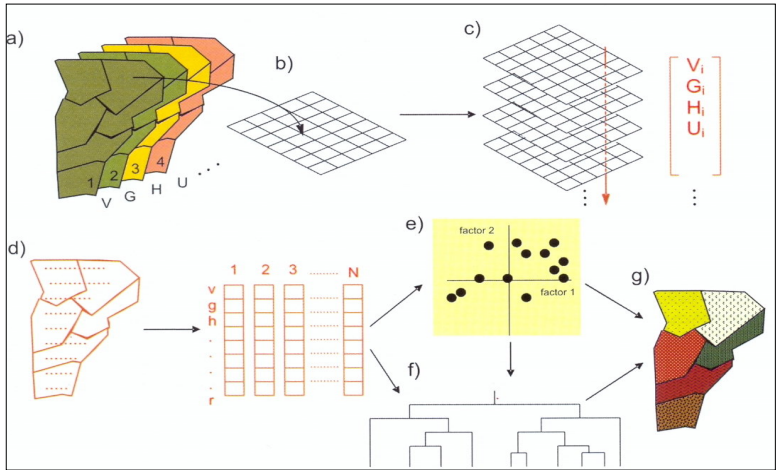
Biodiversity



Carbon store





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Case study: Urdaibai BR
The *Plan for Landscape Management*

- Aim: contribute to the debate about the role of ecosystem services in conservation
- to what extent the conservation of biodiversity will ensure the provision of ecosystem services?.

• Questions:

1- which ecosystems are the most important producers of biodiversity, carbon storage and water regulation?

2- to what extent do the biodiversity, carbon storage and water regulation hotspots overlap?

Methodology

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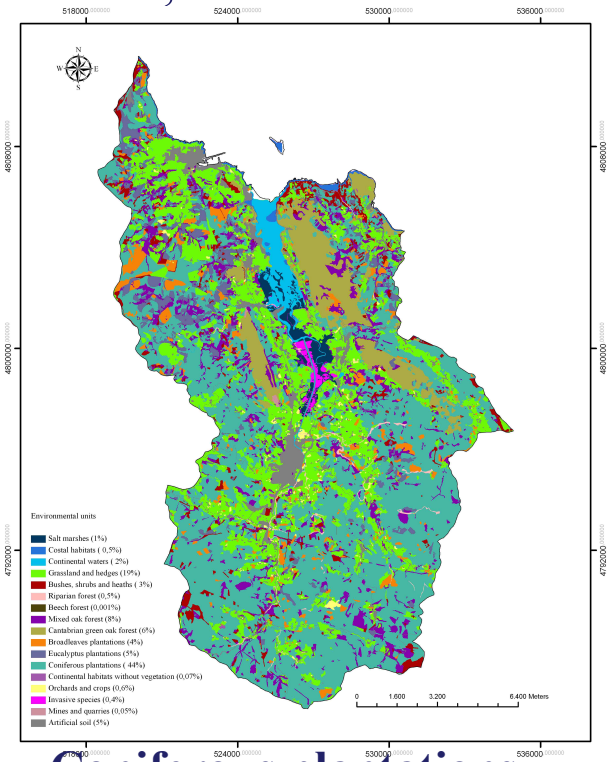
- **Study area:** watershed in northern Spain: Urdaibai B.R.
- Costal and mountainous landscapes. 220km2 ; 44,000 inh.



Coniferous plantations 44%, natural forests 15%

<u>Biodiversity</u> was calculated and valued as (CITA):

- **B = f (r) + f (q) + f (p)**

  richness; habitat quality (succession); degree of legal protection.

<u>Carbon storage</u> C (biomass and soil) was valued as (IPCC, 2003):

- **Inventory of organic C stored in the soil (Neiker-Ihobe, 2004). CB (biomass)**

  CB = V*BEF*(1+R)*D*CF

  the root-to-shoot ratio; wood density; the carbon fraction of dry matter

<u>Water flow regulation</u> was based on the TETIS model (Vélez et al., 2009) (WC) was calculated as (mm / year):

- **WC = Hu/R**

  water storaged in the soil; annual rainfall; corrected annual potential evapotranspiration

- A Geographic Information System-based approach was designed to estimate spatially the value of the biodiversity and ecosystem services.

Spatial units were grid cells with a size of 4 m^2.

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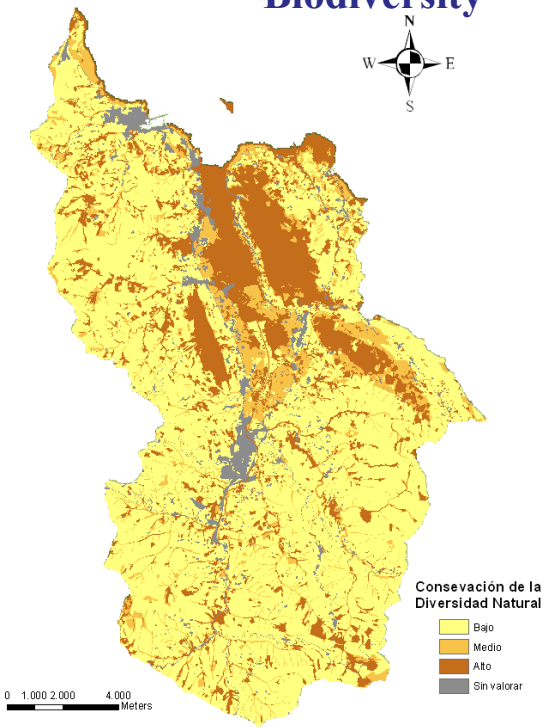
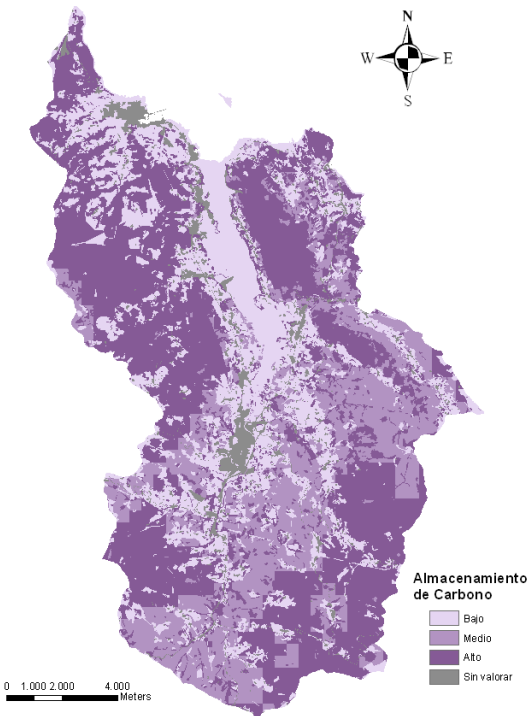
Results: Maps of biodiversity, carbon storage, water flow regulation, aesthetic value and recreation

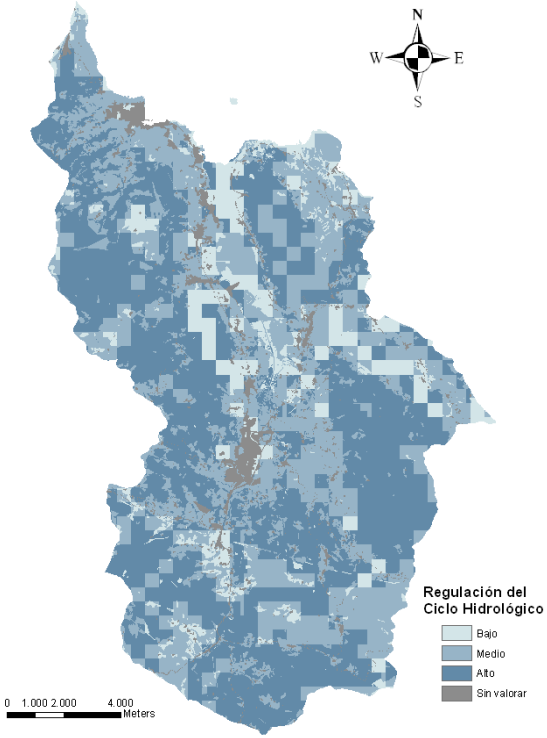
Biodiversity



C storage



Water flow



- Results

- Natural forests are the ecosystems that most contribute to biodiversity, carbon storage and water flow regulation
- Conservation of natural forests should improve biodiversity, carbon storage and water flow regulation (Master Plan for Use and Management)

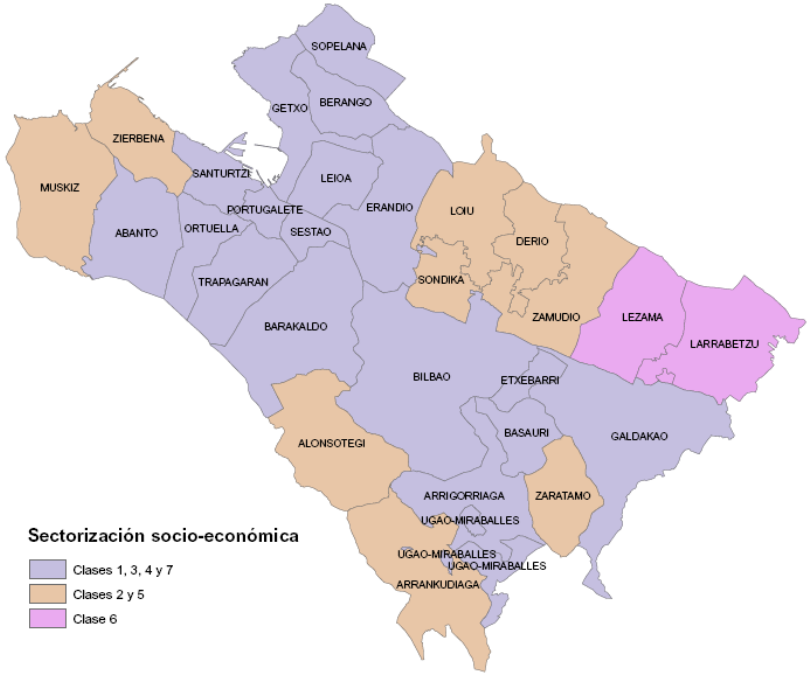
- **Forest plantations contribute to some ecosystem services but have negative effects on the biodiversity**
- **Conservation based only on ecosystem services might be detrimental to biodiversity**

Onaindia et al. 2013. Environmental science and policy 33: 283-294
Onaindia et al., 2013. *Forest Ecology and Mangement* 289:1-9.

-Social demand. Case of study: metropiltan area of Bilbao (30 minutes RB). A urban/ rural/natural gradient

406 km^2

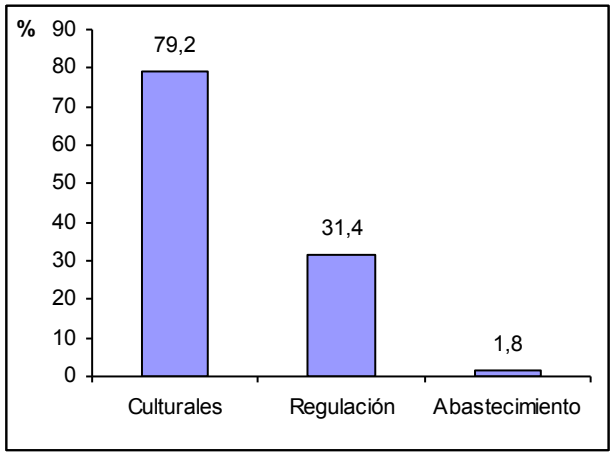
- 893.298 inhabitantes
- 2.200 inh/km^2
- (Bilbao 8.564 inhab/km



-High % of urban soil: services
- Primary sector
- Mixed uses: agriculture and industrial

✓Define multifunctional areas

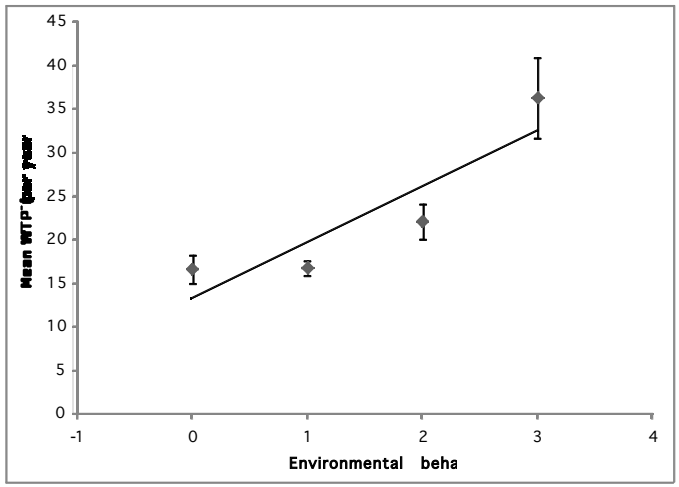
Social approach: demand of ES



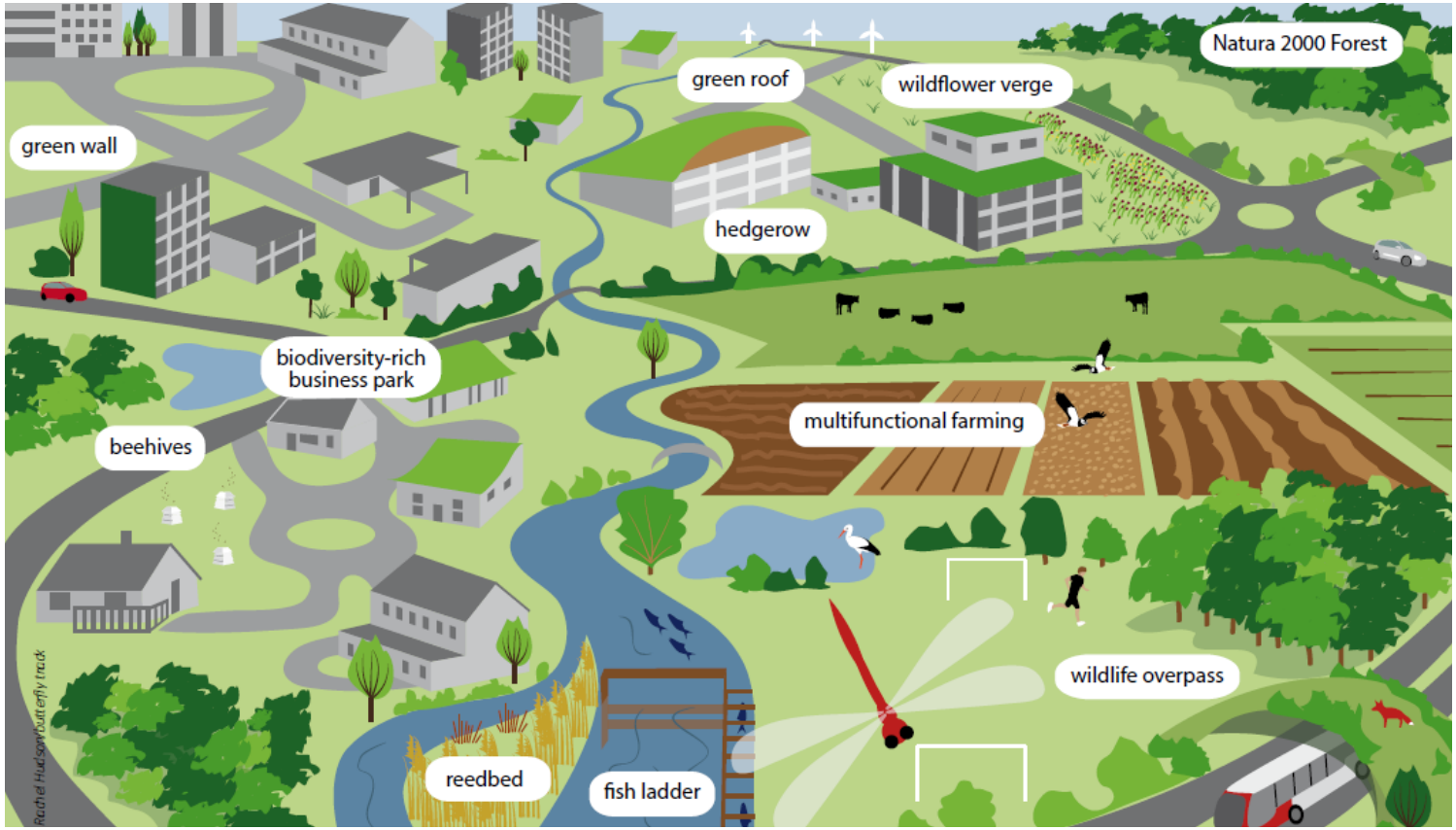
The most important services:
-Biodiversity
- Air quality

- **Education level and age : most influent for the value given to ES**

Williness to pay (WTP)



Connected green infrastructures: natural/rural/urban



There isa great deal of permeability between the urban-rural- natural environments as well as integration of the periurban landscape in urban processes (mutual dependency).

3- Indicators of multifunctionality

Define an index of landscape multifunctionality based on ES

The contribution of the municipalities to the provision of ecosystem services is not considered for economical incentives, even though they are fundamental for human well-being

1,200 km^2, 250 municiplities, 2,200,000 inhabitants

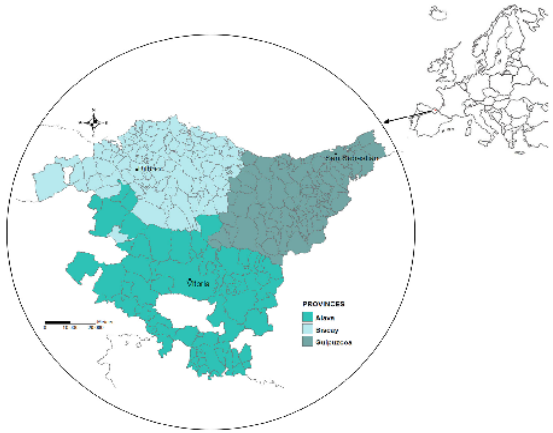


Fig. 1. Study area.

Rodríguez-Loinaz et al., 2014. *Journal of Environmental Mangement 147*:152-163.

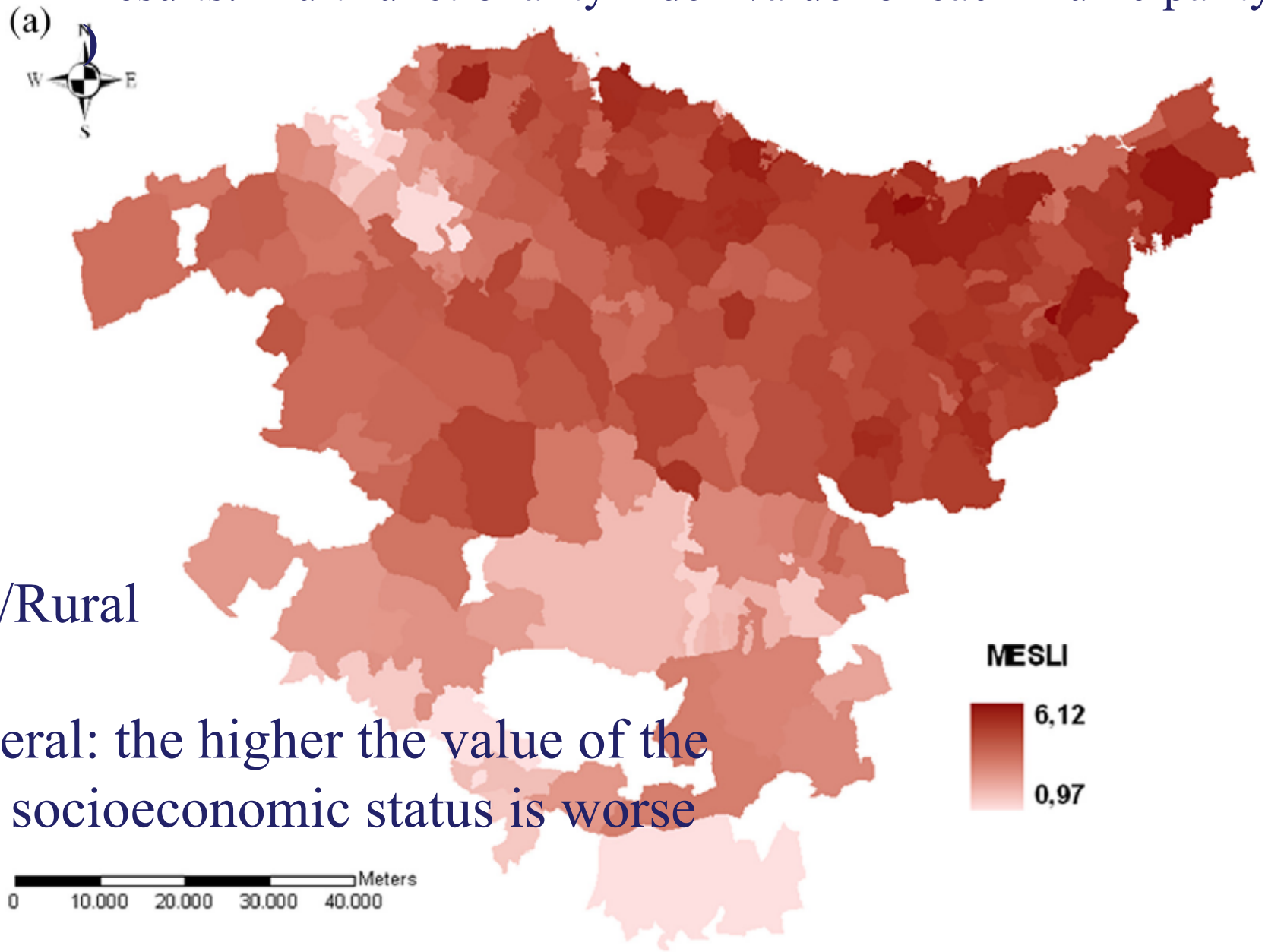
Selected indicators of Ecosystem Services: 15 indicators for 11 ES

Table 1
List of selected ecosystem services and biodiversity values with their potential indicators and low and high performance benchmarks (Min. t. s., Max. t. s.: minimum and maximum value in entire time series data). References that use the indicator, or a similar indicator, are noted.

Services	Indicators	Low performance benchmarks	Target	References
Provisioning				
Food	DC: Density of head of cattle (N°/100 ha)	0	Max. t. s.	Burkhard et al., 2012; Kandziora et al., 2012
	AP: Agricultural production (Ton/ha)	0	Max. t. s.	Maes et al., 2012; European Commission, 2014
Raw materials	Timb: Timber in forest plantations (m^3/ha)	0	Max. t. s.	Burkhard et al., 2012; Maes et al., 2012
Freshwater	RO: Runoff = renewable water supply (mm)	Min. t. s.	Max. t. s.	MEA, 2005
Regulating				
Global climate regulation	SCSB: Stored C in soil and biomass (Ton C/ha)	0	Max. t. s.	Maes et al., 2012; Kandziora et al., 2012; van Oudenhoven et al., 2012; Layke et al., 2012
Maintenance of soil fertility	OCS: Organic C in soil (Ton C/ha)	0	Max. t. s.	Maes et al., 2012
Local climate regulation	Et: Evapotranspiration (mm)	Min. t. s.	Max. t. s.	Burkhard et al., 2012; Kandziora et al., 2012; Layke et al., 2012
Water flow regulation	SWS: Soil water storage capacity (mm)	0	Max. t. s.	van Oudenhoven et al., 2012; Layke et al., 2012
	SWI: Soil water infiltration capacity (cm/h)	0	Max. t. s.	Maes et al., 2012; Layke et al., 2012; Gomez-Baggethun and Barton, 2012
Water purification	RF: Cover of riparian forest in river margins (% in 25 m buffer)	0%	100%	Plieninger et al., 2012; European Commission, 2014
	NF: Cover of natural forest (% of municipality's surface)	0%	Max. t. s.	European Commission, 2014
Erosion prevention	Eros: Areas without erosion problems (% of municipality's surface)	0%	100%	Kandziora et al., 2012
Cultural				
Tourism	RTS: Density of rural tourism establishments (N°/km^2)	0	Max. t. s.	Burkhard et al., 2012; Kandziora et al., 2012
Biodiversity				
	SP: Special protection area	0	Max. t. s.	Maes et al., 2012

$$\text{MESLI} = \sum_{i=1}^{11} \frac{\text{Observed value}_i - \text{Low performance benchmark}_i}{\text{Target}_i - \text{Low performance benchmark}_i}$$

Results: Multifunctionality index value for each municipality



Urban/Rural

In general: the higher the value of the index, socioeconomic status is worse

Results for management

- The indicator is a tool for measuring the multifunctionality, and to develop a system of socio-economic compensation for the provision of ecosystem services at municipality level

- Recognising the contribution of the municipalities to human well-being has the potential to improve the socioeconomic situation and reduce the differences between them

4- Conclusions

The perspective of ecosystem services contributes to develop sound land-use policies and planning actions

- Conservation Plans based on ecosystem services and biodiversity. Urdaibai (PRUG), Planning for the Metropolitan area of Bilbao (PTP), Stretegy for Land Management (DOT)
- Socio-economic compensation for landscape multifunctionality. Inex

- **Important issues**:
  - Stakeholders ‘ participation and collaboration between researchers, technicians and politicians
  - Development of technical tools: mapping, indicators, others (spatially explicit accurate information).
  - Engagement in Networks

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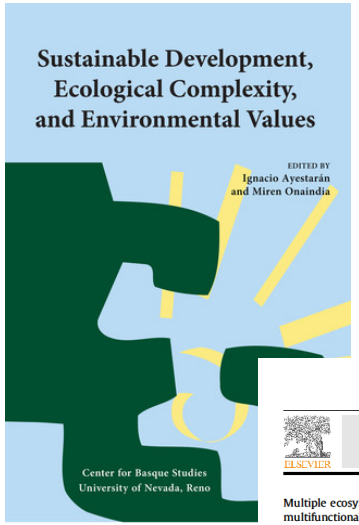
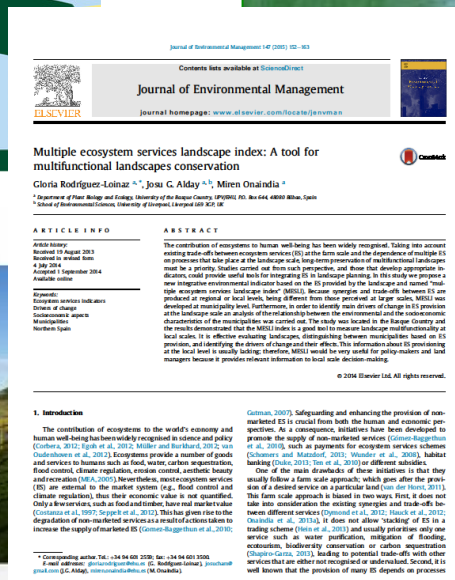
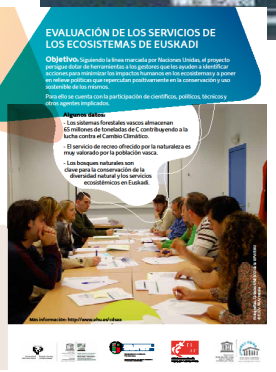
Outreach materials







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[1] University of the Basque Country
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[4] Urdaibai Biosphere Reserve
[5] UNESCO Etxea

And many active stakeholders

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Thank you
Eskerrik asko

Think global and act local

…….Sustainable Development Goals….