

Action A.5 of Project PANLIFE ECOSYSTEM SERVICES of Natura 2000 Network in Calabria (South Italy)



PANLIFE
LIFE13 NAT/IT/001075

1. Introduction

2. Transfer Function Method and Results

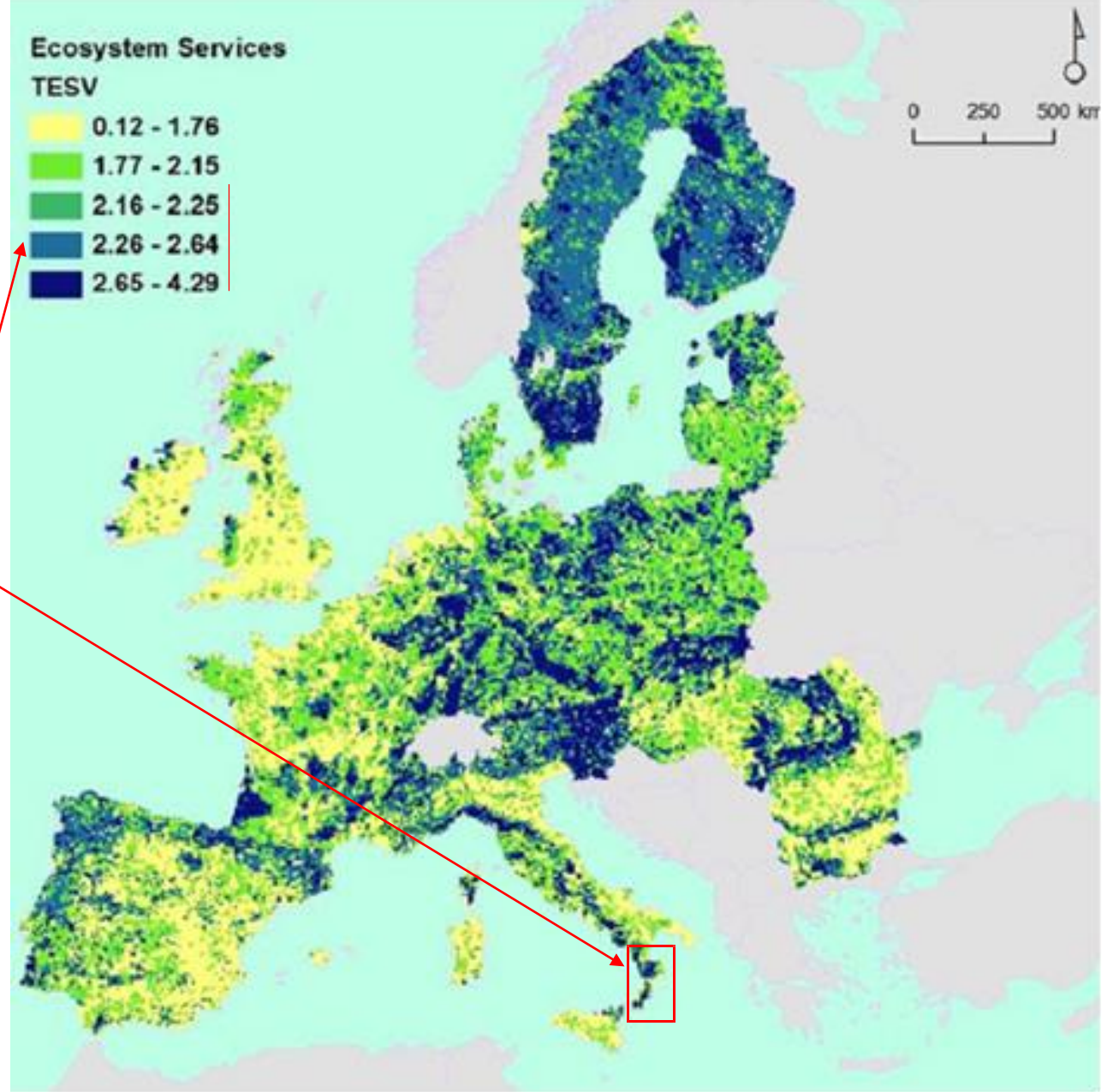
3. From extrapolated to to actual local ESs

- Water provision from springs within SCIs
- Carbon Stock
- Carbon Flux
- Wood production

4. Next steps

1.Introduction

Calabria's TESH gets medium – high values for most of the region

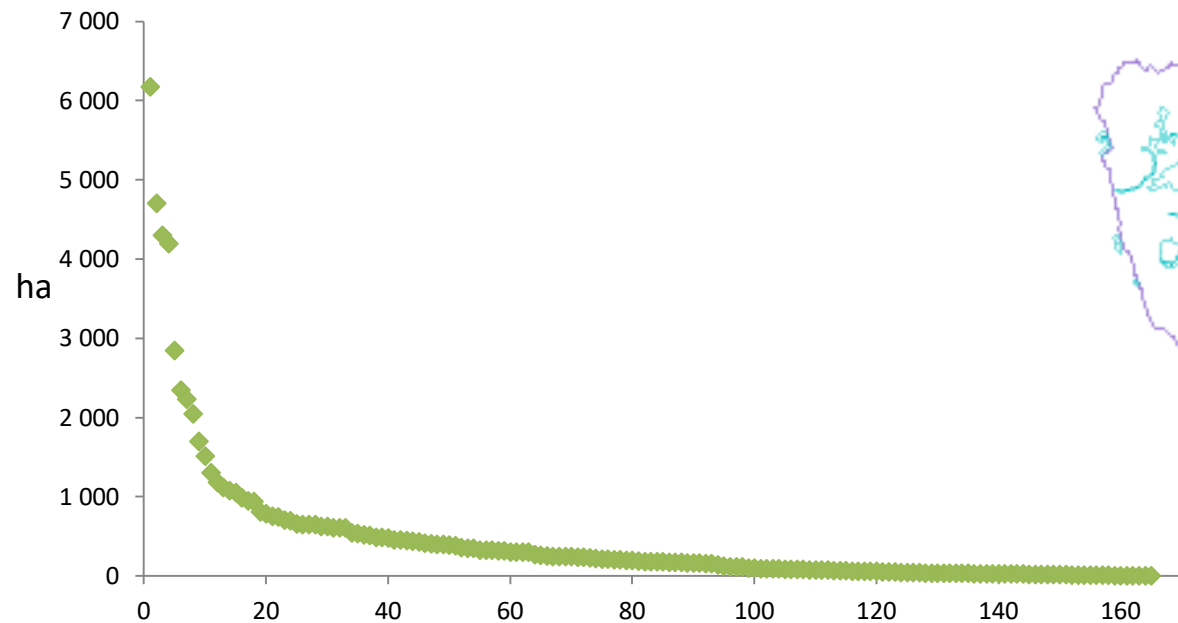


Total Ecosystem Service Values (TESV, i.e., availability of multiple ESs) in Europe (Maes J. *et al.* 2102)
Calabria region is in the red rectangle

Spatial scale	Ca 100 - 500km	Ca 50 - 100km	Ca 1 - 5km	Ca 1 - 5m
<p>Examples of typical organisms and ecological processes</p>	<p>Iconic, large-ranging species</p> <p>Habitat specialists</p> <p>Species sensitive to disturbance</p> <p>Self contained and/or unique ecosystems</p>	<p>Habitat specialists limited by dispersal between seasons</p> <p>Metapopulation dynamics</p> <p>Source-sink dynamics</p>	<p>Species limited by resource segregation within seasons</p> <p>Mobile specialists</p> <p>Habitat generalists</p> <p>Central place foragers</p>	<p>Soil fauna</p> <p>Community shifts</p>
<p>Typical ecosystem services</p>	<p>Watershed/potable water</p> <p>Carbon sequestration</p>	<p>Pollination and biocontrol adjacent to habitat fragments</p>	<p>Pollination and biocontrol over entire landscapes</p>	<p>Soil quality</p>

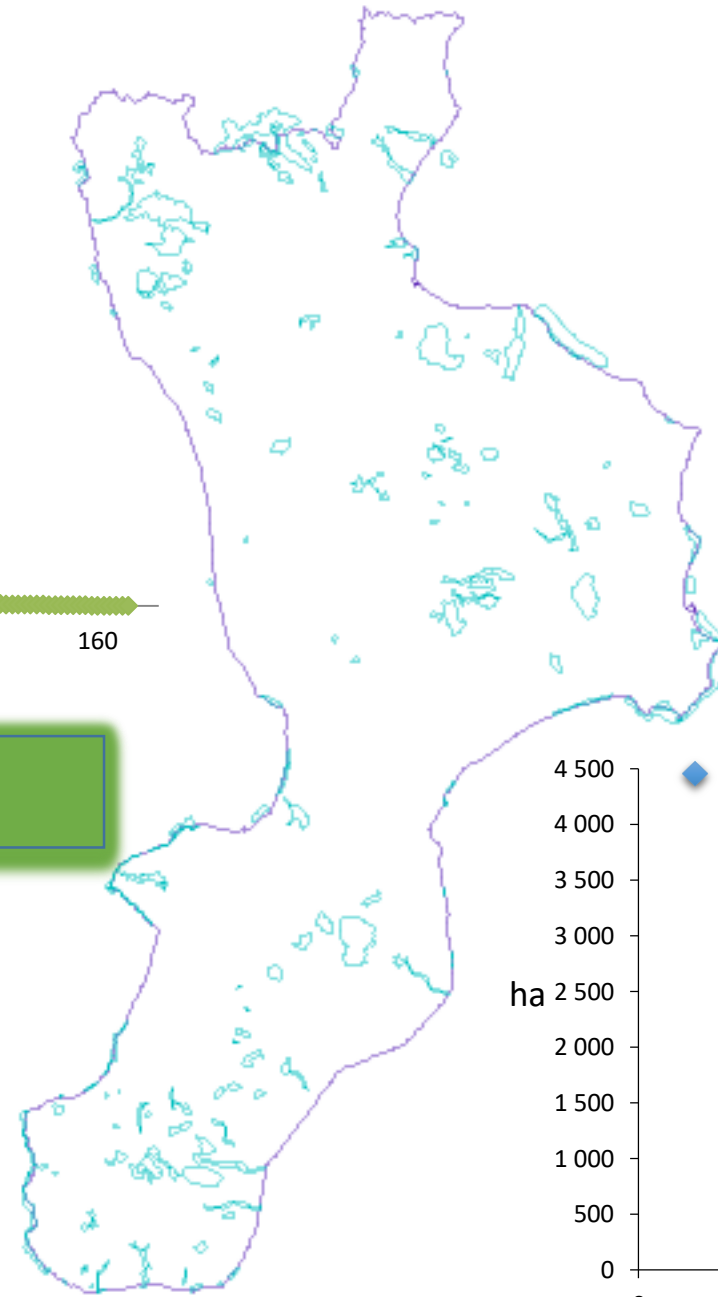
FIGURE 1 | A simplistic representation of spatial scales at which ecological processes modulating biodiversity and multiple ecosystem services operate. Nature reserves can effectively protect species (e.g., iconic, large-ranging mammals) that are sensitive to anthropogenic disturbance, whereas dispersal-limited species (e.g., strict habitat specialists) occurring in highly fragmented landscapes benefit from conservation efforts based on sparing habitat patch

SCIs - spatial composition of Calabria NATURA 2000 Network (Standard Forms)

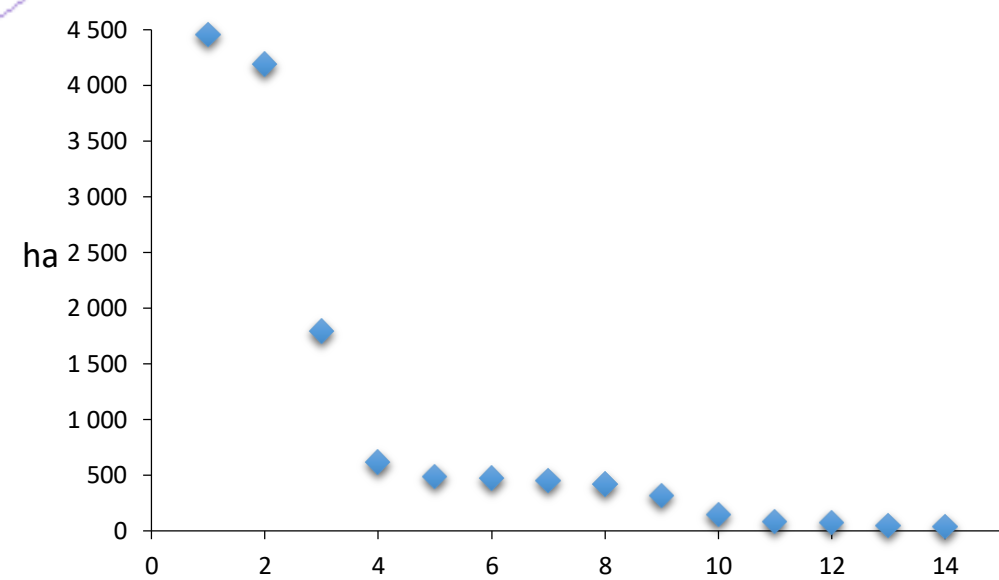


Ranking of terrestrial SCIs; y = total surfaces

About 9% of the regional «natural system»
(i.e., w/o agro-ecosystems)

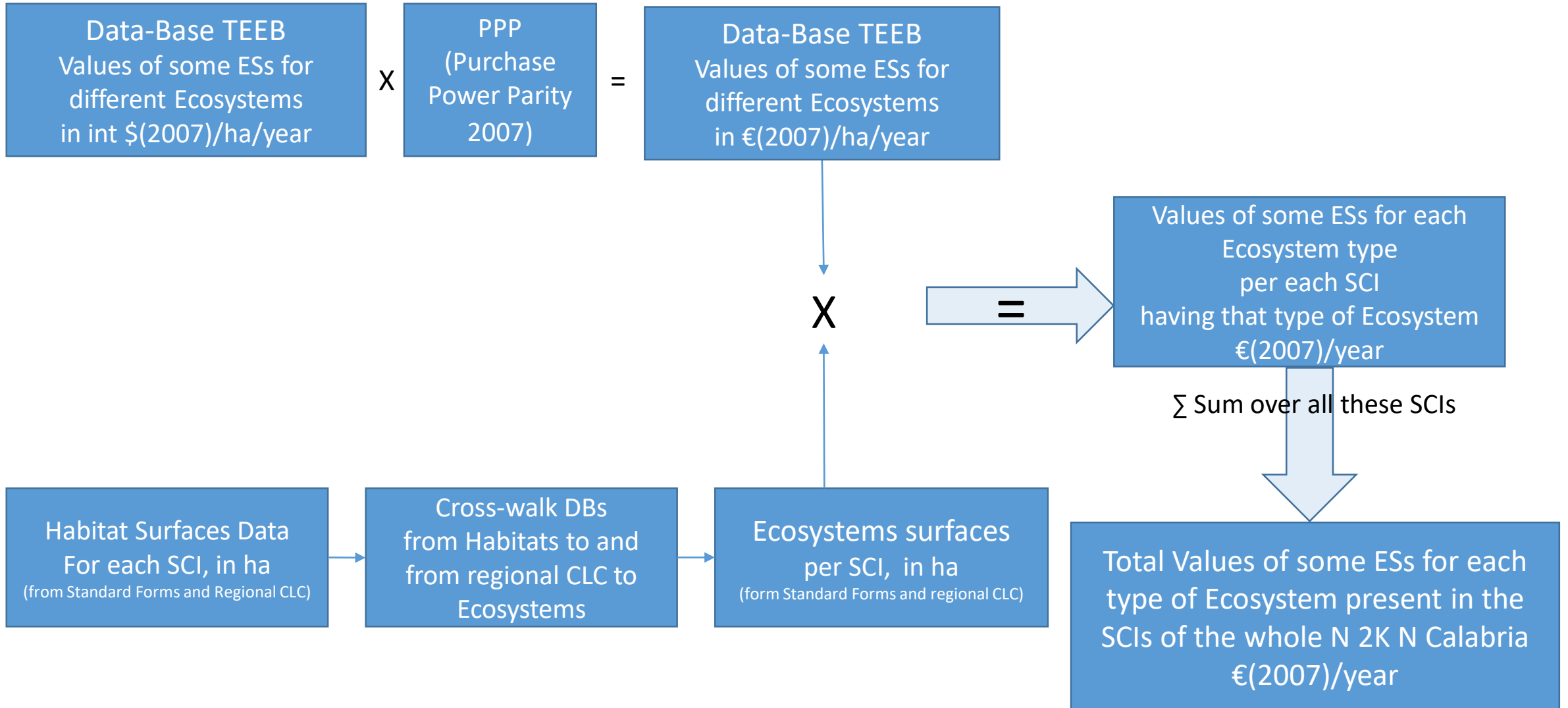


Ranking of marine SCIs; y = total surfaces

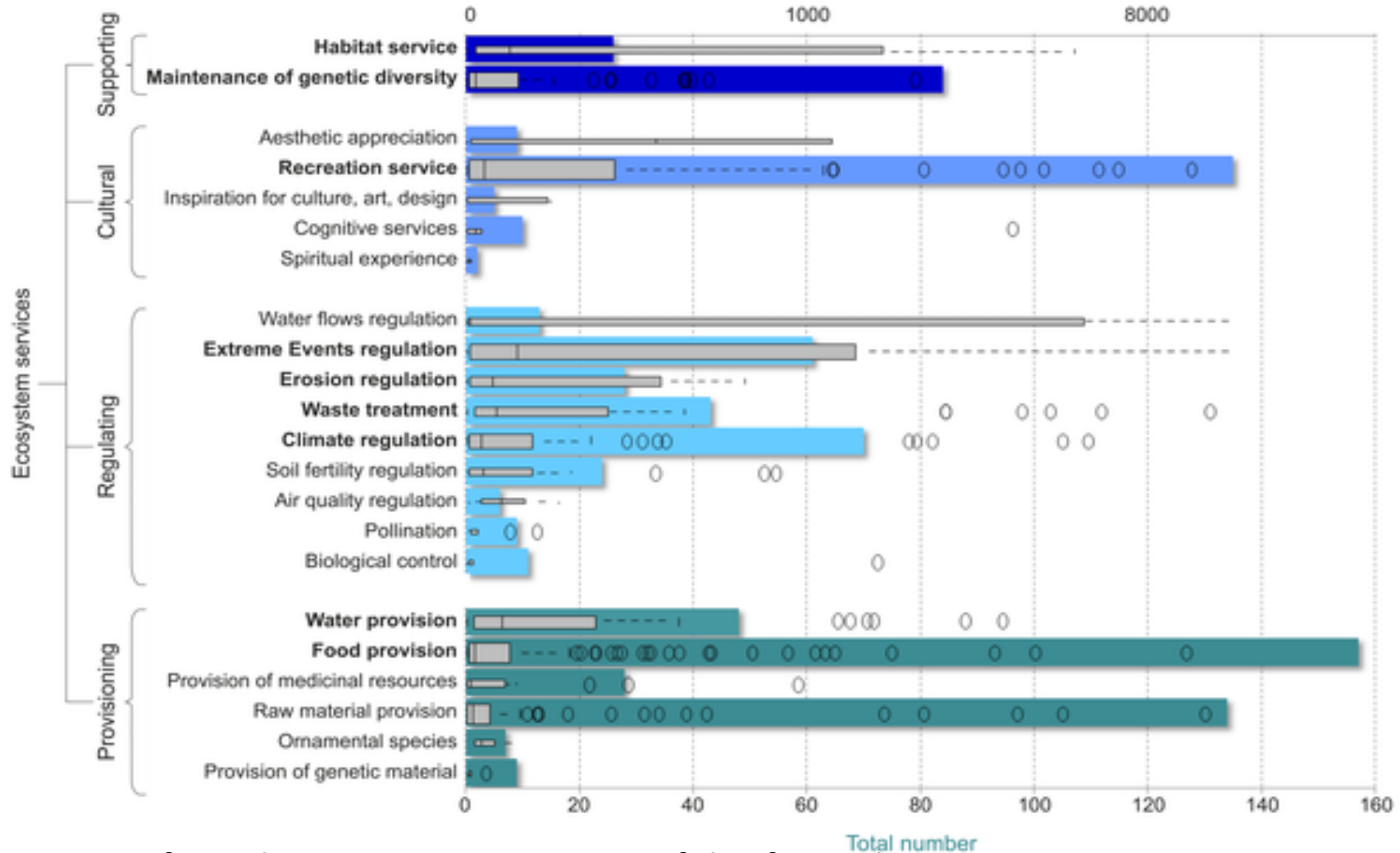


2. Transfer Function Method as «SCOPING EXERCISE»

A «glimpse» of economic values of Ecosystem Services of Natura 2000 Network Calabria

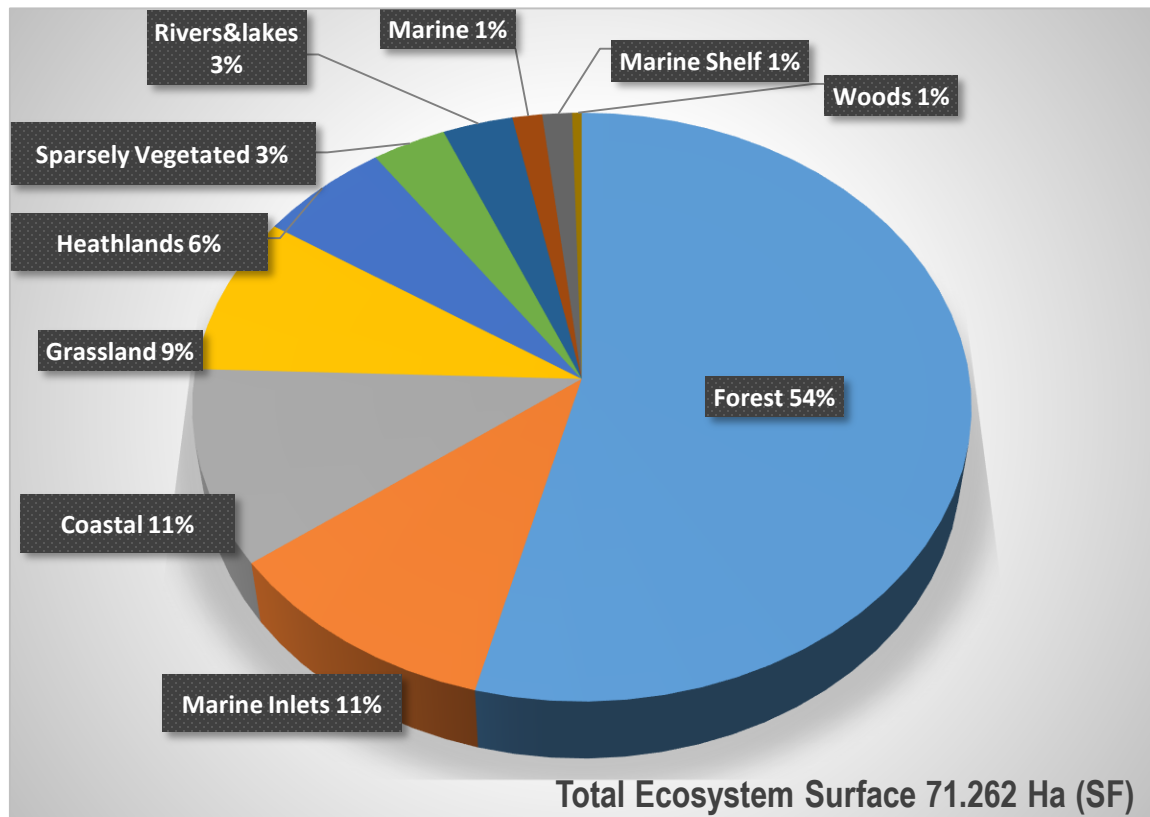


Range of monetary valued ecosystem services Int \$ (2007)/ha/year



We got, from the TEEB Data-Base, one of this for each ecosystem present in our region

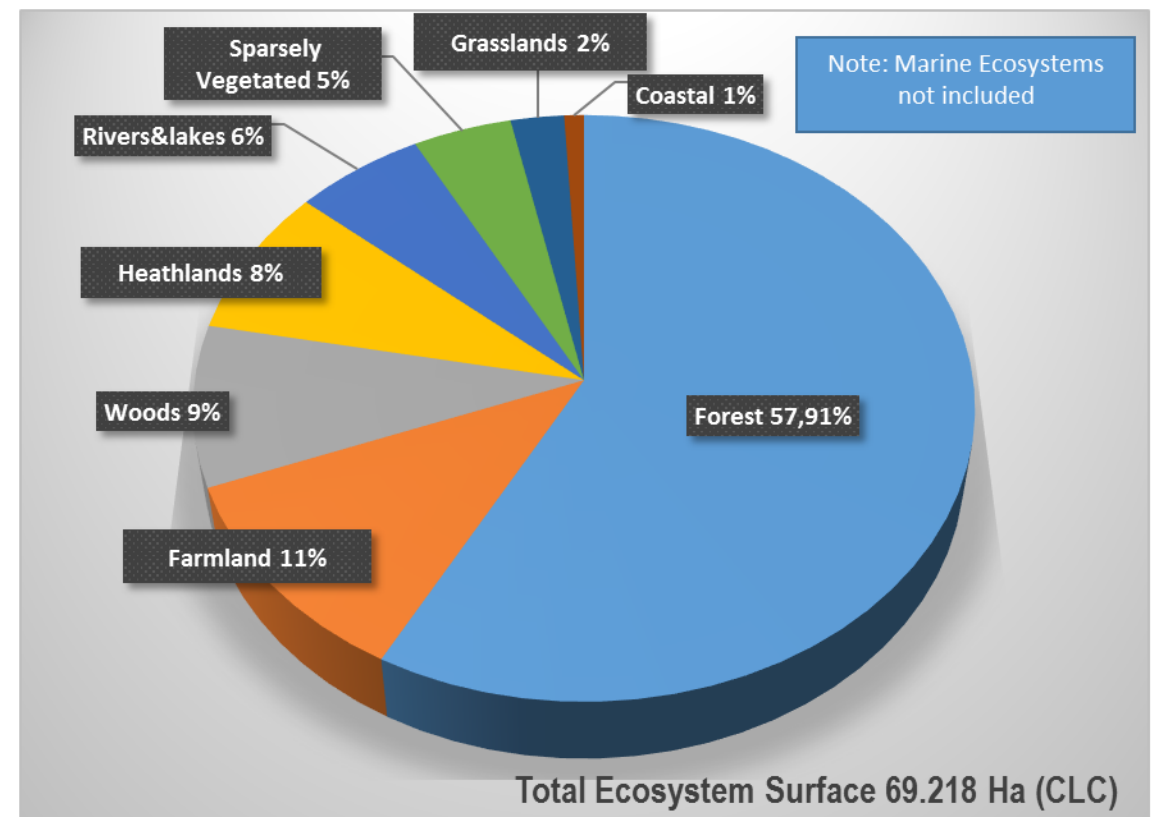
Standard Forms



Note: No geo-representation possible
(no geo-referenced habitat surfaces in the Standard Forms and therefore in the ecosystem groups of cross-walk DB)

Roscher S., Condé S., Bailly Maitre J. (2015)
Final database on linkages between species/habitat-types and broad ecosystems. ETC/BD report to the EEA.

(Regional) CLC

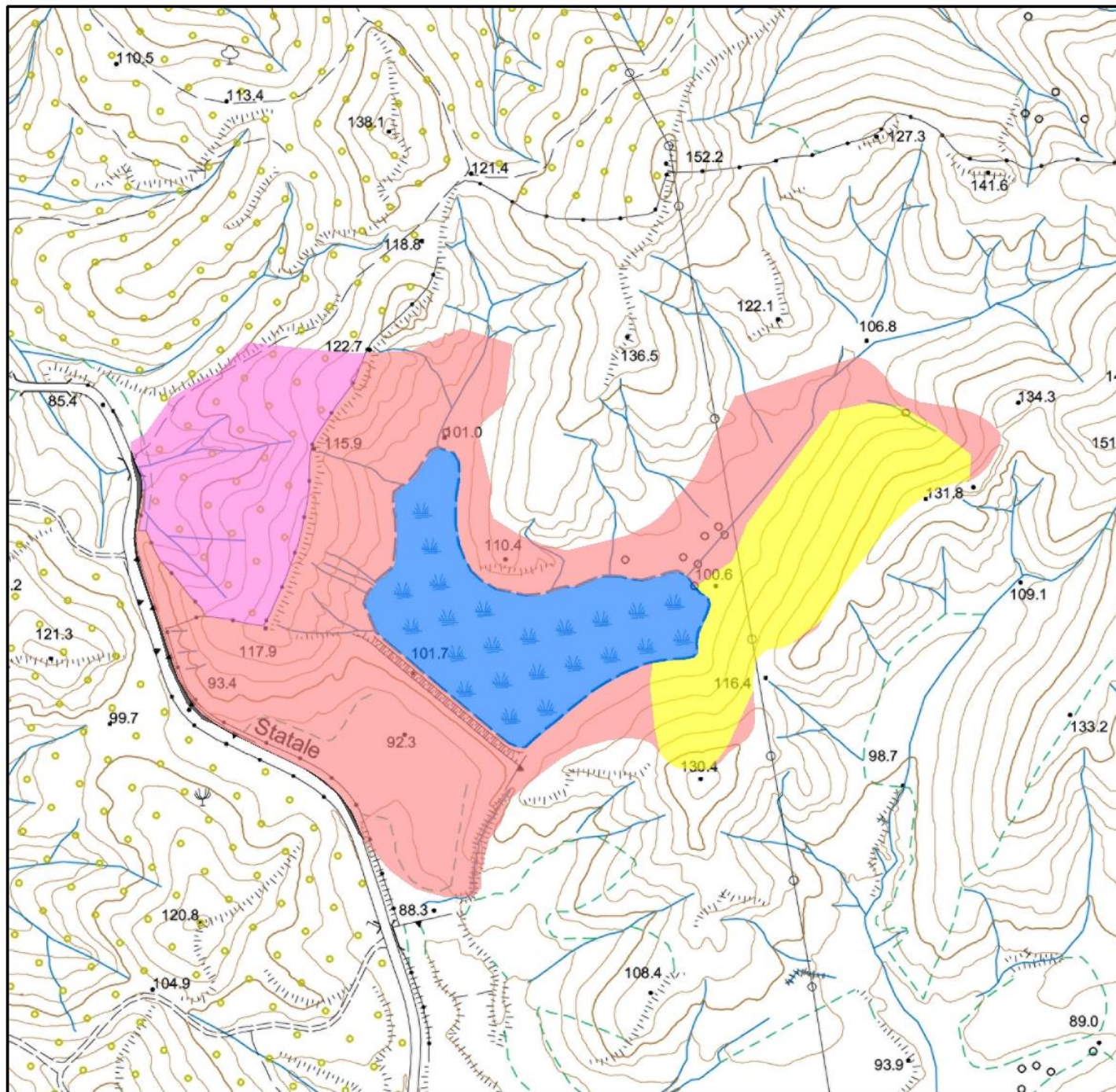


Note: Geo-representation possible
(From regional CLC classes to MAES ecosystems according to BISE cross-walk table)

Linkages of species and habitat types to MAES ecosystems, European Environment Agency,
Data Prod-ID: DAT-143-en Created 20 Aug 2015 Published 05 Oct 2015 Last modified 01 Dec 2015

IT9320046

- Croplands
- Coastal
- Forest
- Grasslands
- Heathland and shrub
- Marine inlets and transitional water
- Rivers and lakes
- Sparsely vegetated areas
- Urban
- Woodland



Stime basate su transfer function

Localiteno: Punt:

Coordinate:

Area	0.0000	0.0000	0.0000	0.0000	0.0000
Area di cropland	0.0000	0.0000	0.0000	0.0000	0.0000
Area di forest	0.0000	0.0000	0.0000	0.0000	0.0000
Area di grasslands	0.0000	0.0000	0.0000	0.0000	0.0000
Area di heathland and shrub	0.0000	0.0000	0.0000	0.0000	0.0000
Area di marine inlets and transitional water	0.0000	0.0000	0.0000	0.0000	0.0000
Area di rivers and lakes	0.0000	0.0000	0.0000	0.0000	0.0000
Area di sparsely vegetated areas	0.0000	0.0000	0.0000	0.0000	0.0000
Area di urban	0.0000	0.0000	0.0000	0.0000	0.0000
Area di woodland	0.0000	0.0000	0.0000	0.0000	0.0000
Area di cropland	0.0000	0.0000	0.0000	0.0000	0.0000
Area di forest	0.0000	0.0000	0.0000	0.0000	0.0000
Area di grasslands	0.0000	0.0000	0.0000	0.0000	0.0000
Area di heathland and shrub	0.0000	0.0000	0.0000	0.0000	0.0000
Area di marine inlets and transitional water	0.0000	0.0000	0.0000	0.0000	0.0000
Area di rivers and lakes	0.0000	0.0000	0.0000	0.0000	0.0000
Area di sparsely vegetated areas	0.0000	0.0000	0.0000	0.0000	0.0000
Area di urban	0.0000	0.0000	0.0000	0.0000	0.0000
Area di woodland	0.0000	0.0000	0.0000	0.0000	0.0000

Stime basate su transfer function

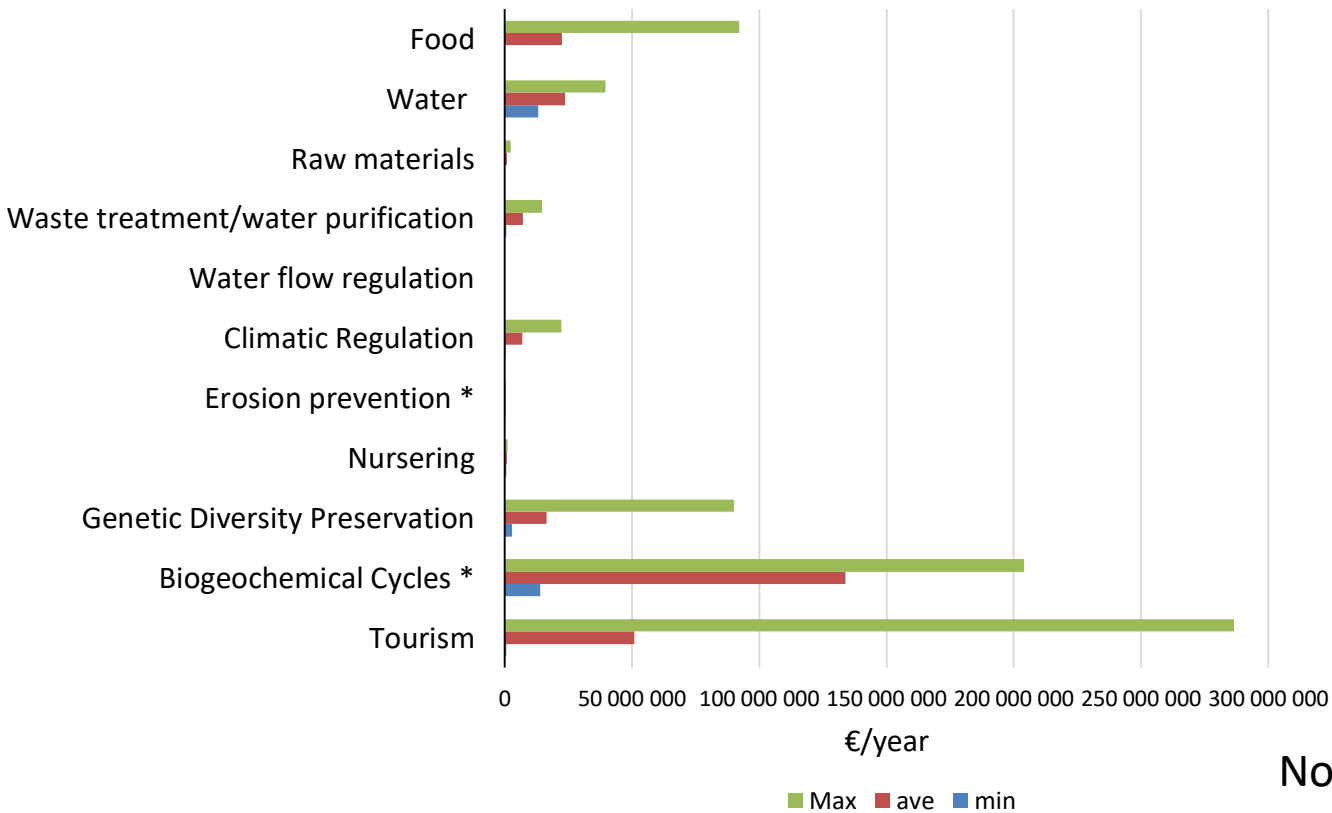
Localiteno: Punt:

Coordinate:

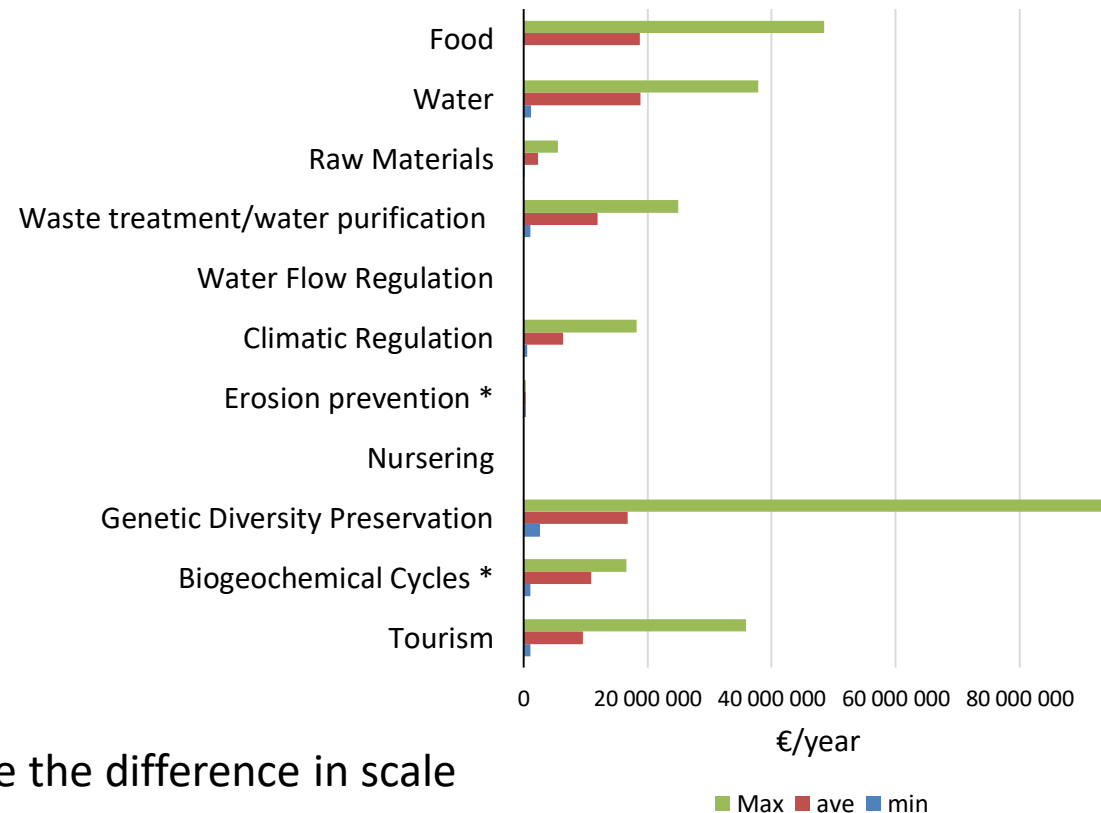
Area	0.0000	0.0000	0.0000	0.0000	0.0000
Area di cropland	0.0000	0.0000	0.0000	0.0000	0.0000
Area di forest	0.0000	0.0000	0.0000	0.0000	0.0000
Area di grasslands	0.0000	0.0000	0.0000	0.0000	0.0000
Area di heathland and shrub	0.0000	0.0000	0.0000	0.0000	0.0000
Area di marine inlets and transitional water	0.0000	0.0000	0.0000	0.0000	0.0000
Area di rivers and lakes	0.0000	0.0000	0.0000	0.0000	0.0000
Area di sparsely vegetated areas	0.0000	0.0000	0.0000	0.0000	0.0000
Area di urban	0.0000	0.0000	0.0000	0.0000	0.0000
Area di woodland	0.0000	0.0000	0.0000	0.0000	0.0000
Area di cropland	0.0000	0.0000	0.0000	0.0000	0.0000
Area di forest	0.0000	0.0000	0.0000	0.0000	0.0000
Area di grasslands	0.0000	0.0000	0.0000	0.0000	0.0000
Area di heathland and shrub	0.0000	0.0000	0.0000	0.0000	0.0000
Area di marine inlets and transitional water	0.0000	0.0000	0.0000	0.0000	0.0000
Area di rivers and lakes	0.0000	0.0000	0.0000	0.0000	0.0000
Area di sparsely vegetated areas	0.0000	0.0000	0.0000	0.0000	0.0000
Area di urban	0.0000	0.0000	0.0000	0.0000	0.0000
Area di woodland	0.0000	0.0000	0.0000	0.0000	0.0000

Main Results of the «SCOPING EXERCISE» via Transfer Function Method

ESs from Standard Forms Data



ESs from (Regional) CLC Data



Note the difference in scale

Ecosystems considered in the analysis:
 Forest, Woods, Grassland, Rivers&Lakes, Coastal (terrestrial), Marine

Note: Marine Ecosystems
 not included in CLC

3. From extrapolated to actual local ESs for forest and woods habitats/ecosystems

- Water provision from springs within SCIs
- Carbon Stock
- Carbon Flux
- Wood production

Water provision from springs within SCIs

- $Vol_i = (F_i * s_m) / 1000$

- $ESV = Vol_i * t_m$

- The beneficiaries have been computed considering the intersection between municipalities (number of people) and SCIs where springs of drinking water are present. In this way it was possible to calculate the per capita value

Carbon Stock

$$tC = \left(\sum_t Mepi_{tp,r} * a_{tp,i} + (Mepi_{tp,r} * a_{tp,i}) * Rad_{tp} + (Mepi_{tp,r} * a_{tp,i}) * Let_{tp} \right) * 0,5$$

$Mepi_{tp}$ = forest epigean mass for each forest/habitat type (tp);

Rad_{tp} = root/shoot ratio for each forest/habitat type

Let_{tp} = conversion factor of C-epigean in C-litter for each forest/habitat type

a_{tp} = surface for each forest/habitat type

- $VtC = tC * Price$

(min 4€/tC; med 35€/tC; Max 53€/tC)

Rashid R. e Seizov P. (2012) e Ding H., Nunes P. A. L. D. and Teelucksingh S. (2011)

Carbon Flux

$$FC = (Incr_{tp} * a_{tp} * BEF_{tp} * WBD_{tp} * 0,5)$$

$Incr_{tp}$ = increase of epigeal volume per hectar and forest/habitat type;

a_{tp} = area per forest/habitat type (tp);

BEF_{tp} = Biomass Expansion Factor (epigeal biomass/growing stock) per forest/habitat type;

WBD_{tp} = wood basal density, dry weight/wet weight (t/m³) per forest/habitat type.

- $VFC = FC * Price$

(min 12€/tC; Max 17€/tC)

(Schirpke, U., Scolozzi, R., De Marco, C. 2014)

Wood production

$$TCI_{tp} = (a_{tp} * CI_{tp})$$

- TCI_{tp} = Total current increase per forest/habitat type (tp) ($m^3/year$);
- a_{tp} = area per forest/habitat type (tp) (ha);
- CI_{tp} = Current increase, per hectare and forest/habitat type ($m^3/ha/year$);

$$EV_{tp} = (TCI_{tp} * P_{tp})$$

EV_{tp} = Economic value of wood and forest/habitat type;

TCI_{tp} = Total current increase per forest/habitat type (tp) ($m^3/year$), assuming that the increase can be divided into woody assortments (firewood, lumber and Forest biomass for energy uses) ;

P_{tp} = Price by woody assortment per forest/habitat type (tp);

Water from springs within SCIs of N 2K N Calabria - €/year						
	# of springs	# SCI	m ³ /year	€ 1.05/m ³	€ 0.051/m ³	€ 0.15/m ³
Drinking	63	25	15,651,317	16,433,883	-	-
Irrigation	69	26	14,204,419	-	724,425	2,130,663
Total	132	51	29,855,736			

Waters Total Value of springs within SCIs of N 2K N Calabria - €/year		
	min	Max
Drinking	16,433,883	16,433,883
Irrigation	724,425	2,130,663
Total	17,158,308	18,564,546

Water form springs within SCIs of N 2K N Calabria - undetermined use - €/year						
# of springs	# SCI	Potential use	m ³ /year	€ 1.05/m ³	€ 0.051/m ³	€ 0.15/m ³
142	35	Drinking "OR"	48,839,803	51,281,793	-	-
		Irrigation	12,042,691	-	614,177	1,806,404

Total potential value of waters from springs within SCIs of N 2K N Calabria - €/year			
	Total	Total min	Total Max
Drinking	67,715,676		
Irrigation		1,338,603	3,937,067

Beneficiaries



342,583
(Average
per capita
value:
48€/year)

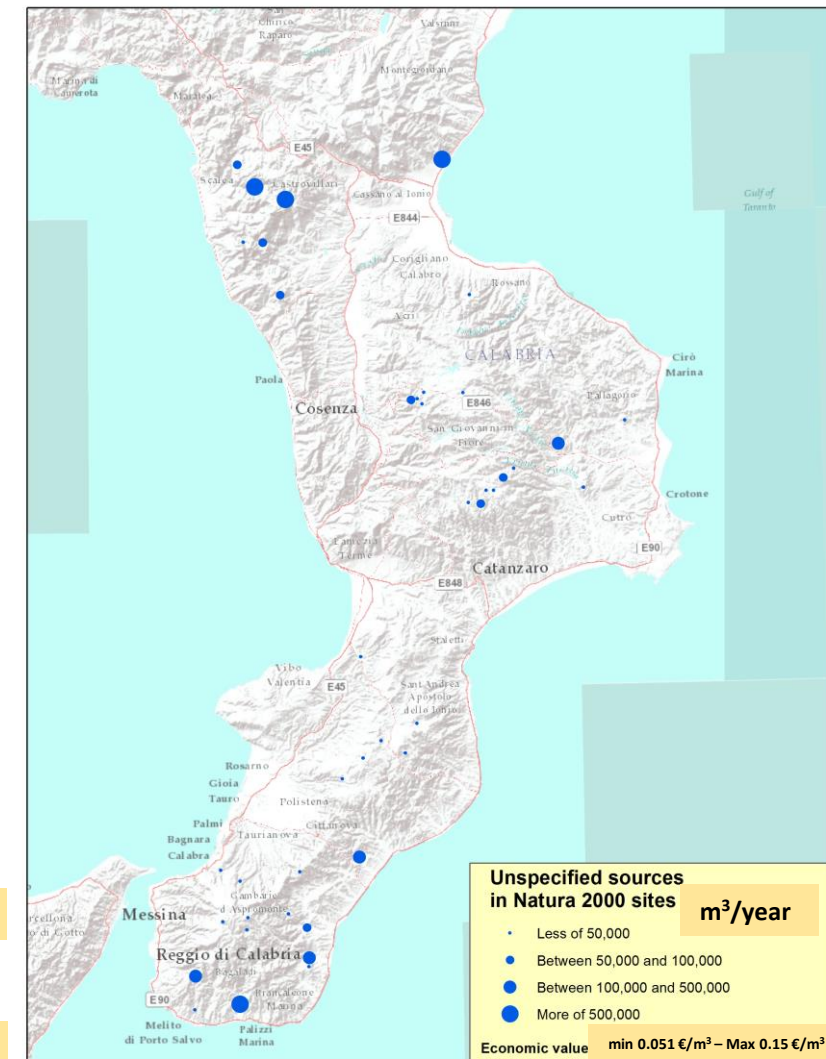
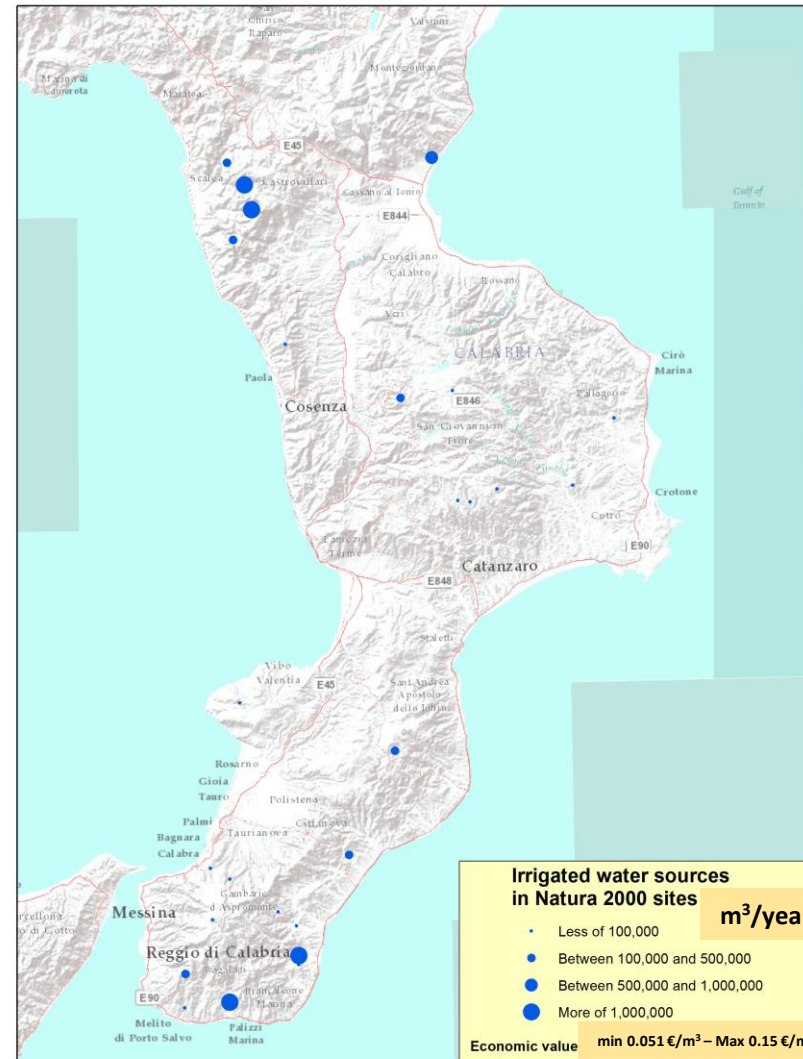
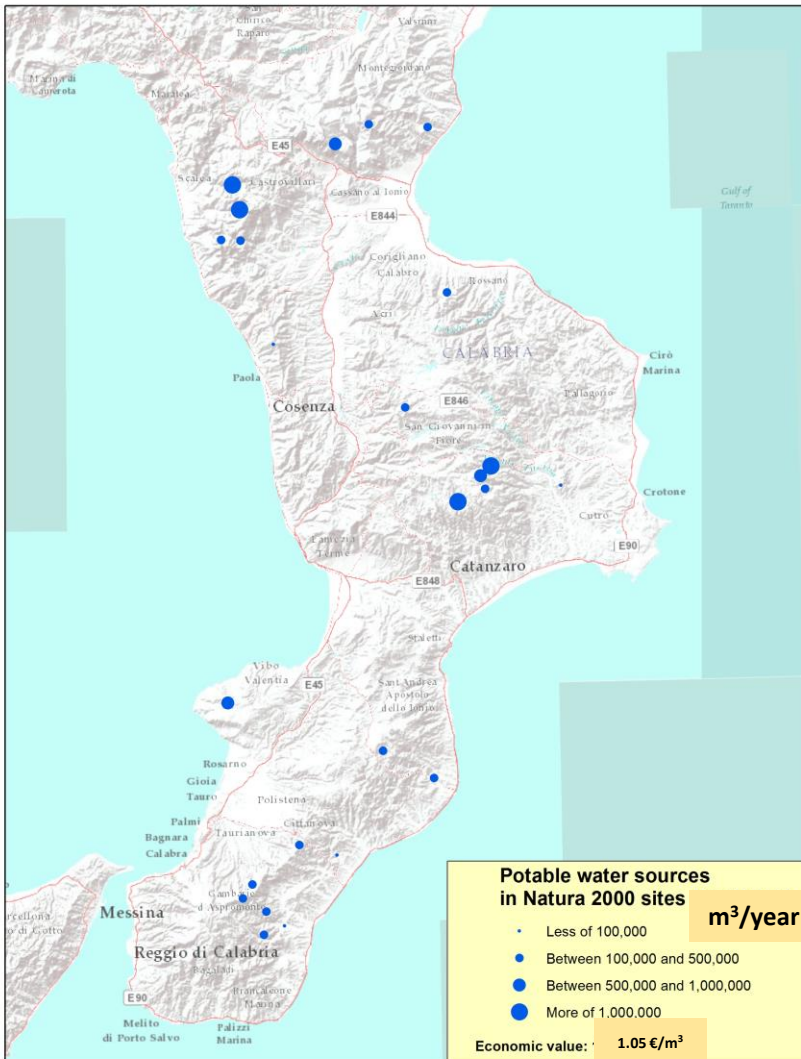


Ecosystem Service: Water Provision (from the springs present in the SCIs of N 2K N Calabria)

Estimates of ecosystem services supplied by the source
Drinking water

Estimates of ecosystem services supplied by the source
Irrigation water

Estimates of ecosystem services supplied by the source
Unspecified sources



Direct estimates of (Provisioning) ESs «Stock and Carbon Flux» and «Wood production»
Forest&woods ecosystems within SCIs of N 2K N Calabria
(from National Forest Inventory)

From Standard Forms

From (regional) CLC

Carbon Stock (tC) - Forest&woods of SCIs N 2K N Calabria - in €

	min (4€/tC)	average (35€/tC)	Max (53€/tC)
Total Value 120 SCIs (ha 37,560)	75,967,137	664,712,450	1,006,564,567

Carbon Stock (tC) - Forest&woods of SCIs N 2K N Calabria - in €

	min (4€/tC)	average (35€/tC)	Max (53€/tC)
Total Value 137 SIC (ha 41,508)	79,073,286	691,891,257	1,047,721,046

Carbon Flux (tC/year) - Forest&woods of SCIs N 2K N Calabria - in €/year

	min (12€/t)	Max (17€/t)
Total Value 120 SCIs (ha 37,560)	1,004,569	1,423,139

Carbon Flux (tC/anno) - Forest&woods of SCIs N 2K N Calabria - in €/year

	min (12€/t)	Max (17€/t)
Total Value 137 SCIs (ha 41,508)	1,039,588	1,472,750

COMPETITIVE ESs

Wood production - Forest&woods of N 2K N Calabria - in €/year

Timber	4,840,025
Firewoods	5,121,776
Biomass (energetic use)	1,277,568
Total Value 120 SCIs (ha 37,560)	11,239,369

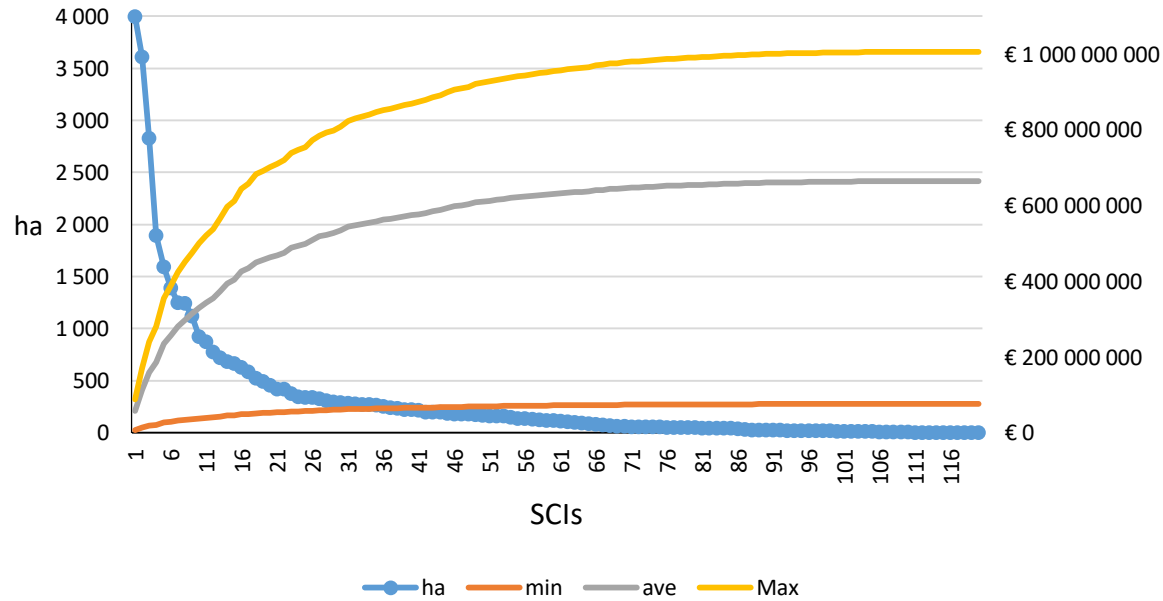
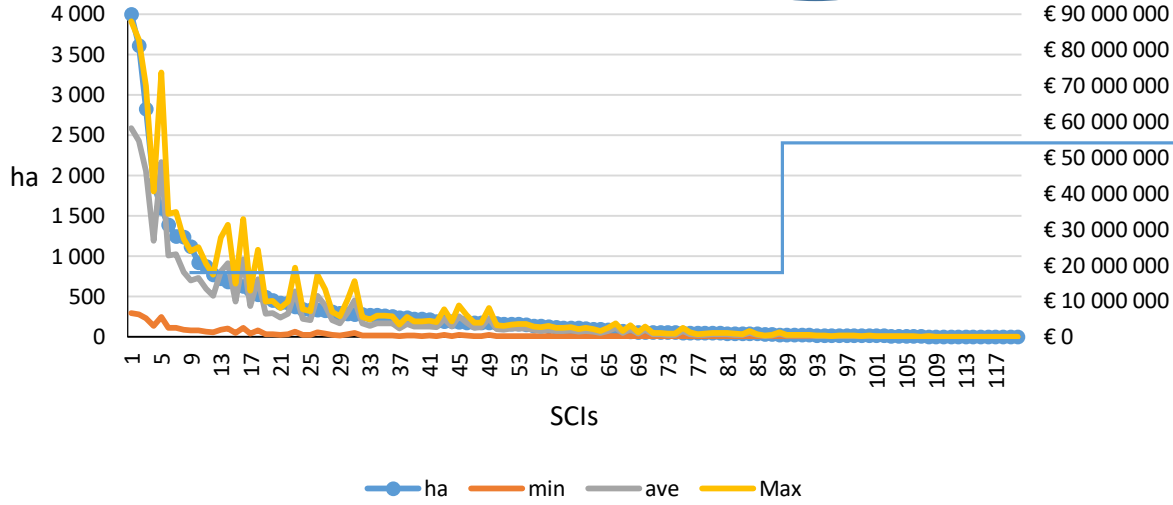
Wood production – Forest&woods of N 2K N Calabria - in €/year

Timber	8,308,477
Firewoods	5,752,023
Biomass (energetic use)	1,615,182
Total Value 137 SCIs (ha 41,508)	15,675,682

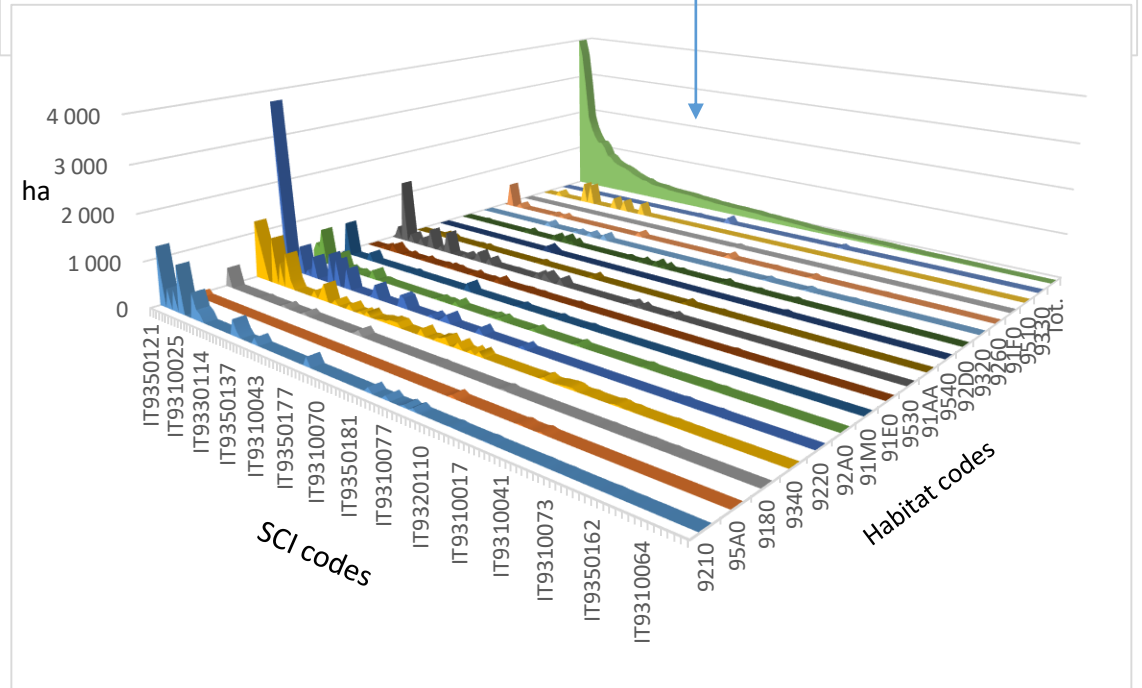
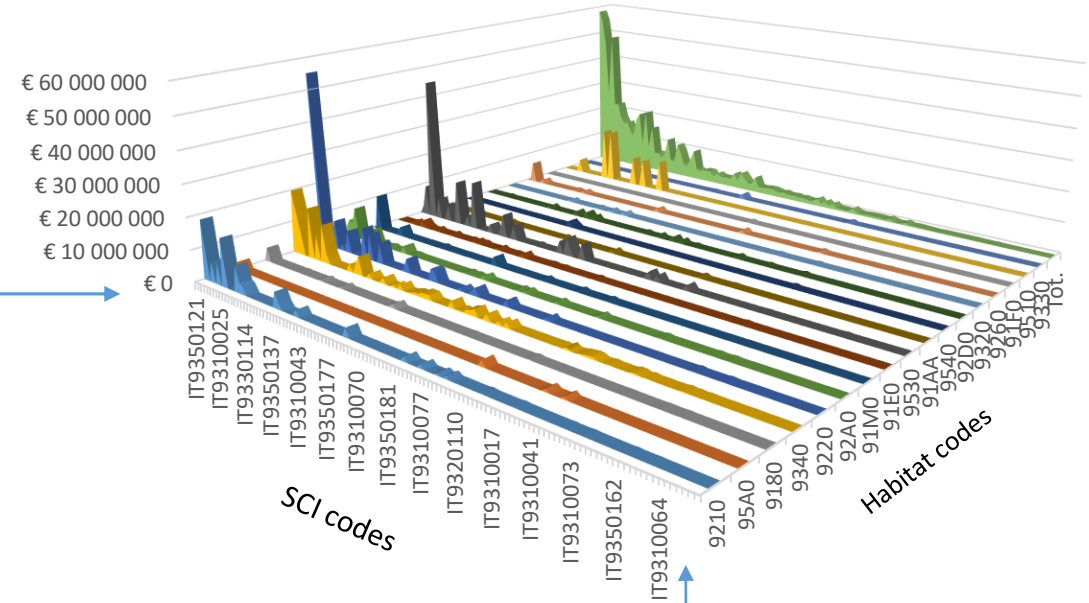
Carbon Stock (tC) – Forest&woods of N 2K N Calabria (from SF) in €

min (4€/tC) **average(35€/tC)** Max (53€/tC)

Total Value 120 SCIs (ha 37,560) 75,967,137 664,712,450 1,006,564,567

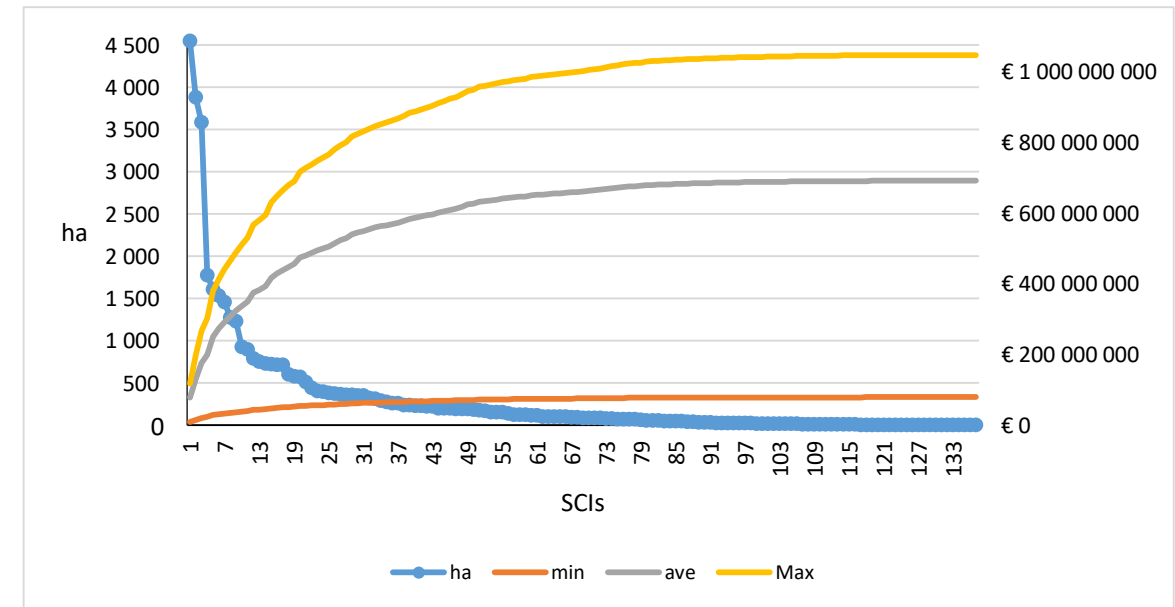
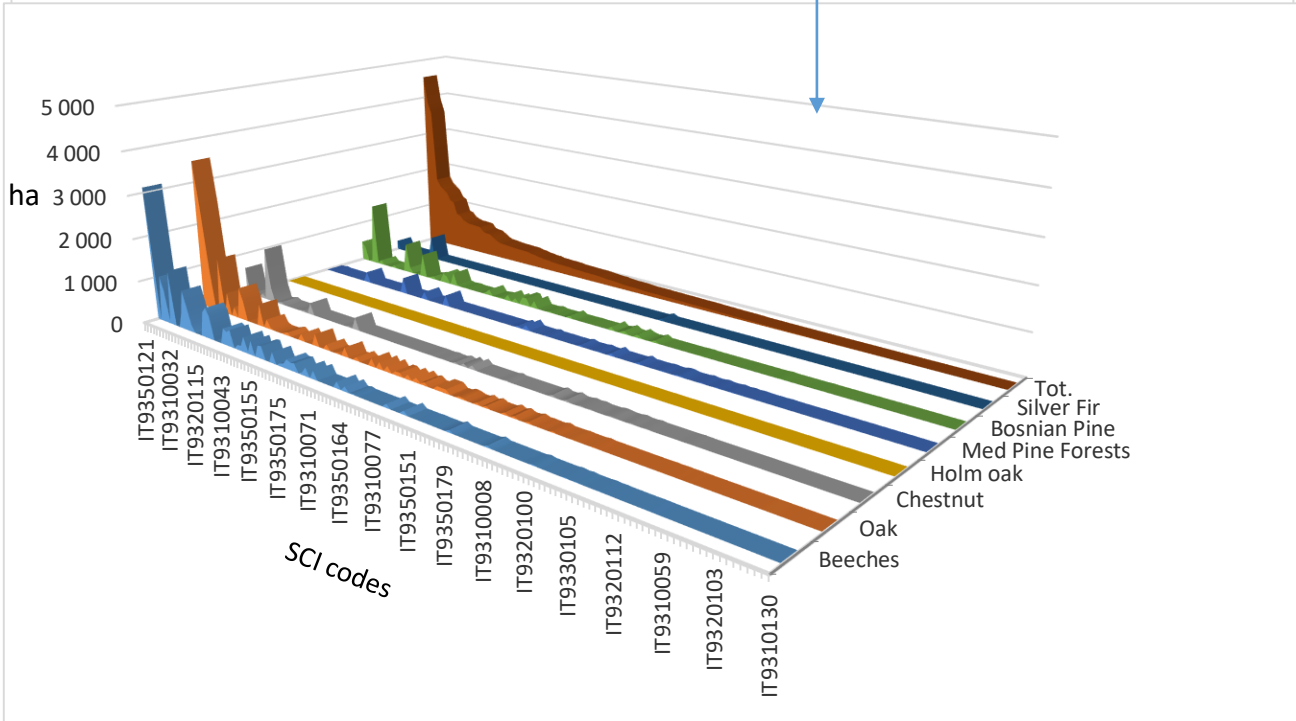
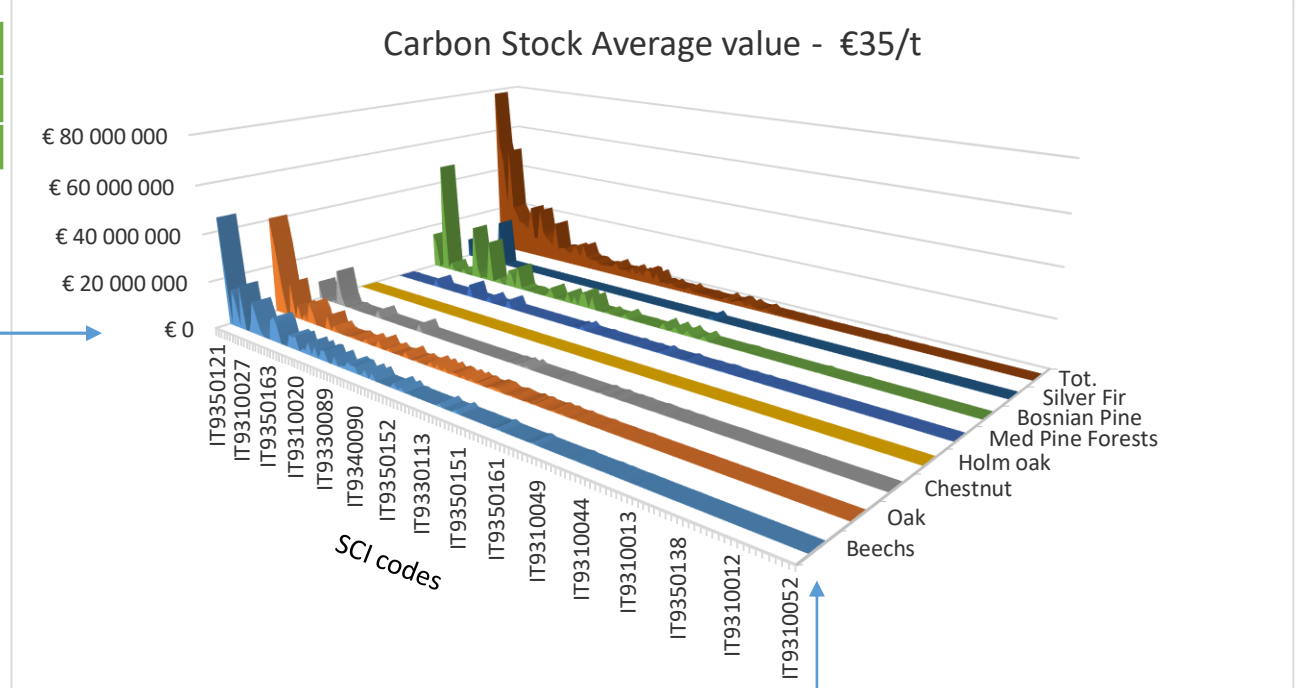
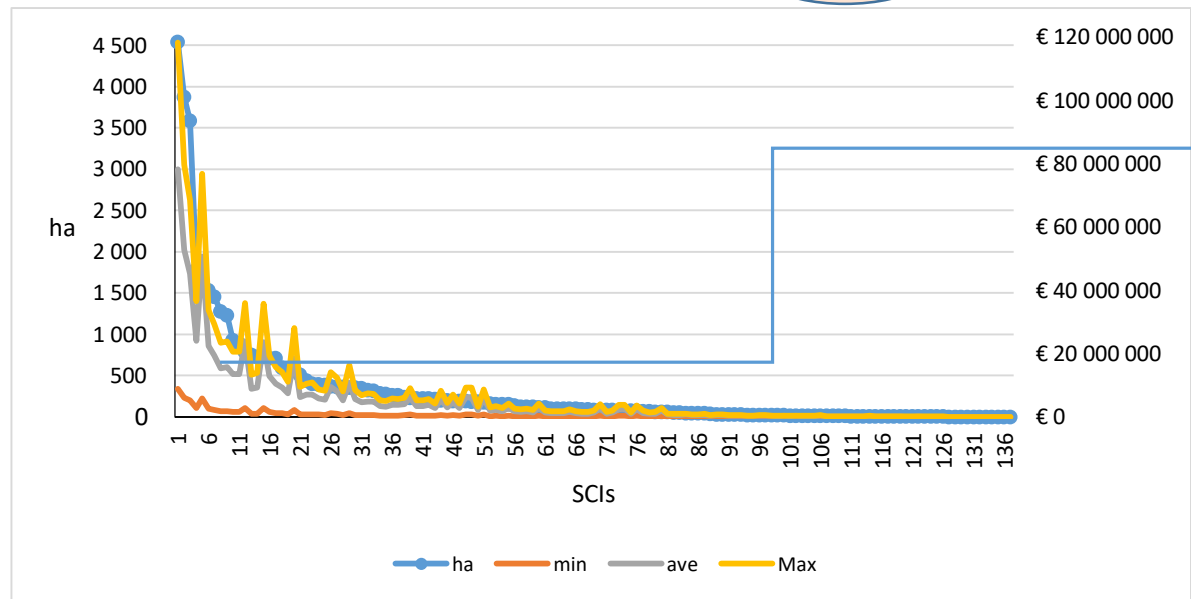


Carbon Stock Average value - €35/t



Carbon Stock (tC) – Forest&woods of N 2K N Calabria (from CLC) in €

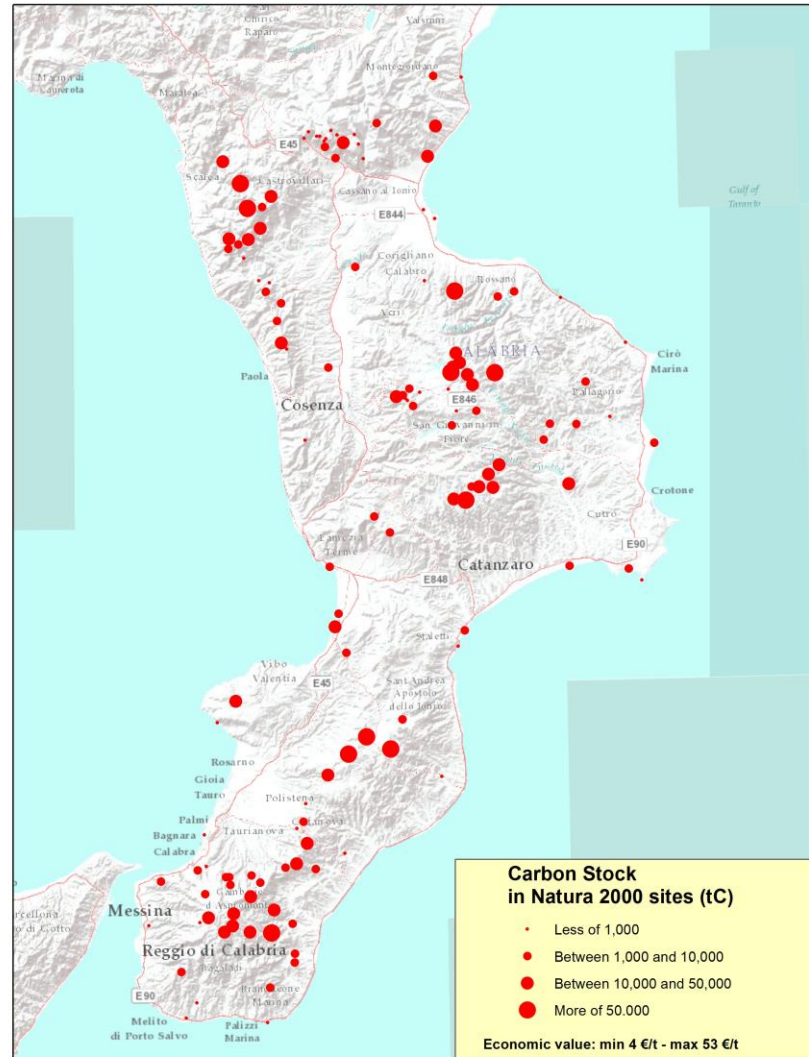
	min (4€/tC)	average (35€/tC)	Max (53€/tC)
Total Value 137 SCIs (ha 41,508)	79,073,286	691,891,257	1,047,721,046



Ecosystem Service: Carbon Stock (tC), Flux (tC/year) and Wood production (t/ha)

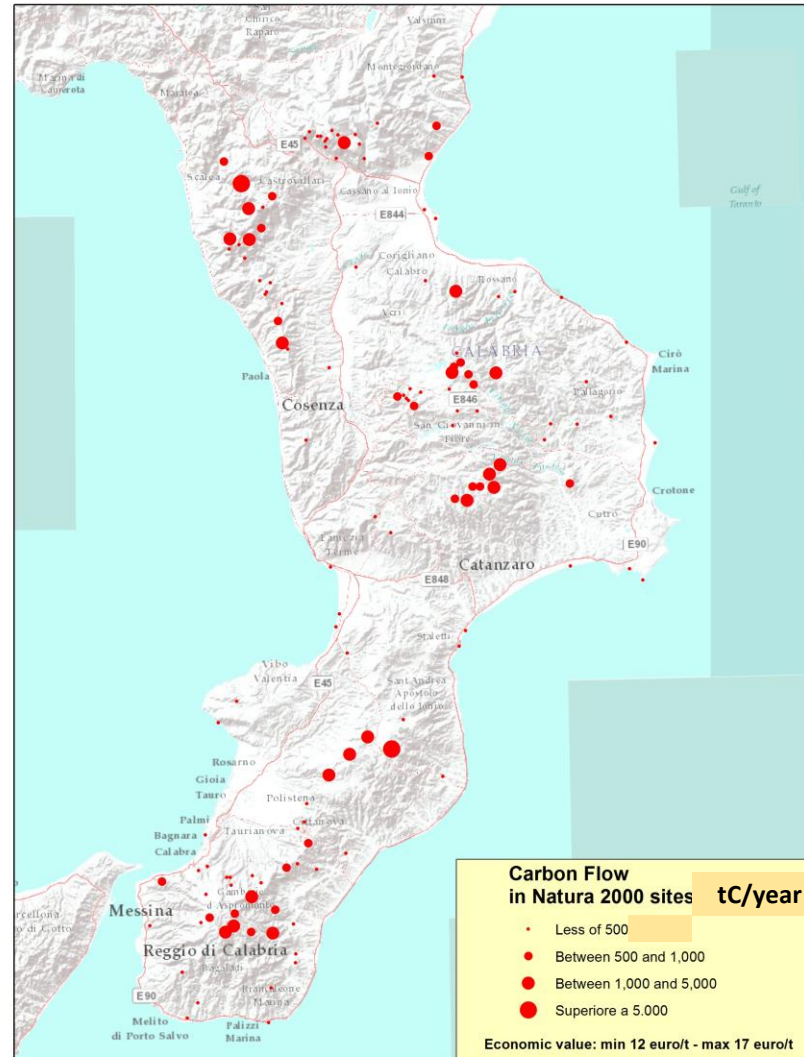
Estimates of ecosystem services provided by forest habitat

Carbon Stock - Total



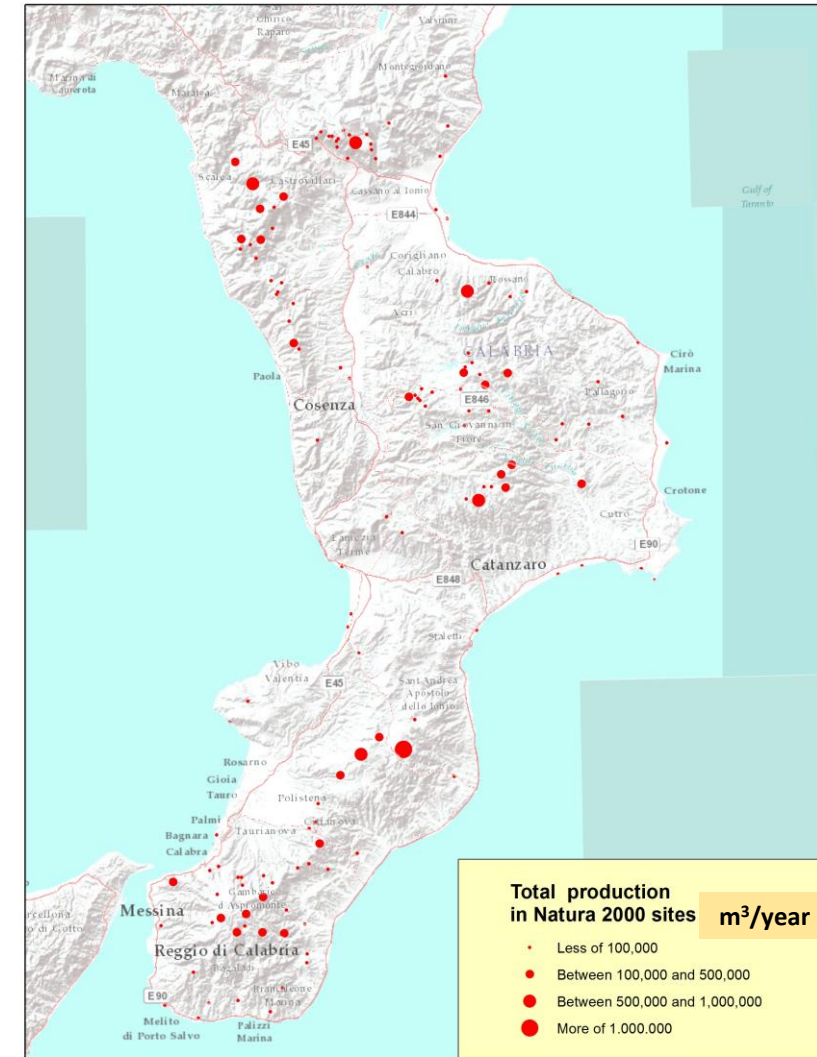
Estimates of ecosystem services provided by forest habitat

Carbon Flow - Total



Estimates of ecosystem services provided by forest habitats

Wood Total production



4. Next steps

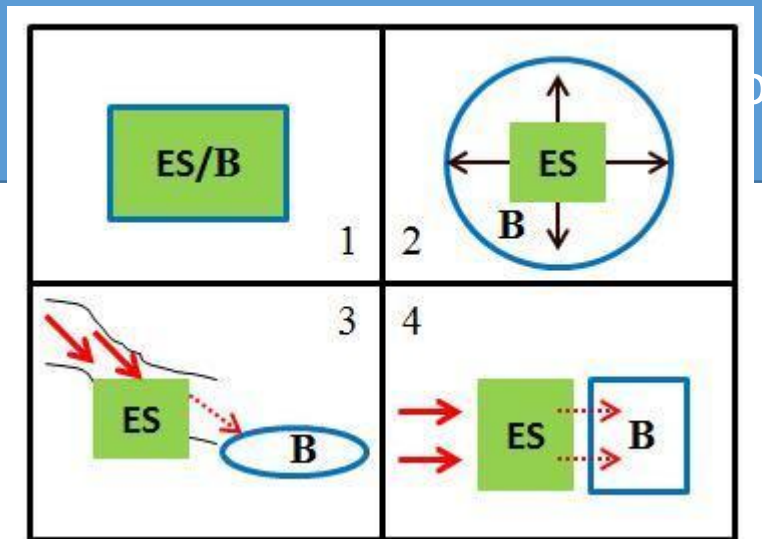
More «locally detailed» estimates of several other ESs are in progress (accordingly to the finding of appropriate data), specifically:

- Fodder
- The recharge of aquifers
- The protection from hydraulic risks
- The protection from landslides risks

And possibly,

- The eco-touristic actual and potential flux (and income)
- The coastal protection effects of seagrasses beds (*Cimodocea nodosa*)

Moreover, we are trying to better define the beneficiaries, *sensu* F. Villa, B. Voigt, J. D. Erickson (2014), of the ESs we estimated (as potential ESs) for the SCIs of N 2K N Calabria.



ES = Ecosystem Services, B = Beneficiaries