

A model of environmental accounting for the system of the natural protected areas in Friuli Venezia Giulia: the S.A.R.A. project

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CENTRO DI ECOLOGIA TEORICA ED APPLICATA





Structure of the presentation

- Introduction
- Methodology
- Results
- Discussion and conclusion

Introduction

The S.A.R.A. project

- 2007 C.E.T.A. and the Friuli Venezia Giulia Region:
Environmental accounting model for the Regional Environmental
Areas System
in Italian Sistema Aree Regionali Ambientali, S.A.R.A.
- realised in the name and on the behalf of the Autonomous Region
of Friuli Venezia Giulia in the framework of the S.A.R.A. Project,
cofinanced by the EU DOCUP Objective 2, 2000/2006 action 3.1.1



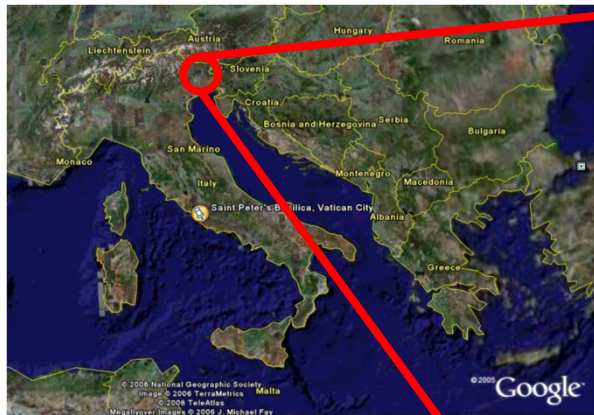
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FESR



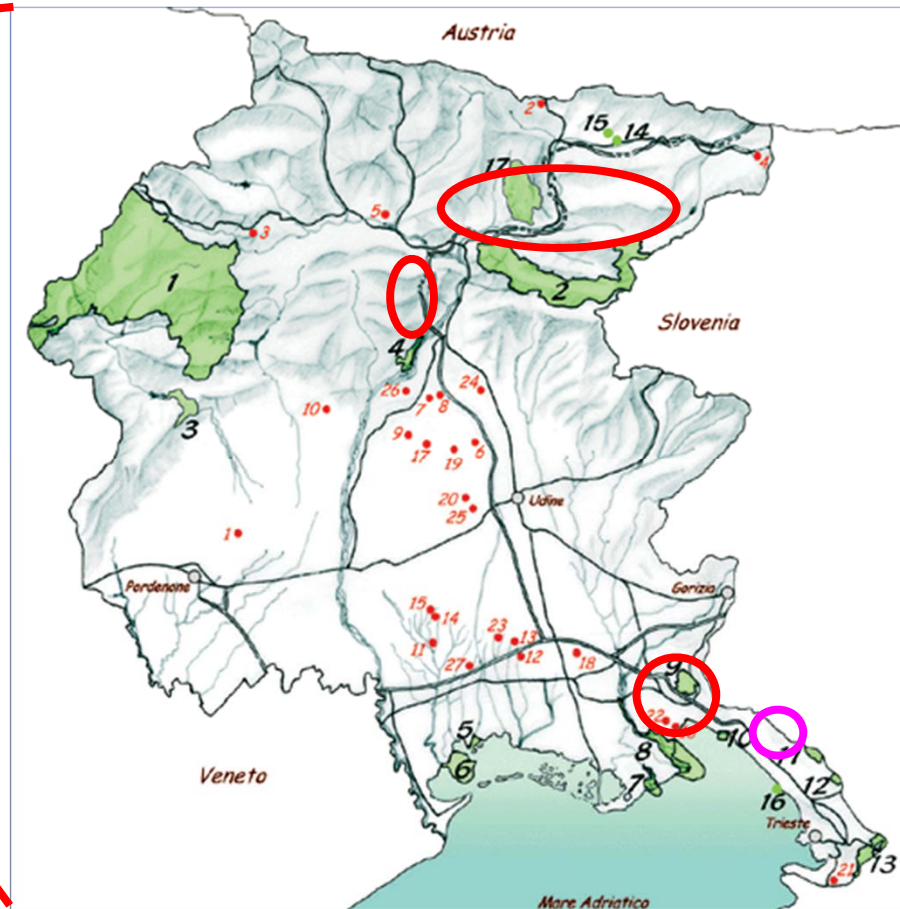
Ministero dell'Economia
e delle Finanze

Introduction

Sistema Aree Regionali Ambientali – S.A.R.A. Regional Environmental Areas System



- 2 Regional Parks
- 12 Regional Reserves
- 3 National Reserves
- 27 Biotopes
- 55.000 hectares = 7% FVG



Methodology

Satellite account in the System of national accounting

	System of Environmental and Economic Accounting SEEA	European Statistical System	Description
Flow account	Physical Flow Accounts	<i>Material Flow Accounts – MFA</i>	Records flows of material between the anthropic and the natural system, Analyses the natural resources use and relates it to the economy trend
	Hybrid Flow Accounts: National Account Matrix including Environmental Accounts – NAMEA	<i>National Account Matrix including Environmental Accounts</i>	Records physical flows between the anthropic and the natural system (gas emissions), relates them with the economic activities and the GDP
Economic account or Expenses account	Environmental depletion/defensive/degradation expenditure accounts	<i>Environmental Protection Expenditure Accounts</i> SERIEE – EPEA (ex-post)	Records economic trades involving the environment (nature conservation expenses), economic activities producing good and service for the environment
		<i>Resource Use and Management Expenditure Accounts</i> SERIEE - RUMEA (ex-ante)	
Asset account	<i>Environmental Asset Accounts</i>	<i>Natural Resource Asset Accounts</i>	Records asset account of natural resources in physical unit measure



Methodology

Limitations

Implementing the available environmental accounting models met some limitations:

- scale
 - macro not micro
- unit of measurement
 - physical not monetary
- accounting
 - costs not benefits

Methodology

Environmental accounting model

Environmental accounting		
Natural stock account STOCK	Natural flow account FLOW	
Quality analysis	Costs: monetary (<i>protected area Authority's costs</i>)	Benefits: monetary (<i>protected area Authority's revenues</i>)
quantity analysis	environmental (<i>environmental costs</i>)	environmental (<i>environm. benefits</i>)

Σ = wealth produced/consumed by the protected area



Methodology

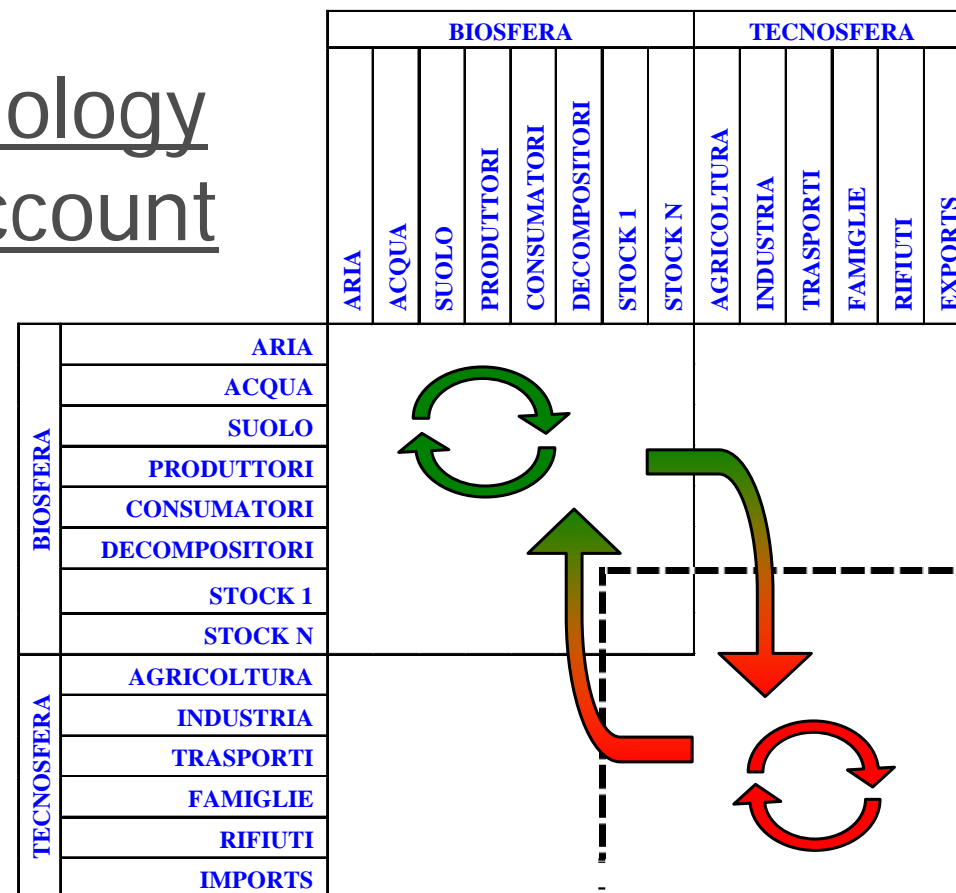
Natural stock account

- Qualitative classification by
 - class
 - order
 - family
 - genus
 - species
- Quantitative classification
 - Assigning a numeric value to the density

Methodology

Natural flow account at MACRO scale

Methodology Flow account



Fonte: Nebbia, 1996



Methodology

Natural flow account at MICRO scale

Costs

- monetary
costs contained in the Reserve's profit and loss account
- environmental
flows between the technosphere and the biosphere

Benefits

- monetary
revenues contained in the Reserve's profit and loss account
- environmental
flows between the biosphere and the technosphere

Methodology

Costs

- **Environmental**

- Macro: national accounting sectors

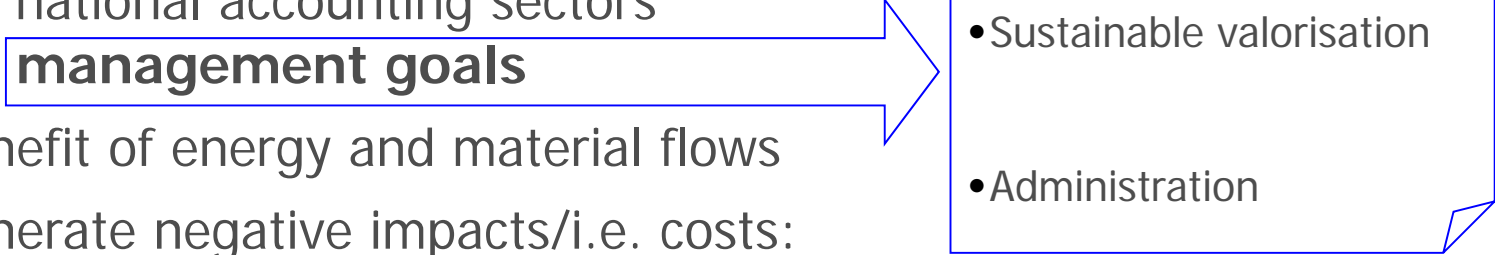
Micro: **management goals**

- benefit of energy and material flows
- generate negative impacts/i.e. costs:
 - anthropic presence
 - consumption of: raw materials, motor and heating fuel, electricity, water

- **Consumes = CO2 = (Social cost carbon) = €**

- **Monetary**

- Reclassification of the costs according to the five management goals

- 
- Management
 - Sustainable valorisation
 - Administration

Methodology

Benefits

- **Environmental**

- Macro: components (air, water, soil, etc.)

- Micro: **ecosystem functions**

- generate energy and material flows
- generate positive impacts/i.e. benefits::

- Costanza et al. 1997

*The value of the worlds ecosystem
services and natural capital*

"Nature"

- **Total economic value = €**

- **Monetary**

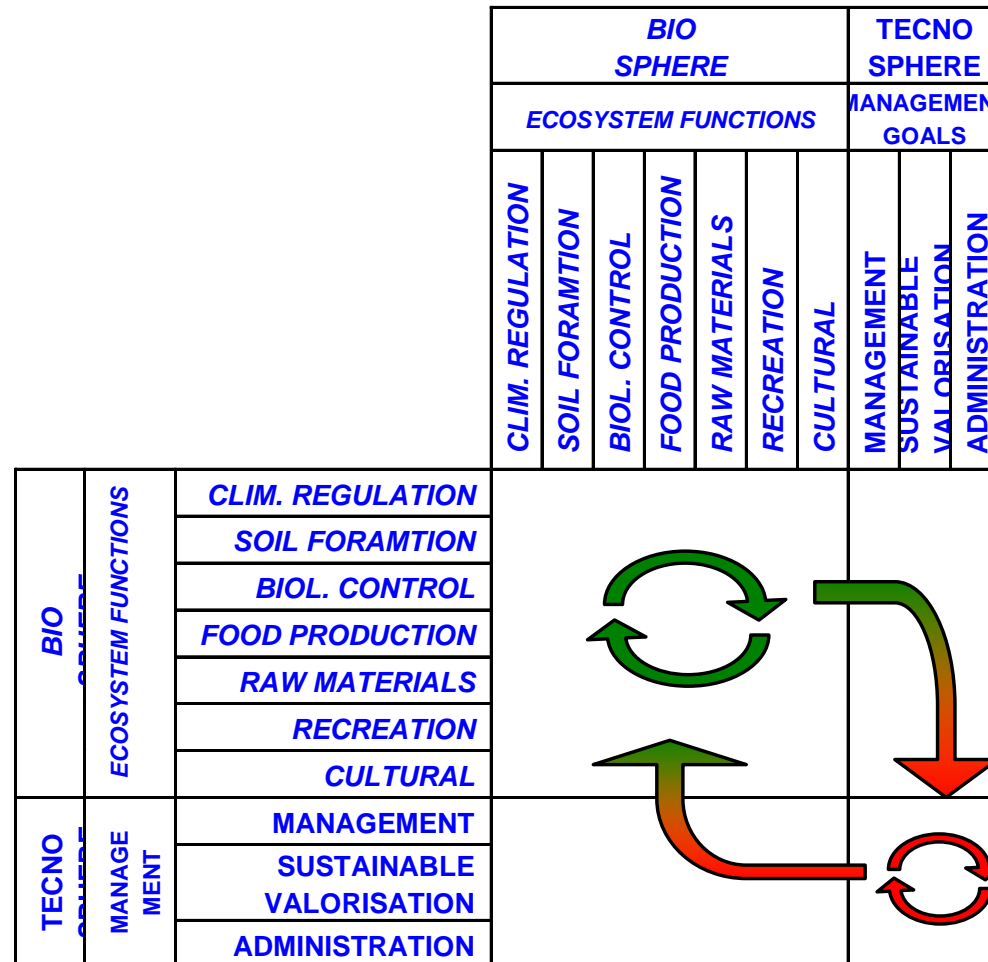
- Reclassification of the revenues according to the five management goals

- *Climate regulation*
- *Soil formation*
- *Biological control*
- *Food production*
- *Raw materials*
- *Recreation*
- *Cultural*

Fonte: Costanza et al., 1997

Methodology

MICRO: Biosphere-Technosphere flow matrix of S.A.R.A.





Results

Prealpi Giulie Regional Natural Park: Management goals

- Management goals
 - Management
 - Promotion, information and dissemination
 - Tourist and natural valorisation, land management, research, study
- Categories of environmental costs
 - anthropic presence
 - consumption of raw materials
 - consumption of motor fuel
 - consumption of heating fuel
 - electricity
 - water

Results

Prealpi Giulie Regional Natural Park: Ecosystem function

Temperate forest	Grassland	Ice/rock
Climate regulation	Gas regulation	
Water regulation	Climate regulation	
Soil formation	Water regulation	
Waste treatment	Erosion control	
Biological control	Soil formation	
Food production	Waste treatment	
Raw materials (timber)	Pollination	
Recreation	Biological control	
Cultural	Food production	
	Genetic resources	
	Recreation	



Results

Prealpi Giulie Regional Natural Park: Environmental asset account

- Qualitative analyses
 - Description
 - Physic environment
 - Vegetation
 - Flora: [Allegato 1 – Specie floristiche del Parco naturale delle Prealpi Giulie](#)
 - Fauna: [Allegato 2 – Specie faunistiche \(uccelli nidificanti e mammiferi\) del Parco naturale delle Prealpi Giulie](#)

Results

Prealpi Giulie Regional Natural Park: Environmental asset account

- Quantitative analyses

- Fauna: census

Species	Figures
Steinbock	170-200
Chamois	295-350 (considering also outside Park area)
Deer	100
Greek partridge	50-60 (year 2004)
Marmot	63 (year 2004)

- Vegetation: monetization

- Forest resources: *Temperate Forest function*

- Climate regulation: CO2 absorption € 21.868.552

- Raw materials: timber value € 28.897.879

- Grass resources: *Grassland function*

- Climate regulation: CO2 absorption € 6.097.944

- **Total natural asset account € 56.864.375**

Results

Prealpi Giulie Regional Natural Park:

Flow account

- Environmental costs: consumption of motor fuel

	Consume liter	Density kg l ⁻¹	kg	kgCO ₂ (kg fuel) ⁻¹	CO ₂ equivalent kg	Sc c€ (kgCO ₂) ⁻¹	Environm. cost €
	1	2	3=1*2	4	5=3*4	6	7=5*6
Diesel	1.553,71	0,85	1.320,65	3,28	4.331,74	0,93	40,29
Total	1.553,71		1.320,65		4.331,74		40,29

- Environmental benefits: *Food production*

Products	Quantity	Value	Environmental benefit
	kg	ha	€
Mushroom	175	12,66	2.218,04
Blueberry	31	11,19	345,62
Raspberry	18	10,60	187,97
Chestnut	34	2,94	101,06
Strawberry	0	0,00	
Hazelnut	143	0,71	101,06
Total	401		2.953,75

Environmental benefits: *Climate regulation*

CO2 absorption - FLOW

Category	Area	Total annual increment	Net mean annual increment	Biomass conversion and expansion factor	Above-ground/under-ground biomass rate	Conversion factor	Carbon	Social cost of carbon	Environmental benefit
	Sup	I _{caT}	I _N	BCEF	1+R	CF	C	S _{cc}	
	ha	t ha ⁻¹ year ⁻¹	m ³ ha ⁻¹ year ⁻¹	t m ⁻³	t t ⁻¹	tC tss ⁻¹	t year ⁻¹	c€ kgC ⁻¹	€
	1	2=3*4*5	3	4	5	6	7=1*2*6	8	9=7*8*1000/100
QUERCO-CARPINETI e ROVERETI	0,00	9,45	5	1,40	1,35	0,42	0	3,33	0
BOSCHI MISTI DI LATIFOGIE	50,00	15,12	8	1,40	1,35	0,42	318	3,33	10.573
OSTRIO-QUERCETI	120,96	5,586	3	1,40	1,33	0,42	284	3,33	9.450
ACERI-FRASSINETI	0,92	11,508	6	1,40	1,37	0,42	4	3,33	148
PINETE (MUGHETE)	1.172,56	2,25	2	0,75	1,5	0,42	1.108	3,33	36.899
FAGGETE	3.646,59	11,76	6	1,40	1,4	0,42	18.011	3,33	599.774
PICEO-FAGGETI	13,18	5,64	4	1,00	1,41	0,42	31	3,33	1.040
ABIETI-PICEO-FAGGETI	0,00	6,345	6	0,75	1,41	0,42	0	3,33	0
PECCETE DI SOSTITUZIONE	0,00	5,325	5	0,75	1,42	0,42	0	3,33	0
PECCETE MONTANE, ALTIMONTANE	130,84	4,26	4	0,75	1,42	0,42	234	3,33	7.795
Total	5.135						19.990		665.680



Results

Prealpi Giulie Regional Natural Park: Flow account

- Costs and revenues of the Authority
 - *Long Term Financial Plan* of the Prealpi Giulie Regional Natural Park

Results

Prealpi Giulie Regional Natural Park:

Flow account

Environmental costs	€ 27.062,66	Environmental benefits		€ 7.048.217,95
Anthropic presence	€ 26.772,52	Forest	Climateregulation	€ 452.780,75
Raw materials	€ 4,43		Soil formation	€ 12.837,60
Motor fuel	€ 40,29		Biological control	€ 21.230,14
Heating fuel	€ 0,00		Food production	€ 2.953,75
Energy	€ 245,43		Raw materials	€ 604.069,62
			Recreation	€ 5.850.819,96
			Cultural	€ 102.329,29
		Grassland	Food production	€ 1.196,83
Authority costs	€ 1.128.235,98	Authority revenues		€ 1.128.235,98
Total costs	€ 1.155.298,64	Total benefits		€ 8.176.453,93
Total net benefits produced				€7.021.155,29

Discussion and conclusions

- From a **methodological** perspective
 - steps forward in the accounting framework:
scale, unit of measurement, benefits
- From an **analytical** perspective
 - net benefits of about € 7 million
sustainable development
refunding public funds, per each euro the Park produce 7,37 euro of benefits
- From a **policy** perspective
 - indicators to monitor interaction between economy/environment
 - tool for strategic planning and policy analysis in order to identify more sustainable development paths
- More research should be done in order to investigate difficulties connected with the model implementation



Thank you for your attention!!!

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Ecosystem functions

Functions	Ecosystem processes and components	Goods and services (examples)
<i>Regulation Functions</i>		
1 Gas regulation	<i>Maintenance of essential ecological processes and life support systems</i> Role of ecosystems in bio-geochemical cycles (e.g. CO ₂ /O ₂ balance, ozone layer, etc.)	1.1 UVb-protection by O ₃ (preventing disease). 1.2 Maintenance of (good) air quality. 1.3 Influence on climate (see also function 2.)
2 Climate regulation	Influence of land cover and biol. mediated processes (e.g. DMS-production) on climate	Maintenance of a favorable climate (temp., precipitation, etc) for, for example, human habitation, health, cultivation
3 Disturbance prevention	Influence of ecosystem structure on dampening env. disturbances	3.1 Storm protection (e.g. by coral reefs). 3.2 Flood prevention (e.g. by wetlands and forests)
4 Water regulation	Role of land cover in regulating runoff & river discharge	4.1 Drainage and natural irrigation. 4.2 Medium for transport
5 Water supply	Filtering, retention and storage of fresh water (e.g. in aquifers)	Provision of water for consumptive use (e.g. drinking, irrigation and industrial use)
6 Soil retention	Role of vegetation root matrix and soil biota in soil retention	6.1 Maintenance of arable land. 6.2 Prevention of damage from erosion/siltation
7 Soil formation	Weathering of rock, accumulation of organic matter	7.1 Maintenance of productivity on arable land. 7.2 Maintenance of natural productive soils
8 Nutrient regulation	Role of biota in storage and re-cycling of nutrients (eg. N,P&S)	Maintenance of healthy soils and productive ecosystems
9 Waste treatment	Role of vegetation & biota in removal or breakdown of xenic nutrients and compounds	9.1 Pollution control/detoxification. 9.2 Filtering of dust particles. 9.3 Abatement of noise pollution
10 Pollination	Role of biota in movement of floral gametes	10.1 Pollination of wild plant species. 10.2 Pollination of crops
11 Biological control	Population control through trophic-dynamic relations	11.1 Control of pests and diseases. 11.2 Reduction of herbivory (crop damage)
<i>Habitat Functions</i>		
	<i>Providing habitat (suitable living space) for wild plant and animal species</i>	Maintenance of biological & genetic diversity (and thus the basis for most other functions)
12 Refugium function	Suitable living space for wild plants and animals	Maintenance of commercially harvested species
13 Nursery function	Suitable reproduction habitat	13.1 Hunting, gathering of fish, game, fruits, etc. 13.2 Small-scale subsistence farming & aquaculture
<i>Production Functions</i>		
	<i>Provision of natural resources</i>	
14 Food	Conversion of solar energy into edible plants and animals	14.1 Building & Manufacturing (e.g. lumber, skins). 14.2 Fuel and energy (e.g. fuel wood, organic matter). 14.3 Fodder and fertilizer (e.g. krill, leaves, litter).
15 Raw materials	Conversion of solar energy into biomass for human construction and other uses	15.1 Improve crop resistance to pathogens & pests. 15.2 Other applications (e.g. health care)
16 Genetic resources	Genetic material and evolution in wild plants and animals	16.1 Drugs and pharmaceuticals. 16.2 Chemical models & tools. 16.3 Test- and assay organisms
17 Medicinal resources	Variety in (bio)chemical substances in, and other medicinal uses of, natural biota	Resources for fashion, handicraft, jewelry, pets, worship, decoration & souvenirs (e.g. furs, feathers, ivory, orchids, butterflies, aquarium fish, shells, etc.)
18 Ornamental resources	Variety of biota in natural ecosystems with (potential) ornamental use	
<i>Information Functions</i>		
	<i>Providing opportunities for cognitive development</i>	
19 Aesthetic information	Attractive landscape features	Enjoyment of scenery (scenic roads, housing, etc.)
20 Recreation	Variety in landscapes with (potential) recreational uses	Travel to natural ecosystems for eco-tourism, outdoor sports, etc.
21 Cultural and artistic information	Variety in natural features with cultural and artistic value	Use of nature as motive in books, film, painting, folklore, national symbols, architect., advertising, etc.
22 Spiritual and historic information	Variety in natural features with spiritual and historic value	Use of nature for religious or historic purposes (i.e. heritage value of natural ecosystems and features)
23 Science and education	Variety in nature with scientific and educational value	Use of natural systems for school excursions, etc. Use of nature for scientific research

Climate regulation

CO2 Absorption - STOCK

Espansione: dal commerciale al tal quale

Conversione: dalle unità di volume alle unità di peso

Categoria	Superficie	Biomassa totale	Biomassa epigea	Fattore di espansione conversione	Rapporto biomassa epigea/ipogea	Fattore di conversione	Carbonio	Social cost of carbon	Beneficio ambientale
	Sup	B _T	B _E	BCEF	1+R	CF	C	Sc _c	
	ha	t ha ⁻¹	m ³ ha ⁻¹	t m ⁻³	t t ⁻¹	tC tss ⁻¹	t	c€ kgC ⁻¹	€
	1	2=3*4*5	3	4	5	6	7=1*2*6	8	9=7*8*1000/100
QUERCO-CARPINETI e ROVERETI		170	90	1,40	1,35	0,42	0	3,33	0
BOSCHI MISTI DI LATIFOGIE	50,00	246	130	1,40	1,35	0,42	5.160	3,33	171.818
OSTRIO-QUERCETI	120,96	168	90	1,40	1,33	0,42	8.514	3,33	283.503
ACERI-FRASSINETI	0,92	230	120	1,40	1,37	0,42	89	3,33	2.962
PINETE (MUGHETE)	1.172,56	169	150	0,75	1,5	0,42	83.105	3,33	2.767.403
FAGGETE	3.646,59	353	180	1,40	1,4	0,42	540.337	3,33	17.993.226
PICEO-FAGGETI	13,18	353	250	1,00	1,41	0,42	1.951	3,33	64.978
ABIETI-PICEO-FAGGETI		286	270	0,75	1,41	0,42	0	3,33	0
PECCETE DI SOSTITUZIONE		234	220	0,75	1,42	0,42	0	3,33	0
PECCETE MONTANE, ALTIMONT	130,84	320	300	0,75	1,42	0,42	17.557	3,33	584.662
Totale	5.135,05						656.713		21.868.552

Raw materials

Timber value

Conversione: dalle unità di volume alle unità di peso

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