Forest Bioenergy in the Protected Mediterranean Areas

Impact assessment of increase biomass use in the short, medium and long term in the protected areas

Annex 1 : Study area report - ITALY

Workpackage 3 - Testing

Activity A.3.5. - Threats and benefits of increase the biomass use in the protected areas

Deliverable D.3.5.1 – Impact assessment of increase biomass use in the short, medium and long term in the protected areas

February 2018

Programme Cofinanced by the European Regional Development Fund
Programme Cofinancé par le Fonds Européen de Développement Régional

Table of contents

1 PRELIMINARY ASSESSMENT IN THE STUDY AREAS

1.1 Regional Natural Park of Madonie (Italy)

Report was prepared by:

Giuseppe BAIAMONTE, Federico MARRONE, Salvatore TINERVIA (PP2 – Enviland ltd)

Donato LA MELA VECA, Sebastiano SFERLAZZA (LP - Sicily Region, Department of Rural and Territorial Development)

Gaetano LA PLACA (PP1 – Municipality of Petralia Sottana)

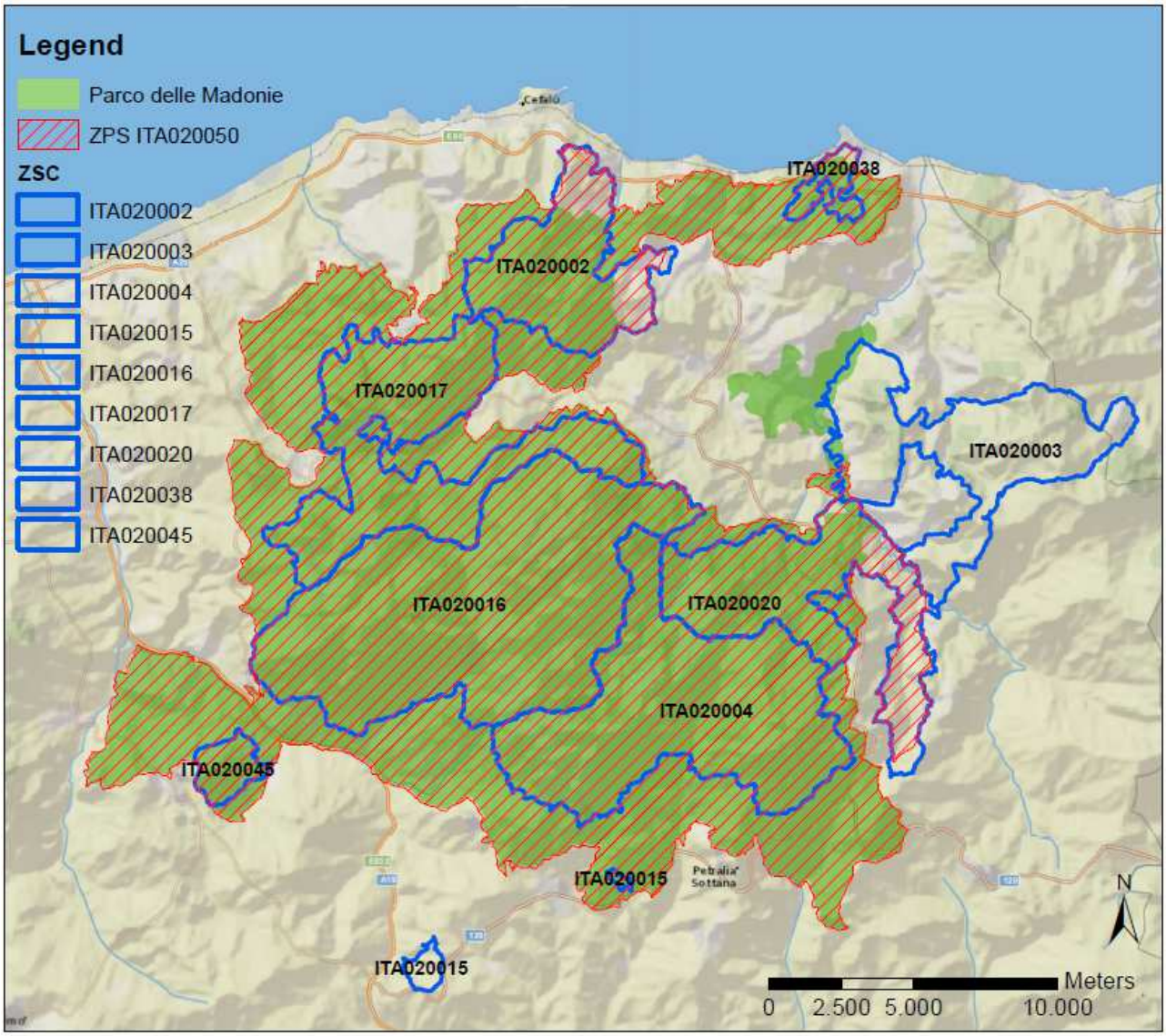
1.1.1 Biotic components

Short description

Sicily is the largest island of Italy and is acknowledged as a biodiversity hotspot. The island has an area of approximately 25500 Km^2, about 1000 Km of coastline and an elevation ranging from 0 to 3340 m (Mount Etna). It has a vascular flora of 3252 species and 321 exclusive endemic taxa. Most of the biological diversity is located on the major mountainous systems like the Madonie Mountains, where about 1700 taxa occur and the endemism rate is over 20%.

The “Madonie Mountains” Natura 2000 sites include 11 different Special Areas of Conservation (SAC) and 1 Special Protection Area (SPA).

The Natura 2000 sites in the Regional Natural Park of Madonie



In the following tables the habitat, the plant and the animal species present in the Natura 2000 sites are listed. In the tables 1 and 2 those habitats and plants species which could be affect by the forest management operations are also indicated.

Table 1: List of habitat types present on the sites (from SDF).

Natura 2000 site code	Natura 2000 site name	Type	Natura 2000 site area (ha)	Habitat code	Qualifying Natura 2000 habitat types	Forest management could influence the habitat
ITA020001	Rocca di Cefalù	SAC	36	5330	Thermo-Mediterranean and pre-desert scrub	x
				6220	Pseudo-steppe with grasses and annuals of the Thero-Brachypodietea	x
				8210	Calcareous rocky slopes with chasmophytic vegetation	x
				8310	Caves not open to the public	x
ITA020002	Boschi di Gibilmanna e Cefalù	SAC	2570	3120	Oligotrophic waters containing very few minerals generally on sandy soils of the West Mediterranean, with Isoetes spp	x
				5330	Thermo-Mediterranean and pre-desert scrub	x
				6220	Pseudo-steppe with grasses and annuals of the Thero-Brachypodietea	x
				6510	Lowland hay meadows (Alopecurus pratensis, Sanguisorba officinalis)	x
				8130	Western Mediterranean and thermophilous scree	x
				8210	Calcareous rocky slopes with chasmophytic vegetation	x
				8310	Caves not open to the public	x
				91AA	Eastern white oak woods	✓
				9260	Castanea sativa woods	✓
				9330	Quercus suber forests	✓
				9340	Quercus ilex and Quercus rotundifolia forests	✓
				9540	Mediterranean pine forests with endemic Mesogean pines	✓
ITA020003	Boschi di San Mauro Castelverde	SAC	3559	3150	Natural eutrophic lakes with Magnopotamion or Hydrocharition - type vegetation	x
				3290	Intermittently flowing Mediterranean rivers of the Paspalo-Agrostidion	x
				5330	Thermo-Mediterranean and pre-desert scrub	x
				6220	Pseudo-steppe with grasses and annuals of the Thero-Brachypodietea	x
				6510	Lowland hay meadows (Alopecurus pratensis, Sanguisorba officinalis)	x
				8130	Western Mediterranean and thermophilous scree	x
				8210	Calcareous rocky slopes with chasmophytic vegetation	x
				91AA	Eastern white oak woods	✓
				9260	Castanea sativa woods	✓
				92A0	Salix alba and Populus alba galleries	✓

Natura 2000 site code	Natura 2000 site name	Type	Natura 2000 site area (ha)	Habitat code	Qualifying Natura 2000 habitat types	Forest management could influence the habitat
				92D0	Southern riparian galleries and thickets (Nerio-Tamaricetea and Securinegion tinctoriae)	x
				9330	Quercus suber forests	✓
				9340	Quercus ilex and Quercus rotundifolia forests	✓
ITA020004	Monte S. Salvatore, Monte Catarineci, Vallone Mandarini, ambienti umidi	SAC	5815	3150	Natural eutrophic lakes with Magnopotamion or Hydrocharition - type vegetation	x
				4090	Endemic oro-Mediterranean heaths with gorse	x
				5330	Thermo-Mediterranean and pre-desert scrub	x
				6220	Pseudo-steppe with grasses and annuals of the Thero-Brachypodietea	x
				6420	Mediterranean tall humid grasslands of the Molinio-Holoschoenion	x
				6430	Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels	x
				6510	Lowland hay meadows (Alopecurus pratensis, Sanguisorba officinalis)	x
				7140	Transition mires and quaking bogs	x
				8130	Western Mediterranean and thermophilous scree	x
				8210	Calcareous rocky slopes with chasmophytic vegetation	x
				91AA	Eastern white oak woods	✓
				91M0	Pannonian-Balkanic turkey oak – sessile oak forests	✓
				9210	Apeninne beech forests with Taxus and Ilex	✓
				9220	Apennine beech forests with Abies alba and beech forests with Abies nebrodensis	✓
				92A0	Salix alba and Populus alba galleries	✓
				9340	Quercus ilex and Quercus rotundifolia forests	✓
				9380	Forests of Ilex aquifolium	✓
ITA020015	Complesso Calanchivo di Castellana Sicula	SAC	182	1430	Halo-nitrophilous scrubs (Pegano-Salsoletea)	
				3140	Hard oligo-mesotrophic waters with benthic vegetation of Chara spp	

Natura 2000 site code	Natura 2000 site name	Type	Natura 2000 site area (ha)	Habitat code	Qualifying Natura 2000 habitat types	Forest management could influence the habitat
				3150	Natural eutrophic lakes with Magnopotamion or Hydrocharition - type vegetation	x
				6220	Pseudo-steppe with grasses and annuals of the Thero-Brachypodietea	x
				92A0	Salix alba and Populus alba galleries	✓
				92D0	Southern riparian galleries and thickets (Nerio-Tamaricetea and Securinegion tinctoriae)	x
ITA020016	Monte Quacella, Monte dei Cervi, Pizzo Carbonara, Monte Ferro, Pizzo Otiero	SAC	8355	4090	Endemic oro-Mediterranean heaths with gorse	x
				5330	Thermo-Mediterranean and pre-desert scrub	x
				6210	Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia)	x
				6220	Pseudo-steppe with grasses and annuals of the Thero-Brachypodietea	x
				6430	Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels	x
				6510	Lowland hay meadows (Alopecurus pratensis, Sanguisorba officinalis)	x
				7140	Transition mires and quaking bogs	x
				8130	Western Mediterranean and thermophilous scree	x
				8210	Calcareous rocky slopes with chasmophytic vegetation	x
				8310	Caves not open to the public	x
				91AA	Eastern white oak woods	✓
				91M0	Pannonian-Balkanic turkey oak – sessile oak forests	✓
				9210	Apeninne beech forests with Taxus and Ilex	✓
				9220	Apennine beech forests with Abies alba and beech forests with Abies nebrodensis	✓
				9260	Castanea sativa woods	✓
				92A0	Salix alba and Populus alba galleries	✓
				9340	Quercus ilex and Quercus rotundifolia forests	✓
				9380	Forests of Ilex aquifolium	✓
ITA020017	Complesso Pizzo Dipilo e Querceti su calcare	SAC	4387	3150	Natural eutrophic lakes with Magnopotamion or Hydrocharition - type vegetation	x
				3290	Intermittently flowing Mediterranean rivers of the Paspalo-Agrostidion	x
				5330	Thermo-Mediterranean and pre-	x

Natura 2000 site code	Natura 2000 site name	Type	Natura 2000 site area (ha)	Habitat code	Qualifying Natura 2000 habitat types	Forest management could influence the habitat
					desert scrub	
				6220	Pseudo-steppe with grasses and annuals of the Thero-Brachypodietea	x
				6510	Lowland hay meadows (Alopecurus pratensis, Sanguisorba officinalis)	x
				8130	Western Mediterranean and thermophilous scree	x
				8210	Calcareous rocky slopes with chasmophytic vegetation	x
				8310	Caves not open to the public	x
				91AA	Eastern white oak woods	✓
				92A0	Salix alba and Populus alba galleries	✓
				9330	Quercus suber forests	✓
				9340	Quercus ilex and Quercus rotundifolia forests	✓
ITA020018	Foce del Fiume Pollina e Monte Tardara	SAC	2095	1210	Annual vegetation of drift lines	x
				2110	Embryonic shifting dunes	x
				3120	Oligotrophic waters containing very few minerals generally on sandy soils of the West Mediterranean, with Isoetes spp	x
				3290	Intermittently flowing Mediterranean rivers of the Paspalo-Agrostidion	x
				5330	Thermo-Mediterranean and pre-desert scrub	x
				6220	Pseudo-steppe with grasses and annuals of the Thero-Brachypodietea	x
				6510	Lowland hay meadows (Alopecurus pratensis, Sanguisorba officinalis)	x
				8210	Calcareous rocky slopes with chasmophytic vegetation	x
				91AA	Eastern white oak woods	✓
				92D0	Southern riparian galleries and thickets (Nerio-Tamaricetea and Securinegion tinctoriae)	x
				9330	Quercus suber forests	✓
				9340	Quercus ilex and Quercus rotundifolia forests	✓
ITA020020	Querceti sempreverdi di Geraci Siculo e Castelbuono	SAC	3380	3120	Oligotrophic waters containing very few minerals generally on sandy soils of the West Mediterranean, with Isoetes spp	x
				3290	Intermittently flowing Mediterranean rivers of the Paspalo-Agrostidion	x
				5230		
				5330	Thermo-Mediterranean and pre-	x

Natura 2000 site code	Natura 2000 site name	Type	Natura 2000 site area (ha)	Habitat code	Qualifying Natura 2000 habitat types	Forest management could influence the habitat
					desert scrub	
				6220	Pseudo-steppe with grasses and annuals of the Thero-Brachypodietea	x
				6340		
				6510	Lowland hay meadows (Alopecurus pratensis, Sanguisorba officinalis)	x
				7140	Transition mires and quaking bogs	x
				8130	Western Mediterranean and thermophilous scree	x
				8210	Calcareous rocky slopes with chasmophytic vegetation	x
				91AA	Eastern white oak woods	✓
				92A0	Salix alba and Populus alba galleries	✓
				9330	Quercus suber forests	✓
				9340	Quercus ilex and Quercus rotundifolia forests	✓
ITA020038	Sugherete di Contrada Serradaino	SAC	341	5330	Thermo-Mediterranean and pre-desert scrub	x
				6220	Pseudo-steppe with grasses and annuals of the Thero-Brachypodietea	x
				8210	Calcareous rocky slopes with chasmophytic vegetation	x
				92A0	Salix alba and Populus alba galleries	✓
				92D0	Southern riparian galleries and thickets (Nerio-Tamaricetea and Securinegion tinctoriae)	x
				9330	Quercus suber forests	✓
				9540	Mediterranean pine forests with endemic Mesogean pines	✓
ITA020045	Rocca di Sciara	SAC	400	5330	Thermo-Mediterranean and pre-desert scrub	x
				6220	Pseudo-steppe with grasses and annuals of the Thero-Brachypodietea	x
				6510	Lowland hay meadows (Alopecurus pratensis, Sanguisorba officinalis)	x
				8130	Western Mediterranean and thermophilous scree	x
				8210	Calcareous rocky slopes with chasmophytic vegetation	x
				91AA	Eastern white oak woods	✓
				9340	Quercus ilex and Quercus rotundifolia forests	✓
ITA020050	Parco delle Madonie	SPA	40860	3120	Oligotrophic waters containing very few minerals generally on sandy soils of the West Mediterranean, with Isoetes spp	x

Natura 2000 site code	Natura 2000 site name	Type	Natura 2000 site area (ha)	Habitat code	Qualifying Natura 2000 habitat types	Forest management could influence the habitat
				3150	Natural eutrophic lakes with Magnopotamion or Hydrocharition - type vegetation	x
				3290	Intermittently flowing Mediterranean rivers of the Paspalo-Agrostidion	x
				4090	Endemic oro-Mediterranean heaths with gorse	x
				5230		
				5330	Thermo-Mediterranean and pre-desert scrub	x
				6220	Pseudo-steppe with grasses and annuals of the Thero-Brachypodietea	x
				6420	Mediterranean tall humid grasslands of the Molinio-Holoschoenion	x
				6430	Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels	x
				6510	Lowland hay meadows (Alopecurus pratensis, Sanguisorba officinalis)	x
				7140	Transition mires and quaking bogs	x
				8130	Western Mediterranean and thermophilous scree	x
				8210	Calcareous rocky slopes with chasmophytic vegetation	x
				91AA	Eastern white oak woods	✓
				91M0	Pannonian-Balkanic turkey oak–sessile oak forests	✓
				9210	Apeninne beech forests with Taxus and Ilex	✓
				9220	Apennine beech forests with Abies alba and beech forests with Abies nebrodensis	✓
				9260	Castanea sativa woods	✓
				92A0	Salix alba and Populus alba galleries	✓
				92D0	Southern riparian galleries and thickets (Nerio-Tamaricetea and Securinegion tinctoriae)	x
				9330	Quercus suber forests	✓
				9340	Quercus ilex and Quercus rotundifolia forests	✓
				9380	Forests of Ilex aquifolium	✓
				9540	Mediterranean pine forests with endemic Mesogean pines	✓

Table 2: List of plant species referred to in Article 4 of Directive 2009/147/EC and listed in Annex II of Directive 92/43/EEC (from SDF). Refer to SDFs and Management plan for a complete list of other important species of flora and fauna.

Natura 2000 site code	Natura 2000 site name	Type	Natura 2000 site area (ha)	Species group	Species code	Qualifying Natura 2000 species scientific name	Forest management could influence the species
ITA020001	Rocca di Cefalù	SAC	36	P	1468	*Dianthus rupicola*	x
ITA020002	Boschi di Gibilmanna e Cefalù	SAC	2570	P	1468	*Dianthus rupicola*	x
				P	1905	*Ophrys lunulata*	x
ITA020003	Boschi di San Mauro Castelverde	SAC	3559	P	-	-	
ITA020004	Monte S. Salvatore, Monte Catarineci, Vallone Mandarini, ambienti umidi	SAC	5815	P	1431	*Abies nebrodensis*	x
				P	1790	*Leontodon siculus*	x
				P	1883	*Stipa austroitalica*	x
ITA020015	Complesso Calanchivo di Castellana Sicula	SAC	182	P	1757	*Aster sorrentinii (syn. Tripolium sorrentinoi)*	x
ITA020016	Monte Quacella, Monte dei Cervi, Pizzo Carbonara, Monte Ferro, Pizzo Otiero	SAC	8355	P	1790	*Leontodon siculus*	x
				P	1905	*Ophrys lunulata*	x
				P	1883	*Stipa austroitalica*	x
ITA020017	Complesso Pizzo Dipilo e Querceti su calcare	SAC	4387	P	1468	*Dianthus rupicola*	x
				P	1790	*Leontodon siculus*	x
				P	1905	*Ophrys lunulata*	x
ITA020018	Foce del Fiume Pollina e Monte Tardara	SAC	2095	P	1468	*Dianthus rupicola*	x
				P	1790	*Leontodon siculus*	x
ITA020020	Querceti sempreverdi di Geraci Siculo e Castelbuono	SAC	3380	P	1468	*Dianthus rupicola*	x
				P	1790	*Leontodon siculus*	x

Natura 2000 site code	Natura 2000 site name	Type	Natura 2000 site area (ha)	Species group	Species code	Qualifying Natura 2000 species scientific name	Forest management could influence the species
ITA020038	Sugherete di Contrada Serradaino	SAC	341	P	1468	*Dianthus rupicola*	x
				P	1790	*Leontodon siculus*	x
ITA020045	Rocca di Sciara	SAC	400	P	1468	*Dianthus rupicola*	x
				P	1790	*Leontodon siculus*	x
ITA020050	Parco delle Madonie	SPA	40860	P	1431	*Abies nebrodensis*	x
				P	1757	*Aster sorrentinii (syn. Tripolium sorrentinoi)*	x
				P	1468	*Dianthus rupicola*	x
				P	1790	*Leontodon siculus*	x
				P	1905	*Ophrys lunulata*	x
				P	1883	*Stipa austroitalica*	x
				P	1757	*Aster sorrentinii (syn. Tripolium sorrentinoi)*	x

Table 3: List of the animal species referred to in Article 4 of Directive 2009/147/EC and listed in Annex II of Directive 92/43/EEC (from SDF) which are considered to be particularly threatened by forestry activities. Refer to SDFs and Management plan for a complete list of the species of flora and fauna.

Natura 2000 site code	Natura 2000 site name	Type	Natura 2000 site area (ha)	Species group	Species code	Qualifying Natura 2000 species scientific name
ITA020001	Rocca di Cefalù	SAC	36	B	A155	*Scolopax rusticola*
				M	1302	*Rhinolophus ferrumequinum*
ITA020002	Boschi di Gibilmanna e Cefalù	SAC	2570	B	A233	*Jynx torquilla*
				B	A155	*Scolopax rusticola*
				B	A287	*Turdus viscivorus*
ITA020003	Boschi di San Mauro	SAC	3559	B	A233	*Jynx torquilla*
				B	A155	*Scolopax rusticola*

Natura 2000 site code	Natura 2000 site name	Type	Natura 2000 site area (ha)	Species group	Species code	Qualifying Natura 2000 species scientific name
	Castelverde			B	A287	*Turdus viscivorus*
ITA020004	Monte S. Salvatore, Monte Catarineci, Vallone Mandarini, ambienti umidi	SAC	5815	B	A233	*Jynx torquilla*
				B	A155	*Scolopax rusticola*
ITA020015	Complesso Calanchivo di Castellana Sicula	SAC	182	B	A233	*Jynx torquilla*
ITA020016	Monte Quacella, Monte dei Cervi, Pizzo Carbonara, Monte Ferro, Pizzo Otiero	SAC	8355	I	1088	*Cerambyx cerdo*
				I	1084	*Osmoderma eremita*
				I	1087	*Rosalia alpina*
				B	A233	*Jynx torquilla*
				B	A155	*Scolopax rusticola*
ITA020017	Complesso Pizzo Dipilo e Querceti su calcare	SAC	4387	I	1088	*Cerambyx cerdo*
				I	1084	*Osmoderma eremita*
				I	1087	*Rosalia alpina*
				B	A233	*Jynx torquilla*
				B	A155	*Scolopax rusticola*
ITA020018	Foce del Fiume Pollina e Monte Tardara	SAC	2095	B	A155	*Scolopax rusticola*
ITA020020	Querceti sempreverdi di Geraci Siculo e Castelbuono	SAC	3380	I	1088	*Cerambyx cerdo*
				I	1087	*Rosalia alpina*
				B	A233	*Jynx torquilla*
				B	A155	*Scolopax rusticola*
ITA020038	Sugherete di Contrada Serradaino	SAC	341	B	A155	*Scolopax rusticola*
ITA020045	Rocca di Sciara	SAC	400	B	A233	*Jynx torquilla*
				B	A155	*Scolopax rusticola*
ITA020050	Parco delle Madonie	SPA	40860	I	1088	*Cerambyx cerdo*
				I	1087	*Rosalia alpina*
				B	A233	*Jynx torquilla*
				B	A155	*Scolopax rusticola*
				M	1302	*Rhinolophus ferrumequinum*
				M	1303	*Rhinolophus hipposideros*

The Madonie Mountains are the terminal portion of the Italian Appennine mountain range and are mainly constituted of sedimentary rocks formed during the Triassic (about 200 mya), carbonate rocks(concentrated in the core area) and siliceous rocks (Numidian Flysch, more common in the northern part, facing the Tyrrenian Sea, and in the southern part). They have a significant morphologic diversity, with a gentler terrain in areas with a prevalence of clay and a rougher one where the presence of calcareous rocks is higher.

The macro-climate is Mediterranean, but local climate is strongly affected by altitude and aspect. Temperature rises from spring to summer, reaching its maximum in August (with a mean daily maximum temperature of 29.8 °C). Temperature gradually declines through autumn and reaches its minimum in January (with a mean daily minimum temperature of 9.6 °C).

Mean annual precipitation ranges from 741.5 mm (on the coast) to 931.8 mm, with significant peaks during fall and winter, and the number of rain days ranges from 80 to 100. At higher altitudes, snow is frequent during winter and can persist until late spring. Northern facing slopes are exposed to high atmospheric humidity coming from the Tyrrenian Sea condensating into mist and so mitigating summer draught.

The area is characterized by ten different bioclimatic types, ranging from Thermomediterranean dry to Oromediterranean humid, each corresponding to a different natural potential vegetation type.

Lithologic, geomorphologic and climatic diversity are the main causes of the impressive biological diversity of the Madonie area, which is extremely heterogeneous and significantly different from the surrounding geographical context.

Nonetheless, natural history does not completely explain the biological richness of the area and human history has given a significant contribution to land mosaic diversification.

On the Madonie mountains, main woodlands types include acidophilous (*Anemone apenninae-Fagetum*) and basiphilous beech formations (*Luzulo siculae-Fagetum*), mixed durmast and holly formations (*Ilici aquifolii-Quercetum austrotyrrhenicae*), deciduous oak formations (*Ilici aquifoliae-Quercetum congestae, Oleo sylvestris-*

Quercetum virgilianae, Quercetum leptobalanae), holm oak dominated communities (*Geranio versicoloris-Quercetum ilicis, Teucrio siculi-Quercetum ilicis, Aceri campestris-Quercetum ilicis*), cork oak formations (*Erico-Quercion Ilicis*).

Acidophilous beech formation (*Anemone apenninae-Fagetum*) are located in the area of origin of *Abies nebrodensis*, a small territory between Vallone Madonna degli Angeli, Monte Cavallo (1.757 m), Monte dei Pini (1.673 m) and Monte Scalone (1.654 m). The dominant tree species is *Fagus sylvatica*, associated with *Acer pseudoplatanus, Sorbus graeca, Daphne laureola, Euphorbia amygdaloides subsp. arbuscula, Ilex aquifolium* and, marginally, *Abies nebrodensis*, whose relict population counts 30 individuals. The most frequent herbaceous species are *Allium pendulinum*,

Anemone apennina, Asperula odorata, Cyclamen hederifolium subsp. hederifolium, Corydalis solida, Doronicum orientale, Galium odoratum, Geranium versicolor, Lamium flexuosum var. pubescens, Luzula sicula, Mycelis muralis, Neottia nidus-avis, Scilla bifolia, Hieracium racemosus subsp. pignattianum, Ranunculus umbrosus, Allium ursinum, Anthriscus nemorosa.

Basiphilous beech woods (*Luzulo siculae-Fagetum*) occur on carbonate substrates at elevations ranging from 1400 and 1900 m a.s.l. These are prevalently discontinuous patches, with the exception of the areas of Monte Mufara, Pizzo Antenna Grande, Monte dei Cervi and Monte Daino. The dominant tree species is *Fagus sylvatica*, often associated with impressive *Acer pseudoplatanus* individuals. The most significant shrubs are *Sorbus graeca, Orthilia secunda, Euphorbia meuselii,* rarely *Rhamnus cathartica* and *Ilex aquifolium*. Where tree cover is less dense it is possible to observe the presence of *Astragalus nebrodensis, Crataegus laciniata, Prunus cupaniana* and *Rosa sicula*. The most frequent herbaceous species are *Allium pendulinum, Anemone apennina, Asperula odorata, Cardamine chelidonia, Cyclamen hederifolium, Corydalis solida, Doronicum orientale, Galium odoratum, Geranium versicolor, Lamium flexuosum var. pubescens, Luzula sicula, Monotropa hypopitis, Mycelis muralis, Neottia nidus-avis, Scilla bifolia, Hieracium racemosus subsp. pignattianum.*

The discontinuity of these beech formations is due to adverse environmental conditions, since Sicily is the southern end of *Fagus sylvatica* distribution range, and anthropic disturbance.

Durmast and holly woods (*Ilici aquifolii-Quercetum austrotyrrhenicae*) are relict formations occurring on Numidic flysch substrates at elevations ranging from 1100 and 1500 m a.s.l. The dominant tree species is *Quercus petraea subsp. austrotyrrhenica* associated with *Acer obtusatum, A. campestre* and, less frequently, *A. monspessulanum, Sorbus torminalis e Ulmus glabra*. The prevalent species in the undergrowth is *Ilex aquifolium*, even though single individuals of different species, such as *Malus sylvestris, Crataegus laciniata, Prunus spinosa, Euonymus europaeus, Daphne laureola, Rhamnus cathartica, Ruscus aculeatus,* are often present. Interesting herbaceous species are not uncommon, such as *Aquilegia vulgaris, Anemone apennina, Dactylorhiza romana, Festuca drymeia, Lathyrus venetus, Primula vulgaris, Symphytum gussonei, Viola reichenbachiana.*

In some areas, such as Bosco Pomieri, there are several ancient durmast trees (more than 600 years old).

Between Cozzo Luminario and Pizzo Stefano and in Piano Pomo, there are five holly patches and a total of 317 individuals of impressive size.

Deciduous oak woods *(Ilici aquifoliae-Quercetum congestae, Oleo sylvestris-Quercetum virgilianae, Quercetum leptobalanae*) are widespread on the territory, but the largest are located in Romito, Timpa Rossa, Obo and Gurgo (Cefalù), between Rocca Stefana and Pianetti (Gratteri), in Bosco Cava and Vicaretto (Geraci Siculo), on the hills in Montaspro, Orippotto, Portella Arena, Portella Prana, Pizzo Cerro and Favara (Isnello). These formations may have a tree cover between 50 and 100% constituted mainly by deciduous oak of the *Quercus pubescens* s. l. group associated with *Quercus ilex, Fraxinus ornus, Acer campestre, A. monspessulanum, Quercus suber*. Shrub cover may be thick or scattered, the most frequent species being *Calicotome infesta, Cytisus villosus, Clematis vitalba, Crataegus monogyna, C. oxyacantha, Daphne laureola, Erica arborea, Euphorbia characias, Fraxinus ornus, Lonicera etrusca, Pyrus amygdaliformis, Prunus spinosa, Rubia peregrina, Smilax aspera.*

The thermophilous association *Oleo sylvestris-Quercetum virgilianae* occurs under 1000 m a.s.l. and is dominated by *Quercus virgiliana* and *Q. amplifolia*. On siliceous substrates some acidophilic species, such as *Arbutus unedo, Cytisus villosus, Erica*

arborea, Clinopodium vulgare subsp. arundanum, Echinops siculus, Festuca drymeja, Luzula forsteri, Melica arrecta, Melittis albida, Poa sylvicola, Pulicaria odora, Symphytum gussonei, Teucrium siculum, are frequent.

On the hilly areas around Isnello, between 700 and 1000 m a.s.l., a different association (*Quercetum leptobalanae*) is dominated by *Quercus leptobalanos*, with other deciduous oaks such as *Q. dalechampii* and *Q. congesta*.

Acidophilous holm oak woods (*Geranio versicoloris-Quercetum ilicis, Teucrio siculi-Quercetum ilicis*) are widespread on the territory in a range between 400 and 1300 m a.s.l. The most extensive formations are located in Pizzo S. Angelo (Cefalù), Pizzo Cerro (Collesano), Bosco Comunale, Pizzo Castellana and Sempria (Castelbuono), in boscho di Cava and Vicaretto (Geraci Siculo), between Bosco Orippotto and Piano Zucchi (Isnello). *Quercus ilex* is typically associated with acidophilic species, such as *Arbutus unedo, Asplenium adiantum-nigrum, Cytisus villosus, Erica arborea, Festuca drymeja, Pulicaria odora, Teucrium siculum, Thalictrum calabricum*. Other species, more tolerant in terms of substrate, are *Asplenium onopteris, Daphne laureola, Rubus ulmifolius, Hedera helix, Prunus spinosa, Rhamnus alaternus, Phyllirea latifolia, Malus sylvestris*.

Basiphilous holm oak woods (*Aceri campestris-Quercetum ilicis*) occur in a range between 400 and 1800 m a.s.l.. At these unusually high altitudes these formations can come into contact with durmast and holly woods and beech woods. The most extensive formations are located in Monte Castellaro (Collesano), in the foothills of Monte Fanusi and Cozzo di Castellazzo (Scillato), in Gonato and Monticelli (Castelbuono), in Monte Balatelli, Pizzo Antenna Piccola and Piano Zucchi (Isnello). *Quercus ilex* is associated with *Ilex aquifolium, Acer campestre, A. monspessulanum, Sorbus greca* and oaks of the *Quercus pubescens s. l.* group. Shrubs include many taxa belonging to *Quercetalia* and *Quercetea ilicis*, such as *Euphorbia characias, Fraxinus ornus, Lonicera etrusca, Pistacia terebinthus, Pyrus amygdaliformis, Rubia peregrina, Rosa sempervirens, Ruscus aculeatus, Clematis vitalba e Tamus communis.*

Cork oak woods (*Erico-Quercion Ilicis*) are mainly located around Cefalù, Pollina, S. Mauro Castelverde, Lascari, Collesano, Gratteri, Castelbuono and Geraci Siculo. These are relict formations that used to be much more extensive. They are located in a range

between 400 and 1300 m a.s.l. on siliceous substrates. Their structure is often altered due to the repeated passage of fire. The dominant tree is *Quercus suber* associated with *Quercus virgiliana, Q. amplifolia, Q. dalechampii, Q. × bivoniana, Q. ilex, Fraxinus ornus*. Shrubs can have a significant cover, especially when tree density is lower. Frequent species are *Erica arborea* and *Arbutus unedo*, often assosiceted with *Asparagus acutifolius, Bupleurum fruticosum, Calicotome infesta, Cistus creticus, C. monspeliensis, C. salvifolius, Cytisus villosus, Daphne gnidium, Lavandula stoechas, Lonicera implexa, L. etrusca, Osyris alba, Pistacia lentiscus, Phillyrea latifolia, Rosa sempervirens, Rubia peregrina, Ruscus aculeatus, Smilax aspera*.

In some cases, *Genista aristata*, characteristic of the *Genisto aristatae-Quercetum suberis* association, or the endemic *Genista madoniensis* occur as well.

Pine woods (*Cisto cretici-Pinetum pineae*) are interspersed within cork oak woods in the Cefalù and Gratteri areas. These formations are dominated by *Pinus pinea* and characterized by the presence of *Cistus creticus* and *Eryngium bocconei*. Other significant tree species are *Quercus virgiliana, Q. amplifolia, Q. dalechampii, Q. × bivoniana, Q. ilex and Fraxinus ornus*. Many other taxa are often present, especially when tree cover is less dense, such as *Erica arborea, Arbutus unedo, Asparagus acutifolius, Calicotome infesta, Cytisus villosus, Cistus creticus, Lavandula stoechas, Lonicera implexa, L. etrusca, Osyris alba, Pistacia lentiscus, Rubia peregrina, Ruscus aculeatus, Smilax aspera, Cistus monspeliensis, C. salvifolius.*

Chestnut woods, within the study area, do not present a continuous coverage but are distributed in patches of variable extension depending on local climate and soil characteristics. They are more widespread between 400 and 1300 m a.s.l. in the municipalities of Cefalù, Pollina, Castelbuono, Geraci Siculo, Petralia Sottana, Polizzi Generosa and Castellana Sicula. The prevalent tree, *Castanea sativa*, is associated with other species such as *Quercus pubescens s.l., Fraxinus ornus, Quercus ilex* and *Quercus suber*. Typical shrubs are *Arbutus unedo, Crataegus monogyna, Clematis vitalba, Cytisus villosus, Erica arborea, Euonimus europaeus, Hedera helix, Rubus ulmifolius, Ruscus aculeatus, Smilax aspera* and *Tamus communis*. These formations, once favoured by human activities, are now often degraded.

The vegetation present along mountain watercourses can be ascribed to the *Populion albae* alliance. Frequent species are *Populus alba, P. canescens, P. nigra, Salix alba subsp. alba, S. pedicellata, Ulmus canescens, U. glabra, Fraxinus angustifolia subsp. angustifolia, Sambucus nigra, Ficus carica var. caprificus*. Some relevant shrubs and herbaceous species are *Arum italicum, Brachypodium sylvaticum, Carex pendula, Dorycnium rectum, Equisetum telmateja, Hypericum hircinum, Rubus ulmifolius, Solanum dulcamara, Tamus communis*.

Downstream, it is not uncommon to observe formations significantly different from both the floristic and structural point of view, often impoverished, characterized by *Salix alba subsp. alba* and *S. pedicellata*, sometimes with *S. purpurea* and *Populus nigra*. On river gravel beds, mainly on the Pollina and Northern Imera rivers and their tributaries, typical vegetation is dominated by Nerium oleander associated with shrubs such as *Spartium junceum, Calicotome infesta* and *Rubus ulmifolius*. Sites with higher salinity substrates, rich in silt and clay, are often dominated by *Tamarix africana*, *T. gallica* and *Vitex agnus-castus*.

Plant communities: potential impacts on habitats (according to Directive 92/43/EEC) and tree plantations

The following matrices were compiled for each habitat, based on expert assessment.

Matrices were compiled on the assumption that biomass use is not the main goal of the activities, but rather a programmed positive and sustainable result of silvicultural and phytosanitary measures intended to be beneficial to the woods.

Magnitude	Impact	Description
	None	The operation will cause no relevant impact or may be beneficial to plant community structure or functionality, with regard to the threat considered
I	Low	The operation will cause limited impact to plant community structure or functionality, with regard to the threat considered
II	Medium	The operation will cause significant impact to plant community structure or functionality, with regard to the threat considered
III	High	The operation will cause extreme impact to plant community structure or functionality, with regard to the threat considered. In this case operation should not be performed.

Colour	Reversibility	Description
	Short term	Plant community structure or functionality will be unaffected or recover in a short amount of time.
	Medium term	Plant community structure or functionality will recover over a period of time measured in years.
	Long term	Plant community structure or functionality will recover over a period of time measured in decades.
	Irreversible	Impact is irreversible and plant community will not recover. Operation should not be performed.

With regard to the introduction of synanthropic or alien species, the reversibility will not be estimated, due to the extreme complexity of the issue

Potential impacts on habitats (according to Directive 92/43/EEC):

Natura 2000 Habitat Code:	91AA*: Eastern white oak woods												
THREATS	OPERATIONS												INDICATORS
	Silvicultural and harvesting practices (high forest and coppice)											Post harvesting management	
	Thinning/Shelterwood cutting/Salvage cutting					Crown pruning		Clear cutting					
	Felling and Arrangement	Storing (Winch)	Storing (Raceways)	Yarding (Raceways)	Yarding (Tractor)	Cutting	Yarding	Felling and Arrangement	Storing (Winch)	Storing (Raceways)	Yarding (Raceways)	Yarding (Tractor)	Chipping	
direct removal of natural vegetation		I	I	I	I			III	II	I	I	I		vegetation sampling life-form spectrum/ diversity indices
alteration of floristic composition		I	I	I	I			III	II	I	I	I		
reduction of protected and endemic species population		I	I	I	I			III	II	I	I	I		presence of protected and endemic species
introduction of synanthropic species	I	I	I	I	I	I	I	III	I	I	I	I		presence of synanthropic species
introduction of alien species	I	I	I	I	I	I	I	III	I	I	I	I		presence of alien species
reduction of natural regeneration		I	I	I	I			III	II	I	I	I		presence of natural regeneration
damage to natural regeneration		I	I	I	I			III	II	I	I	I		presence of damages to natural regeneration

Woods in which the dominating tree species are deciduous oaks of the Quercus pubescens s.l. group. associated with Quercus ilex, Fraxinus ornus, Acer campestre, A. monspessulanum, Quercus suber.

Shrub cover may be thick or scattered, the most frequent species being Calicotome infesta, Cytisus villosus, Clematis vitalba, Crataegus monogyna, C. oxyacantha, Daphne laureola, Erica arborea, Euphorbia characias, Fraxinus ornus, Lonicera etrusca, Pyrus amygdaliformis, Prunus spinosa, Rubia peregrina, Smilax aspera.

69 species (38 plants) of Community interest or otherwise relevant for biodiversity conservation are present in the habitat.

The progressive aging of coppices and the risk of fire are the main general threats to the habitat.

Therefore, silvicultural actions (thinning) aimed at constituting coppice with standards systems and high forest systems will be beneficial. The long-term goal is to create more evolved ecosystems and to favour seed reproduction instead of agamic reproduction.

Fire prevention measures should take place but total removal of deadwood should be avoided.

Phytosanitary interventions should be assessed on a case by case basis, especially in regard to old age trees.

Natura 2000 Habitat Code:	91M0: Pannonian-Balkanic turkey oak –sessile oak forests												
THREATS	OPERATIONS												INDICATORS
	Silvicultural and harvesting practices (high forest and coppice)											Post harvesting management	
	Thinning/Shelterwood cutting/Salvage cutting					Crown pruning		Clear cutting					
	Felling and Arrangement	Storing (Winch)	Storing (Raceways)	Yarding (Raceways)	Yarding (Tractor)	Cutting	Yarding	Felling and Arrangement	Storing (Winch)	Storing (Raceways)	Yarding (Raceways)	Yarding (Tractor)	Chipping	
direct removal of natural vegetation	II	I	I	I	I	I	I	III	II	I	I	I		vegetation sampling life-form spectrum/ diversity indices
alteration of floristic composition	II	I	I	I	I	I	I	III	II	I	I	I		
reduction of protected and endemic species population	II	I	I	I	I	I	I	III	II	I	I	I		presence of protected and endemic species
introduction of synanthropic species	I	I	I	I	I	I	I	III	I	I	I	I		presence of synanthropic species
introduction of alien species	I	I	I	I	I	I	I	III	I	I	I	I		presence of alien species
reduction of natural regeneration	II	I	I	I	I	I	I	III	II	I	I	I		presence of natural regeneration
damage to natural regeneration	II	I	I	I	I	I	I	III	II	I	I	I		presence of damages to natural regeneration

Phytosanitary interventions and limited actions aimed at favouring the natural evolution of vegetation should be allowed.

Fire prevention measures should take place.

Natura 2000 Habitat Code:	9210*: Apennine beech forests with Taxus and Ilex												
THREATS	OPERATIONS												INDICATORS
	Silvicultural and harvesting practices (high forest and coppice)											Post harvesting management	
	Thinning/Shelterwood cutting/Salvage cutting					Crown pruning		Clear cutting					
	Felling and Arrangement	Storing (Winch)	Storing (Raceways)	Yarding (Raceways)	Yarding (Tractor)	Cutting	Yarding	Felling and Arrangement	Storing (Winch)	Storing (Raceways)	Yarding (Raceways)	Yarding (Tractor)	Chipping	
direct removal of natural vegetation		I	I	I	I	I	I	III	II	I	I	I		vegetation sampling life-form spectrum/ diversity indices
alteration of floristic composition		I	I	I	I	I	I	III	II	I	I	I		
reduction of protected and endemic species population		I	I	I	I	I	I	III	II	I	I	I		presence of protected and endemic species
introduction of synanthropic species	I	I	I	I	I	I	I	III	I	I	I	I		presence of synanthropic species
introduction of alien species	I	I	I	I	I	I	I	III	I	I	I	I		presence of alien species
reduction of natural regeneration		I	I	I	I	I	I	III	II	I	I	I		presence of natural regeneration
damage to natural regeneration		I	I	I	I	I	I	III	II	I	I	I		presence of damages to natural regeneration

Woods in which the dominating tree species is *Fagus sylvatica*.

47 species (32 plants) of Community interest or otherwise relevant for biodiversity conservation are present in the habitat.

The progressive aging of coppices and erosion are the main general threats to the habitat. Therefore, silvicultural actions (thinning) aimed at constituting high forest systems will be beneficial. The long-term goal is to create more stable and diverse ecosystems and to favour seed reproduction instead of agamic reproduction.

Natura 2000 Habitat Code:	9220*: Apennine beech forests with Abies alba and beech forests with Abies nebrodensis												
THREATS	OPERATIONS												INDICATORS
	Silvicultural and harvesting practices (high forest and coppice)											Post harvesting management	
	Thinning/Shelterwood cutting/Salvage cutting					Crown pruning		Clear cutting					
	Felling and Arrangement	Storing (Winch)	Storing (Raceways)	Yarding (Raceways)	Yarding (Tractor)	Cutting	Yarding	Felling and Arrangement	Storing (Winch)	Storing (Raceways)	Yarding (Raceways)	Yarding (Tractor)	Chipping	
direct removal of natural vegetation	*	*	*	*	*	*	*	*	*	*	*	*	*	vegetation sampling life-form spectrum/ diversity indices
alteration of floristic composition	*	*	*	*	*	*	*	*	*	*	*	*	*	
reduction of protected and endemic species population	*	*	*	*	*	*	*	*	*	*	*	*	*	presence of protected and endemic species
introduction of synanthropic species	*	*	*	*	*	*	*	*	*	*	*	*	*	presence of synanthropic species
introduction of alien species	*	*	*	*	*	*	*	*	*	*	*	*	*	presence of alien species
reduction of natural regeneration	*	*	*	*	*	*	*	*	*	*	*	*	*	presence of natural regeneration
damage to natural regeneration	*	*	*	*	*	*	*	*	*	*	*	*	*	presence of damages to natural regeneration

Fagus sylvatica woods in the area of origin of *Abies nebrodensis*.

18 species (4 plants) of Community interest or otherwise relevant for biodiversity conservation are present in the habitat.

The relict population of *Abies nebrodensis* is of particular relevance and is threatened by the limited number of individuals (24) capable of producing fertile strobiles.

NO INTERFERENCE WITH CURRENT CONSERVATION MEASURES SHOULD TAKE PLACE.

Cutting should be limited to exotic species. Beach wood thinning aimed at constituting high forest systems and favouring seed reproduction would be beneficial.

Natura 2000 Habitat Code:	9260: Castanea sativa woods												
THREATS	OPERATIONS												INDICATORS
	Silvicultural and harvesting practices (high forest and coppice)											Post harvesting management	
	Thinning/Shelterwood cutting/Salvage cutting					Crown pruning		Clear cutting					
	Felling and Arrangement	Storing (Winch)	Storing (Raceways)	Yarding (Raceways)	Yarding (Tractor)	Cutting	Yarding	Felling and Arrangement	Storing (Winch)	Storing (Raceways)	Yarding (Raceways)	Yarding (Tractor)	Chipping	
direct removal of natural vegetation		I	I	I	I			II	II	I	I	I		vegetation sampling life-form spectrum/ diversity indices
alteration of floristic composition		I	I	I	I			II	II	I	I	I		
reduction of protected and endemic species population		I	I	I	I			II	II	I	I	I		presence of protected and endemic species
introduction of synanthropic species	I	I	I	I	I	I	I	III	I	I	I	I		presence of synanthropic species
introduction of alien species	I	I	I	I	I	I	I	III	I	I	I	I		presence of alien species
reduction of natural regeneration		I	I	I	I			II	II	I	I	I		presence of natural regeneration
damage to natural regeneration		I	I	I	I			II	II	I	I	I		presence of damages to natural regeneration

Anthropogenic Castanea sativa woods. Other tree species are often present, such as Quercus pubescens s.l., Fraxinus ornus, Quercus ilex and Quercus suber.

25 species (9 plants) of Community interest or otherwise relevant for biodiversity conservation are present in the habitat.

Phytosanitary interventions should be performed, especially against Chryphonectria parasitica.

Fire prevention measures should take place.

Natura 2000 Habitat Code:	92A0: Salix alba and Populus alba galleries 92D0: Southern riparian galleries and thickets (Nerio-Tamaricetea and Securinegion tinctoriae)												
THREATS	OPERATIONS												INDICATORS
	Silvicultural and harvesting practices (high forest and coppice)											Post harvesting management	
	Thinning/Shelterwood cutting/Salvage cutting					Crown pruning		Clear cutting					
	Felling and Arrangement	Storing (Winch)	Storing (Raceways)	Yarding (Raceways)	Yarding (Tractor)	Cutting	Yarding	Felling and Arrangement	Storing (Winch)	Storing (Raceways)	Yarding (Raceways)	Yarding (Tractor)	Chipping	
direct removal of natural vegetation	II	I	I	I	I	I	I	III	II	I	I	I		vegetation sampling life-form spectrum/ diversity indices
alteration of floristic composition	II	I	I	I	I	I	I	III	II	I	I	I		
reduction of protected and endemic species population	II	I	I	I	I	I	I	III	II	I	I	I		presence of protected and endemic species
introduction of synanthropic species	I	I	I	I	I	I	I	III	I	I	I	I		presence of synanthropic species
introduction of alien species	I	I	I	I	I	I	I	III	I	I	I	I		presence of alien species
reduction of natural regeneration	II	I	I	I	I	I	I	III	I	I	I	I		presence of natural regeneration
damage to natural regeneration	II	I	I	I	I	I	I	III	I	I	I	I		presence of damages to natural regeneration

The habitat 92A0 is constituted by riparian woods with poplars (Populus alba, P. canescens, P. nigra) and willows (Salix alba subsp. alba, S. pedicellata), associated with Ulmus canescens, U. glabra, Fraxinus angustifolia subsp. angustifolia, Sambucus nigra and Ficus carica var. caprificus.

25 species (6 plants) of Community interest or otherwise relevant for biodiversity conservation are present in the habitat.

The habitat 92D0 is constituted by pioneer riparian communities usually with Tamarix africana, T. gallica Nerium oleander and Vitex agnus-castus.

28 species (6 plants) of Community interest or otherwise relevant for biodiversity conservation are present in the habitat.

Only limited actions aimed at favouring the natural evolution of vegetation should be allowed.

Habitat 92A0 (Salix alba and Populus alba galleries) and 92D0 (Southern riparian galleries and thickets, Nerio-Tamaricetea and Securinegion tinctoriae) have been assessed in single matrix, since they both refer to azonal vegetation occurring in riparian ecosystems.

Natura 2000 Habitat Code:	9330: Quercus suber forests												
THREATS	OPERATIONS												INDICATORS
	Silvicultural and harvesting practices (high forest and coppice)											Post harvesting management	
	Thinning/Shelterwood cutting/Salvage cutting					Crown pruning		Clear cutting					
	Felling and Arrangement	Storing (Winch)	Storing (Raceways)	Yarding (Raceways)	Yarding (Tractor)	Cutting	Yarding	Felling and Arrangement	Storing (Winch)	Storing (Raceways)	Yarding (Raceways)	Yarding (Tractor)	Chipping	
direct removal of natural vegetation	I	I	I	I	I			III	II	I	I	I		vegetation sampling life-form spectrum/ diversity indices
alteration of floristic composition	I	I	I	I	I			III	II	I	I	I		
reduction of protected and endemic species population	I	I	I	I	I			III	II	I	I	I		presence of protected and endemic species
introduction of synanthropic species	I	I	I	I	I	I	I	III	I	I	I	I		presence of synanthropic species
introduction of alien species	I	I	I	I	I	I	I	III	I	I	I	I		presence of alien species
reduction of natural regeneration	I	I	I	I	I			III	II	I	I	I		presence of natural regeneration
damage to natural regeneration	I	I	I	I	I			III	II	I	I	I		presence of damages to natural regeneration

Quercus suber woods with the presence of other oaks, including deciduous oaks of the *Quercus pubescens s.l.* group and other species such as *Q. ×bivoniana, Q. ilex, Fraxinus ornus*.

55 species (9 plants) of Community interest or otherwise relevant for biodiversity conservation are present in the habitat.

The main general threats to the habitat are fires and the presence of hemiparasitic species *Loranthus europaeus* and *Viscum album*.

Phytosanitary interventions should be performed, especially to control *Loranthus europaeus* and *Viscum album*.

Fire prevention measures are critical to the protection of this habitat.

Limited actions aimed at favouring the natural evolution of vegetation should be allowed, in strict compliance with Management Plan directives and existing regulations.

Natura 2000 Habitat Code:	9340: Quercus ilex and Quercus rotundifolia forests												
THREATS	OPERATIONS												INDICATORS
	Silvicultural and harvesting practices (high forest and coppice)											Post harvesting management	
	Thinning/Shelterwood cutting/Salvage cutting					Crown pruning		Clear cutting					
	Felling and Arrangement	Storing (Winch)	Storing (Raceways)	Yarding (Raceways)	Yarding (Tractor)	Cutting	Yarding	Felling and Arrangement	Storing (Winch)	Storing (Raceways)	Yarding (Raceways)	Yarding (Tractor)	Chipping	
direct removal of natural vegetation		I	I	I	I			III	II	I	I	I		vegetation sampling life-form spectrum/ diversity indices
alteration of floristic composition		I	I	I	I			III	II	I	I	I		
reduction of protected and endemic species population		I	I	I	I			III	II	I	I	I		presence of protected and endemic species
introduction of synanthropic species	I	I	I	I	I	I	I	III	I	I	I	I		presence of synanthropic species
introduction of alien species	I	I	I	I	I	I	I	III	I	I	I	I		presence of alien species
reduction of natural regeneration		I	I	I	I			III	II	I	I	I		presence of natural regeneration
damage to natural regeneration		I	I	I	I			III	II	I	I	I		presence of damages to natural regeneration

Woods in which the dominating tree species is *Quercus ilex*.

55 species (9 plants) of Community interest or otherwise relevant for biodiversity conservation are present in the habitat.

The progressive aging of coppices and the risk of fire are the main general threats to the habitat.Therefore, silvicultural actions (thinning) aimed at constituting coppice with standards systems and high forest systems will be beneficial. The long-term goal is to create more evolved ecosystems and to favour seed reproduction instead of agamic reproduction.

Fire prevention measures should take place but total removal of deadwood should be avoided.

Phytosanitary interventions should be assessed on a case by case basis, especially in regard to old age trees.

Natura 2000 Habitat Code:	9380: Forests of Ilex aquifolium												
THREATS	OPERATIONS												INDICATORS
	Silvicultural and harvesting practices (high forest and coppice)											Post harvesting management	
	Thinning/Shelterwood cutting/Salvage cutting					Crown pruning		Clear cutting					
	Felling and Arrangement	Storing (Winch)	Storing (Raceways)	Yarding (Raceways)	Yarding (Tractor)	Cutting	Yarding	Felling and Arrangement	Storing (Winch)	Storing (Raceways)	Yarding (Raceways)	Yarding (Tractor)	Chipping	
direct removal of natural vegetation		I	I	I	I			III	II	I	I	I		vegetation sampling life-form spectrum/ diversity indices
alteration of floristic composition		I	I	I	I			III	II	I	I	I		
reduction of protected and endemic species population		I	I	I	I			III	II	I	I	I		presence of protected and endemic species
introduction of synanthropic species	I	I	I	I	I	I	I	III	I	I	I	I		presence of synanthropic species
introduction of alien species	I	I	I	I	I	I	I	III	I	I	I	I		presence of alien species
reduction of natural regeneration		I	I	I	I			III	II	I	I	I		presence of natural regeneration
damage to natural regeneration		I	I	I	I			III	II	I	I	I		presence of damages to natural regeneration

Woods with *Ilex aquifolium* and *Quersus petraea subsp. austrothyrrenica*, associated with *Acer obtusatum*, *A. campestre* and, less frequently, *A. monspessulanum, Sorbus torminalis* and *Ulmus glabra*.

33 species (16 plants) of Community interest or otherwise relevant for biodiversity conservation are present in the habitat.

The progressive aging of coppices and diseases are the main general threats to the habitat.

Therefore, silvicultural actions aimed at increasing biodiversity and favouring seed reproduction will be beneficial.

Phytosanitary interventions should be assessed on a case by case basis, especially in regard to old age trees.

Natura 2000 Habitat Code:	9540: Mediterranean pine forests with endemic Mesogean pines												
THREATS	OPERATIONS												INDICATORS
	Silvicultural and harvesting practices (high forest and coppice)											Post harvesting management	
	Thinning/Shelterwood cutting/Salvage cutting					Crown pruning		Clear cutting					
	Felling and Arrangement	Storing (Winch)	Storing (Raceways)	Yarding (Raceways)	Yarding (Tractor)	Cutting	Yarding	Felling and Arrangement	Storing (Winch)	Storing (Raceways)	Yarding (Raceways)	Yarding (Tractor)	Chipping	
direct removal of natural vegetation		I	I	I	I	I	I	III	I	I	I	I		vegetation sampling life-form spectrum/ diversity indices
alteration of floristic composition		I	I	I	I	I	I	III	I	I	I	I		
reduction of protected and endemic species population		I	I	I	I	I	I	III	I	I	I	I		presence of protected and endemic species
introduction of synanthropic species	I	I	I	I	I	I	I	III	I	I	I	I		presence of synanthropic species
introduction of alien species	I	I	I	I	I	I	I	III	I	I	I	I		presence of alien species
reduction of natural regeneration		I	I	I	I	I	I	III	II	I	I	I		presence of natural regeneration
damage to natural regeneration		I	I	I	I	I	I	III	II	I	I	I		presence of damages to natural regeneration

Woods dominated by *Pinus pinea* in the Cefalù area, with scattered individulas of *Quercus suber, Q. virgiliana* and, less frequently, *Q. ilex*.

33 species of Community interest or otherwise relevant for biodiversity conservation are present in the habitat.

Fires are the main general threat to the habitat, therefore fire prevention measures should take place.

Silvicultural actions should be aimed at keeping an uneven age of the stands, increasing underwood biodiversity and favouring the development of *Quercus suber* natural regeneration.

Potential impacts on the forest categories not included in the "Habitats Directive:

Forest categories not included in the "Habitats Directive"	Broadleaved reforestation													
THREATS	OPERATIONS													INDICATORS
	Silvicultural and harvesting practices (high forest and coppice)												Post harvesting management	
	Thinning/Shelterwood cutting/Salvage cutting					Crown pruning		Clear cutting						
	Felling and Arrangement	Storing (Winch)	Storing (Raceways)	Yarding (Raceways)	Yarding (Tractor)	Cutting	Yarding	Felling and Arrangement	Storing (Winch)	Storing (Raceways)	Yarding (Raceways)	Yarding (Tractor)	Chipping	
direct removal of natural vegetation														vegetation sampling life-form spectrum/ diversity indices
alteration of floristic composition														
reduction of protected and endemic species population														presence of protected and endemic species
introduction of synanthropic species	I													presence of synanthropic species
introduction of alien species	I													presence of alien species
reduction of natural regeneration	I													presence of natural regeneration
damage to natural regeneration	I													presence of damages to natural regeneration

In the area of study, broadleaved plantations made prevalent use of *Eucalyptus camaldulesis* and *E. rostrata* (especially in Gratteri and Collesano).

Silvicultural actions should be aimed at gradually removing the allochthonous species and planting suitable autochthonous trees and shrubs.

Forest categories not included in the "Habitats Directive"	Coniferous reforestation												
THREATS	OPERATIONS												INDICATORS
	Silvicultural and harvesting practices (high forest and coppice)											Post harvesting management	
	Thinning/Shelterwood cutting/Salvage cutting					Crown pruning		Clear cutting					
	Felling and Arrangement	Storing (Winch)	Storing (Raceways)	Yarding (Raceways)	Yarding (Tractor)	Cutting	Yarding	Felling and Arrangement	Storing (Winch)	Storing (Raceways)	Yarding (Raceways)	Yarding (Tractor)	Chipping	
direct removal of natural vegetation														vegetation sampling life-form spectrum/ diversity indices
alteration of floristic composition														
reduction of protected and endemic species population														presence of protected and endemic species
introduction of synanthropic species	I							I						presence of synanthropic species
introduction of alien species	I							I						presence of alien species
reduction of natural regeneration	I							I						presence of natural regeneration
damage to natural regeneration	I							I						presence of damages to natural regeneration

In the area of study, coniferous plantations have different composistions.

In the Polizzi Generosa and Petralia Sottana area, prevalent species are *Cedrus atlantica*, *C. deodora* and *Pinus nigra s.l.*.

In the same area, there are extensive plantations with *Pinus nigra, Cedrus sp. pl., Abies cephalonica, Pseudotsuga menziesii,* with broadleaved species such as *Acer negundo* and *Robinia pseudacacia*.

Pine plantations are mainly located in the Cefalù area. They are dominated by *Pinus pinea*, but many other species occur, such as *Quercus suber, Quercus virgiliana, Q. amplifolia e Fraxinus ornus.* Common underwood species are *Erica arborea, Arbutus unedo, Asparagus acutifolius, Calicotome infesta, Cistus sp pl., Daphne gnidium, Lonicera implexa, L. etrusca, Osyris alba, Rubia peregrina, Ruscus aculeatus, Smilax aspera.*

Pinus halepensis plantations, mixed with exotic and indigenous broadleaved trees, are mainly located near Insello and Gratteri.

In the Petralia Sottana, Polizzi Generosa and Geraci Siculo area, mixed plantations include tree specie such as *Cupressus sempervirens, C. macrocarpa, Pinus halepensis* and *P. nigra*.

Silvicultural actions should be aimed at gradually thinning existing stands, removing exotic species, planting suitable autochthonous trees and shrubs and favouring their natural regeneration.

Forest categories not included in the "Habitats Directive"	Tree plantations for wood production													
THREATS	OPERATIONS													INDICATORS
	Silvicultural and harvesting practices (high forest and coppice)												Post harvesting management	
	Thinning/Shelterwood cutting/Salvage cutting					Crown pruning		Clear cutting						
	Felling and Arrangement	Storing (Winch)	Storing (Raceways)	Yarding (Raceways)	Yarding (Tractor)	Cutting	Yarding	Felling and Arrangement	Storing (Winch)	Storing (Raceways)	Yarding (Raceways)	Yarding (Tractor)	Chipping	
direct removal of natural vegetation														vegetation sampling life-form spectrum/ diversity indices
alteration of floristic composition														
reduction of protected and endemic species population														presence of protected and endemic species
introduction of synanthropic species														presence of synanthropic species
introduction of alien species														presence of alien species
reduction of natural regeneration														presence of natural regeneration
damage to natural regeneration														presence of damages to natural regeneration

The main purpose of these plantations is wood production, therefore no restrictive measure are necessary.

Animal communities: potential impacts on habitats (according to Directive 92/43/EEC) and tree plantations

The following matrix is the template on which the matrices reported below for each habitat (or different habitats lumped in a single matrix) were compiled. In this frame, the following habitats (sensu EU Directive) were lumped in single matrices since they are assumed to be ecologically, structurally and climatically coherent and to host similar faunal assemblages:

Habitats 91AA*, 91M0, 9330 and 9340 are lumped in a single matrix since they all refer to oak-dominated wood types (both deciduous and evergreen) located at low or moderate elevation, hosting in the study area a similar faunal assemblage.

Habitats 9380 and 9210* include broadleaved wood types located at higher altitudes, in the supraMediterrranean climatic belt. The animal communities of these habitat types present the more pronounced affinities with a temperate Apennine fauna, with the presence of relic microthermic taxa.

Habitats 92A0 and 92D0 are related to riparian habitats, whose animal communities are mostly influenced by the presence of lotic water bodies.

Matrices were compiled based on based on an expert assessment and on the assumption that biomass extraction is not the primary goal of the forestry activities, but rather a side-product of appropriate silvicultural and phytosanitary measures compatible with the management of protected areas and intended to be beneficial to the forest stands.

Magnitude	Impact	Description
	None	The operation will cause no relevant impact or may be beneficial to animal community structure or composition, with regard to the threat considered
I	Low	The operation will cause limited impact to animal community structure or composition, with regard to the threat considered
II	Medium	The operation will cause significant impact to animal community structure or composition, with regard to the threat considered
III	High	The operation will cause extreme impact to animal community structure or composition, with regard to the threat considered..

Colour	Reversibility	Description
	Short term	Animal community structure or composition will be unaffected or recover in a short amount of time..
	Medium term	Animal community structure or composition will recover over a period of time measured in years..
	Long term	Animal community structure or composition will recover over a period of time measured in decades
	Irreversible	Animal community structure or composition recover will take an extremely long time. Operation should preferably not be performed.

Potential impacts on habitats (according to Directive 92/43/EEC):

Natura 2000 Habitat Code:	**91AA*: Eastern white oak woods 91M0: Pannonia-Balkanic turkey oak-sessile oak forests 9330: *Quercus suber* forests 9340: *Quercus ilex* and *Quercus rotundifolia* forests**												
THREATS	**OPERATIONS**												**INDICATORS**
	Silvicultural and harvesting practices (high forest and coppice)											**Post harvesting management**	
	Thinning/Shelterwood cutting/Salvage cutting					Crown pruning		Clear cutting					
	Felling and Arrangement	Storing (Winch)	Storing (Raceways)	Yarding (Raceways)	Yarding (Tractor)	Cutting	Yarding	Felling and Arrangement	Storing (Winch)	Storing (Raceways)	Yarding (Raceways)	Yarding (Tractor)	Chipping
Noise	II	II			III	III	III	III	II			III	III	Birds (Non-Strigiformes)
Soil compaction	I	I	I	I	III	I	III	I	II	I	I	III	I	Ground-active beetles
Decrease of habitat suitability	III	II			III	II	I	III	II			II	III	Xylobiont and Saproxylic beetles; Birds (Strigiformes)
Decrease of the availability of trophic resources	II	I				II	I	III	I				I	Xylobiont beetles; Birds (non-Strigiformes)
Casualties	III	I			II	III	I	III				II		Monitoring of carcasses

This matrix refers to both priority and non-priority habitats characterised by dominance of *Quercus* spp. In the study area, the progressive aging of coppices and the risk of fire are the main general threats to these habitats. Fire prevention measures should take place but total removal of deadwood should be avoided.

The faunal assemblages inhabiting these forest types include both vertebrate and invertebrate species referred to in Article 4 of Directive 2009/147/EC and listed in Annex II of Directive 92/43/EEC, which should be monitored with particular attention.

In particular, forestry interventions carried out in SAC where the presence of saproxylic beetles is reported (e.g. *Cerambyx cerdo* and *Rosalia alpina* in ITA020020) should be preceded by dedicate sampling surveys as described in the relevant section of this document.

Natura 2000 Habitat Code:	**9210*: Apennine beech forests with *Taxus* and *Ilex* 9380: Forests of *Ilex aquifolium***												
THREATS	**OPERATIONS**												**INDICATORS**
	Silvicultural and harvesting practices (high forest and coppice)											**Post harvesting management**	
	Thinning/Shelterwood cutting/Salvage cutting					Crown pruning		Clear cutting					
	Felling and Arrangement	Storing (Winch)	Storing (Raceways)	Yarding (Raceways)	Yarding (Tractor)	Cutting	Yarding	Felling and Arrangement	Storing (Winch)	Storing (Raceways)	Yarding (Raceways)	Yarding (Tractor)	Chipping
Noise	II	II			III	III	III	III	II			III	III	Birds (Non-Strigiformes)
Soil compaction	I	I	I	I	III	I	III	I	II	I	I	III	I	Ground-active beetles
Decrease of habitat suitability	III	II			II	II	I	III	II			II	II	Xylobiont and Saproxylic beetles; Birds (Strigiformes)
Decrease of the availability of trophic resources	III	I				II	I	III	I				I	Xylobiont beetles; Birds (non-Strigiformes)
Casualties	III	I			II	III	I	III				II		Monitoring of carcasses

This matrix refers to forest stands in which the dominating tree species is *Fagus sylvatica*, usually associated with *Taxus baccata* and *Ilex aquifolium;* this last species might also be dominant (habitat 9380).

The progressive aging of coppices and erosion are the main general threats to the habitat. Total removal of deadwood should be avoided.

These habitats hosts the most important Sicilian populations of rare saproxylic beetles as *Rosalia alpina* and *Osmoderma eremita*, and conspicuous populations of forest birds. Due to the relic nature of these habitats and animal communities, they are particularly fragile and the possible impact of forestry activities should be carefully monitored, also implementing dedicated sampling efforts for the priority taxa possibly present.

Natura 2000 Habitat Code:	**9220*: Apennine beech forests with *Abies* alba and beech forests with *Abies nebrodensis***													
THREATS	**OPERATIONS**													**INDICATORS**
	Silvicultural and harvesting practices (high forest and coppice)												**Post harvesting management**	
	Thinning/Shelterwood cutting/Salvage cutting					Crown pruning		Clear cutting						
	Felling and Arrangement	Storing (Winch)	Storing (Raceways)	Yarding (Raceways)	Yarding (Tractor)	Cutting	Yarding	Felling and Arrangement	Storing (Winch)	Storing (Raceways)	Yarding (Raceways)	Yarding (Tractor)	Chipping	
Noise	*	*	*	*	*	*	*	*	*	*	*	*	*	Birds (Non-Strigiformes)
Soil compaction	*	*	*	*	*	*	*	*	*	*	*	*	*	Ground-active beetles
Decrease of habitat suitability	*	*	*	*	*	*	*	*	*	*	*	*	*	Xylobiont and Saproxylic beetles; Birds (Strigiformes)
Decrease of the availability of trophic resources	*	*	*	*	*	*	*	*	*	*	*	*	*	Xylobiont beetles; Birds (non-Strigiformes)
Casualties	*	*	*	*	*	*	*	*	*	*	*	*	*	Monitoring of carcasses

This matrix refers to *Fagus sylvatica* woods in the area of origin of the Sicilian endemic species *Abies nebrodensis*. The relict population of *Abies nebrodensis* is of particular relevance and is threatened by the limited number of individuals capable of producing fertile strobiles. The animal community inhabiting this habitat is similar to that inhabiting habitat 9210.

NO INTERFERENCE WITH CURRENT CONSERVATION MEASURES SHOULD TAKE PLACE.

Natura 2000 Habitat Code:	9260: *Castanea sativa* woods												
THREATS	OPERATIONS												INDICATORS
	Silvicultural and harvesting practices (high forest and coppice)											Post harvesting management	
	Thinning/Shelterwood cutting/Salvage cutting					Crown pruning		Clear cutting					
	Felling and Arrangement	Storing (Winch)	Storing (Raceways)	Yarding (Raceways)	Yarding (Tractor)	Cutting	Yarding	Felling and Arrangement	Storing (Winch)	Storing (Raceways)	Yarding (Raceways)	Yarding (Tractor)	Chipping	
Noise	II	I			II	II	I	II	I			II	II	Birds (Non-Strigiformes)
Soil compaction	I	I	I	I	III	I	III	I	II	I	I	III	I	Ground-active beetles
Decrease of habitat suitability	II	II			II	II	I	III	II			II	II	Xylobiont and Saproxylic beetles; Birds (Strigiformes)
Decrease of the availability of trophic resources	II	I				II	I	III	I				I	Xylobiont beetles; Birds (non-Strigiformes)
Casualties	III	I			II	III	I	III	I			II		Monitoring of carcasses

This matrix refers to anthropogenic *Castanea sativa* woods. Animal communities inhabiting this habitat are resilient to human disturbance, so that the implementation of standard monitoring activities is adequate for a getting a sound evaluation of the possible exerted impacts.

Natura 2000 Habitat Code:	92A0: *Salix alba* and *Populus alba* galleries 92D0: Southern riparian galleries and thickets (Nerio-Tamaricetea and Securinegion tinctoriae)													
THREATS	OPERATIONS													INDICATORS
	Silvicultural and harvesting practices (high forest and coppice)												Post harvesting management	
	Thinning/Shelterwood cutting/Salvage cutting					Crown pruning		Clear cutting						
	Felling and Arrangement	Storing (Winch)	Storing (Raceways)	Yarding (Raceways)	Yarding (Tractor)	Cutting	Yarding	Felling and Arrangement	Storing (Winch)	Storing (Raceways)	Yarding (Raceways)	Yarding (Tractor)	Chipping	
Noise	II	II			III	III	III	III	II			III	III	Birds (Non-Strigiformes)
Soil compaction	I	I	I	I	III	I	III	I	I	I	I	III	I	Ground-active beetles
Decrease of habitat suitability	II	II			II	II	I	III	II			II	II	Xylobiont and Saproxylic beetles; Birds (Strigiformes)
Decrease of the availability of trophic resources	II	I				II	I	III	I				I	Xylobiont beetles; Birds (non-Strigiformes)
Casualties	III	I			II	III	I	III	I			II		Monitoring of carcasses

This matrix refers to riparian habitats. Only limited actions aimed at favouring the natural evolution of vegetation should be allowed. When forestry interventions are carried out in limited areas, thus allowing the re-colonisation of disturbed areas from neighbouring untouched patches, the animal communities inhabiting these habitats are moderately resilient to human disturbance, so that the implementation of standard monitoring activities is adequate for a getting a sound evaluation of the possible exerted impacts.

Natura 2000 Habitat Code:	9540: Mediterranean pine forests with endemic Mesogean pines												
THREATS	OPERATIONS												INDICATORS
	Silvicultural and harvesting practices (high forest and coppice)											Post harvesting management	
	Thinning/Shelterwood cutting/Salvage cutting					Crown pruning		Clear cutting					
	Felling and Arrangement	Storing (Winch)	Storing (Raceways)	Yarding (Raceways)	Yarding (Tractor)	Cutting	Yarding	Felling and Arrangement	Storing (Winch)	Storing (Raceways)	Yarding (Raceways)	Yarding (Tractor)	Chipping	
Noise	II	II			II	II	II	II	II			II	III	Birds (Non-Strigiformes)
Soil compaction	I	I	I	I	II	I	II	I	I	I	I	III	I	Ground-active beetles
Decrease of habitat suitability	II	II			I	II	I	III	I			I	I	Xylobiont and Saproxylic beetles; Birds (Strigiformes)
Decrease of the availability of trophic resources	II	I				II	I	III	I				I	Xylobiont beetles; Birds (non-Strigiformes)
Casualties	II	I			II	II	I	III	I			II		Monitoring of carcasses

This matrix refers to woods dominated by *Pinus pinea*, with scattered individuals of *Quercus suber*, *Q. virgiliana* and, less frequently, *Q. ilex*. Fires are the main general threat to the habitat, therefore fire prevention measures should take place.

Animal communities inhabiting this habitat types are sharply different in different study areas, so that a generalization is almost impossible, and each case-study should be studied independently. As a rule, the animal communities inhabiting this habitat type are moderately resilient to human disturbance, so that the implementation of standard monitoring activities is adequate for a getting a sound evaluation of the possible exerted impacts.

Forest categories not included in the "Habitats Directive"	Broadleaved reforestation												
THREATS	OPERATIONS												INDICATORS
	Silvicultural and harvesting practices (high forest and coppice)											Post harvesting management	
	Thinning/Shelterwood cutting/Salvage cutting					Crown pruning		Clear cutting					
	Felling and Arrangement	Storing (Winch)	Storing (Raceways)	Yarding (Raceways)	Yarding (Tractor)	Cutting	Yarding	Felling and Arrangement	Storing (Winch)	Storing (Raceways)	Yarding (Raceways)	Yarding (Tractor)	Chipping	
Noise	I				I	I	I	I				I	I	Birds (Non-Strigiformes)
Soil compaction					I		I					I		Ground-active beetles
Decrease of habitat suitability								I						Xylobiont and Saproxylic beetles; Birds (Strigiformes)
Decrease of the availability of trophic resources	I					I		I						Xylobiont beetles; Birds (non-Strigiformes)
Casualties	I				I	I	I	I				I		Monitoring of carcasses

This matrix refers to broadleaved plantations largely dominated by *Eucalyptus* spp.

Silvicultural actions should be aimed at gradually removing these allochthonous species and planting suitable autochthonous trees and shrubs.

Animal communities inhabiting this habitat are usually simplified and resilient to human disturbance, so that the implementation of standard monitoring activities is adequate for a getting a sound evaluation of the possible exerted impacts.

Forest categories not included in the "Habitats Directive"	Coniferous reforestation													
THREATS	OPERATIONS													INDICATORS
	Silvicultural and harvesting practices (high forest and coppice)												Post harvesting management	
	Thinning/Shelterwood cutting/Salvage cutting					Crown pruning		Clear cutting						
	Felling and Arrangement	Storing (Winch)	Storing (Raceways)	Yarding (Raceways)	Yarding (Tractor)	Cutting	Yarding	Felling and Arrangement	Storing (Winch)	Storing (Raceways)	Yarding (Raceways)	Yarding (Tractor)	Chipping	
Noise	I				I	I	I	I				I	I	Birds (Non-Strigiformes)
Soil compaction					I		I					I		Ground-active beetles
Decrease of habitat suitability								II						Xylobiont and Saproxylic beetles; Birds (Strigiformes)
Decrease of the availability of trophic resources	I					I		II						Xylobiont beetles; Birds (non-Strigiformes)
Casualties	I				I	I	I	I				I		Monitoring of carcasses

This matrix refers to coniferous plantations dominated by the genera *Pinus*, *Cedrus*, *Abies* and *Pseudotsuga, sometimes associated with broadleaved allochthonous and autochthonous species.*

Silvicultural actions should be aimed at gradually thinning existing stands, removing exotic species, planting suitable autochthonous trees and shrubs and favouring their natural regeneration.

Animal communities inhabiting this habitat are usually simplified and resilient to human disturbance, so that the implementation of standard monitoring activities is adequate for a getting a sound evaluation of the possible exerted impacts.

Forest categories not included in the "Habitats Directive"	Tree plantations for wood production												
THREATS	OPERATIONS												INDICATORS
	Silvicultural and harvesting practices (high forest and coppice)											Post harvesting management	
	Thinning/Shelterwood cutting/Salvage cutting					Crown pruning		Clear cutting					
	Felling and Arrangement	Storing (Winch)	Storing (Raceways)	Yarding (Raceways)	Yarding (Tractor)	Cutting	Yarding	Felling and Arrangement	Storing (Winch)	Storing (Raceways)	Yarding (Raceways)	Yarding (Tractor)	Chipping	
Noise	I				I	I	I	I				I	I	Birds (Non-Strigiformes)
Soil compaction					I		I					I		Ground-active beetles
Decrease of habitat suitability								I						Xylobiont and Saproxylic beetles; Birds (Strigiformes)
Decrease of the availability of trophic resources	I					I		I						Xylobiont beetles; Birds (non-Strigiformes)
Casualties	I				I	I	I	I				I		Monitoring of carcasses

The main purpose of these plantations is wood production, therefore no restrictive measure are necessary.

Animal communities inhabiting this habitat are usually very simplified and soundly resilient to human disturbance, so that the implementation of standard monitoring activities is adequate for a getting a sound evaluation of the possible exerted impacts.

1.2 Abiotic components

Short description

The Madonie Natural Park is characterized by extraordinary interest, both botanical, zoological, geological and cultural. The Park is marked by a wide massif known as Madonie Mountains that are characterized by a significant morphologic diversity, with a maximum height of 1979 m a.s.l.

The macro-climate is Mediterranean, but local climate is strongly affected by altitude: there are 10 different bioclimatic types ranging from Thermomediterranean-Dry to Oromediterranean humid. Mean annual precipitation ranges from 500-600 mm (on the coast) up to 1000-1200 mm (on Mount Carbonara, the highest peak). Mean annual temperature ranges from 18-19°C (on the coast) to 7-8 °C (on Mount Carbonara, the highest peak).

The geomorphological setting is extremely varied and includes many landscapes characterizing several Sicilian areas; it results from the interaction between geomorphological processes, tectonic movements and climatic changes. The Madonie are mainly made up by sedimentary rocks carbonate or siliceous formed during the Quaternary Period. The carbonates are concentrated in the core area of the Madonie, while the siliceous substrata (Numidian Flysch) are more common in the northern part, facing the Tyrrenian Sea, and in the southern part. Calcareous rocks are associated with karst processes and with a rough and uneven morphology, while areas with a prevalence of clay and sand have a gentler morphology.

The Madonie Mountains are characterized by an articulated morphology and a highly developed hydrographic network due to rivers (Imera settentrionale, Imera meridionale, Pollina) and several streams (e.g., Roccella, Lascari, Castelbuono, etc.). These conditions arrange to activation of hydrogeological instability phenomena such as rill and gully erosion.

The mean volume of deadwood measured for forest stands on Palermo province by Sicilian Regional Forest Inventory is about 2.6 m3 ha-1, lower than regional average (3.2 m3 ha-1).

Wildfires are a threat for the forest formations of the Madonie Mountains. Here, in the last 5 years both number of wildfires and total area burned are increasing, due also to the exacerbating warming trends and reoccurring droughts. The average burned area was 1487 ha within the 14 municipalities of Madonie Natural Park.

Abiotic components: potential impacts on habitats (according to Directive 92/43/EEC) and tree plantations

Magnitude	Impact	Description
	None	The operation will cause no relevant impact or may be beneficial to abiotic components, with regard to the threat considered
I	Low	The operation will cause limited impact to abiotic components, with regard to the threat considered
II	Medium	The operation will cause significant impact to abiotic components, with regard to the threat considered
III	High	The operation will cause extreme impact to abiotic components, with regard to the threat considered

Colour	Reversibility	Description
	Short term	Abiotic components will be unaffected or recover in a short amount of time
	Medium term	Abiotic components will recover over a period of time measured in years
	Long term	Abiotic components will recover over a period of time measured in decades
	Irreversible	Abiotic components recover will take an extremely long time. Operation should preferably not be performed

The following habitats (sensu Directive 92/43/EEC) were lumped in single matrix since they are assumed to be ecologically, structurally and climatically coherent:

Habitats 91AA*, 91M0, 9330, 9340 and 9260 are lumped in a single matrix since they are thermophilic and mesophilic forest stands, located at low and moderate altitude up to 1300-1500 m a.s.l.. They are characterized by the same management risks.

Habitat 9210* and 9380 were lumped in single matrix since they grow in the supra-Mediterranean vegetation belt from 1200 up to 2000 m a.s.l.. They are characterized by the same management risks.

Habitat 9220*, 92A0 and 92D0 are lumped in a single matrix since they are subjected to conservation measures (such as 9220*) or limited actions aimed at favouring the natural evolution (such as riparian habitats). In both cases, no harvesting practice is assumed.

Potential impacts on habitats (according to Directive 92/43/EEC):

Natura 2000 Habitat Code:	**91AA* Eastern white oak woods 91M0 Pannonian-Balkanic turkey oak–sessile oak forests 9330 Quercus suber forests 9340 Quercus ilex and Quercus rotundifolia forests 9260 *Castanea sativa* woods**												
THREATS	**OPERATIONS**												**INDICATORS**
	Silvicultural and harvesting practices (high forest and coppice)											**Post harvesting management**	
	Thinning/Shelterwood cutting/Salvage cutting					Crown pruning		Clear cutting					
	Felling and Arrangement	Storing (Winch)	Storing (Raceways)	Yarding (Raceways)	Yarding (Tractor)	Cutting	Yarding	Felling and Arrangement	Storing (Winch)	Storing (Raceways)	Yarding (Raceways)	Yarding (Tractor)	Chipping	
Reduction of deadwood	I	II			II			III	III	III	III	III		Deadwood
Reduction of litter cover	I	I			I			III	III	III	III	III		Litter
Reduction of litter height	I	I			I			III	III	III	III	III		
Reduction of SOC	I	I			I			II	II	II	II	II		Soil Organic Carbon (SOC)
Presence of Rill erosion	I	I			I			III	III	III	III	III		Erosion
Presence of Interrill erosion	I	I			I			III	III	III	III	III		
Presence of Gully erosion	I	I			I			III	III	III	III	III		
Increase of Soil Bulk Density	I	I			I			II	II	II	II	II		Soil Bulk Density
Fuel model features	I	I			I			III	III	III	III	III		Fire risk

This matrix refers to both priority and non-priority habitats characterised by dominance of deciduous and evergreen oaks and the chestnut forests. In the study area, the coppice abandonment and the risk of fire are the main threats to these habitats. Best management practices to increase and/or consolidate forest resilience: a) salvage felling of fire degraded oak forests, b) introduction of native oak species in stands lacking of seed-bearing trees, c) reducing forest fuel loads to decrease wildfire risk, d) grazing exclusion, e) actions aimed at enhancing complex structural forests (i.e., conversion of coppices into high forests, tree-oriented silviculture techniques). Clear cutting could cause relevant impacts to abiotic component, unless the following indications are adopted: i) it must be performed on small plots with slope <25%, ii) use raceways to reduce reversibility time of impacts, iii) it must be avoided on old-growth forest stands.

Natura 2000 Habitat Code:	9210* Apennine beech forests with *Taxus* and *Ilex* 9380 Ilex aquifolium forests												
THREATS	OPERATIONS												INDICATORS
	Silvicultural and harvesting practices (high forest and coppice)											Post harvesting management	
	Thinning/Shelterwood cutting/Salvage cutting					Crown pruning		Clear cutting					
	Felling and Arrangement	Storing (Winch)	Storing (Raceways)	Yarding (Raceways)	Yarding (Tractor)	Cutting	Yarding	Felling and Arrangement	Storing (Winch)	Storing (Raceways)	Yarding (Raceways)	Yarding (Tractor)	Chipping	
Reduction of deadwood	I	II			II			III	III	III	III	III		Deadwood
Reduction of litter cover	I	I			I			III	III	III	III	III		Litter
Reduction of litter height	I	I			I			III	III	III	III	III		
Reduction of SOC	I	I			I			III	III	III	III	III		Soil Organic Carbon (SOC)
Presence of Rill erosion	II	II			II			III	III	III	III	III		Erosion
Presence of Interrill erosion	II	II			II			III	III	III	III	III		
Presence of Gully erosion	III	III			III			III	III	III	III	III		
Increase of Soil Bulk Density	I	I			I			III	III	III	III	III		Soil Bulk Density
Fuel model features	I	I			I			III	III	III	III	III		Fire risk

This matrix refers to both priority and non-priority habitats growing in the mountain-Mediterranean vegetation belt on shallow soils. At higher altitudes beech cover is highly fragmented and trees are often shrub-like, with multiple stems and reduced height. Forest fragmentation and canopy gap formation activating erosive processes are the main threats to these habitats.

Best management practices to increase and/or consolidate forest resilience: a) actions aimed at enhancing complex structural forests (i.e., conversion of coppices into high forests, tree-oriented silviculture techniques), b) Bio-engineering technique for soil erosion control.

All forestry activities could cause relevant impacts with reference to erosion that is main threat to the habitat. Therefore, high reduction of land cover should be avoided on slope >25%. Clear cutting should be performed on small plots with slope <25%.

Natura 2000 Habitat Code:	9220* Apennine beech forests with *Abies* alba and *Abies nebrodensis* 92A0 *Salix alba* and *Populus alba* galleries 92D0 Southern riparian galleries and thicket (Nerio-Tamaricetea and Securinegion tinctoriae)												
THREATS	**OPERATIONS**												**INDICATORS**
	Silvicultural and harvesting practices (high forest and coppice)											**Post harvesting management**	
	Thinning/Shelterwood cutting/Salvage cutting					Crown pruning		Clear cutting					
	Felling and Arrangement	Storing (Winch)	Storing (Raceways)	Yarding (Raceways)	Yarding (Tractor)	Cutting	Yarding	Felling and Arrangement	Storing (Winch)	Storing (Raceways)	Yarding (Raceways)	Yarding (Tractor)	Chipping	
Reduction of deadwood														Deadwood
Reduction of litter cover														Litter
Reduction of litter height														
Reduction of SOC														Soil Organic Carbon (SOC)
Presence of Rill erosion														Erosion
Presence of Interrill erosion														
Presence of Gully erosion														
Increase of Soil Bulk Density														Soil Bulk Density
Fuel model features														Fire risk

The relict population of *Abies nebrodensis* is of particular relevance and is threatened by the limited number of individuals capable of producing fertile strobiles. No interference with current conservation measures should take place. For riparian habitats (code 92A0-92D0), only limited actions aimed at favouring the natural evolution of vegetation should be allowed.

Natura 2000 Habitat Code:	9540 Mediterranean pine forests with endemic Mesogean pines												
THREATS	OPERATIONS												INDICATORS
	Silvicultural and harvesting practices (high forest and coppice)											Post harvesting management	
	Thinning/Shelterwood cutting/Salvage cutting					Crown pruning		Clear cutting					
	Felling and Arrangement	Storing (Winch)	Storing (Raceways)	Yarding (Raceways)	Yarding (Tractor)	Cutting	Yarding	Felling and Arrangement	Storing (Winch)	Storing (Raceways)	Yarding (Raceways)	Yarding (Tractor)	Chipping	
Reduction of deadwood	II	II			II	II	II	III	III	III	III	III		Deadwood
Reduction of litter cover	I	I			I	I	I	III	III	III	III	III		Litter
Reduction of litter height	I	I			I	I	I	III	III	III	III	III		
Reduction of SOC	I	I			I	I	I	III	III	III	III	III		Soil Organic Carbon (SOC)
Presence of Rill erosion	I	I			I	II	II	III	III	III	III	III		Erosion
Presence of Interrill erosion	I	I			I	II	II	III	III	III	III	III		
Presence of Gully erosion	I	I			I	I	I	III	III	III	III	III		
Increase of Soil Bulk Density	I	I			I	I	I	III	III	III	III	III		Soil Bulk Density
Fuel model features	I	I			I	I	I	III	III	III	III	III		Fire risk

This matrix refers to Mediterranean pine stands with high naturalness degree. These stands are main constituted of *Pinus pinea*, with scattered individuals of *Quercus suber*, *Q. virgiliana* and, less frequently, *Q. ilex*. Fires are the main general threat to the habitat, therefore fire prevention measures should take place. Silvicultural actions should be aimed at enhancing complex structural forests, increasing understorey biodiversity and favouring the renaturalization processes of autochthonous oak species. Clear cutting could cause relevant impacts to abiotic component and it must be performed on small plots with slope <25%.

Potential impacts on forest categories not included in the "Habitats Directive":

Forest categories not included in the "Habitats Directive"	Tree plantations for wood production												
THREATS	OPERATIONS												INDICATORS
	Silvicultural and harvesting practices (high forest and coppice)											Post harvesting management	
	Thinning/Shelterwood cutting/Salvage cutting					Crown pruning		Clear cutting					
	Felling and Arrangement	Storing (Winch)	Storing (Raceways)	Yarding (Raceways)	Yarding (Tractor)	Cutting	Yarding	Felling and Arrangement	Storing (Winch)	Storing (Raceways)	Yarding (Raceways)	Yarding (Tractor)	Chipping	
Reduction of deadwood	I	I			I			II	II			II		Deadwood
Reduction of litter cover	I	I			I			II	II			II		Litter
Reduction of litter height	I	I			I			II	II			II		
Reduction of SOC	I	I			I			II	II			II		Soil Organic Carbon (SOC)
Presence of Rill erosion	I	I			I			II	II			II		Erosion
Presence of Interrill erosion	I	I			I			II	II			II		
Presence of Gully erosion	I	I			I			II	II			II		
Increase of Soil Bulk Density		I			I				I			I		Soil Bulk Density
Fuel model features	I	I			I			II	II			II		Fire risk

The main purpose of these plantations is wood production, therefore no restrictive measure are necessary. For all forestry activities, it is advisable use the raceways to reduce magnitude and reversibility of impacts.

Forest categories not included in the "Habitats Directive"	Autochthonous broadleaved reforestation													
THREATS	OPERATIONS													INDICATORS
	Silvicultural and harvesting practices (high forest and coppice)												Post harvesting management	
	Thinning/Shelterwood cutting/Salvage cutting					Crown pruning		Clear cutting						
	Felling and Arrangement	Storing (Winch)	Storing (Raceways)	Yarding (Raceways)	Yarding (Tractor)	Cutting	Yarding	Felling and Arrangement	Storing (Winch)	Storing (Raceways)	Yarding (Raceways)	Yarding (Tractor)	Chipping	
Reduction of deadwood	I	I			II			III	III	III	III	III		Deadwood
Reduction of litter cover	I	I			II			III	III	II	II	III		Litter
Reduction of litter height	I	I			II			III	III	II	II	III		
Reduction of SOC	I	I			I			II	II	I	I	II		Soil Organic Carbon (SOC)
Presence of Rill erosion	I	I			II			III	III	II	II	III		Erosion
Presence of Interrill erosion	I	I			II			III	III	II	II	III		
Presence of Gully erosion	I	I			II			III	III	II	II	III		
Increase of Soil Bulk Density	I	I			I			II	II	I	I	II		Soil Bulk Density
Fuel model features	I	I			I			III	III	III	III	III		Fire risk

This matrix refers to artificial stands main constituted of *Quercus* ssp., *Fraxinus* ssp., *Acer ssp.* and *Alnus ssp.*. Silvicultural actions should be aimed to favoring mixing of species and hydrogeological stability of forests: practices in order to favor of species improving soil quality (nutrients, texture, and structure), which at the same time

ensure or maintain adequate levels of organic matter in the soil, ensuring the improvement of water supply and the same conditions of light and temperature favorable to the acceleration of progressive successional forest dynamics.

Clear cutting could cause relevant impacts to abiotic component, unless the following indications are adopted: i) it must be performed on small plots with slope <25%, ii) use raceways to reduce reversibility time of impacts, iii) it must be avoided on old-growth forest stands.

Use of tractors or machines for yardind should be assessed on a case by case basis to avoid the reduction of deadwood, litter and the activation of erosive processes.

Forest categories not included in the "Habitats Directive"	*Allochthonous broadleaved reforestation*												
THREATS	**OPERATIONS**												**INDICATORS**
	Silvicultural and harvesting practices (high forest and coppice)											**Post harvesting management**	
	Thinning/Shelterwood cutting/Salvage cutting					Crown pruning		Clear cutting					
	Felling and Arrangement	Storing (Winch)	Storing (Raceways)	Yarding (Raceways)	Yarding (Tractor)	Cutting	Yarding	Felling and Arrangement	Storing (Winch)	Storing (Raceways)	Yarding (Raceways)	Yarding (Tractor)	Chipping	
Reduction of deadwood	I	I			II			II	II	I	I	II		Deadwood
Reduction of litter cover	I	I			II			II	II	I	I	II		Litter
Reduction of litter height	I	I			II			II	II	I	I	II		
Reduction of SOC	I	I			I			II	II	I	I	II		Soil Organic Carbon (SOC)
Presence of Rill erosion	I	I			II			II	II	I	I	II		Erosion
Presence of Interrill erosion	I	I			II			II	II	I	I	II		
Presence of Gully erosion	I	I			II			II	II	I	I	II		
Increase of Soil Bulk Density	I	I			I			II	II	I	I	II		Soil Bulk Density
Fuel model features	I	I			I			II	II	I	I	II		Fire risk

This matrix refers to artificial stands of eucalyptus ssp. (in particular *E. globulus*, *E. camaldulensis*, *E. gomphocephala*). Silvicultural actions should be aimed to renaturalization of forest plantations with i) selective thinning on *Eucalyptus* spp. and ii) introduction of native tree and shrub species. Removal of deadwood and litter should be avoided. High reduction of land cover should be avoided on slope >25% to avoid the activation of erosive processes.

Forest categories not included in the "Habitats Directive"	Autochthonous coniferous reforestation												
THREATS	OPERATIONS												INDICATORS
	Silvicultural and harvesting practices (high forest and coppice)											Post harvesting management	
	Thinning/Shelterwood cutting/Salvage cutting					Crown pruning		Clear cutting					
	Felling and Arrangement	Storing (Winch)	Storing (Raceways)	Yarding (Raceways)	Yarding (Tractor)	Cutting	Yarding	Felling and Arrangement	Storing (Winch)	Storing (Raceways)	Yarding (Raceways)	Yarding (Tractor)	Chipping	
Reduction of deadwood	I	I			II	II	II	III	III	III	III	III		Deadwood
Reduction of litter cover	I	I			II	I	I	III	III	II	II	III		Litter
Reduction of litter height	I	I			II	I	I	III	III	II	II	III		
Reduction of SOC	I	I			I	I	I	II	II	I	I	II		Soil Organic Carbon (SOC)
Presence of Rill erosion	I	I			II	II	II	III	III	II	II	III		Erosion
Presence of Interrill erosion	I	I			II	II	II	III	III	II	II	III		
Presence of Gully erosion	I	I			II	I	I	III	III	II	II	III		
Increase of Soil Bulk Density	I	I			I	I	I	II	II	I	I	II		Soil Bulk Density
Fuel model features	I	I			I	I	I	III	III	III	III	III		Fire risk

This matrix refers to coniferous plantations main constituted of Mediterranean conifers (e.g., *Pinus halepensis*, *Pinus pinea*, *Pinus pinaster*, *Cupressus* ssp., *Cedrus* ssp.). Best management practices to increase and/or consolidate forest resilience: a) Selective thinning on coniferous to reduce interspecific competition, b) Introduction of native oak species in stands lacking of seed-bearing trees, c) Reducing forest fuel loads to decrease wildfire risk. Clear cutting could cause relevant impacts to abiotic component, unless the following indications are adopted: i) it must be performed on small plots with slope <25%, ii) use raceways to reduce magnitude of impacts. Use of tractors or machines for yarding should be assessed on a case by case basis to avoid the reduction of deadwood, litter and the activation of erosive processes.

Forest categories not included in the "Habitats Directive"	*Allochthonous coniferous reforestation*												
THREATS	OPERATIONS												INDICATORS
	Silvicultural and harvesting practices (high forest and coppice)											Post harvesting management	
	Thinning/Shelterwood cutting/Salvage cutting					Crown pruning		Clear cutting					
	Felling and Arrangement	Storing (Winch)	Storing (Raceways)	Yarding (Raceways)	Yarding (Tractor)	Cutting	Yarding	Felling and Arrangement	Storing (Winch)	Storing (Raceways)	Yarding (Raceways)	Yarding (Tractor)	Chipping	
Reduction of deadwood	I	I			II	II	II	II	II	I	I	II		Deadwood
Reduction of litter cover	I	I			II	I	I	II	II	I	I	II		Litter
Reduction of litter height	I	I			II	I	I	II	II	I	I	II		
Reduction of SOC	I	I			I	I	I	II	II	I	I	II		Soil Organic Carbon (SOC)
Presence of Rill erosion	I	I			II	II	II	II	II	I	I	II		Erosion
Presence of Interrill erosion	I	I			II	II	II	II	II	I	I	II		
Presence of Gully erosion	I	I			II	I	I	II	II	I	I	II		
Increase of Soil Bulk Density	I	I			I	I	I	II	II	I	I	II		Soil Bulk Density
Fuel model features	I	I			I	I	I	II	II	I	I	II		Fire risk

This matrix refers to coniferous plantations main constituted of allochthonous conifers (e.g., *Pinus radiata*, *Abies alba*, *Pseudotsuga menziesii*). Silvicultural actions should be aimed to renaturalization of forest plantations: interventions aimed to pander renaturalization processes with the aim of increasing the stability and thus the efficiency of ecological-structural ecosystem. Interventions to reintegrate native species in forests free of seed-bearing trees were also foreseen. Removal of

deadwood and litter should be avoided. High reduction of land cover should be avoided on slope >25% to avoid the activation of erosive processes. Clear cutting could cause relevant impacts to abiotic component, unless the following indications are adopted: i) it must be performed on small plots with slope <25%, ii) use raceways to reduce reversibility time and magnitude of impacts.

1.2.1 Social, economic and demographic components and ecosystem services

Short description

The area related to the case study is composed by the following municipalities:

- Caltavuturo;
- Castelbuono;
- Castellana Sicula;
- Cefalù;
- Collesano;
- Geraci Siculo;
- Gratteri;
- Isnello;
- Petralia Soprana;
- Petralia Sottana;
- Polizzi Generosa;
- Pollina;
- San Mauro Castelverde;
- Scillato;
- Sclafani Bagni.

This area is large little more than 1,300 square kilometres, the total number of inhabitants is close to 56,000, whit a density is 42.7 population/km2, lower than Sicilian population density (195 population/Km2). The most part of population of working age (62.1%), while more modest is the share of young (11.0%); the 26.9% of people, instead, is older than 65 years, highlighting a greater share of old people than the entire Sicilian area data (where the share of person with an age higher than 65 years is 18.9%)(ISTAT, 2017). The unemployment rate (16.3%) revealed in the interested area is lower than the Sicilian region and Palermo province rates (respectively 22.0% and 24.4%), as well as, the educational level of people resident in the area object of study is, on average, lower than Sicilian people.

Regarding to the socio-economic aspects, in the area object of study 67 firms are operate that carry out activities pertinent to the forest-wood-energy supply chain, and other 200 firms that are involved in other satellite activities. More in detail, 12 firms operate in the first phase of supply chain (biomass harvesting and extraction, silviculture and other forestry activities including the logging and support services)

while 55 firms operate in the second phase of supply chain (processing and marketing of wood, sawmilling, manufacture of products of wood, operations of sale of timber, and transportation services). About the firms involved in the satellite activities, the most part of these, carry out accommodation and restaurant services activities.

From the collected data emerges that the most widespread legal form, among the firms involved in the activities related to the supply chain, is the individual firm, followed by the cooperative and company, differently, among the firms that operate in the accommodation and restaurant services, individual firms and companies represent the most part of the population. The difficulty to obtain information about the economic data of firms from statistical institutes and from the chamber of commerce, does not allow us to refer the data to all the firms operating along the supply chain and in the satellite activities, and in the municipalities mainly affected by the project. However, we can consider that the net income of firms is, on average, greater for the firms involved in the second phase of supply chain which show also the best performance in terms of Labour Productivity, while the major part of workforce is employed in the firms operating in the satellite activities.

Socio-Demographic Indicators' Table (Base Values)

Socio-Demographic Indicators	Value Before operations				
	Unit of measure	data	Year	Source	territorial reference*
Population	number of inhabitants	53,915	2017	ISTAT	Protected area municipalities
Population structure	% of population aged under 15 years	11.0%	2017	ISTAT	Protected area municipalities
	% of population aged 15-64 years	62.1%			
	%population aged 65 years and over	26.9%			
Per capita income	mean value of per capita income for resident families close to the protected areas	8,950	2015	ISTAT	Protected area municipalities
Unemployment rate	% of persons in work age who are unemployed	16.3%	2016	ISTAT	Castelbuono, Cefalù, Gangi and Petralia Sottana Local labor systems
Educational level	% of persons who have an upper secondary degree	41.7%	2011	ISTAT	Protected area municipalities
Energetic self-sufficiency	% of consumed energy provided by the biomass plant on the total energy consumed				

* Specify the territory to which the available data refers to (ie, municipality/municipalities, and/or province in the study area etc..)

Socio-Economic Indicators' Table (Base Values)

Socio-Economic Indicators		Value Before operations				
		Unit of measure	data	Year	Source	territorial reference*
Total firms**	firms involved in the biomass harvesting and extraction	Number of firms	12	2017	Chamber of Commerce	Protected area municipalities
	firms involved in processing and marketing of wood	Number of firms	55	2017	Chamber of Commerce	Protected area municipalities
	firms involved in bioenergy production and distribution	Number of firms	0	2017	Chamber of Commerce	Protected area municipalities
	firms involved in satellite activities	Number of firms	194	2017	Chamber of Commerce	Protected area municipalities
Legal form**	firms involved in the biomass harvesting and extraction	% of individual firms, companies, and cooperatives	Ind. Firms 58.3% Companies 8.3% Cooperatives 33.4%	2017	Chamber of Commerce	Protected area municipalities
	firms involved in processing and marketing of wood	% of individual firms, companies, and cooperatives	Ind. Firms 68.4% Companies 5.3% Cooperatives 26.3%	2017	Chamber of Commerce	Protected area municipalities
	firms involved in bioenergy production and distribution	% of individual firms, companies, and cooperatives	N.A.	2017	Chamber of Commerce	Protected area municipalities
	firms involved in satellite activities	% of individual firms, companies, and cooperatives	Ind. Firms 51.0% Companies 44.8% Cooperatives 4.2%	2017	Chamber of Commerce	Protected area municipalities
Net income**	firms involved in the biomass harvesting and extraction	mean value of net income	7.250€ (data referred to 2 firms)	2017	Chamber of Commerce	Protected area municipalities
	firms involved in processing and marketing of wood	mean value of net income	541.693€ (data referred to 19 firms)	2017	Chamber of Commerce	Protected area municipalities
	firms involved in bioenergy production and distribution	mean value of net income	0	2017	Chamber of Commerce	Protected area municipalities
	firms involved in satellite activities	mean value of net income	158.259€ (data referred to 111 firms)	2017	Chamber of Commerce	Protected area municipalities
Labour Productivity (LP)**	firms involved in the biomass harvesting and extraction	Mean value of LP	5.438€/work unit	2017	Our elaboration	Protected area municipalities
	firms involved in processing and marketing of wood	Mean value of LP	211.483€/work unit	2017	Our elaboration	Protected area municipalities
	firms involved in bioenergy production and distribution	Mean value of LP	N.A.	2017	Our elaboration	Protected area municipalities
	firms involved in satellite activities	Mean value of LP	33.084€/work unit	2017	Our elaboration	Protected area municipalities
Workforce**	firms involved in the biomass harvesting and extraction	Number of workers	16	2017	Chamber of Commerce	Protected area municipalities
	firms involved in processing and marketing of wood	Number of workers	146	2017	Chamber of Commerce	Protected area municipalities

	firms involved in bioenergy production and distribution	Number of workers	0	2017	Chamber of Commerce	Protected area municipalities
	firms involved in satellite activities	Number of workers	928	2017	Chamber of Commerce	Protected area municipalities
Workforce Age**	**firms involved in the biomass harvesting and extraction**	Mean value of age of workers				
	firms involved in processing and marketing of wood	Mean value of age of workers				
	firms involved in bioenergy production and distribution	Mean value of age of workers				
	firms involved in satellite activities	Mean value of age of workers				
Type of contracts**	**firms involved in the biomass harvesting and extraction**	Number of employees with fixed-term contract and permanent contract				
	firms involved in processing and marketing of wood	Number of employees with fixed-term contract and permanent contract				
	firms involved in bioenergy production and distribution	Number of employees with fixed-term contract and permanent contract				
	firms involved in satellite activities	Number of employees with fixed-term contract and permanent contract				
Position or job**	**firms involved in the biomass harvesting and extraction**	Number of skilled and unskilled employees				
	firms involved in processing and marketing of wood	Number of skilled and unskilled employees				
	firms involved in bioenergy production and distribution	Number of skilled and unskilled employees				
	firms involved in satellite activities	Number of skilled and unskilled employees				

R&D Investments***	**firms involved in the biomass harvesting and extraction**	A - Mean value of turnover destined in the research and development activity; B - number of patents developed; C - number of employees employed in the research & development activity				
	firms involved in processing and marketing of wood	A - Mean value of turnover destined in the research and development activity; B - number of patents developed; C - number of employees employed in the research & development activity				
	firms involved in bioenergy production and distribution	A - Mean value of turnover destined in the research and development activity; B - number of patents developed; C - number of employees employed in the research & development activity				
	firms involved in satellite activities	A - Mean value of turnover destined in the research and development activity; B - number of patents developed; C - number of employees employed in the research & development activity				
Innovations introduction**	**firms involved in the biomass harvesting and extraction**	Mean value of number of the adopted certifications				
	firms involved in processing and marketing of wood	Mean value of number of the adopted certifications				

	firms involved in bioenergy production and distribution	Mean value of number of the adopted certifications				
	firms involved in satellite activities	Mean value of number of the adopted certifications				
Tangible Resources**	**firms involved in the biomass harvesting and extraction**	Mean value of machineries and equipment of firms				
	firms involved in processing and marketing of wood	Mean value of machineries and equipment of firms				
	firms involved in bioenergy production and distribution	Mean value of machineries and equipment of firms				
	firms involved in satellite activities	Mean value of machineries and equipment of firms				

* In this column is specified the territory to which the available data refers to (ie, municipality/municipalities, and/or province in the study area etc..)
** For each phase of supply chain has been considered the firms operating close to the protected areas, and identified by the following NACE Codes (Rev.2):

- biomass harvesting and extraction 02.1; 02.2; 02.4;
- processing and marketing of wood 16.1; 16.2; 46.13; 46.73.1; 49.41;
- bioenergy production and distribution 35.1;
- satellite activities 02.3; 01.7; 91.04; 55.1; 56.1.

*** Insert at least one of the three indicators.
As above, for each phase of supply chain consider the firms operating close to the protected areas, and identified by the following NACE Codes (Rev.2):

- biomass harvesting and extraction 02.1; 02.2; 02.4;
- processing and marketing of wood 16.1; 16.2; 46.13; 46.73.1; 49.41;
- bioenergy production and distribution 35.1;
- satellite activities 02.3; 01.7; 91.04; 55.1; 56.1.

[a] Data has been replaced by the production value.
- [b] The result is given by the ratio between the mean production value and the mean number of employees of firms included in each phase of supply chain.

REFERENCES

Plant communities

Abbate B., Di Stefano E., Ferruzza G., Incandela A., Renda, P. Fase tettonica pliocenica nelle Madonie (Sicilia centro-settentrionale). Rivista Mineraria Siciliana. 1993;6: 37-45. Italian.

Barbour M. G., J. H. Burk, W. D. Pitts, 1987. Terrestrial Plant Ecology, 2nd Ed., Benjamin/Cummings, Palo Alto, CA., 634 p.

Bazan G., Marino P., Guarino R., Domina G., Schicchi R. Bioclimatology and vegetation series in Sicily: a geostatistical approach. Ann Bo. Fenn. 2015;52:(1-2): 1-18. doi: http://dx.doi.org/10.5735/085.052.0202

Braun-Blanquet J., 1951. Pflanzensoziologie. Grundzüge der vegetationnskunde. Springer-Verlag, Wien.

Chytrý, M. & Otýpková Z., 2003. Plot sizes used for phytosociological sampling of European vegetation. Journal of Vegetation Science 14(4):563- 570

"Communication From The Commission To The Council, The European Parliament, The European Economic And Social Committee And The Committee Of The Regions Towards An EU Strategy On Invasive Species" (retrieved September 19, 2017)

Elzinga C. L., Salzer D. W., Willoughby J. W., 1998. Measuring & Monitoring Plant Populations.

Fisher, W S, L E Jackson, G W Suter and P Bertram (2001), "Indicators for human and ecological risk assessment: a U.S. Environmental Protection Agency perspective", Human and Ecological Risk Assessment, 7, pages 961–970.

Jackson, L E, J C Kurtz and W S Fisher (2000), Evaluation Guidelines for Ecological Indicators (US Environmental Protection Agency, Office of Research and Development, Research Triangle Park NC).

Giardina G., Raimondo F.M., Spadaro V. A catalogue of the plants growing in Sicily. Bocconea. 2007;20: 5-582.

Holling C. S., 1973. Resilience and stability of ecological systems. Annu Rev Ecol Syst 4:1-23.

ISPRA, 2016. Manuali per il monitoraggio di specie e habitat di interesse comunitario (Direttiva 92/43/CEE) in Italia: habitat.

IAVS (International Association for Vegetation Science), 2017. Vegetation Classifcation Methods." https://sites.google.com/site/vegclassmethods/(accessed September 19, 2017)

Lovejoy T. E., HannaH, L. J., 2005. Climate Change and Biodiversity. Yale University Press. pp 418.

La Mantia T., Maetzke F. G., Maetzke F, 2007. Produzione e utilizzazione delle biomasse dei rimboschimenti in Sicilia. L'Italia forestale e montana, 5/6, 437-451.

Moss D., Wyatt B.K. The CORINE biotopes project: a database for conservation of nature and wildlife in the European community. Appl Geogr. 1994;14(4): 327-349. doi:10.1016/0143-6228(94)90026-4.

Pignatti S., 1953. Introduzione allo studio fitosociologico della pianura veneta orientale con particolare riguardo alla vegetazione litoranea - Arch. Bot. 28 (4): 265-329; 29 (1): 1-25, 65-98, 129-174.

Raimondo F.M., Surano N., Schicchi R. Carta del paesaggio e della biodiversità vegetale del Parco delle Madonie (Sicilia). Naturalista Siciliano. 2004;28: 71-137.

Raunkiaer C., 1934. The Lifeforms of plants and Statistical Plant Geography. Oxford University Press, Oxford. pp 632.

Schicchi R., editor. Piano di gestione "Monti Madonie. C.I.R.I.T.A., Università degli Studi di Palermo; 2008. Available from: http://www.artasicilia.eu/old_site/web/pdg_definitivi/definitivi/ddg_def/ddg_monti_madonie_183_2012.pdf

Walker B., Holling C. S., Carpenter S. R., Kinzig A. 2004. Adaptability and Transformability in Social-Ecological Systems. Ecology and Society 9:5.

Wikum D. A. & Shanholtzer G. F., 1978. Application of the Braun-Blanquet cover-abundance scale for vegetation analysis in land development studies. Environ Manag 2(4):323-329

Animal communities

Audisio, P., Baviera, C., Carpaneto, G.M., Biscaccianti, A.B., Battistoni, A., Teofili, C., Rondinini, C., 2014. Lista Rossa IUCN dei Coleotteri saproxilici Italiani. Comitato Italiano IUCN e Ministero dellAmbiente e della Tutela del Territorio e del Mare, Roma.

Blondel J., 1975. L'analyse des peuplement d'oiseaux, éléments d'un diagnostic écologique. 1. La méthode des échantillonnages fréquentiels progressifs (E.F.P.). Terre et Vie, 29: 533-589.

Blondel J., Ferry C. & Frochot B., 1981. Point counts with unlimited distance. In: Estimating numbers of terrestrial birds. Ralph C.J. & Scott J.M. (Eds). Studies in Avian Biology, 6: 414-420.

Brown G.R. & I.M. Matthews, 2016. A review of extensive variation in the design of pitfall traps and a proposal for a standard pitfall trap design for monitoring ground active arthropod biodiversity. Ecology and Evolution, 6: 3953-3964.

Campanaro A., Bardiani M., Spada L., Carnevali L., Montalto F., Antonini G., Mason F. & Audisio P. (eds), 2011. Linee guida per il monitoraggio e la conservazione dell'entomofauna saproxilica. Quaderni Conservazione Habitat, 6. Cierre Grafica, Verona, 8 pp. + CD-ROM.

Carpaneto, G.M., Paolo Audisio, Marco A. Bologna, Pio Federico Roversi, Franco Mason, 2017. Guidelines for the Monitoring of the Saproxylic Beetles protected in Europe. Nature Conservation 20, Special Issue (available at: https://natureconservation.pensoft.net/issue/996/)

Contarini E. & Strocchi A. (eds), 2009. Dizionarietto dei termini tecnici di morfologia ed ecologia degli artropodi. Notiziario della Società per gli Studi naturalistici della Romagna 1/2009 n. 40, supplemento n. 2 : 222 pp.

Galko J., C. Nikolov, A. Kunca, J. Vakula, A. Gubka, M. Zúbrik, S. Rell & B. Konôpka, 2016. Effectiveness of pheromone traps for the European spruce bark beetle: a comparative study of four commercial products and two new models. Lesn. Cas. For. J. 62: 207–215.

Hardy, P.C., and M.L. Morrison. 2000. Factors affecting the detection of elf owls and western screech owls. Wildl. Soc. Bull. 28(2):333-342.

JURC, Maja (ed.), 2012. Saproxylic beetles in Europe : monitoring, biology and conservation, (Studia forestalia Slovenica, ISSN 0353-6025, 137). Ljubljana. Slovenian Forestry Institute, Silva Slovenica.

Nieto A. & K.N.A. Alexander, 2010. European Red List of Saproxylic Beetles. Luxembourg: Publications Office of the European Union.

Penteriani, V., Delgado, M.M., Campioni, L. & Lourenço, R. 2010. Moonlight makes owls more chatty. PLoS One 5(1): e8696. doi:10. 1371/journal.pone.0008696.

Ranius, T. & Jansson, N. (2002) A comparison of three methods to survey saproxylic beetles in hollow oaks. Biodiversity & Conservation 11: 1759-1771.

Speight M.C.D., 1989. Les invertebres saproxiliques et leur protection. Conseil de l'Europe, Collection Sauvegau- Conseil de l'Europe, Collection Sauvegaurde de la nature, n. 42: 77 pp

Stoch F., Genovesi P. (ed.), 2016. Manuali per il monitoraggio di specie e habitat di interesse comunitario (Direttiva 92/43/CEE) in Italia: specie animali. ISPRA, Serie Manuali e linee guida, 141/2016.

Veschuyl J., Riffell S., Millerc D. & T. Bently Wigleyd, 2011. Biodiversity response to intensive biomass production from forest thinning in North American forests – A meta-analysis. Forest Ecology and Management, 261: 221–232.

Abiotic components

AA VV (2008). Sistema Informativo Forestale Della Regione Siciliana; Istruzioni per il Rilievo Degli Attributi di Seconda Fase: Palermo, Italy; p. 261

Binkley D, Fisher RF (2012). Ecology and management of forest soils. Fourth edition. Wiley-Blackwell, 362 pp.

Borrelli P, Schutt B (2014). Assessment of soil erosion sensitivity and post-timber-harvesting erosion response in a mountain environment of Central Italy. Geomorphology 204 412–424

Cerdá A, Doerr SH (2005). Influence of vegetation recovery on soil hydrology and erodibility following fire: an 11-year investigation. Int. J. Wildland Fire 14, 423–437.

Costa Freitas MB, Xavier A, Fragoso R (2017). Integration of Fire Risk in a Sustainable Forest Management Model. Forests 8, 270, 1-20.

Cullotta S, Bagarello V, Baiamonte G, Gugliuzza G, Iovino M, La Mela Veca DS, Maetzke FG, Palmeri V, Sferlazza S (2016). Comparing Different Methods to Determine Soil Physical Quality in a Mediterranean Forest and Pasture Land. Soil Science Society of America Journal, 80: 1038-1056

Ferretti F, Cantiani P, De Meo I, Paletto A (2014). Assessment of soil protection to support forest planning: an experience in southern Italy. Forest Systems 23(1): 44-51

Froehlich HA, McNabb DH (1983). Minimizing soil compaction Pacific Northwest forests. Sixth North America forest soil conference on forest soils and treatment impacts, pp.159–192.

Froehlich HA, Miles DWR, Robbins RW (1985). Soil bulk density recovery on compacted skid trails in Central Idaho. Soil Science Society of America Journal 49: 1015–1017.

Johnson DW, Curtis PS (2001). Effects of forest management on soil C and N storage: meta analysis. Forest Ecology and Management 140, 227-238.

Lombardi F, Marchetti M, Corona P, Merlini P, Chirici G, Tognetti R, Puletti N (2015). Quantifying the effect of sampling plot size on the estimation of structural indicators in old-growth forest stands. For. Ecol. Manag., 346, 89–97.

Murray CD, Buttle JM (2004). Infiltration and soil water mixing on forested and harvested slopes during spring snowmelt, Turkey Lakes Watershed, central Ontario. Journal of Hydrology 306: 1–20.

Paletto A, De Meo I, Cantiani P, Ferretti F (2014). Effects of forest management on the amount of deadwood in Mediterranean oak ecosystems. Annals of Forest Science, Springer Verlag/EDP Sciences, 71(7): 791-800.

Smith HG, Sheridan GJ, Lane PN, Bren LJ (2011). Wildfire and salvage harvesting effects on runoff generation and sediment exports from radiata pine and eucalypt forest catchments, south-eastern Australia. Forest Ecol. Manage. 261, 570–581.

Tabacchi G, Di Cosmo L, Gasparini P, Morelli S (2011). Stima del volume e della fitomassa delle principali specie forestali italiane. Equazioni di previsione, tavole del volume e tavole della fitomassa arborea epigea. Consiglio per la Ricerca e la sperimentazione in Agricoltura, Unità di Ricerca per il Monitoraggio e la Pianificazione Forestale, Trento, pp. 412.

Wang J, LeDoux CB, Edwards P, Jones M (2005). Soil bulk density changes caused by mechanized harvesting: A case study in central Appalachia. Forest Products Journal 55(11): 37-40.

Social, economic and demographic components and ecosystem services

Adamowicz, W.L, Bhardwaj, V. and Macnab, B. (1993). “Experiments on the difference between willingness to pay and willingness to accept”, Land Economics, Vol. 69, No. 4, pp. 416-427.

Breidert, C., Hahsler, M. and Reutterer, T. (2006). “A review of methods for measuring willingness-to-pay”, Innovative Marketing, Vol. 2 No. 4, pp. 8-32.

Burns, T. and Stalker, G.M. (1977). The Management of Innovation, 2d ed. London: Tavistock.

Ciriacy-Wantrup, S.V. (1947). “Capital returns from soil conservation practices”, Journal of Farm Economics, Vol. 29, No. 4, pp.1181-1196.

Davis, R. (1963). The value of outdoor recreation: an economic study of the marine woods. PhD Thesis. Harvard University.

del Rio, P. and Burguillo, M. (2008). “Assessing the impact of renewable energy deployment on local sustainability: Towards a theoretical framework”, Renewable and Sustainable Energy Reviews, Vol. 12, No. 5, pp. 1325-1344.

Domac, J., Richards, K. and Risovic, S. (2005). “Socio-economic drivers in implementing bioenergy projects”, Biomass and Bioenergy, Vol. 28, No. 2, pp. 97-106.

Federici, S., Vitullo, M., Tulipano, S., De Laurentis, R. and Seufert, G. (2008). “An approach to estimate carbon stocks change in forest carbon pools under the UNFCCC: the italian case”, iForest, Vol. 1, No. 1, pp. 86-95.

Fisher, B., Turner, R.K. and Morling, P. (2009). “Defining and classifying ecosystem services for decision making”, Ecological Economics, Vol. 68, No. 3, pp. 643-653.

FUTURIS Etrusca s.r.l. (2012). Progetto per la realizzazione di una centrale elettrica a biomasse vergini nel comune di Piombino (LI). Studio sulle ricadute socio-economiche dell’intervento.

Grilli, G., Ciolli, M., Garegnani, G., Geri, F., Sacchelli, S., Poljanec, A., Vettorato, D. and Paletto, A. (2017). “A method to assess the economic impacts of forest biomass use on ecosystem services in a National Park”, Biomass and Bioenergy, Vol. 98, No. 1, pp. 252-263.

Grilli, G., Curetti, G., De Meo, I., Garegnani, G., Miotello, F., Pojanec, A., Vettorato, D. and Paletto, A. (2015). "Experts' Perceptions of the Effects of Forest Biomass Harvesting on Sustainability in the Alpine Region", South-East European Forestry, Vol. 6, No. 1, pp. 77-95.

Hastik, R., Basso, S., Geitner, C., Haida, C., Poljanec, A., Portaccio, A., Vrš aj, B. and Walzer, C. (2015). "Renewable energies and ecosystem service impacts", Renewable and Sustainable Energy Reviews, Vol. 48, No. 1, pp. 608-623.

Hult, G.T. M., Hurley, R.F. and Knight, G.A. (2004). "Innovativeness: Its Antecedents and Impact on Business Performance". Industrial Marketing Management, Vol. 33, No. 5, pp. 429-438.

Intergovernmental Panel on Climate Change (2003). Good Practice Guidance for Land Use, Land Use Changes and Forestry.

Louviere, J.J. and Woodworth, G. (1983). "Design and analysis of simulated consumer choice or allocation experiments: an approach based on aggregate data, Journal of Marketing Research, Vol. 20, No. 4, pp. 350-367.

Plottu, E. and Plottu, B. (2007). "The concept of Total Economic Value of environment: a reconsideration within a hierarchical rationality", Ecological Economics, Vol. 61, No. 1, pp. 52-61.

Teece, D.J., Pisano, G. and Shuen, A. (1997). "Dynamic Capabilities and Strategic Management". Strategic Management Journal, Vol. 18, No. 7, pp. 509-533.

Varun, Prakash, R. and Bhat, I.K. (2009). "Energy, economics and environmental impacts of renewable energy systems", Renewable and Sustainable Energy Reviews, Vol. 13, No. 1, pp. 2716-2721.

Willis, K. and Garrod, G. (1991). "An individual travel-cost method of evaluating forest recreation", Journal of Agricultural Economics, Vol. 1, No. 42, pp. 33-42.

Wilson, M.A. and Hoehn, J.P. (2006). "Valuing environmental goods and services using benefit transfer: The state-of-the art and science", Ecological Economics, Vol. 60, No. 2, pp. 335-342.

Zaltman, G., Duncan, R. and Holbek, J. (1973). Innovations and Organizations. New York: Wiley.

Forest Bioenergy in the Protected Mediterranean Areas

www.interreg-med.eu\ForBioEnergy

REGIONE SICILIANA
ASSESSORATO REGIONALE DELL'AGRICOLTURA, DELLO SVILUPPO RURALE E DELLA PESCA MEDITERRANEA
DIPARTIMENTO REGIONALE DELLO SVILUPPO RURALE E TERRITORIALE

Municipality of Petralia Sottana

ENVELAND

GOZDARSKI INŠTITUT SLOVENIJE
SLOVENIAN FORESTRY INSTITUTE

RDA Green Karst

amufor municipios forestales valencianos

Cámara Valencia

VELEBIT

Disclaimer

Programme Cofinanced by the European Regional Development Fund
Programme Cofinancé par le Fonds Européen de Développement Régional