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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 - SPAIN

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

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1 PRELIMINARY ASSESSMENT IN THE STUDY AREAS

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1.1 Introduction of the study

The surface of the Community of Valencia is 2.325.499 ha of which 917.748,35 ha are protected (39,47%). Concretely, the protected surface of the Region of Enguera "Canal de Navarrés" represents 82,65% (58.620,78 ha) regarding the total surface of the region (70.929 ha) and in Enguera, it is represented by 74,55% (18.023 ha) of its total area (24.175 ha).

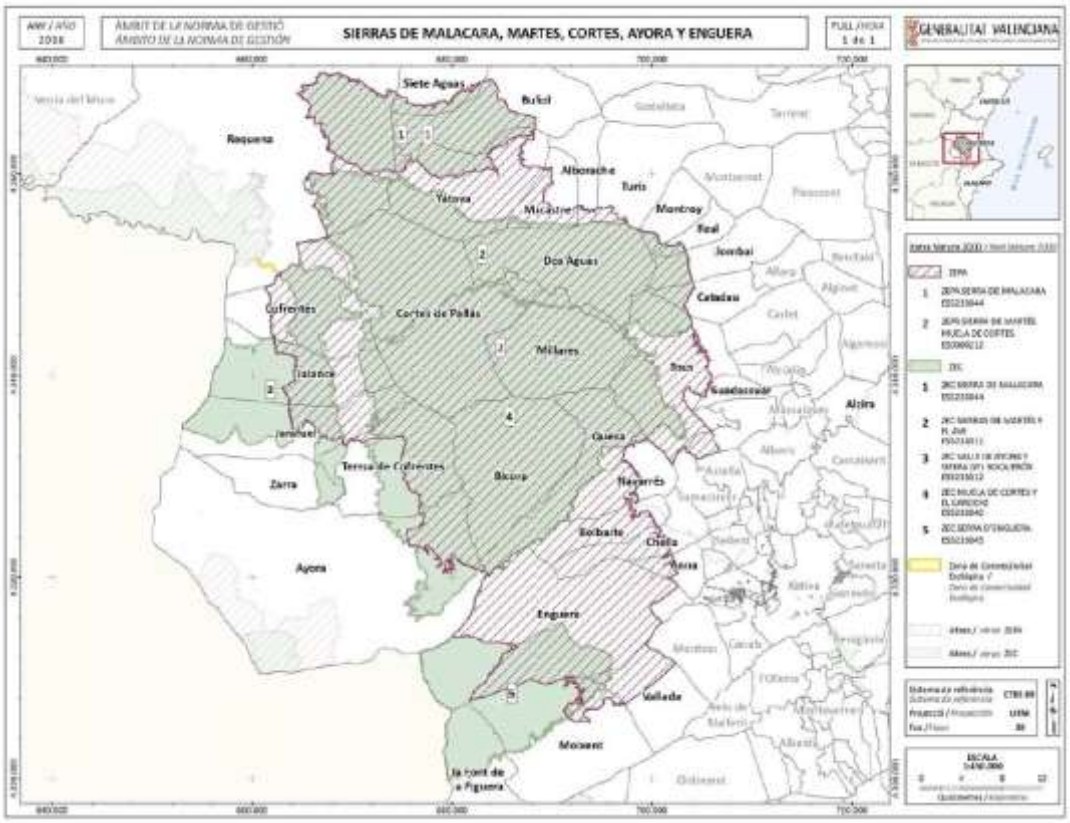

Figure 1. Zoning of the management regulation "Macizo del Caroig"
(Source: Decreto 10/2017, de 27 de enero[1] - *Decree 10/2017, of 27 January*)

[1] DECRETO 10/2017, de 27 de enero, del Consell, por el que se declaran como zonas especiales de conservación (ZEC) los lugares de importancia comunitaria (LIC) la Sierra de Martés y el Ave, la Muela de Cortes y el Caroche,Valle de Ayora y la Sierra del Boquerón, Sierra de Enguera, y Sierra de Malacara, se modifica el ámbito territorial de la zona de especial protección para las aves (ZEPA) denominada Sierras de

Specifically, the following Natura 2000 sites are represented in the management regulation:

Table 1. Management regulation "Macizo del Caroig" (Source: Decreto 10/2017, de 27 de enero)

Code	Natura 2000 sites	Involved municipalities
ES5233044	SAC "Sierra de Malacara"	Requena, Siete Aguas, Buñol, Yátova
ES5233011	SAC "Sierras de Martés y el ave"	Requena, Yátova, Macastre, Dos Aguas, Montroy, Real, Llombai, Catadau, Tous, Millares, Cortes de Pallàs, Cofrentes
ES5233040	SAC "Muela de Cortes y el Caroche"	Cortes de Pallás, Dos Aguas, Millares, Tous, Quesa, Navarrés, Bicorp, Ayora, Teresa de Cofrentes, Jarafuel, Jalance, Cofrentes.
ES5233012	SAC "Valle de Ayora y Sierra del Boquerón"	Cofrentes, Jalance, Jarafuel, Zarra, Teresa de Cofrentes.
ES5233045	SAC "Serra d'Énguera"	**Enguera**, Vallada, Moixent/Mogente, la Font de la Figuera
ES5233044	SPA "Sierra de Malacara"	Requena, Siete Aguas, Buñol, Yátova
ES0000212	SPA "Sierra de Martés-Muela de Cortes"	Requena, Yátova, Macastre, Alborache, Turís, Montroy, Real, Llombai, Catadau, Tous, Millares, Dos Aguas, Cortes de Pallás, Cofrentes, Jalance, Jarafuel, Teresa de Cofrentes, Bicorp, Ayora, Quesa, Navarrés, Guadassuar, Alzira, Bolbaite, Chella, Anna, **Enguera**, Vallada, Moixent/Mogente

Concerning the surface where the assessment is implemented, the management regulation "Macizo del Caroig" has an area of 195.008,59 ha, the SPA Sierra de Martés-Muela de Cortés of 153.191,44 ha and the SAC ES5233045 Sierra de Enguera of 17.323,70 ha (8.835,56 ha are included in the municipality Enguera).

It is noted that the SAC ES5233045 Sierra de Enguera is overlapping with the SPA ES0000212 Sierras de Martés-Muela de Cortes. Furthermore, in its area (ES5233045) there is also a Municipal Natural Area which is named "Barranco de la Hoz" and it is regulated by the Decree 142/2010, of 17 September[2]; a catalogued cave named "Sima de la Caseta de Damiano" (Decree 65/2006, of 12 May[3]); a microrreserve of flora "El Chorrillo" (Order of 2 October of 2002[4]) and

Martés-Muela de Cortes, y se aprueba la norma de gestión de tales ZEC y ZEPA, así como de la ZEPA la Sierra de Malacara. [2017/1237]. Conselleria de Agricultura, Medio Ambiente, Cambio Climático y Desarrollo Rural.
[2] Decreto 142/2010, de 17 de septiembre, del Consell, por el que se declara Paraje Natural Municipal el enclave denominado Barranco la Hoz, en el término municipal de Enguera.
[3] Decreto 65/2006, de 12 de mayo, por el que se desarrolla el régimen de protección de las cuevas y se aprueba el Catálogo de Cuevas de la Comunitat Valenciana.
[4] Orden de 22 de octubre de 2002, de la Conselleria de Medio Ambiente, por la que se declaran 22 microrreservas vegetales de la provincia de Valencia.

two reserves of the fauna which are "Balsa blanca" (Order of 17 June of 2009[5]) and "Cova dels Mosseguellos" (Order of 12 february of 2009[6]).

Specifically, the SAC Sierra de Enguera is an extensive mountainous area where the scrub and forest ecosystems have a high interest for wild animals. In this area, relevant ravines with rocky habitats and rivers of high value are represented.

1.1.1 Biotic components

It is observed that the public ownership of the province of Valencia is represented by 325.810,9 ha (51,8%), the private one by 251.855,6 ha (40,0%) and the unknown-unassigned by 51.830,6 ha (8,2%). Concretely, the forest ownership in Valencia is represented by the municipality by 80,9%, as it is the case of Navalón forest V-074.

On the one hand, Navalón forest V-074 has a perimeter of 232.702,71 m and its public surface has 2.870,73 ha, being its total surface of 5.015 ha. The V-074 forest is demarcated and delimitated. Moreover, it has a surface of enclaves that amounts to 1.481,09 ha.

On the other hand, the wood volume of V-074 is 110.142,38 m^3 and its stock is 61.679,73 Tw. Its potential use of biomass is mainly concentrated in clearing and thinning treatments of young and medium-aged regenerated stands of *Pinus halepensis.* Moreover, small quantities of biomass are obtained through thinning treatments of *Pinus pinaster*. Concretely, according to the Integral and Sustainable Forest Management Plan of Enguera (2014-2034), there is a real possibility of 8.000 tons per year of municipal forest biomass

Furthermore, Navalón forest has a wide intraspecific and interspecific diversity, as well as some diversity regarding the ecosystems which are showed in the figure 2. Specifically, its vegetation is composed by:

- Mature stand of *Pinus halepensis* and *Pinus pinaster.*

[5] Orden de 17 de junio de 2009, de la Conselleria de Medio Ambiente, Agua, Urbanismo y Vivienda por la que se declaran siete reservas de fauna en la Comunitat Valenciana.
[6] Orden de 12 de febrero de 2008, de la Conselleria de Medio Ambietne, Agua, Urbanismo y Vivienda por la que se declaran cuatro reservas de fauna en la Comunitat Valenciana.

- Areas of regenerated pine forest of *Pinus halepensis*.
- Areas with predominance of heliophilous scrub: oak woods, rosemary bush thicket, etc.
- Ravines and watercourse with forest and riverbank vegetation.
- Crops and pastures.

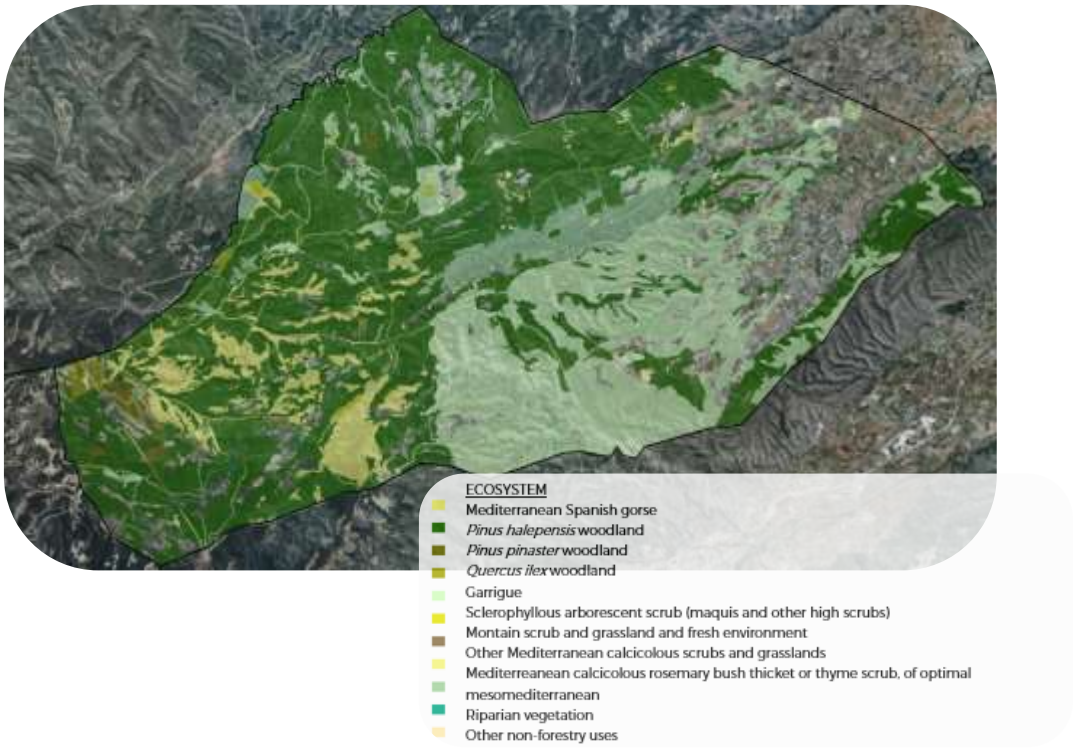

Figure 2. Ecosystems included in the Navalón forest

Finally, analysing the information provided by CORINE, the following codes are included in the "Navalón" forest:

Table 2. CORINE data in Navalón V-074 forest (source: LIFE+ project: Bioenergy and Fire prevention)

Code_06	Definition	Surface (ha)	Surface (%)
211	Arable land	118,27	2,68
223	Olive groves	34,70	0,79
242	Mosaic of crops	160,37	3,63
243	Agricultural land with natural vegetation	113,51	2,57
312	Coniferous forests	817,60	18,51
323	Sclerophyllous scrub	1.551,98	35,13
324	Transitional forest scrub	1.620,79	36,69
Total		**4.417,22**	**100**

The consecutive maps show the protected areas in the Valencian Community, the location of the management regulation "Macizo del Caroig" and the representation of the corresponding SAC and SPA in the municipality of Enguera and in the Navalón Forest V-074:.

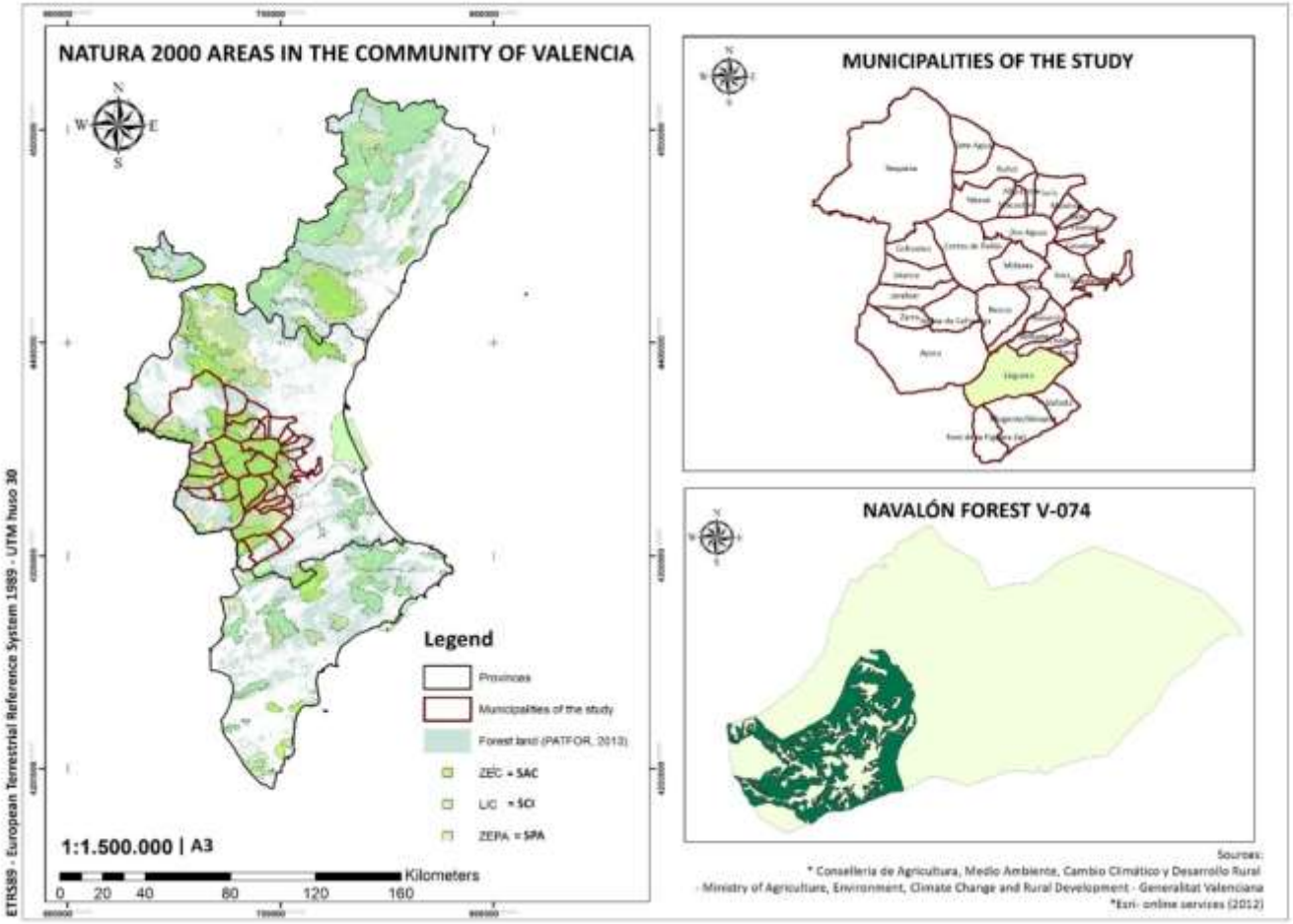

Figure 3. Natura 2000 areas in the Valencian Community with focused on the protected municipalities included in the management regulation "Macizo del Caroig" and on the Navalón Forest V-074 as the pilot area of the study.

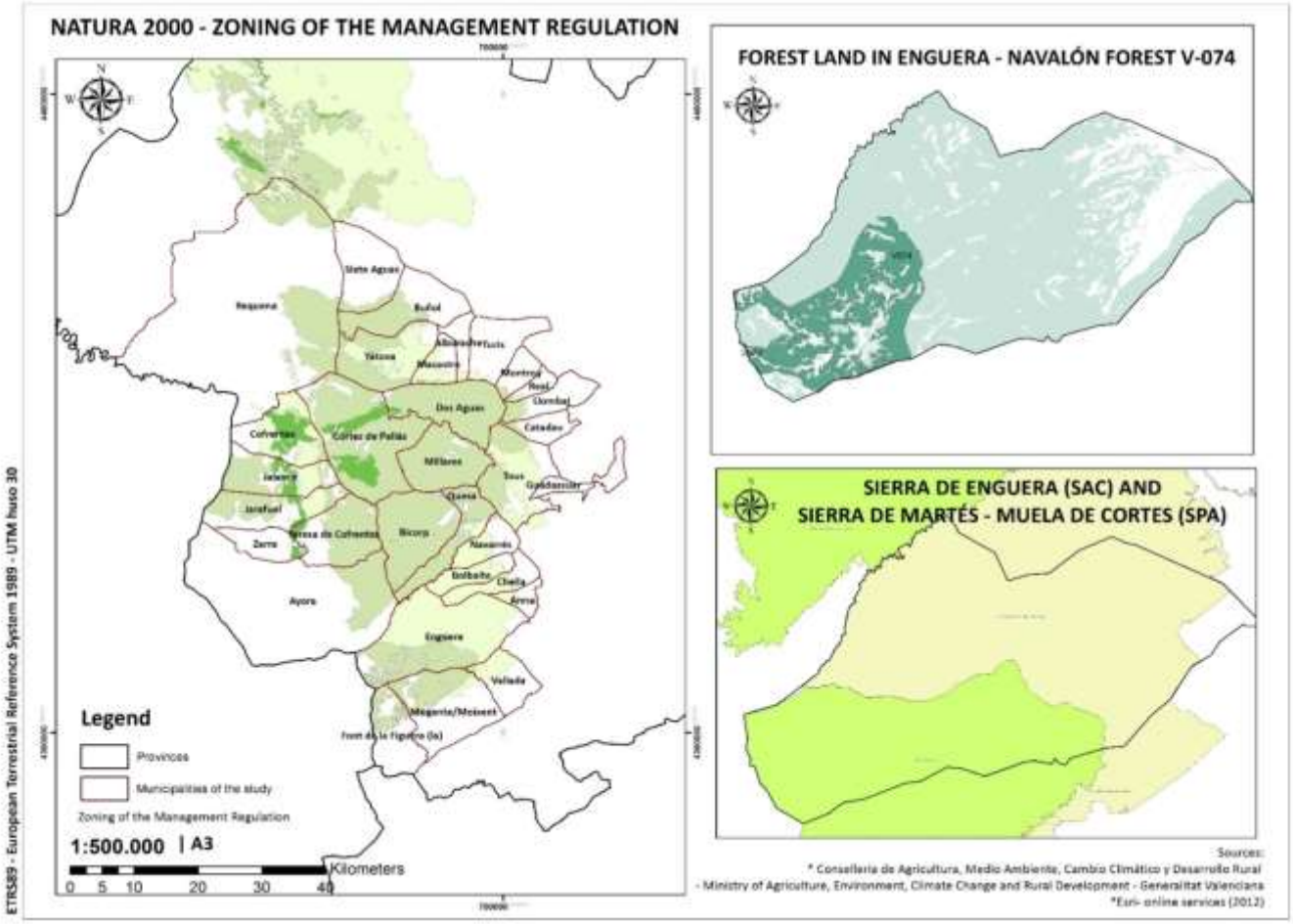

Figure 4. Zoning of the management regulation "Macizo del Caroig" with their corresponding municipalities. Representation of the SAC and SPA in the municipality of Enguera compared with the location of the Navalón forest V-074.

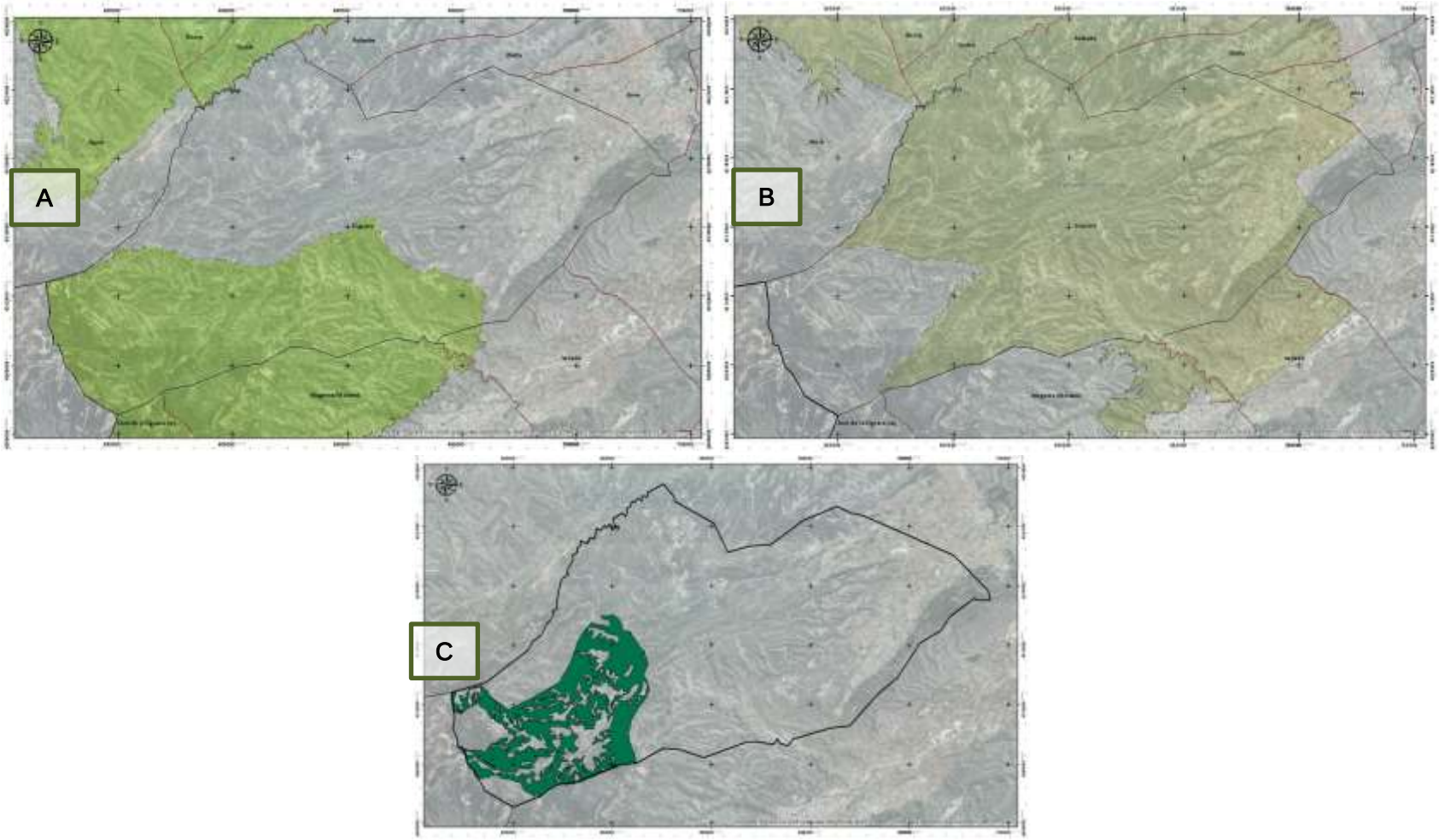

Figure 5. SAC Sierra de Enguera (A), SPA Sierra de Martés-Muela de Cortes (B) and Navalón Forest V-074 (C) in the municipality of Enguera. Source: Esri, DigitalGlobe and Conselleria de Agricultura, Medio Ambiente, Cambio climático y Desarrollo Rural. Generalitat Valenciana

According to the habitats and species Natura 2000 included in the SAC Sierra de Enguera, in the following tables are them described. Moreover, the affection of the forest management operations in the listed habitats is indicated.

Table 3 : List of habitats of community interest of Annex I of the Council Directive 92/43/EEC and species of community interest of Annex II of the Council Directive 92/43/EEC present in the site. Source: Decreto 10/2017, de 27 de enero.

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
ES5233045	Serra d'Enguera/ Sierra de Enguera	SAC	-	3140	Hard oligo-mesotrophic waters with bentthic vegetation of *Chara spp. / Aguas oligomesotróficas calcáreas con vegetación béntica de Chara spp.*	X
			242,60	5210	Arborescent matorral with *Juniperus spp. / Matorrales arborescentes de Juniperus spp.*	X
			545,36	5330	Thermo-Mediterranean and pre-desert scrub / *Matorrales termomediterráneos y preestépicos*	X
			1115,57	6220*	Pseudo-steppe with grasses and annuals of the *Thero-Brachypodietea / Zonas subestépicas de gramíneas y anuales del Thero-Brachypodietea*	X
			-	7220*	Petrifying springs with tufa formation (*Cratoneurion*) / *Manantiales petrificantes con formación de tuf (Cratoneurion)*	x
			122,62	8210	Calcareous rocky slopes with chasmophytic vegetation / *Pendientes rocosas calcícolas con vegetación casmofítica*	x
			-	92A0	*Salix alba* and *Populus alba* galleries / *Bosques galerías de Salix alba y Populus alba*	✓
			-	92D0	Southern riparian galleries and thickets (Nerio-Tamaricetea and Securinegion tinctoriae) / *Galerías y matorrales ribereños termomediterráneos (Nerio-Tamaricetea y Securinegion tinctoriae)*	✓
			-	9340	Quercus ilex and Quercus rotundifolia forests / *Encinares de Quercus ilex y Quercus rotundifolia*	✓

The species included in the ES5233045 is the following:

Natura 2000 site code	Natura 2000 site name	Type	Natura 2000 site area (ha)	Species group	Species code	Qualifying Natura 2000 species scientifc name
ES5233045	Sierra de Enguera	SAC	17.323,77	I	1092	*Austropotamobius pallipes*

The species included in the SPA Sierra de Martés-Muela de Cortes are represented in the table below:

Table 4. Species of avifauna of Annex I of the Birds Directive – Council Directive 2009/147/EC on the conservation of wild birds, present in the SPA Sierra de Martés-Muela de Cortes. Source: Decreto 10/2017, de 27 de enero.

Natura 2000 site code	Natura 2000 site name	Type	Natura 2000 site area (ha)	Species group	Species code	Qualifying Natura 2000 species scientific name
ES0000212	Sierra de Martés - Muela de Cortes	SPA	153.191,44	B	A229	*Alcedo atthis*
				B	A255	*Anthus campestris*
				B	A091	*Aquila chrysaetos*
				B	A215	*Bubo bubo*
				B	A133	*Burhinus oedicnemus*
				B	A243	*Calandrella brachydactyla*
				B	A224	*Caprimulgus europaeus*
				B	A080	*Circaetus gallicus*
				B	A081	*Circus aeruginosus*
				B	A103	*Falco peregrinus*
				B	A245	*Galerida theklae*
				B	A093	*Aquila fasciata*
				B	A092	*Hieraaetus pennatus*
				B	A246	*Lullula arborea*
				B	A242	*Melanocorypha calandra*
				B	A279	*Oenanthe leucura*
				B	A346	*Pyrrhocorax pyrrhocorax*
				B	A302	*Sylvia undata*

Additionally, in the SPA ES0000212, there is the presence of some species of bats which are considered as threatened in the Valencian Community (Table 5):

Site name	Natura 2000 code	Specie	Taxonimic group	Protection category
Sierra de Martés-Muela de Cortes	1310	Miniopterus schreibersii	M	Vulnerable
	1305	Rhinolophus euryale	M	Vulnerable
	1307/1324	Myotis blythii /Myotis myotis	M	Vulnerable

In accordance with the assessment of the current state of conservation of natural habitats and species in the SAC Sierra de Enguera, it is observed that all natural habitats of community interest are favourable regarding the status/rank, the surface, the structure and specific functions and the future perspectives. Therefore, the overall assessment of the state of conservation is favourable.

Regarding the assessment of the SAC Sierra de Martés-Muela de Cortes, the state of conservation is favourable in terms of range, population, habitat, future prospects and global assessment of the species *Circus aeroginosus*, *Aquila chrysaetos, Hieraaetus pennatus* and *Aquila fasciata*, solely the species *Circaetus gallicus* has an unfavourable-inadequate (amber) status in the future prospects and in the global assessment (DECRETO 10/2017, de 27 de enero).

Matrices assessment:

In the Valencian Community and according to the criteria for the utilization of wood and biofuel explained in the PATFOR (2013), it is mentioned that the non-harvest strata is considered those in which among the main species not appear neither *Pinus halepensis, nor* Quercus *ilex* or *faginea.* These species have currently some utilization in the Valencian Community, especially *Pinus halepensis* which is a predominant species in the Valencian forest (39% of the forest land is covered by pine forests of Aleppo).

Furthermore, the forest ecosystems have an important role regarding the regulation of the forest fires to reduce the hazard level. Concretely, the forest actions are focused on carrying out a preventive silviculture as a tool to bushfires prevention and hence, favouring the capacity of the ecosystem to regulate the forest fires.

In connection with the protection figures as Natural Parks, Municipal Natural Areas, Protected Landscapes, Wildlife Reserves, etc, for the execution of a concrete forest utilization plan, the compatibility of uses of the area should be taken into consideration.

Finally, with regard to the following compiled matrices for each habitat, it is included silvicultural and harvesting practices in order to make a first approach about the possible impacts of the biomass extraction, especially in biodiversity, qualify of soil and water, carbon balanced landscape and bushfires prevention. Nevertheless, it is noted that complementary quantitative studies are also required to analyse these impacts.

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

The assessment is based on the magnitude and reversibility parameters as it is described above:

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.

On the one hand, the potential impacts are described for habitats according to Directive 92/43/EEC which are classified as forests:

- 92A0: *Salix alba* and *Populus alba* galleries
- 92D0: Southern riparian galleries and thickets (*Nerio-Tamaricetea* and *Securinegion tinctoriae*)
- 9340: *Quercus ilex* and *Quercus rotundifolia* forests

On the other hand, the impacts are assessed for autochthonous coniferous reforestation which is composed mainly by stands of *Pinus halepensis.* Concretely, the stands of Aleppo pine can be studied as a forest category included in the "Habitats Directive" due to in the habitat 9540 Mediterranean pine forests with endemic Mesogean pines, it is included that "Long-established plantations of these pines, within their natural area of occurrence, and with an undergrowth basically similar to that of paraclimatic formations, are included" (Interpretation manual of European Union Habitats, European Commission, 2013). Therefore, in the pilot area

of Navalón forest V-074 the represented stand has the conditions to be included it as a habitat 9540. The stand is arising from an artificial regeneration by sowing in 1950 due to a forest fire.

In general terms:

- The storing by winch has less impact than by raceways.
- The yarding operation by raceways has more impact than by tractor.
- Clear cutting is considered as the last step of the shelterwood method.
- The reversibility is study according to different periods of time (Short term: 1-5 years; medium term: 5-10 years and long term: > 10 years).
- The reversibility of the introduction of synanthropic or alien species is not estimated because of its extreme complexity.

In general terms by habitats:

- 9340: In this habitat, only felling operations are done by group shelterwood cutting. Normally, the forest operations which are done in these habitats are pruning's with chain saw. Only it is used a small tractor for the logging.
- 9540: Yarding operation of crown pruning is not evaluated in habitat 9540 because it is a non-implemented operation in our study area.

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

1. 92A0 and 92D0

- 92A0: *Salix alba* and *Populus alba* galleries
- 92D0: Southern riparian galleries and thickets (Nerio-Tamaricetea and Securinegion tinctoriae):

Table 5. Description of the 92A0 and 92D0 habitats. Source: Interpretation manual of European Union Habitats (European Commission, 2013) and the Manual Habitat of Spain (Ministry of Agriculture, Food and Environment).

Habitat	Description
92A0	Riparian forests dominated by species of the genus *Populus, Salix* and *Ulmus.* The undergrowth is composed by shrubs (*Rubus, Rosa, Crataegus, Prunus, Sambucus, Cornus,* etc.), herbaceous (*Arun* sp. pl., *Urtica* sp. pl., *Ranunculus ficaria, Geum urbanum,* etc.) and other species as *Humulus lupulus, Bryonia dioica, Cynanchum acutum, Vitis vinifera, Clematic* sp. pl., etc.
92D0	Shrub formations of Mediterranean ravines and riverbanks in warm climate, from semi-arid to sub-humid. Concretely, the plants included in the habitat are *Nerium oleander, Vitex agnus-castus, Tamarix* spp., *Securinegra tinctoria, Prunus lusitanica, Viburnum tinus, Ilex aquifolium.*

As riparian trees the main species in Valencia is *Populus* spp. Regarding the genus *Ulmus*, the Dutch elm disease (DED) has had severe consequences in the Valencian elms because it has removed practically all of them. For this reason, it is one of the most devastating consequences in Europe and in the Valencian Community with a considerable social and cultural impact.

The analysis of these habitats is lumped in a single matrix because both are in riparian ecosystems.

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

Normally, the only treatments done in these habitats are pruning and clear cutting, being the clear cutting mechanized. Nevertheless, it is also noted that in the riparian areas silvicultural treatments are limited with protective function which is the conservation of the habitats and species of community interest. The selection cutting is applied as a method of thinning, as well as selective operations over the non-aerial flight.

According to the "Marco de Acción Prioritaria para la Red Natura 2000 en España 2014-2020 (Julio 2014) - *Priority Action Framework for Natura 2000 in Spain 2014-2020 (July 2014)* " in the habitat 92D0 the priority measures are to recover forests and restore degraded forest stands, encouraging the reversion of forest

plantations and regenerating autochthonous forests. Among other measures concerning both habitats, it is reflected the restoration of fluvial ecosystems and to establish and restore the environmental flow and the natural dynamics of erosion and sedimentation. In these riparian ecosystems are foreseen forestry operations which improve the conservation of the habitats because also the continuity of the stands can have influence on the capacity of the expansion of diseases and pests.

On the other hand, the creation of mosaics is considered as a measure to prevent forest fires (Serrada *et al. 2008*). Concretely, the measure is focused on favouring the wooded stands of riparian species of flow flammability as poplar, willow, silver birch, ash, etc. which are on the bank of the river and in streams. Therefore, through this action the accumulation of scrub and reeds are avoided in the riparian vegetation.

2. 9340: Quercus ilex and Quercus rotundifolia forests

Table 6. Description of the habitat 9340. Source: Interpretation manual of European Union Habitats (European Commission, 2013) and the Manual Habitat of Spain (Ministry of Agriculture, Food and Environment).

Habitat	Description
9340	Mediterranean sclerophyllous forests dominated by holm-oak (*Quercus rotundifolia = Q. ilex subsp. Ballota*). There are four sub-types: • Meso-Mediterranean holm-oak forests • Supra-Mediterranean holm-oak forests • Aquitanian holm-oak woodland • *Quercus rotundifolia* woodland. The species characteristics of the undergrowth are *Arbutus unedo, Phillyrea angustifolia, Pistacia terebinthus, Rubia peregrine, Jasminum fruticans, Smilax aspera, Lonicera etrusca, L. implexa.*

The *Quercus ilex* subsp. *ballota* is a species with an incredible ecological valence. Among the broadleaved trees, the holm-oak occupies the 85% of the area represented by these trees. In the interior area of Valencia, it is rare to have a pure oak-grove, even if the species commonly appears. Nevertheless, it is observed that most of the wooded stands of holm-oak are pure or with very few secondary species. Only the 22% of the surface is represented by the composition of holm-oak with mixed stands and half of this surface is represented by stands of holm-oak and pine trees.

Natura 2000 Habitat Code	9340: *Quercus ilex* and *Quercus rotundifolia* forests													
Action	**Silvicultural and harvesting practices (high forest and coppice)**												**Post harvesting management**	
	Thinning/Shelterwood cutting/Salvage cutting					Crown pruning		Clear cutting						
THREATS	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	**INDICATORS**
direct removal of natural vegetation	II	I			I	I	I							vegetation sampling life-form spectrum / diversity indices
alteration of floristic composition	II	I			I	I	I							
reduction of protected and endemic species population	II	I			I	I	I							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	II	I			I	I	I							presence of natural regeneration
damage to natural regeneration	II	I			I	I	I							presence of damages to natural regeneration

In order to improve the forest stand, it is necessary to make the conversion from coppice forest to high forest through the coppice with standards when the habitat forms a shrub stratum. Thus, the habitat is improved. Moreover, these practices should be applied in the young stands of oak-groves which have a high risk of forest fires for its high combustibility.

The selection of the most suitable trees is required to allow the sexual regeneration of these forests and their generational change, guaranteeing their natural evolution and their future conversion to high forest. Furthermore, in the forest stands of *Pinus halepensis* with presence of *Quercus rotundifolia,* the development of the stands of *Quercus rotundifolia* should be improved through silviculture treatments, enhancing the state of conservation of these habitats (9340).

The forest use and the silvicultural treatments are made in order to reduce the risk of forest fires, as well as the presence of diseases and pests, being compatibles with the conservation of the habitats and species present in the area.

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

The forest operations are addressed to improve the forest stand and to enhance the natural regeneration, while the biodiversity is preserving. This habitat corresponds to the pilot area studied in Enguera and there is also other relevant habitats represented as 5210, 5330 and 6620*. Therefore, the objective is conserving the forest through the application of sustainable forestry practices and consequently, reducing the risk of forest fires. Finally, the regular and dense stands have to avoid the continuity of the stand, reducing the combustibility.

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

In the following matrices the assessment of the potential impacts on habitats is focused on the animal communities. The habitats are those studied previously:

- 92A0: *Salix alba* and *Populus alba* galleries

- 92D0: Southern riparian galleries and thickets (Nerio-Tamaricetea and Securinegion tinctoriae)
- 9340: *Quercus ilex* and *Quercus rotundifolia* forests
- 9540 Mediterranean pine forests with endemic Mesogean pines

The objective of the forest interventions is to reduce the risk of natural disasters, at the same time that the biodiversity is preserved.

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.

In general terms:

- The storing by winch has less impact than by raceways.
- The yarding operation by raceways has more impact than by tractor.
- Clear cutting is considered as the last step of the shelterwood method.
- The reversibility is study according to different periods of time (Short term: 1-5 years; medium term: 5-10 years and long term: > 10 years).
- The reversibility of the introduction of synanthropic or alien species will not be estimated because of its extreme complexity.

In general terms by habitats:

- 9340: In this habitat, only felling operations are done by group shelterwood cutting. Normally, the forest operations which are done in these habitats are pruning's with chain saw. Only it is used a small tractor for the logging.
- 9540: Yarding operation of crown pruning is not evaluated in habitat 9540 because it is a non-implemented operation in our study area.

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

Forest categories included in the "Habitats Directive"	92A0: *Salix alba* and *Populus alba* galleries 92D0: Southern riparian galleries and thicketes (Nerio-Tamaricetea and Securinegion tinctoriae)													
Action	**Silvicultural and harvesting practices (high forest and coppice)**												**Post harvesting management**	
	Thinning/Shelterwood cutting/Salvage cutting					Crown pruning		Clear cutting						
THREATS	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	**INDICATORS**
Noise	II	I	II	II	I	II	I	II	I	II	II	I	II	Birds (Non-Strigiformes)
Soil compaction	I	I	II	II	I	I	II	II	II	II	II	II	I	Ground-active beetles
Decrease of habitat suitability	I	I	I	I	I	I	I	II	I	II	II	I		Xylobiont and Saproxylic beetles; Birds (Strigiformes)
Decrease of the availability of trophic resources	I	I	I	I	I	I	I	II	I	II	II	I		Xylobiont beetles; Birds (non-Strigiformes)
Casualties	II	I	I	I	I	II	I	II	I	II	II	I		Monitoring of carcasses

Through the forest actions the habitat 92D0 is enhanced and among the secondary objectives of management of the riparian areas, their use as wildlife corridor is considered, implementing compatible actions with the presence of the typical fauna species of these habitats.

Forest categories included in the "Habitats Directive"	9340: *Quercus ilex* and *Quercus rotundifolia* forests												
Action	**Silvicultural and harvesting practices (high forest and coppice)**											**Post harvesting management**	
	Thinning/Shelterwood cutting/Salvage cutting					Crown pruning		Clear cutting					
THREATS	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	**INDICATORS**
Noise	II	I			I	II	I						I	Birds (Non-Strigiformes)
Soil compaction	I	I			II	I	II						I	Ground-active beetles
Decrease of habitat suitability	II	II			II	II	I							Xylobiont and Saproxylic beetles; Birds (Strigiformes)
Decrease of the availability of trophic resources	II	I			I	II	I							Xylobiont beetles; Birds (non-Strigiformes)
Casualties	II	I			I	II	I							Monitoring of carcasses

The sustainable management of the forest stands is focused on improving the current conservation state of the habitats and species of community interest. The coppice with standards and thinning systems are carried out in order to enhance the conservation of the habitat 9340 when forms a shrub stratum. On the other hand, in the stands of *Pinus halepensis* with presence of *Quercus rotundifolia*, the development of the holm-oaks should be enhanced through silvicultural treatments.

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

The forest operations are directed to preserve the conservation of the habitats and species, in addition to apply a preventive silviculture to reduce the risk of forest fires, as well as the presence of pests (e.g. *Thaumetopoea pityocampa*) and diseases as the pine bark beetles (e.g. *Tomicus* spp.). Other environmental services (water and soil quality, landscape, etc.) are improved due to the application of forestry operations, enhancing the habitat suitability.

1.1.2 Abiotic components

The information of the abiotic components corresponds to the Navalón forest V-074:

Geology: The geology of the Navalón forest V-074 is represented by the Mesozoic-Cretaceous System. The Cretaceous is the Mesozoic period that represents the greatest extension in the Iberian Peninsula.

Geomorphology: Navalón V-074 is a heterogeneous forest regarding the existing slopes. Most of its surface (50%) has slopes less than 10%. The altitude is distributed approximately between 750-1050 meters above sea level (m a.s.l.). Concretely, the slopes are classified as follows:

Table 7. Surface by slopes in V-074 forest (Source: LIFE+ Project: Bioenergy and Fire prevention)

Slope	Work	Surface (ha)	Surface (%)
S<10%	Work without apparent impediment	2.186,91	49,61
10%<S<30%	Work with special machinery	1.234,98	28,02
30%<S<60%	Only manual work	915,47	20,77
S>60%	No works can be executed	70,58	1,60
	Total	4.407,94	100

Lithology: more than 95% of the territory of the Valencian Community is formed by sedimentary rocks. Specifically, the lithology of the V-074 forest is mostly SC/9 Dolomites, SC/5-10 Calcareous and marls.

Climatology: the meso-mediterranean zone is the climate dominated in Enguera. Therefore, the vegetation is adapted to summer drought and to fire. Frosts are not a limiting factor, being scarce.

Edaphology: the Navalón V-074 has the following description:
Entisols (Order), Orthents (Suborder) and Xerorthent (Group). Concretely, the Xerorthent are entisoles whose suborder belongs to the Orthets in a regime of xeric moisture.

Hydrogeological unit, aquifer systems and catchments: hydrogeological unit 8.28 Caroche Sur, this unit belongs to the Jucar hydrographic basin. The Navalón forest is in the Caroche Sur aquifer. In the forest are located 6 aquifers. Specifically, in the

NE, N and in the centre of the forest, South, as well as located diagonally in the middle of the forest.

On the other hand, with regard to the **harmful abiotic agents**, it is noted the influence of:

- Forest fires: the forest fires represent the main abiotic harmful agent. This factor has to be controlled through a preventive silviculture and an adequate planning both in the management forest plan and in the sectorial forest fires prevention plans. Concretely, in Enguera from 1986 to 2015, the total forest surface affected by forest fires is 6.234,69 ha (Estadística de incendios forestales en la Comunitat Valenciana (1986-2015), Conselleria d'Agricultura, Medi Ambient, Canvi Climàtic i Desenvolupament rural).
- Drought: there is a relevant abiotic agent due to the damage that generates, as well as the vulnerability to pests and diseases. Alhough the forest stands of *Pinus halepensis* are adapted to the drought when that agent becomes very intense, there is vegetative decay, decreases in growth and vulnerability to pests.
- Frosts and snowfalls: even though these are not significant in the study area, these factors can occasionally cause damage in the forest stands.

Impact assessment on 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 forest operations are directed to reduce mainly the risk of natural disasters (essentially forest fires) and to preserve the forest stand - there is neither management without conservation nor conservation without management. The sustainable and integral forest management has benefits in the forest stands, improving the environmental services in the Mediterranean ecosystems. For this reason, it is very important to assess the stand in different periods of time (short, medium and long term) through the application of quantitative indicators in order to have representative data to study the evolution of the forest biomass and of the environmental services. At this stage, a previous assessment of the potential impacts is implemented:

In general terms:

- The storing by winch has less impact than by raceways.
- The yarding operation by raceways has more impact than by tractor.
- Clear cutting is considered as the last step of the shelterwood method.
- The reversibility is study according to different periods of time (Short term: 1-5 years; medium term: 5-10 years and long term: > 10 years).
- The reversibility of the introduction of synanthropic or alien species will not be estimated because of its extreme complexity.

In general terms by habitats:

- 9340: In this habitat, only felling operations are done by group shelterwood cutting. Normally, the forest operations which are done in these habitats are pruning's with chain saw. Only it is used a small tractor for the logging.
- 9540: Yarding operation of crown pruning is not evaluated in habitat 9540 because it is a non-implemented operation in our study area.

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

Natura 2000 Habitat Code:	92A0: *Salix alba* and *Populus alba* galleries 92D0: Southern riparian galleries and thickets (*Nerio-Tamaricetea* and *Securinegion tinctoriae*)												
Action	**Silvicultural and harvesting practices (high forest and coppice)**											**Post harvesting management**	
	Thinning/Shelterwood cutting/Salvage cutting					Crown pruning		Clear cutting					
THREATS	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	**INDICATORS**
Reduction of deadwood								II	II	II	II	II		Deadwood
Reduction of litter cover							I	II	II	III	III	II		Litter
Reduction of litter height							I	II	II	III	III	II		
Reduction of SOC								II	II	III	III	II		Soil Organic Carbon (SOC)
Presence of Rill erosion														Erosion
Presence of Interrill erosion														
Presence of Gully erosion														
Increase of Soil Bulk Density							I	II	II	III	III	II		Soil Bulk Density
Fuel model features								II	II	II	II	II		Fire risk

The selective forest operation with protective function proposed to manage these habitats (92A0 and 92D0) is focused on improving the vitality of the stand and on reducing the risk of natural disasters. Moreover, other silviculture treatments are also beneficial to reduce these risks and to favour riparian species with flow flammability.

These habitats in the study area are associated to be in surfaces with no slopes. Therefore, there is usually no erosion risk and consequently, the assessment of the magnitude of the impact is not carried out. The most impact is focused on the soil compaction. Moreover, as the thinning treatments are protective and limited, there is no reason to evaluate the first step of the shelterwood method. Nevertheless, it is assessed the pruning and the final phase of the shelterwood method as the normal harvesting practices with *Populus* spp.

Natura 2000 Habitat Code:	9340: *Quercus ilex* and *Quercus rotundifolia* forests												
Action	**Silvicultural and harvesting practices (high forest and coppice)**											**Post harvesting management**	
	Thinning/Shelterwood cutting/Salvage cutting					Crown pruning		Clear cutting					
THREATS	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	**INDICATORS**
Reduction of deadwood	I	I			I									Deadwood
Reduction of litter cover	I	I			I		I							Litter
Reduction of litter height	I	I			I		I							
Reduction of SOC	I	I			I		I							Soil Organic Carbon (SOC)
Presence of Rill erosion	I	I			I		I							Erosion
Presence of Interrill erosion	I	I			I		I							
Presence of Gully erosion	I	I			I		I							
Increase of Soil Bulk Density	I	I			I	I	I							Soil Bulk Density
Fuel model features	I	I			I	I	I							Fire risk

The forest operations are directed to the conversion from coppice forest to high forest and to select the best trees to allow the sexual regeneration and guarantee its natural evolution. Furthermore, the forest practices allow the reduction of the potential risk of forest fires and the evolution of the forest stands through the application of a preventive silviculture (e.g. reduction of the amount of biomass). Concretely, it is expected to:

- Make the stand more resilient to natural disasters.
- Use machinery with low forest impact according to the abiotic conditions.
- Integrate the measures of Natura 2000 in order to preserve the biodiversity.
- Valorise the environmental services that forests provide.

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

The forest operations are addressed to implement a multifunctional and sustainable management in order to:

- Reduce the potential risk of forest fires and to allow the evolution of the forest stands through the application of a preventive silviculture (e.g. reduction of the amount of biomass).
- Make the stand more resilient to natural disasters.
- Use machinery with low forest impact according to the abiotic conditions.
- Integrate the measures of Natura 2000 in order to preserve the biodiversity.
- Valorise the environmental services which are provided by forests.

1.1.3 Social, economic and demographic components and ecosystem services.

The social, economic and demographic data is studied according to the protected municipalities included in the zone of the management regulation "Macizo del Caroig", which are the following:

Protected municipalities (33):

A: Alborache, Anna, Alzira and Ayora
B: Bicorp, Bolbaite and Buñol
C: Catadau, Chella, Cofrentes and Cortes de Pallás
D: Dos Aguas
E: Enguera
G: Guadassuar
J: Jalance, Jarafuel
L: La Font de la Figuera and Llombai
M: Macastre, Millares, Moixent and Montroy
N: Navarrés
Q: Quesa
R: Real de Montroy and Requena
S: Siete Aguas
T: Teresa de Cofrentes, Tous and Turís
V: Vallada
Y: Yátova
Z: Zarra

The Valencian province has a surface of 10.763 km^2 and the protected municipalities represents 37,02% (3.984,26 km^2) regarding the Valencian surface. The population of the protected municipalities are represented by 140.162 inhabitants; 5,56% of the total inhabitants of the province of Valencia (2.519.036 inhabitants, (PEGV, 2016). Therefore, the population density in the protected municipalities is 35,18 inhabitants/km^2. The most representative population according to the structure, it is the population aged from 15 to 64 years old (65,28%), followed by whose aged 65 years and over (20,47%) and under 15 years (14,25%). Concerning the educational level just over half of the population has a second and third degree and only 12,74% has third degree. The mean value per capita income for resident families close to the management regulation "Macizo del Caroig" is 11,70

thousand of euros. The unemployment rate in these municipalities is 7,82% (Province of Valencia: 7,66%).

With regard to the socio-economic components, they are studied according to different steps of the supply chain. Concretely the study is separated in four actions (biomass, harvesting and extraction -first group; processing and marketing of wood – second group; bioenergy production and distribution – third group and satellite activities- fourth group) in order to analyse different indicators. In this case, it is noted that not all the protected municipalities have economic activity in the sector. Hence, the socio-economic analysis is made by the representation of 78,8% of the protected municipalities. Furthermore, it could not possible to analyse all the indicators due to the lack of information. Concretely, the indicators which are analysed are: total firms; legal form; net income; labour productivity and the workforce. It is noted that the most firms are involved in the satellite activities (153) while just 14 are in the first step of the supply chain – biomass harvesting and extraction and 81 in its second step. The number of total firms analysed amount to 296. In regard to the legal form, the majority of the firms are classified as companies. Concretely, the mean percentage of the companies analysed is 93,08% instead of being entities.

Respecting the net income, the labour productivity and the workforce, it is observed that there is not available data of all the firms, being the information not representative of the total firms assessed. Nevertheless, some conclusions can be obtained:

- The total incomes are 125.369,81 thousand €, being the firms involved in the second group the most representatives with 85.667,2 thousand € (68,33% of the total firms involved), follow by the second group which represents 20,93% of the total firms.
- The labour productive is higher in the firms involved in bioenergy production and distribution, followed by the second group.
- The number of workers amount to 1.162 employers, being the maximum value in the second group (541), follow by the fourth group (512 workers).

On the other hand, and regarding to the use of biomass in the Navalón forest V-074, it is observed that the forest sustainable practices are implemented to favour the conservation and the improvement of the environmental services as:

- Carbon sequestration.
- Prevent erosion and desertification.
- Forests are filters and biological purifier for many atmospheric pollutants.
- Forests are habitats of high quality for many species, allowing the host of a considerable biodiversity.
- The vegetation has a laminating effect on the avenues and favours the infiltration of water in the underground.

Concretely and concerning the stock of CO_2 analysed in the Forest Management Plan of Enguera, the Navalón forest has 40.874,23 ha of the total carbon stored; 19.755,55 Kg of the wood and 6.995,28 of the bark.

Following the socio-demografic and socio-economic analysis:

Socio-Demographic Indicators	Value Before operations				
	Unit of measure	data	Year	Source	territorial reference
Population[1]	number of inhabitants	140.162	2014	INE	Protected municipalities
Population structure	% of population aged under 15 years	14,25	2017	INE	Protected municipalities
	% of population aged 15-64 years	65,28			
	% population aged 65 years and over	20,47			
Per capita family income [2]	mean value of per capita income for resident families close to the protected areas	11,70	2013	Portal estadístico de la Generalitat Valenciana.	Protected municipalities
Unemployment rate[3]	% of persons in work age who are unemployed	7,82 %	2017	SERVEF	Protected municipalities
Educational level	% of persons who have an upper secondary degree	56,04[4]% (12,74[5]%)	2011	INE. Conselleria de Economía, Industria, Turismo y Empleo	Protected municipalities
Energetic self-sufficiency	% of consumed energy provided by the biomass plant on the total energy consumed	-	-	-	-

[1] Statistics of the Continuous Register by January 1, 2017. Data by municipalities.
[2] Units: thousands of euros per capita. Indicator of the available family income for subregional areas. Indicator of available family income by municipalities. Provisional data.
[3] Territorial data base Banco de Datos Territorial. Registered labour movement. Unemployed applicants according to the sector of economic activity. (CNAE-2009).
[4,5] Second and third degree (4) and third degree (5). There is no available information for 15 municipalities - Population of 16 or more years in family dwellings according to the level of education and sex. Information is only offered for municipalities with more than 2.000 inhabitants. Additionally, information is not provided for those cells obtained with less than 10 records without raising.
INE: Instituto Nacional de Estadística – Spanish Statistical Office.
SERVEF: Servicio Valenciano de Empleo y Formación – Valencian service employment and training

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	14	2018	COCINSV	Protected municipalities
	firms involved in processing and marketing of wood	Number of firms	81	2018	COCINSV	Protected municipalities
	firms involved in bioenergy production and distribution	Number of firms	48	2018	COCINSV	Protected municipalities
	firms involved in satellite activities	Number of firms	153	2018	COCINSV	Protected municipalities
Legal form**[1]	firms involved in the biomass harvesting and extraction	% of individual firms, companies, and cooperatives	Companies: 92,86% Entities: 7,14%	2018	COCINSV	Protected municipalities
	firms involved in processing and marketing of wood	% of individual firms, companies, and cooperatives	Companies: 96,30% Entities: 3,70%	2018	COCINSV	Protected municipalities
	firms involved in bioenergy production and distribution	% of individual firms, companies, and cooperatives	Companies: 91,67% Entities: 8,33%	2018	COCINSV	Protected municipalities
	firms involved in satellite activities	% of individual firms, companies, and cooperatives	Companies: 91,50% Entities: 8,50 %	2018	COCINSV	Protected municipalities
Net income**[2]	firms involved in the biomass harvesting and extraction	mean value of net income	7.579,40 (data referred to 11 firms)	2018	COCINSV	Protected municipalities
	firms involved in processing and marketing of wood	mean value of net income	85.667,2 (data referred to 65 firms)	2018	COCINSV	Protected municipalities
	firms involved in bioenergy production and distribution	mean value of net income	5.877,73 (data referred to 23 firms)	2018	COCINSV	Protected municipalities
	firms involved in satellite activities	mean value of net income	26.245,48 (data referred to 68 firms)	2018	COCINSV	Protected municipalities
Labour Productivity (LP)**[3]	firms involved in the biomass harvesting and extraction	Mean value of LP	69.87 (data referred to 11 firms)	2018	COCINSV	Protected municipalities
	firms involved in processing and marketing of wood	Mean value of LP	151,12 (data referred to 62 firms)	2018	COCINSV	Protected municipalities

	firms involved in bioenergy production and distribution	Mean value of LP	213,83 (data referred to 8 firms)	2018	COCINSV	Protected municipalities
	firms involved in satellite activities	Mean value of LP	86,61 (data referred to 66 firms)	2018	COCINSV	Protected municipalities
Workforce**	**firms involved in the biomass harvesting and extraction**	Number of workers	89 (data referred to 11 firms)	2018	COCINSV	Protected municipalities
	firms involved in processing and marketing of wood	Number of workers	541 (data referred to 62 firms)	2018	COCINSV	Protected municipalities
	firms involved in bioenergy production and distribution	Number of workers	20 (data referred to 8 firms)	2018	COCINSV	Protected municipalities
	firms involved in satellite activities	Number of workers	512 (data referred to 62 firms)	2018	COCINSV	Protected 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				

*Specify 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 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.

*** 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.

[1] The legal form is analysed according to the tax identification number. It is classified by company or entity.
[2] Operating income thousand EUR€
[3] Formula: Operating income thousand EUR€/n° of employees. Only companies or entities which have available data have been considered.

COCINSV: Official Chamber of Commerce, Industry, Services and Shipping of Valencia - Cámara Oficial de Comercio, Industria, Servicios y Navegación de València.

Finally, as the study area is in Navalón forest V-074 which is in Enguera, the demographic and economic components of this municipality is analysed in detail.

In the following graphic is showed the variation of the population from 1996 to 2017:

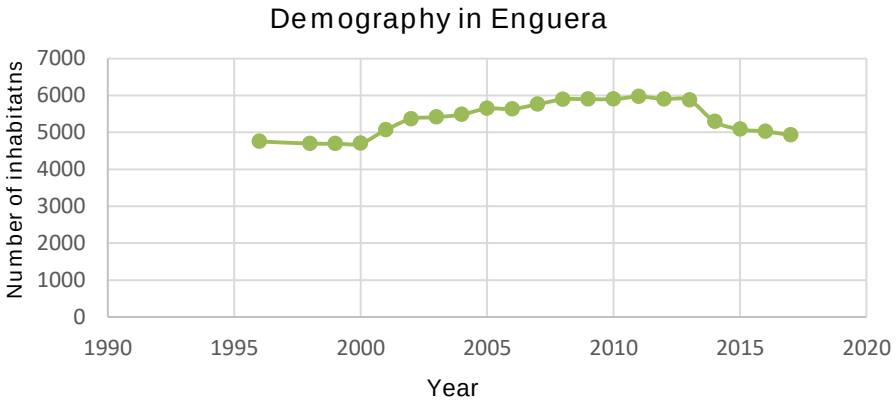

Figure 6. Demography in Enguera (Source: Argos)

The demographic trend was increasing till 2011-2012. From 2012 (5.903 inhabitants) till 2017 (4.926 inhabitants), the population has decreased, concretely by 20% in this last period.

Family income available per capita: In Enguera the family income available per capita is 11.288 euro (2013); the amount is 14.595 euro (2013) in the Valencia capital.

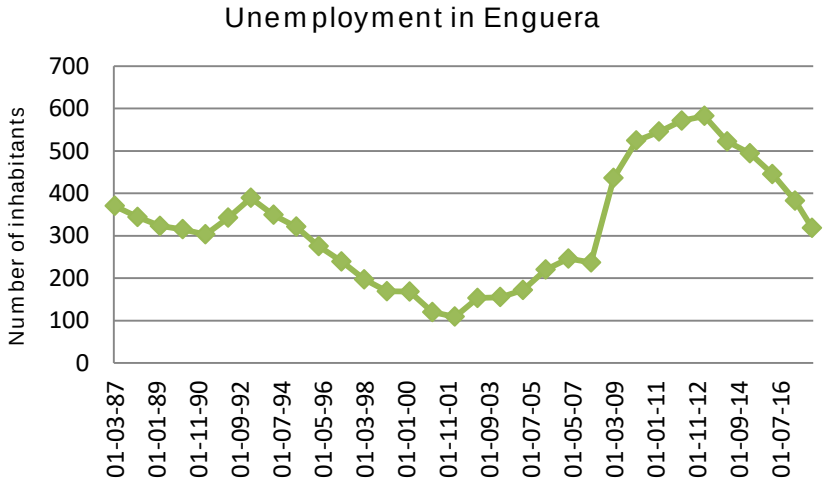

Figure 7. Unemployment in Enguera (31/03/87-31/12/17). Source: Argos

Finally, regarding the number of companies, the services sector predominates of the industrial and very close of the construction. Concerning the employment, it has increased from 2002 to 2013, after 2013 the unemployment has been increasing till now. The municipality has experimented a population decline since 2013. It is noted that by 12,18% of the total inhabitants in Enguera are foreign. On the other hand, the forest use represents 16% of the total uses.

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