



Ecosystem Extent and Condition accounts in Spain

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Outline



I. Spatial units and extent accounts

- a. Spanish national Ecosystem Types classification used for ecosystem extend accounts
- b. Main testing results for cross walking with IUCN and/or WES
- c. Identify and discuss the main bottlenecks.

II. Condition accounts

- a. Methodology based on the 3 stages: (1) reporting variables, (2) reference levels, (3) aggregation
- b. Example on Forest condition accounts in Spain
- c. Main gaps and needs to improve ecosystem condition

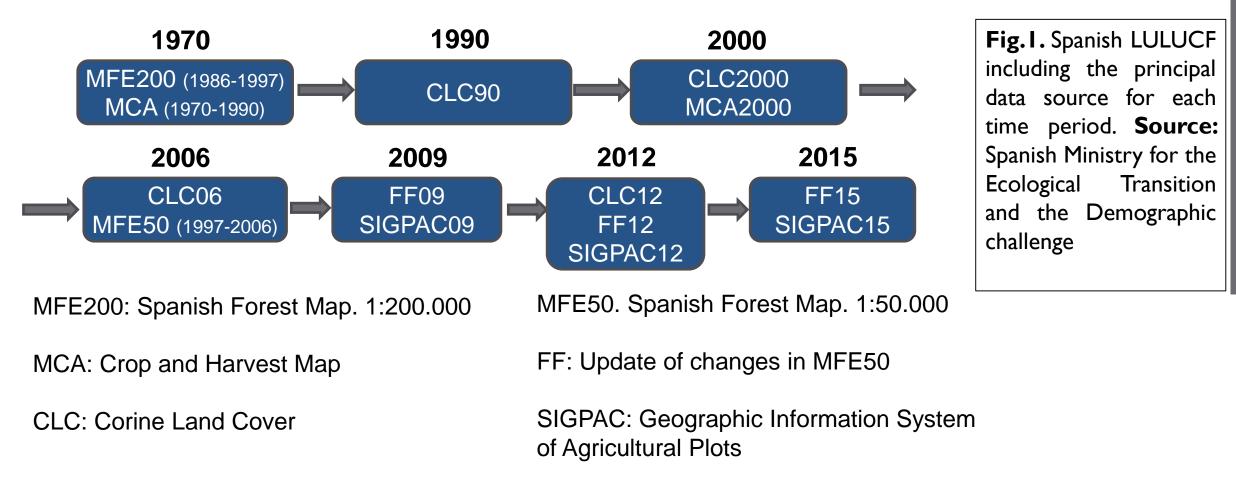
Spanish ecosystem types classification



3

Transition

In Spain we are using LULUCF (Land Use, Land Use Change and Forestry) a multisource dataset for ecosystem accounting. LULUCF provide a high spatial resolution (25 meters per pixel) information for a significant time period (1970-2015).



Spanish ecosystem types classification



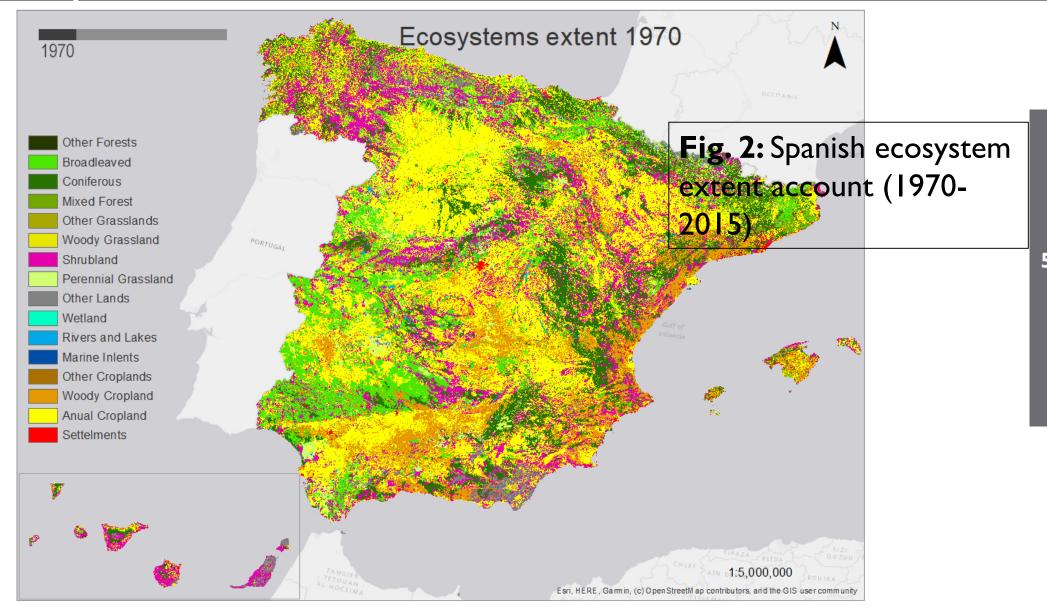
LULUCF (level 2) divided the territory in 16 categories as ecosystem types. MAES (level 1) typology distinguishes 12 main ecosystem types, which is a European reference classification with cross linkages to the habitat types listed in Annex I of the <u>Habitats</u> Directive.

LULUCF_level_I	id_l	MAES_level_l	LULUCF_level_2	id_2
			Broadleaved	110
Forest land	100	Forest and woodland	Coniferous	120
FOREST IANG	100	Forest and woodland	Mixed	130
			Other Forests	100
		Grassland	Woodland	210
Grassland	200	Heathland and shrub	Shrubland	220
Grassialiu	200	Grassland	Perennial	230
		Grassianu	Other Grassland	200
Other Land	400	Sparsely vegetated land	Other Land	400
		Inlands wetlands	Wetlands and Peatlands	500
Wetlands	500	Rivers and lakes	Inland	510
		Marine inlets	Seaside	520
			Perennial woody crops	
Cropland	700	Cropland	Annual crops	720
			Other Crops	700
Settlements	800	Urban	Settlements	800

Table I. Crosswalksbetween LULUCFand MAES ecosystemclassification



Ecosystem Extend Accounts



Testing results for cross walking LULUCF with IUCN



Major type	map unit#	List of national or regional units	Functional group	T2.1 Boreal and montane	needle-leaved forest and	woodland	T2.2 Temperate deciduous forests and shrublands		T4.4 Temperate wooded savannas	T4.5 Temperate grasslands	T7.1 Croplands	T7.2 Sown pastures and old	fields	T7.3 Plantations	T7.4 Urban and infrastructure	Tally check	max	#candida te EFGs
Forest and woodland	110	Broadleaved						1								1	1	1
Forest and woodland	120	Coniferous				1										1	1	1
Forest and woodland	130	Mixed			(0.5	0.	5								1	0.5	2
Forest and woodland	100	Other Forests												1		1	1	1
Grassland	210	Grassland Woodland							1							1	1	1
Grassland	220	Shrubland														C	C	0
Grassland	230	Grassland Perennial								1						1	1	1
Grassland	200	Other Grassland											1			1	1	1
Other Land	400	Other Land														1	0.2	
Wetlands and Peatlands	500/51	Wetlands and Peatlands														1	0.2	
Wetlands and Peatlands	521/52	Water Inland														1	0.125	
Wetlands and Peatlands	522/52	Water Seaside														1	0.195	6
Cropland	710	Perennial woody crops									1					1	1	1
Cropland	720	Annual crops									1					1	1	1
Cropland	700	Other Crops									1					1	1	1
Settlements	800	Settlements													1	1	1	1

Table 2. Results of the cross walking between LULUCF and IUCN ecosystem types classification

Testing results for cross walking LULUCF with IUCN



Some bottlenecks

 LULUCF classification do not include all temperature regimen (e.g. tropical, subtropical...) that in IUCN its crucial for natural and seminatural forest / shrublands ecosystems.

 The classification in Agroecosystems is more detailed in LULUCF than in IUCN. These classifications are very important divisions in the context of Spain (Mediterranean).





Testing results for cross walking with USGS-ESRI work ecosystem



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Fig. 3. Spanish map with the 190 ecosystems types identified using the USGS-ESRI word ecosystem

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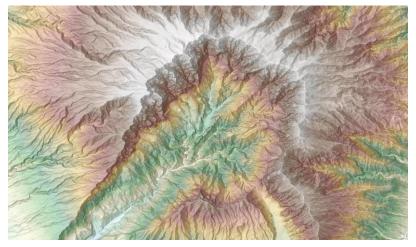
Testing results for cross walking with USGS-ESRI work ecosystem



Some bottlenecks

 We can improve the suitability of this classification by including more local information as local landform classification based on a digital terrain model developed for Spanish Geographic Institute.

2. We identify an important gap in water ecosystem as wetlands.



Source: Spain's high-resolution elevation in Esri World Elevation Services



Condition account. Method



I. Indicators

Selection of national indicator following the hierarchical classification SEEA EEA ecosystem condition typology (SECT).

				SITE	es with mini
1.	NDVI	8.	NDWI		ow two crit
2.	Canopy fraction	9.	SOC	_	
3.	Age of the site	10.	SR. Birds	•	We use the protected
4.	GPP	11.	SR. Reptiles		UICN as le
5.	NPP	12.	SR. Mammals		of protecte
6.	MSPA	13.	SR. Amphibious	•	We only in
7.	Forest area	14.	SR.Vulnerable		which not
	density (FAD)		Vascular plants		since 1970

2. Reference

To ensure the consistency for different variables describing the same ET.

We used the reference based on sites with minimum disturbance follow two criteria:

We use the forest include in protected areas classify for UICN as level I, II, III or IV level of protected categories.

We only include the forests which not have cover change since 1970

3.Aggregation

Evaluate the distance between the indicators in the reference areas with the all of the forest by class and region through Euclidean distance weighted.

Then we have made a four categories condition index by ecosystem group and region from unfavorable to favorable condition.

Forest Condition Accounts Stage 0. Ecosystem typology

Based on LULUCF forests categories (3 types: broadleaved, coniferous, mixed) we use a national classification of forests to create a more detailed forest categories (48 forest types) to assess condition.We use the next categories:

Table 3. Main categories to define forest ecosystem types toassess condition accounts in Spain

LULUCF	NATIONAL INVENTORY	BIOGEOGRAFICAL REGIONS
Broadleaved	Evergreen	Alpine
Coniferous	Deciduous	Atlantic
Mixed	Natural	Mediterrenean
	No natural	Macaronesia



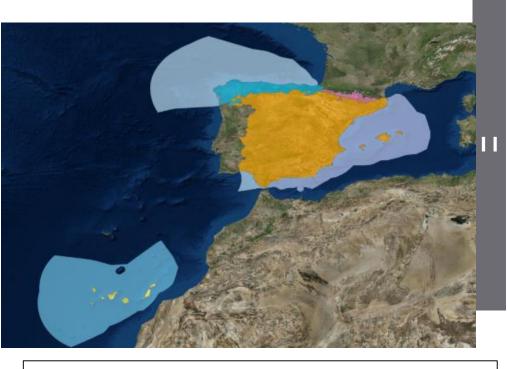


Fig. 3. Map of biogeographical regions in Spain. Source Ministry of Ecological Transition and Demographic Challenge

Forest Condition Accounts Stage 0. Ecosystem typology



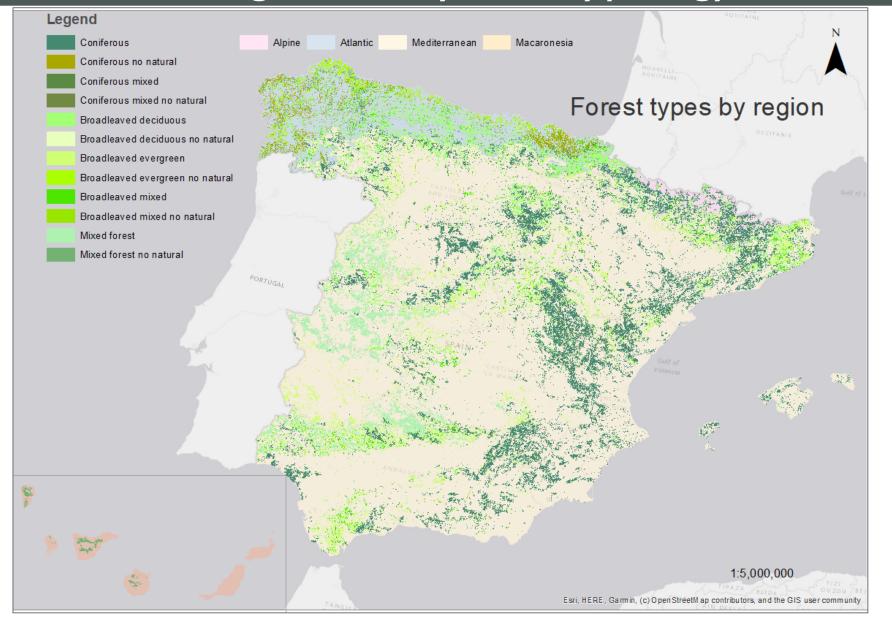


Fig. 4. Map of Spanish forest ecosystem types to assess condition accounts

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Forest Condition Accounts Stage I Reporting variables

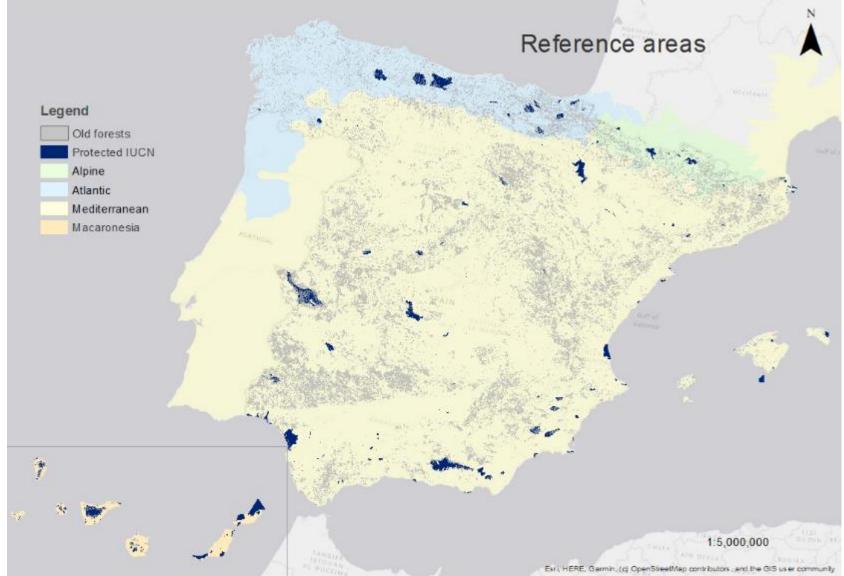


ECT groups	ECT classes	Weight	Indicator	Source	Resolution (m)
Abiotic	Physical state	0.5	NDWI	Landsat	30
ecosystem characteristics	Chemical state	0.5	SOC	JRC	1000
		0.3	SR. Birds	Ministry	10000
		0.15	SR. Reptiles	Ministry	10000
	Compositional	0.3	SR. Mammals	Ministry	10000
	state	0.15	SR. Anfiv.	Ministry	10000
Biotic ecosystem characteristics		0.1	SR.Vulnerable	Ministry	10000
			Vascular plants		
Characteristics	Structural state	0.2	NDVI	Landsat	30
		0.2		Landsat/Modi	30/500
			Tree canopy	S	
	Functional state	0.2	Age of site	LULUCF	25
	Tunctional state	0.2	GPP	Modis	500
		0.2	NPP	Modis	500
		0.5	Morphological	LULUCF	35
Landscape			Spatial Pattern		
Landscape characteristics			Analysis		
characteristics	characteristics	0.5	Forest Area	LULUCF	50
			Density		

Table 4. 14 nationalvariables selected toassess forest conditionand their characteristicsfollowing the hierarchicalclassification SEEA EEAecosystem conditiontypology (SECT).

Forest Condition Accounts Stage II Reference level





We used the reference based on the criteria of minimum disturbance:

- Protected areas classify by IUCN as level I, II, III or IV.
- Forests with not net change since 1970.

Fig. 5. Reference condition areas to assess forest condition accounts in Spain

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Forest Condition Accounts Stage 3 Aggregation



General idea: Evaluate the distance between the normalized variables in the reference areas with the all of the forest by class and region.

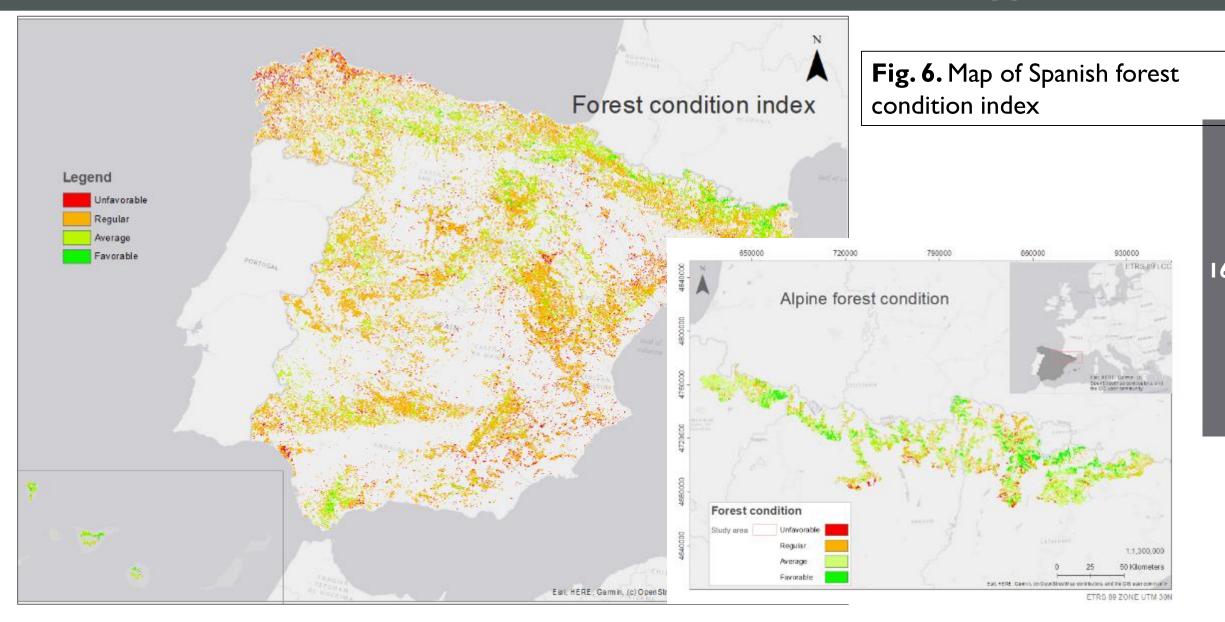
Calculation: Euclidean distance weighted (Equation 1). To aggregation proposes we used the average reference values of the reference areas by group and region.

$$Edw = \sqrt{\sum_{i}^{j} w_i (x_i - y_i)^2}$$
 Equation I

Creation of and ecosystem condition index. Results of the calculation were divided in four categorical quartiles (a. Unfavorable: less to 25%, b. Regular: 25-50%, c. Average: 50-75%; and d. Favorable: higher than 75%).

Forest Condition Accounts





Conclusion



- Exits enough sources of data available to develop extent and condition accounts at national level.
- The appropriateness to link existing land use data and ecosystem classifications need further analysis.
- The proposed international ecosystem classification (IUCN) need further development to be applicable at different levels (national, regional, local).
- The proposed methodologies to assess condition accounts are still under development and need to be validated. For example, a standard list of indicators and reference levels
- Aggregation methods are need it, but we still need more research to scientificaly relates condition accounts index with ecosystem state and trend.

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Thank you!

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Mapping & Assessment for Integrated ecosystem Accounting http://maiaportal.eu/