Principali attività di ricerca

- Sviluppo sostenibile, Analisi e valutazioni di sostenibilità, Economia ambientale e valutazioni ambientali; Valutazione della sostenibilità delle filiere agroalimentari. Economia circolare e sue applicazioni.

- Approfondimento della valutazione degli impatti ambientali di processi o prodotti secondo la logica dell'analisi del ciclo di vita, attraverso l'uso del metodo LCA (Life Cycle Assessment) e sue applicazioni in differenti ambiti (Es. sistemi agricoli e agroalimentari, sistemi produttivi zootecnici, prodotti per la bioedilizia, bioplastiche, riutilizzo di scarti agricoli e alimentari)

- Approfondimento delle valutazioni ambientali e di sostenibilità multicriteriali, anche in ambito geografico, che combinano analisi multicriteriali con l'uso di GIS (Geographic Information System).

Principali attività di ricerca

- Modelli di governance per la valutazione della sostenibilità territoriale delle aree Natura 2000.
- Servizi ecosistemici e pagamenti per servizi ecosistemici (PES).
- Approfondimento dei concetti di Impronta Ecologica, Impronta del Carbonio e Impronta Idrica.
- **Valutazioni di sostenibilità in relazione agli SDGs – Sustainable Development Goals di Agenda 2030, e applicazioni di casi studio a livello nazionale, regionale, e subregionale.**
- **Modelli per la valutazione della sostenibilità a livello territoriale (all'interno del gruppo di lavoro che ha implementato il modello SSAM: Spatial Sustainability Assessment Model).**

International Conference on Sustainable Development

A.D. 1308 unipg

DEPARTMENT OF AGRICULTURAL, FOOD AND ENVIRONMENTAL SCIENCES

Evaluating progress in achieving the SDGs of autonomous communities in Spain: a time frame analysis

L. Paolotti, I. Melendez Pastor, E. Ricciolini, L. Rocchi, A.M. Agulló Torres, A. Boggia

Department of Agricultural, Food and Environmental Sciences, University of Perugia (IT)

1th Annual International Conference on Sustainable Development (ICSD)
"The Midpoint of the SDGs: Global and Local Progress & Challenges"

September 18 – 20, 2023

SUMMARY

Introduction

The UN Agenda 2030 is the current reference point for achieving sustainability in policies and territorial planning at international level

- Ambitious, transformative action plan aimed to “achieving **sustainable development** in its three dimensions - economic, social and environmental” (UN General Assembly, 2015).

- Unfulfilled issues related to extreme poverty, inequality and social injustice, and the protection of the environment by 2030

Introduction

Several studies have been performed at **national level**, performing analysis within a specific country, or making comparisons in terms of SDGs among different countries.

A great attention in the literature has given to the **European context** in particular, thanks to its leading role in the application of the Agenda

→ BUT: ALSO SUBNATIONAL LEVEL VERY IMPORTANT

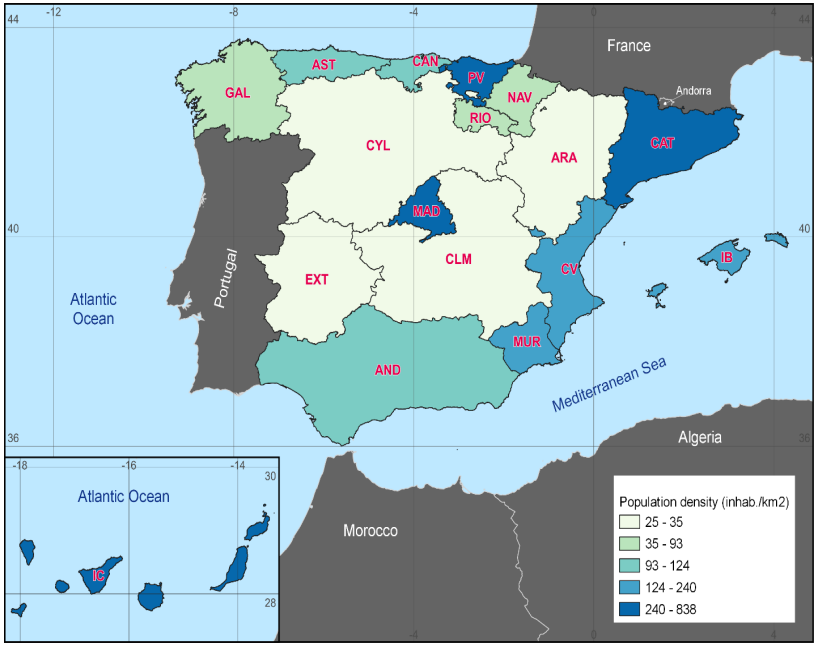
Sustainable development is considered achievable if it originates on the local level

Objective of the study

The objective of this work is to carry out **a sub-national assessment of the Agenda 2030** (level: Autonomous Communities in Spain), by means of an already tested model, found very suitable for territorial sustainability assessment

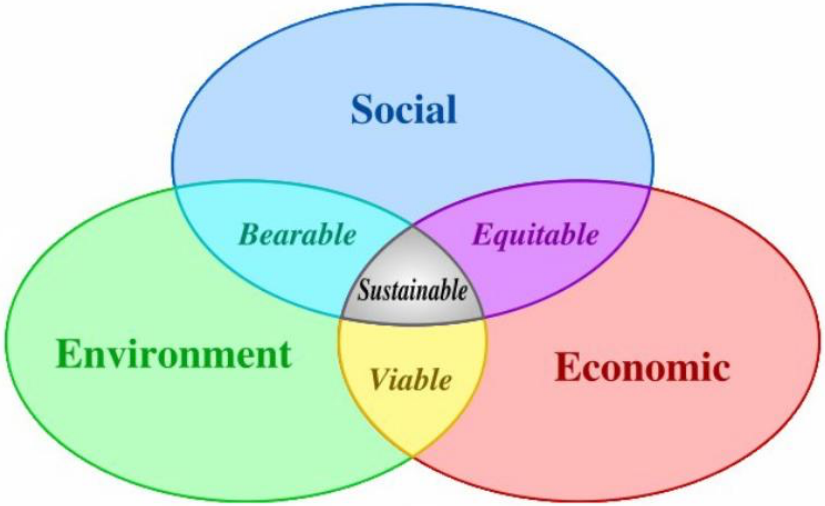
Systems at a local level must be investigated in order to have effective and realistic evaluations of specific territorial contexts, and to determine sound planning actions

Area of study



Methodology: MCDA

SUSTAINABILITY: MULTIDIMENSIONAL CONCEPT



The assessment process is complex, as it involves all dimensions of sustainability. It should be based on a series of indicators that must be aggregated and made comparable through the construction of composite indicators

Multi-Criteria Decision Analysis (MCDA) is one of the most appropriate tools for sustainability assessment

(Several alternatives evaluated by means of multiple criteria)

PROBLEM TO SOLVE → **Different CRITERIA** which describe a set of **ALTERNATIVES,** and which can be weigthed differently.

	Alternative A1	Alternative A2	…	Alternative An
Criterion 1	V_{11}	V_{21}	…	V_{n1}
Criterion 2	V_{12}	V_{22}	…	V_{n2}
…	…			
Criterion k	V_{1k}	V_{2k}	…	V_{nk}

MCDA methods differ for

- Criteria to be considered (qualitative, quantitative, both) → **NORMALIZATION**
- **WEIGHTING PHASE**
- **AGGREGATION** of criteria (compensation or not)
- Kind of **SOLUTION** proposed (ranking, classification, assignation, exc.)

Methodology: SSAM

SSAM

- **S** *Spatial*
- **S** *Sustainability*
- **A** *Assessment*
- **M** *Model*

Model characteristics

A tool that allows territorial sustainability assessments

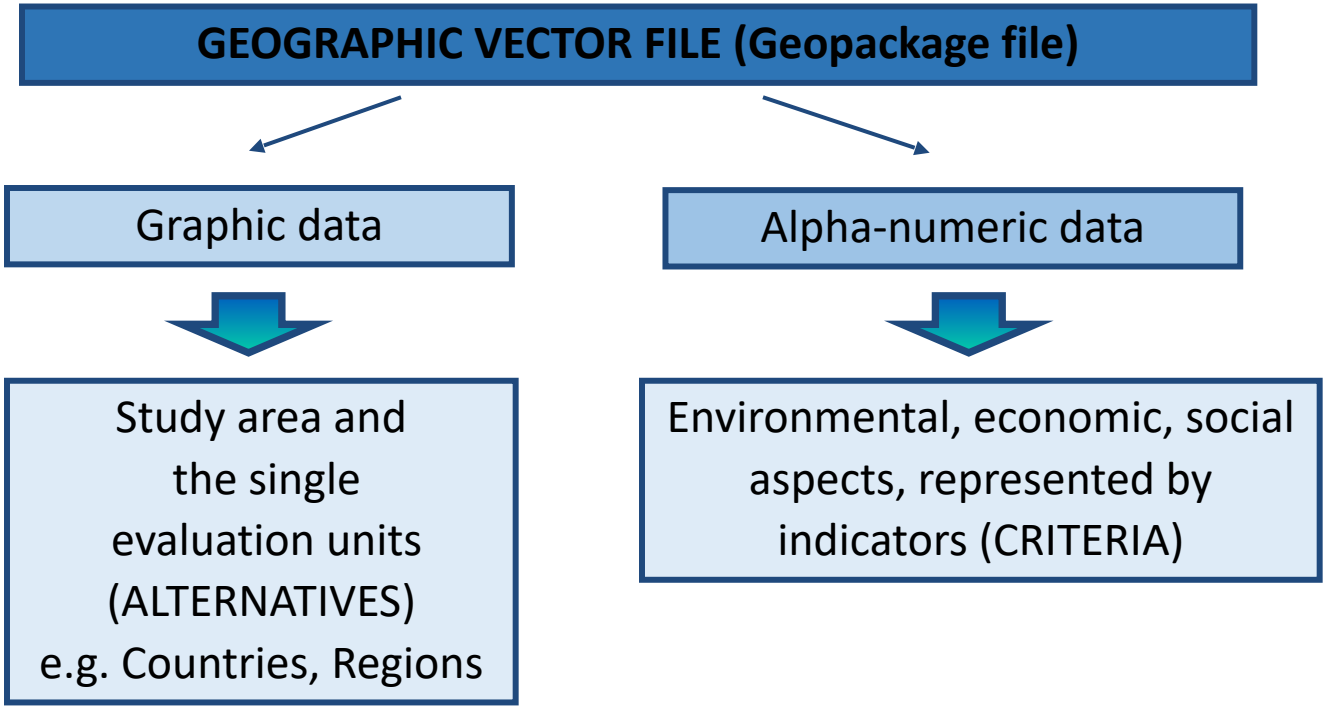
Perfect integration of multicriteria analysis with the geographical dimension (QGIS plugin)

Developed from a collaboration between the University of Perugia and the regional environmental protection agency of Umbria (ARPA) - Italy

Multicriteria algorithm

The **multicriteria algorithm** used for all levels of aggregation is the **TOPSIS** (*Technique for Order of Preference by Similarity to Ideal Solution)* method, which allows a set of alternatives to be evaluated on the basis of their minimum distance from the ideal point and maximum distance from the worst point

SSAM - Characteristics

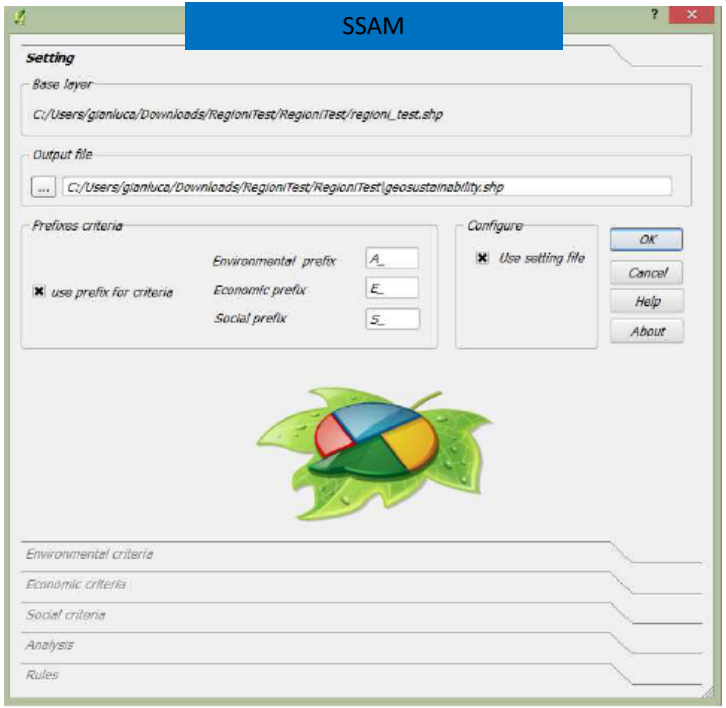


SSAM - Characteristics

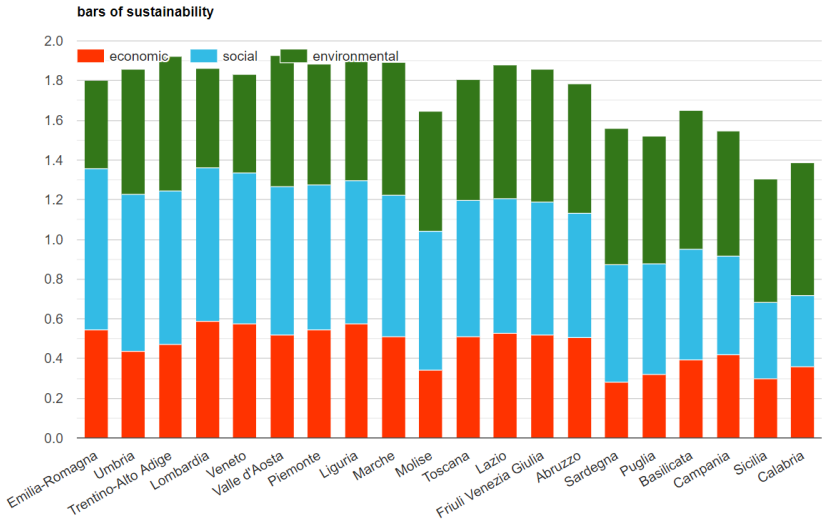
The use of the algorithm available in the plugin allows to treat separately the indicators representing the three dimensions of sustainability, and to compute three different indexes:

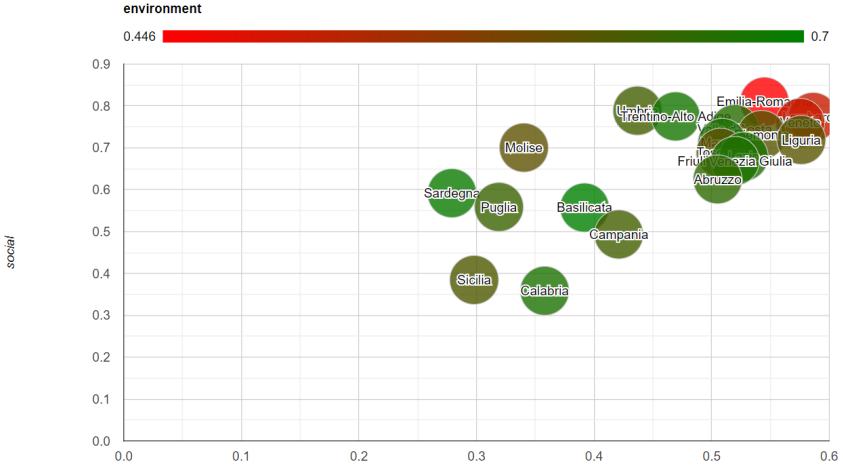
- Environmental index,
- Economic index
- Social index.

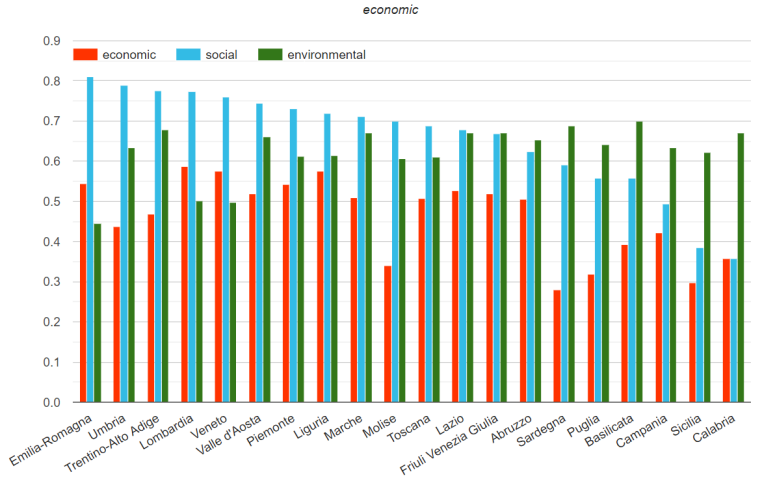
The weighted summation of the three indexes gives an OVERALL *SUSTAINABILITY INDEX* for each geographic unit



Examples of SSAM graphical outputs







Methodology: Indicators and selection criteria

Model input data source: Spanish National Institute of Statistics (INE);
in 2018 INE launched the statistical operation "Agenda 2030 for Sustainable Development Indicators"

We started of Agenda 2030 and the indicators provided by **EUROSTAT** and then examining the specific Spanish indicators, with a focus on the various regions, finding a correspondence with the Eurostat data.

total number of selected indicators: 25 divided into the 3 dimensions

Selection criteria

- **Correspondence with EUROSTAT database related to SDGs**
- **Availability of data** at the supra-communal level for the 17 Spanish autonomous communities ;
- **Years considered: 2019 and 2020 for performing temporal analyisis**
- For some indicators data were not available for the years under analysis, so the **nearest available** years were selected
- **Avoidance of redundant or overlapping indicators**
- **Representativeness of the topic of the concerned dimension**

Methodology: Indicators and weighting phase

EXAMPLE OF SOCIAL INDICATORS

-Population aged 25 to 34 years old with a Higher Education level
-Early leavers from education and training
-Percentage of the adult population (15-64 years) studying education or training in the last four weeks
-People at risk of poverty or social exclusion

EXAMPLE OF ECONOMIC INDICATORS

-Annual growth rate of real GDP per capita
-Research and development expenditure as a share of GDP
-Number of researchers (in full time equivalent) per million inhabitants
-Per capita growth rates of household expenditure and income of total population households

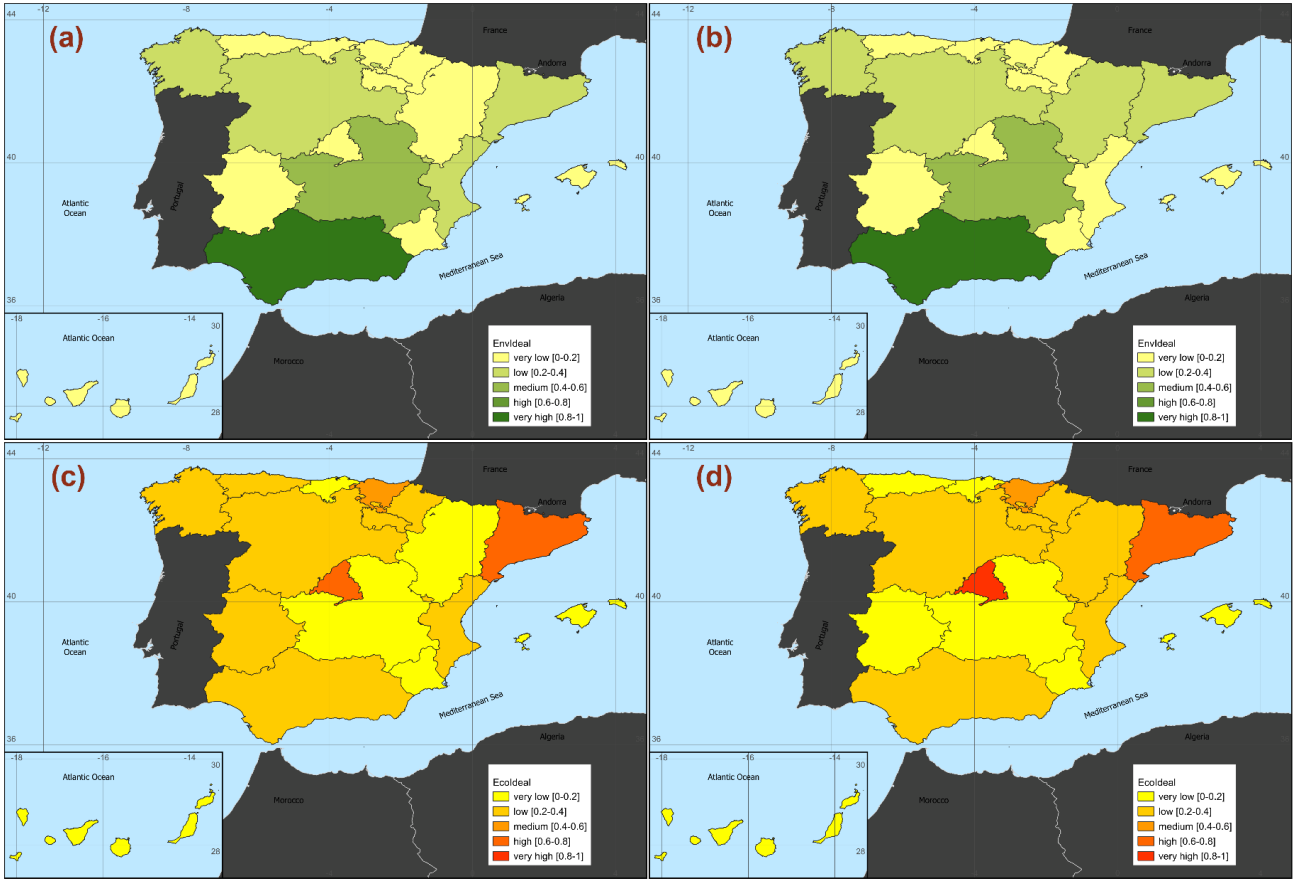
EXAMPLE OF ENVIRONMENTAL INDICATORS

-Urban waste generated per capita
-Renewable energies in the electricity system
-Share of forest area
-Surface of terrestrial sites designated under Natura 2000
-Total greenhouse gas emissions

Weighting phase: **Coefficient of Variation (COV)** (El Santawy and Ahmed, 2012) objective method, based on statistical approach

Results

2019 2020



PRECOVID

-ENVIRONMENTAL: Andalucía (EnvIdeal = 0.857)

-ECONOMIC: Madrid (EcoIdeal = 0.791)

POSTCOVID

-ENVIRONMENTAL: Andalucía (EnvIdeal = 0.823)

-ECONOMIC: Madrid (EcoIdeal = 0.801)

Both in 2019 and 2020, for the Environmental dimension

11 regions very low results

4 regions low results

1 intermediate

1 (Andalucía) very high results

Both in 2019 and 2020, for the Economic dimension

14 regions low or very low results

1 intermediate

2 high/very high (Comunidad de Madrid and Cataluña)

Results

PRECOVID

-SOCIAL: Navarra (SocIdeal = 0.779)

-GLOBAL: Madrid (SustIdeal = 54.613)

POSTCOVID

-SOCIAL: País Vasco (SocIdeal = 0.768)

-GLOBAL: Cataluña (SustIdeal = 53.753)

Social dimension

North: better than the south

8 regions with high results.

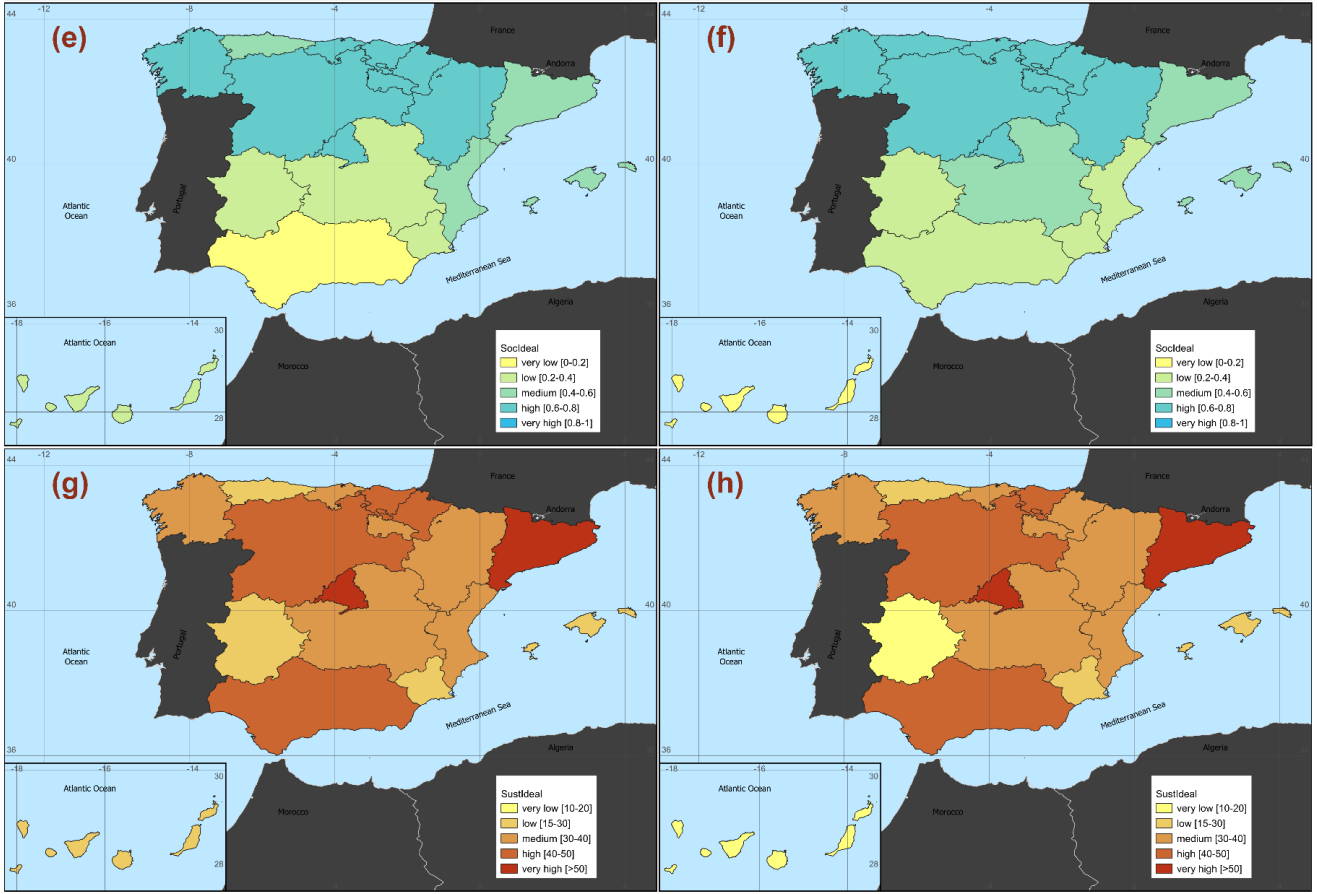
From 2019 to 2020, improvement in Andalucía, Asturias and Castilla-La Mancha and worsening for Islas Canarias, C. Valenciana and Galicia

Global sustainability

General good situation: medium, high/very high indexes, especially in the **centre-north of Spain**.

Negative changes Islas Canarias Extremadura and C. de Navarra

2019 2020



Discussion of results

-Andalucía very high value in the **EnvIdeal index** → may be explained by the **high proportion of the agricultural land devoted to ecological agriculture** (about 45%, much higher than the average value for Spain - less than 6%)

-Comunidad de Madrid: highest values of the **Economic dimension** for both years.
Most remarkable indicator: **number of researchers per million of inhabitants** (more than 35,000 for both years), four times higher than the national average.
-Cataluña: **higher values of the manufacturing indicator**.
-Islas Baleares: lowest value of the EcoIdeal. Economic dimension very linked with tourism industry while the **importance of academic activities (number of researchers) and manufacturing is really poor**.

-Central-north regions consistently exhibited highest values of the **Social dimension**
→Combination of a **reduced unemployment rate** and a **low proportion of population living in households with certain housing deficiencies**.

Discussion of Results

Percentage of change of (2019 to 2020) for the indices EnvIdeal, EcoIdeal, SocIdeal and SustIdeal

Region	EnvIdeal	EcoIdeal	SocIdeal	SustIdeal
Andalucía	-3.9	1.4	28.9	1.9
Aragón	9.1	9.6	-0.8	2.6
Asturias	0.2	-15.2	25.6	11.5
Islas Baleares	-3.4	-20.2	-27.7	-22.5
Islas Canarias	-13.2	-14.9	-63.1	-40.9
Cantabria	-13.7	-0.6	-8.4	-7.6
Castilla y León	-3.7	3.5	-8.0	-4.6
Castilla-La Mancha	-6.1	18.4	39.0	15.4
Cataluña	4.0	4.4	2.7	3.8
Comunidad Valenciana	-10.2	1.5	-28.1	-14.5
Extremadura	-12.2	-20.3	-9.3	-13.9
Galicia	-6.0	-4.3	-5.7	-5.5
Comunidad de Madrid	-11.2	1.3	-4.5	-2.5
Región de Murcia	-15.1	3.6	13.5	3.8
Comunidad de Navarra	3.0	-2.6	-12.9	-8.2
País Vasco	7.0	1.0	5.3	4.1
La Rioja	-14.3	2.1	-3.3	-3.9

Changes in renewable energy production indicator (+48%, -15%)

Increase in the population living in homes with certain housing deficiencies (from 15 to 33%)

Lowest reduction of the GDP during COVID and reduction of severe material deprivation indicator (-58%)

Conclusions

GENERAL SCARCE ENVIRONMENTAL SITUATION

VERY LOW OR LOW RESULTS, IN 2019 AND 2020

GENERAL NEGATIVE ECONOMIC SITUATION

VERY LOW OR LOW RESULTS, IN 2019 AND 2020

GOOD SOCIAL SITUATION

The north had better outcomes than the south, having 8 regions with high results.

The social dimension marks the global ordination of the communities.

-**A DECREASE OF SUSTAINABILITY FROM NORTH TO SOUTH** was detected, both for the social and the global sustainability dimensions, with the exception of Andalucía.

-**A GENERAL DECLINE FOR THE MAJORITY OF THE INDICES (with some exceptions)** was observed by comparing Pre-COVID situation (2019) against COVID-Pandemic (2020).

LIMITATION OF THE STUDY: Relative and not absolute assessment: the best and worst values were chosen within the distribution of available data. Not absolute progress towards the Agenda achievement.

DESPITE THIS: ANALYSIS USEFUL FOR PUBLIC DECISION MAKING:

- To understand which regions are lagging behind others;
- To define the greatest setbacks occurred after the pandemic;
- To set specific territorial measures tailored to the needs of sustainable development.

Thank you!