DO SOLID WASTE LANDFILLS REALLY DECREASE THE ENVIRONMENTAL VALUE?

THE CASE OF THE VALENCIA REGION (SPAIN)

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Technical alternatives for MSW mangement

Recycling

⇩

Composting

⇩

Biomethanization

⇩

Incinerating

⇩

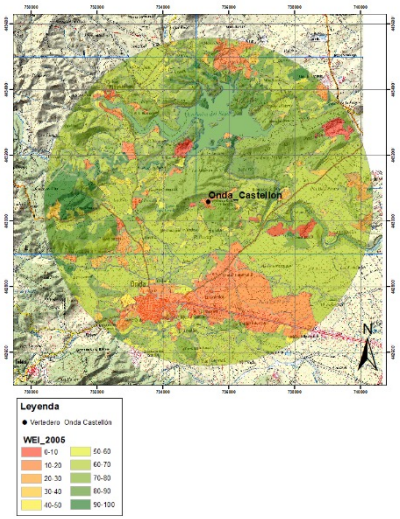
Landfilling

Current research lines

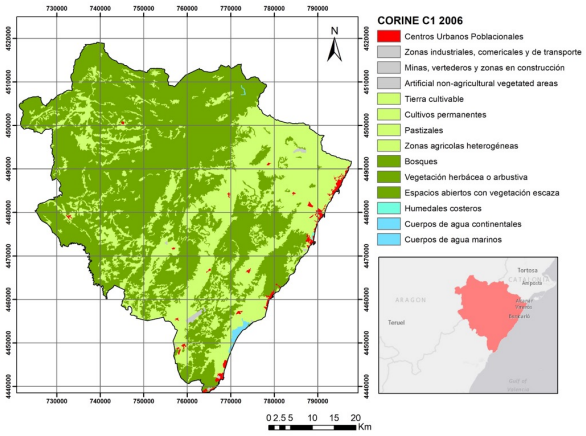
- Which is the optimal location to operate a MSW landfill?
- Which is the optimal capacity of the landfill?
- How should the landfill be operated to maximize biogas production while minimizing operational costs?
- How should the landfill be monitored using environmental indicators?

BIOLAND3

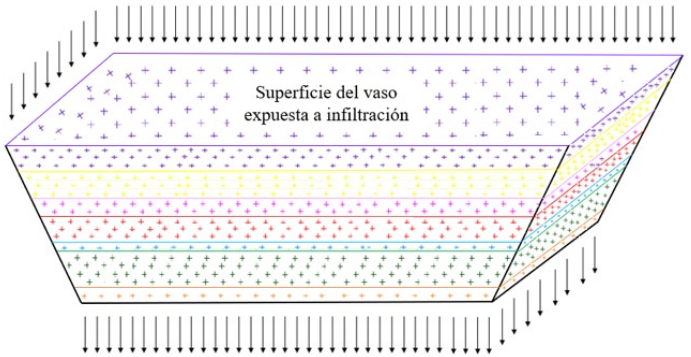
WEI



LCM



BIOLEACH



A new methodology for the evaluation of the land use evolution near MSW landfills using environmental indicators and GIS technologies

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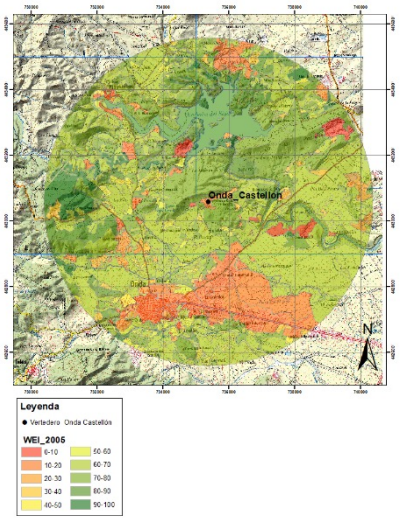
BIOLAND3

WEI



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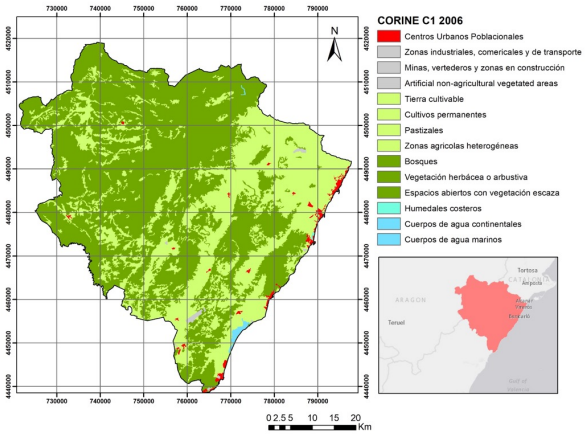

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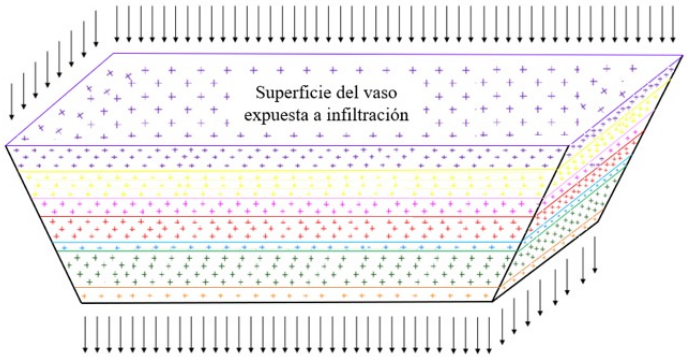
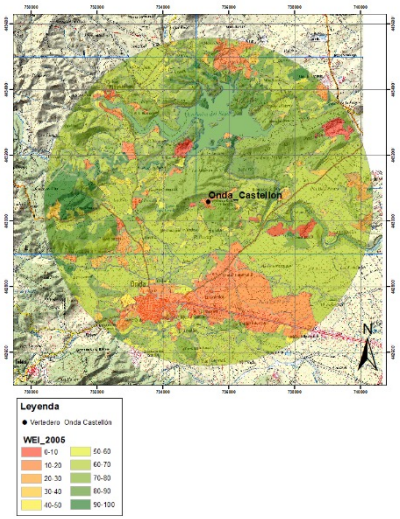


Application of Land Change Model to analyze the evolution of land use over time in the surroundings of the landfill site

BIOLAND3

WEI



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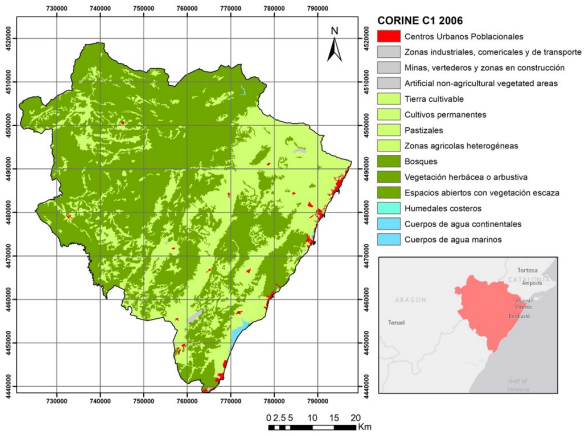

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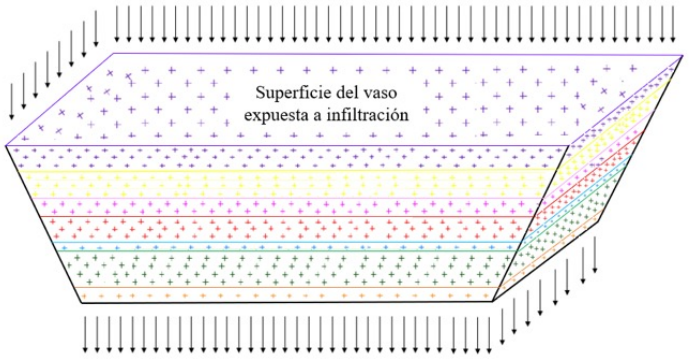
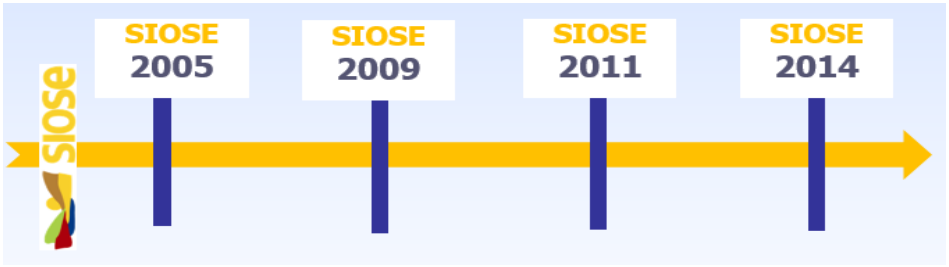


A new numerical model to evaluate the coupled production of biogas and leachate from MSW landfills

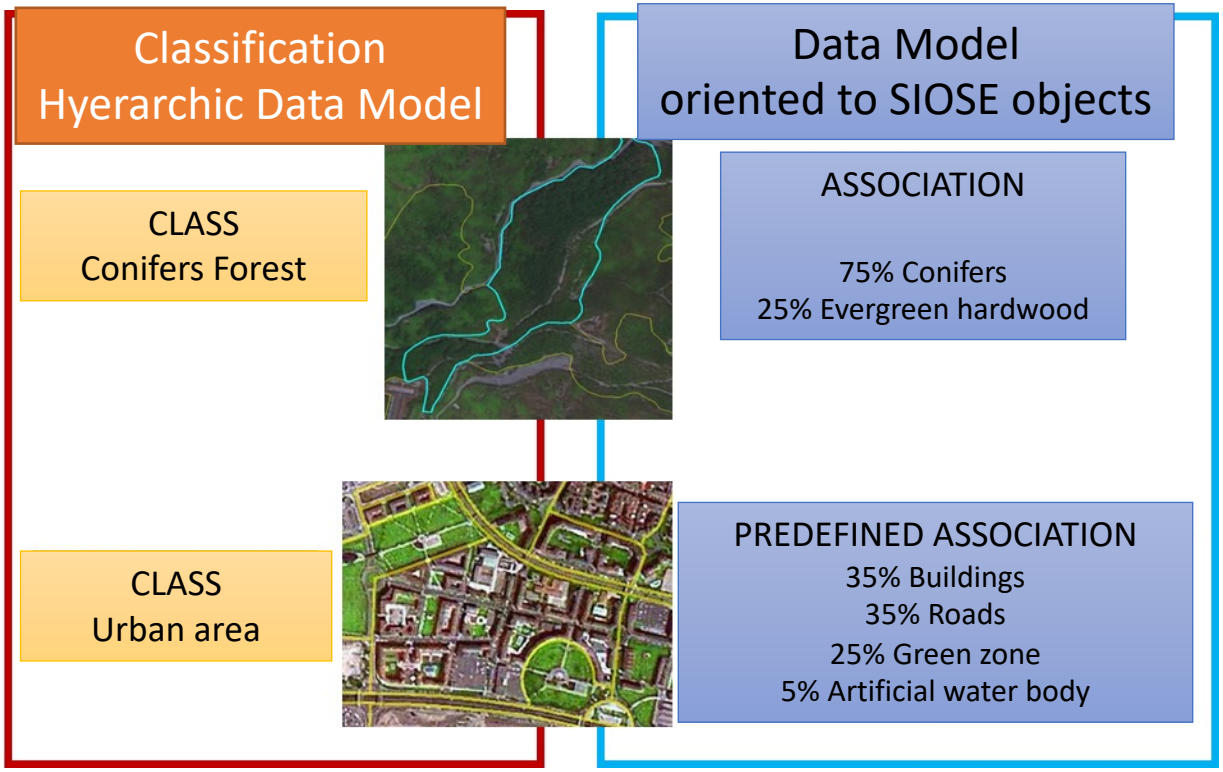
Introduction - SIOSE

- **SIOSE** is the Information System on LANDUSE in Spain;
- Its objective is to generate a database of landuse for all Spain at a 1: 25,000 scale.
- It is produced in a decentralized and coordinated manner between the different administrations following the INSPIRE principles, updated periodically.



Currently under development, High resolution SIOSE (scales 1:1000 and 1:5000)

Introduction

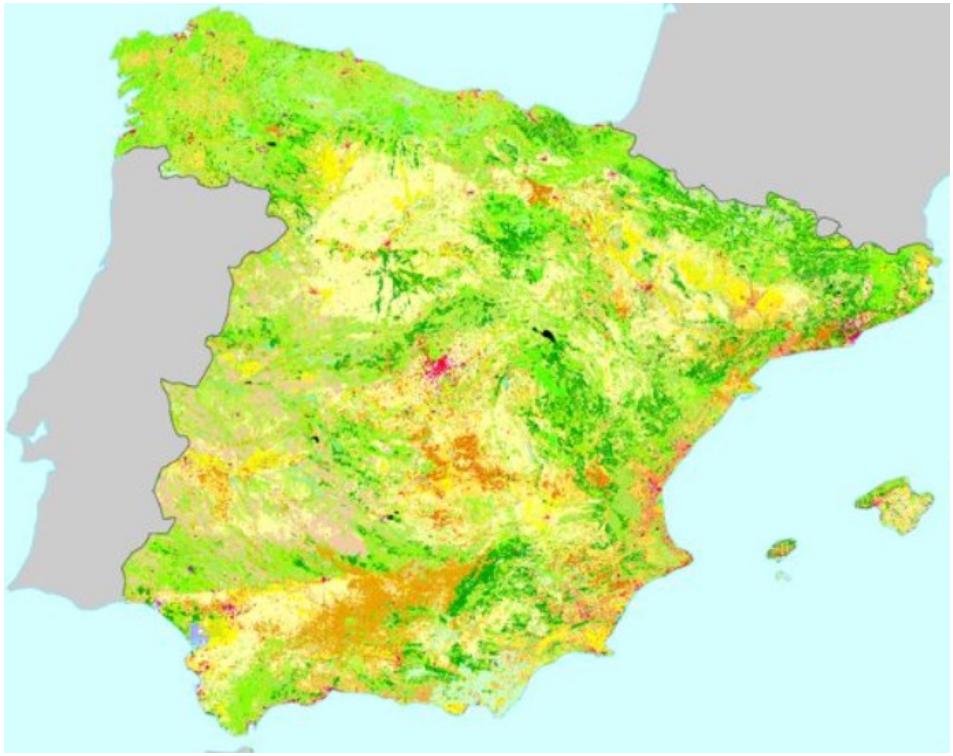


- SIOSE is an object-oriented data model
- Therefore it is multipurpose and extensible
- Its main advantage is that you can customize queries and graphic outputs (maps)
- SIOSE is a database that does not classify the land but describes it by means of coverage or combinations of them with their different occupancy rates and attributes.

Anthropization Index

SIOSE Index – Ministerio de Fomento, Spain.

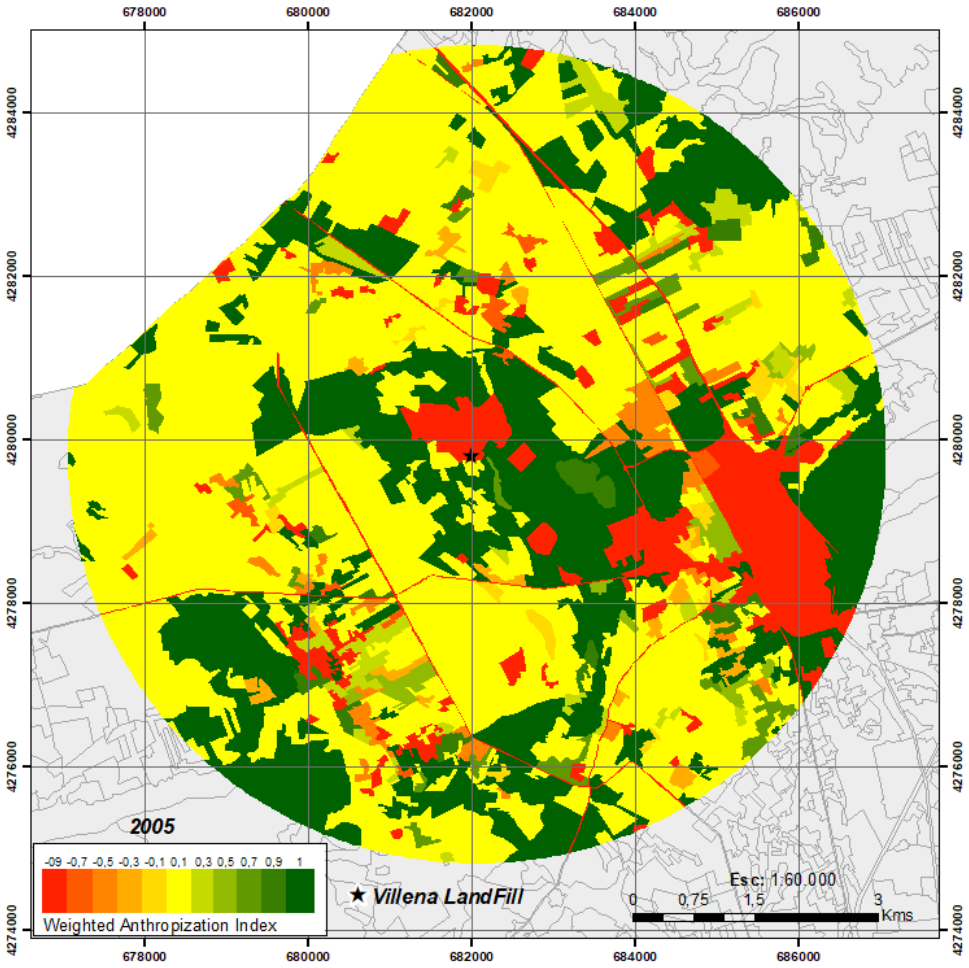
Anthropization Index – Three values (-1, 0, 1)

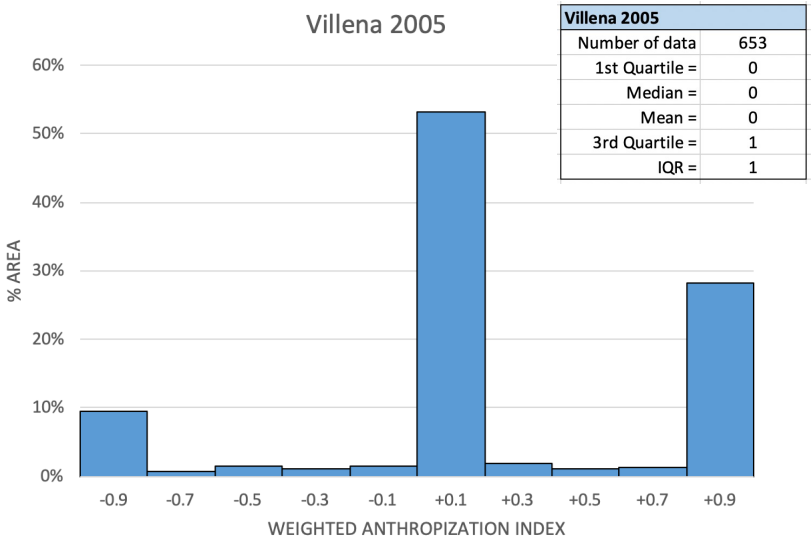


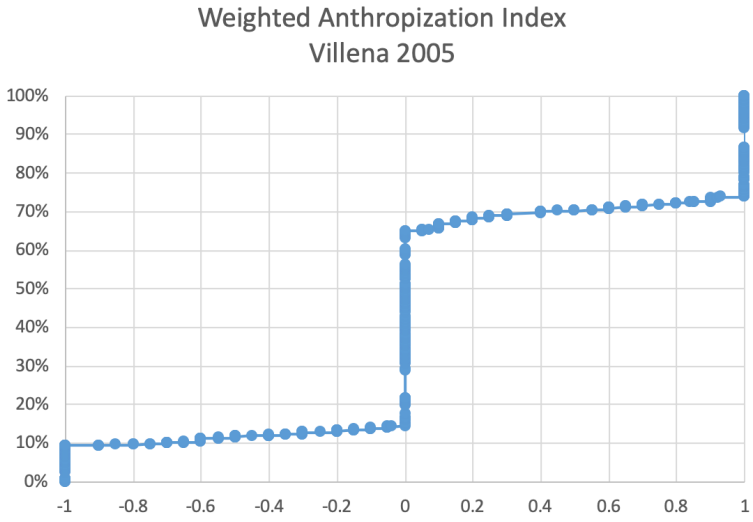
Land Uses

- 1_1_Agriculture
- 1_2_Forestry
- 1_3_MiningAndQuarryng
- 1_4_AquacultureAndFishing
- 2_SecondaryProduction
- 3_1_CommercialServices
- 3_3_CommunityServices
- 3_4_CulturalEntertainmentAndRecreationalServices
- 4_1_TransportNetworks
- 4_3_Utilities
- 5_ResidentialUse
- 6_1_TransitionalAreas
- 6_2_AbandonedAreas
- 6_3_1_LandAreasNotInOtherEconomicUse
- 6_3_2_WaterAreasNotInOtherEconomicUse
- 6_6_NotKnownUse

The Anthropization Index







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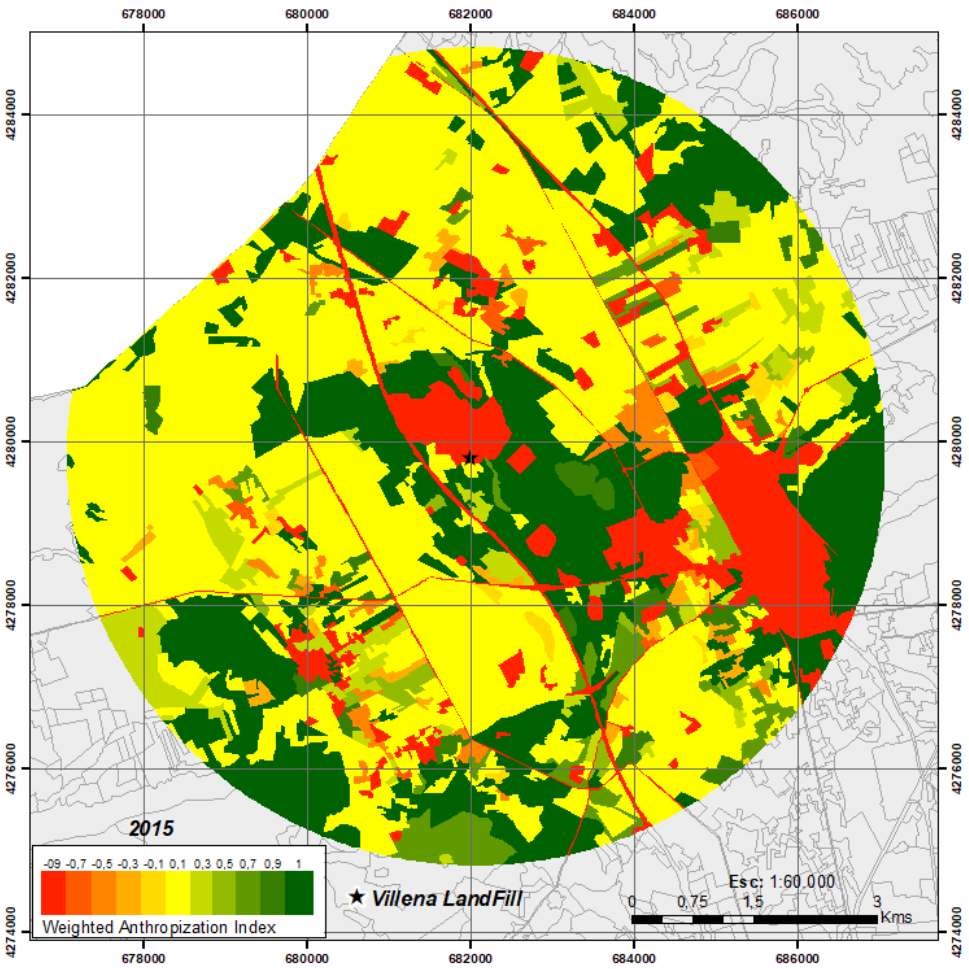
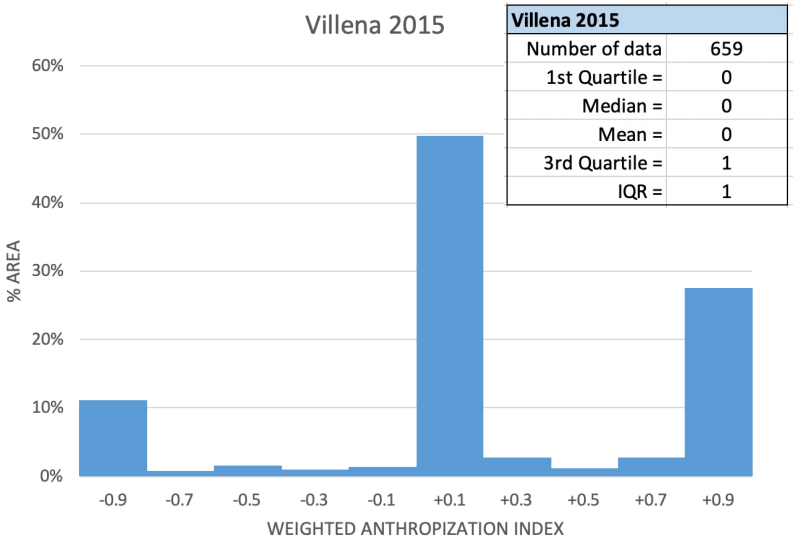
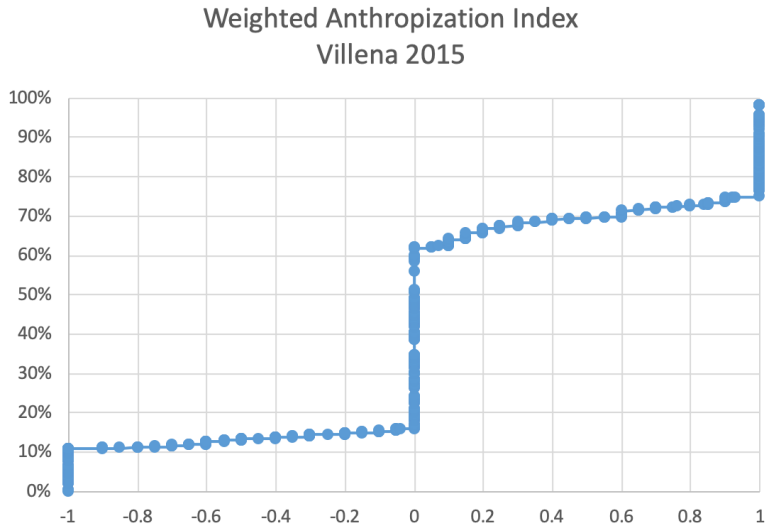
The Anthropization Index







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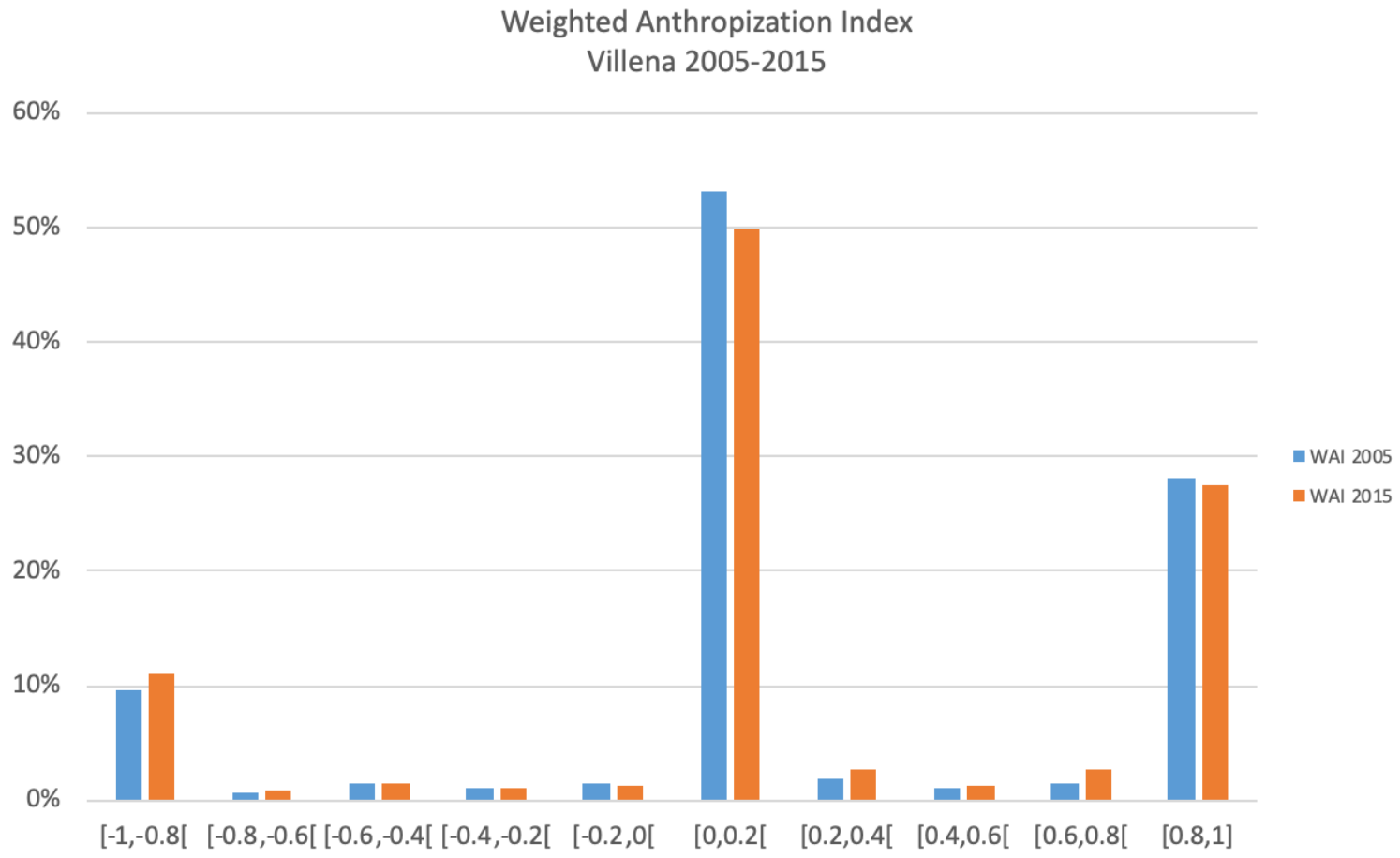
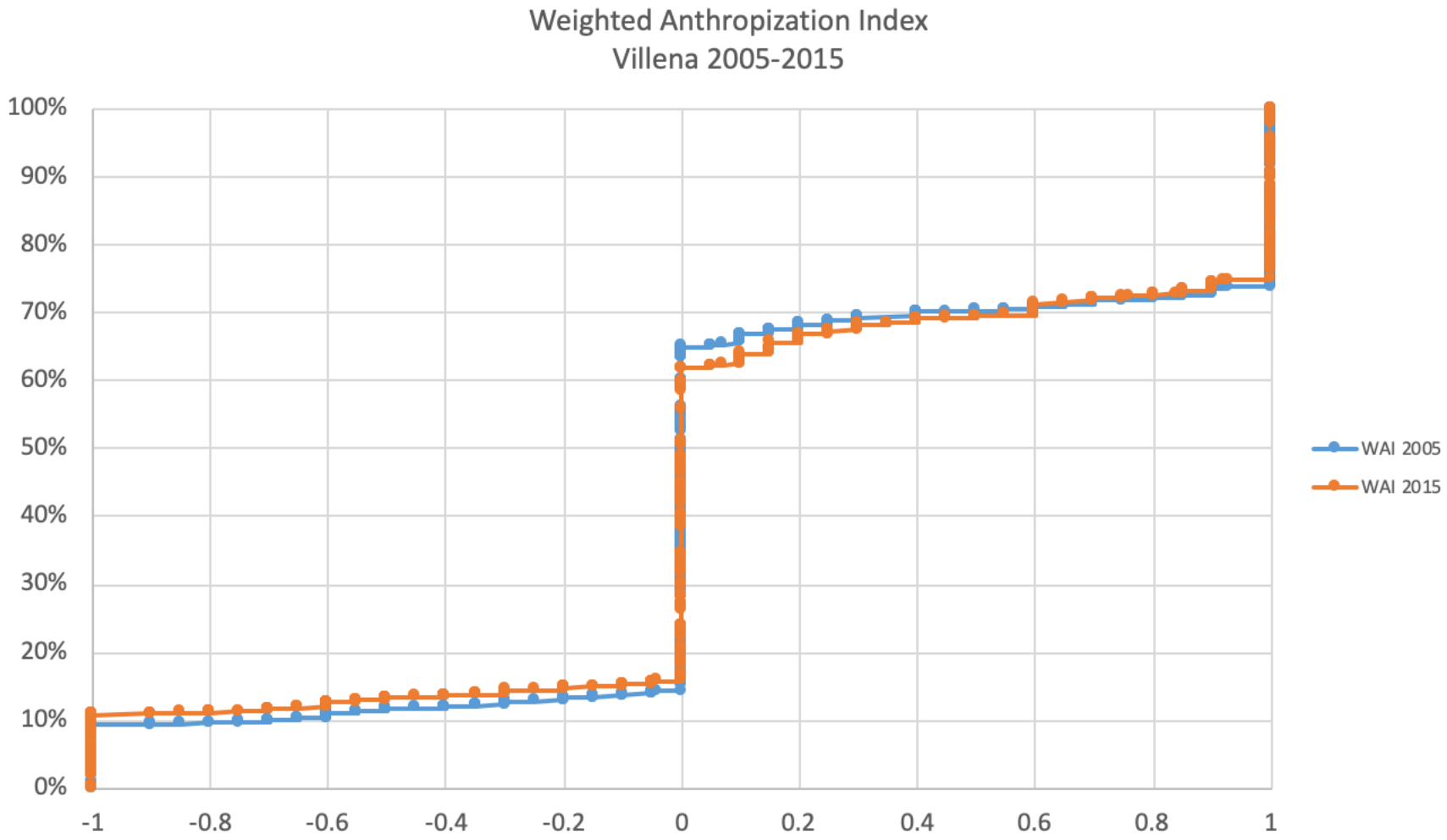


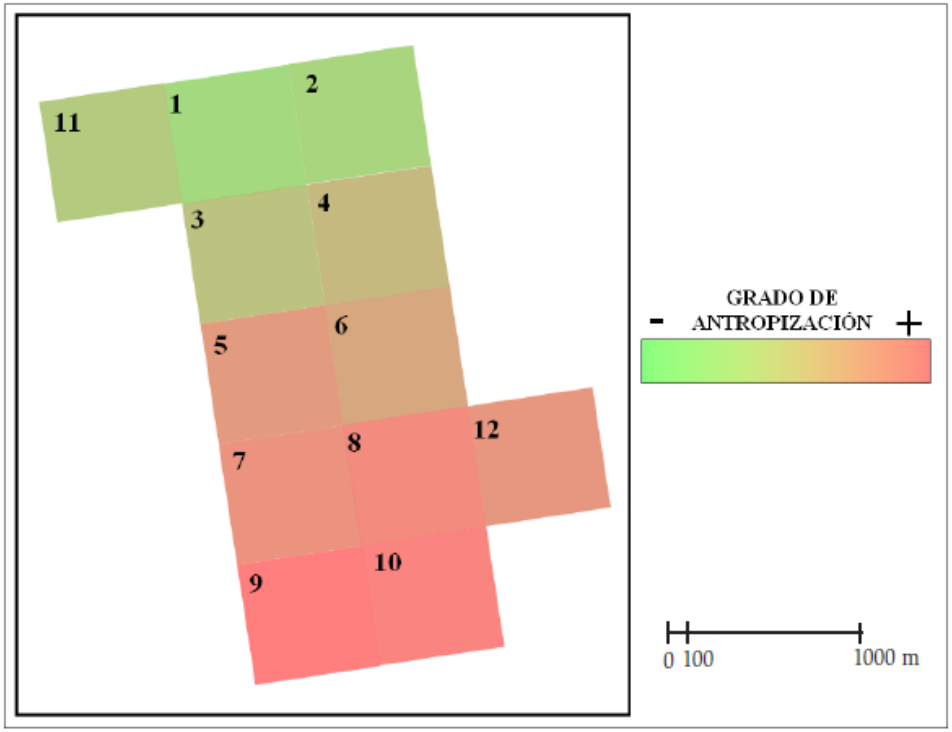
The Anthropization Index



Updating the Anthropization Index

Relative Integrated Anthropization Index (INRA) – Martínez Dueñas (2010)

Land value according to degree of anthropization – Values between (0,1)



$$INRA = (\sum SUA'/n) \cdot 100$$

The Environmental Index – WEI

Therotically based on the landuse Indicators Review - Antón Vallejo (2004)

- Landuse assessment based on occupied land and quantitative classifications
- Landuse assessment based on land production capacity
- Influence that land use will exert on its quality based on biodiversity indicators, life support functions and productivity

Table 3. Environmental value as a function of the WEI range.

WEI Range	Environmental Value
$0 \leq WEI_k < 40$	Low
$40 \leq WEI_k < 70$	Medium
$70 \leq WEI_k \leq 100$	High

81 different cathegories of WEI

The process of determining environmental index values for each land use (EI_j) has been carried out, taking into account the joint consideration of the following five evaluation factors (F_i):

F_1: Anthropic or natural nature of activity developed in soil.
F_2: Water consumption associated with land use.
F_3: Soil degradation (use of chemicals).
F_4: Environmental sustainability of land use (stability of the ecosystem).
F_5: Landscape value of activity carried out in the analyzed area.

Table 2. Basic values of the evaluation factors (F_i) for every land use considered by the SIOSE and final value of the Weighted Environmental Index for a single-use polygon (WEI_k).

Code	Land Use Description	F_1	F_2	F_3	F_4	F_5	WEI_k
EDF	Buildings	20	40	20	15	5	20
ZAU	Artificial green zone and Urban trees	60	65	70	80	75	70
LAA	Artificial water body	65	85	85	65	50	70
VAP	Road, Parking or Pedestrian area	20	40	20	15	5	20
OCT	Other constructions	20	40	20	15	5	20
SNE	Soil without edifications	35	50	50	50	15	40
ZEV	Extraction zones	0	50	0	0	0	10
CHA	Rice crops	60	10	80	45	55	50
CHL	Other crops different from rice	60	65	80	75	70	70
LFC	Citrics	60	65	80	75	70	70
LFN	Non citrics	60	65	80	75	70	70
LVI	Grapes	60	65	80	75	70	70
LOL	Olives	60	65	80	75	70	70
LOC	Other woody crops	60	65	80	75	70	70
PRD	Meadows	80	80	90	100	100	90
PST	Pastureland	80	80	80	80	80	80
FDC	Hardwood deciduous	100	100	100	100	100	100
FDP	Evergreen hardwoods	100	100	100	100	100	100
CNF	Conifers	100	100	100	100	100	100
MTR	Scrub	70	70	70	70	70	70
PDA	Sandy beaches	100	100	50	100	100	90
SDN	Bare soil	70	50	20	20	40	40
ZQM	Burned areas	0	50	0	0	0	10
RMB	Ravines	20	50	20	50	60	40
ACM	Marine cliffs	100	50	50	100	100	80
ARR	Rocky soil	80	50	30	30	60	50

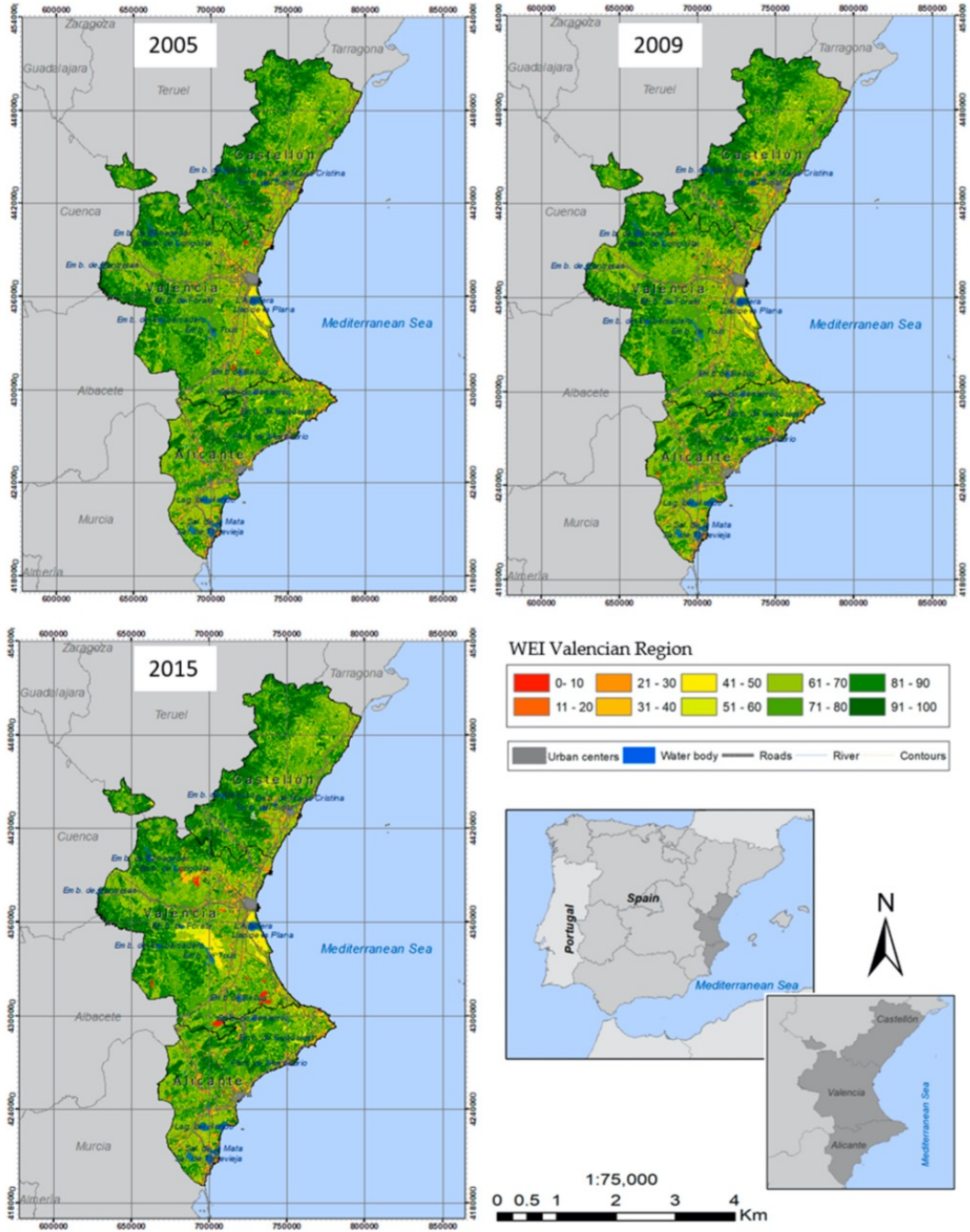
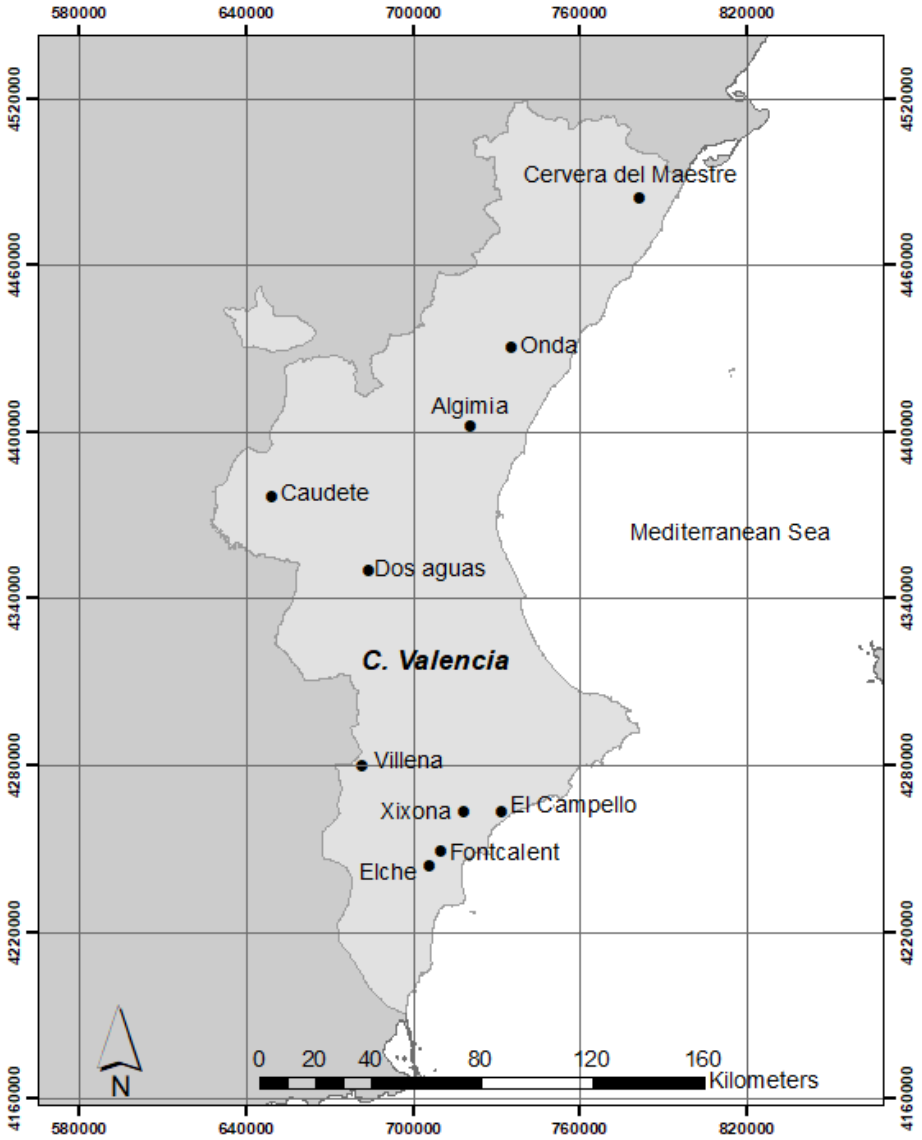


Figure 2. WEI values in the Valencian Region in 2005, 2009 and 2015.

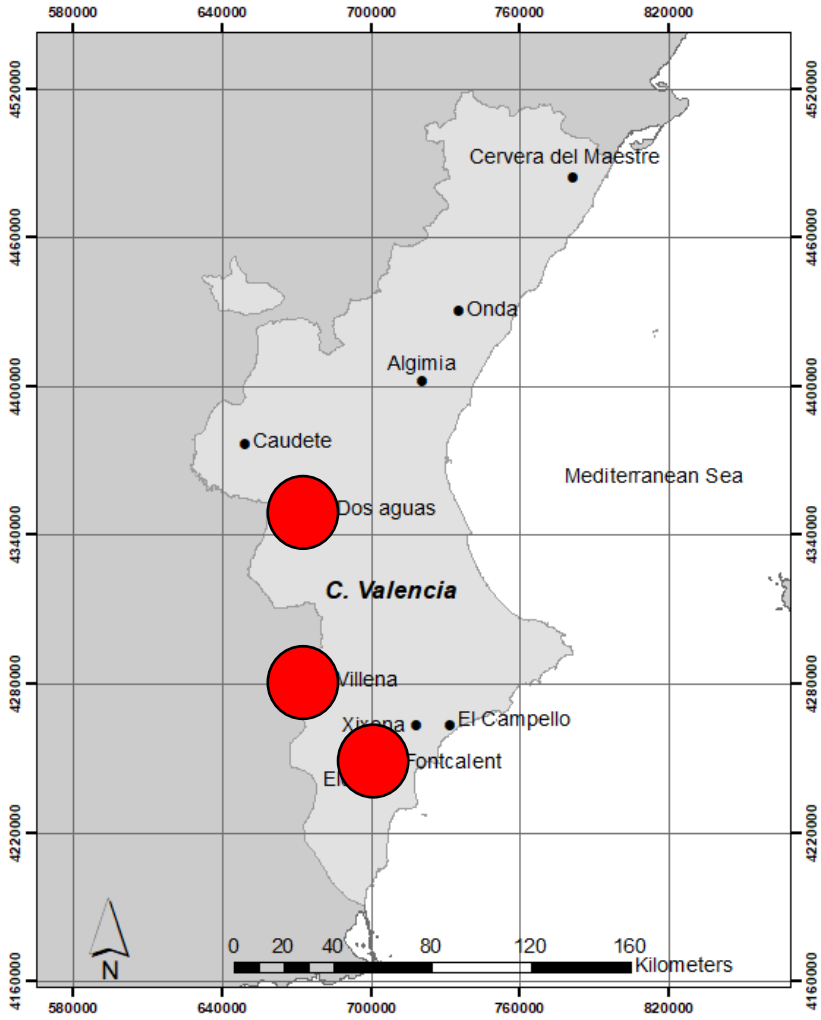
Valencian Community Landfilling facilities



Valencian Community Landfilling facilities

Management area	Landfill	Parent Company	UTM coordinates		Capacity (m^3)
			X	Y	
C1	Cervera del Maestre	U.T.E. PLAN ZONAL R.S.U. ZONA 1ª (Bionord)	781.814	4.484.279	872.865
C2	Onda	RECIPLASA (public company and municipalities)	735.340	4.430.582	684.524
C3-V1	Algimia de Alfara	Reciclado Palancia Belcaire - RPB (TETma)	720.771	4.401.972	808.622
V2	Dos Aguas	U.T.E. DOS AGUAS (SAV, FCC)	684.001	4.350.298	5.618.259
V3	Caudete de las Fuentes	U.T.E ECORED (URBASER)	649.268	4.376.935	1.997.450
A1	El Campello	FCC	732.081	4.263.098	2.412.261
A2	Xixona	RECICLADOS Y COMPOSTAJE PIEDRA NEGRA,S.A.	718.590	4.263.442	2.577.105
A3	Villena	VAERSA (public company)	682.001	4.279.811	1.127.534
A4	Fontcalent	U.T.E. ALICANTE	709.909	4.249.478	5.244.391
A5	Elche	U.T.E. URBAHORMAR (URBASER, HORMIGONES MARTÍNEZ)	705.687	4.244.084	2.500.000

Valencian Community Landfilling facilities

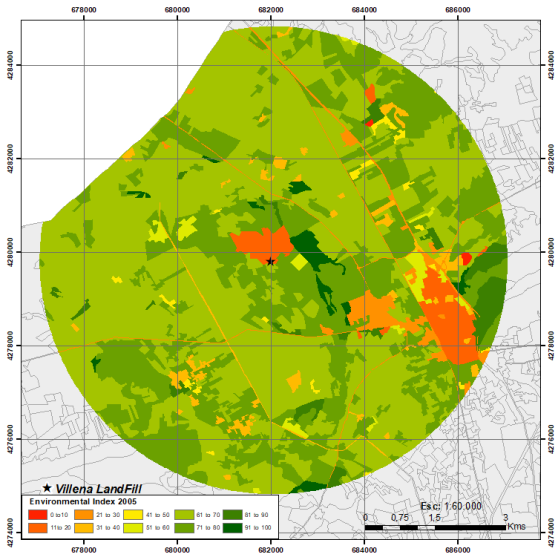


Valencian Community Landfilling facilities

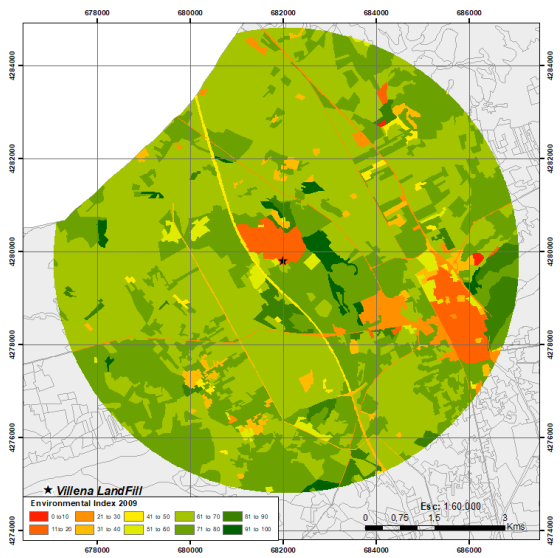
Villena

Application of WEI

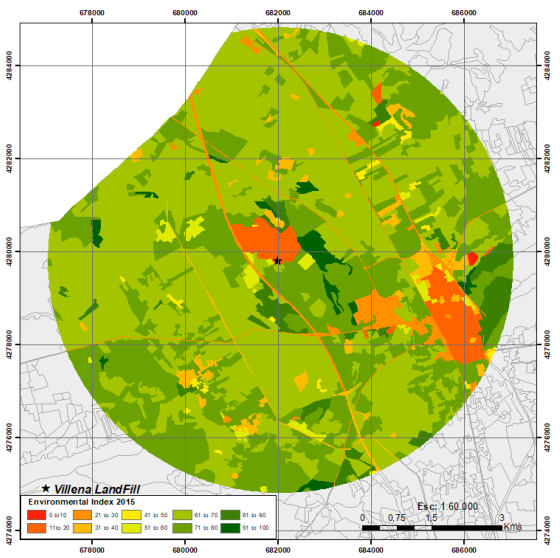
2005



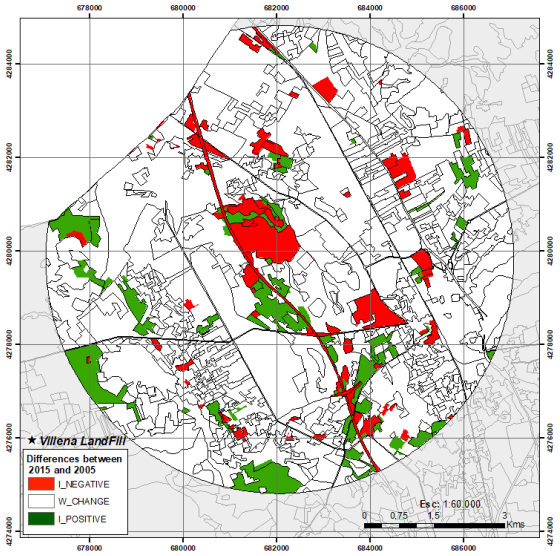
2009



2015



2015-2005



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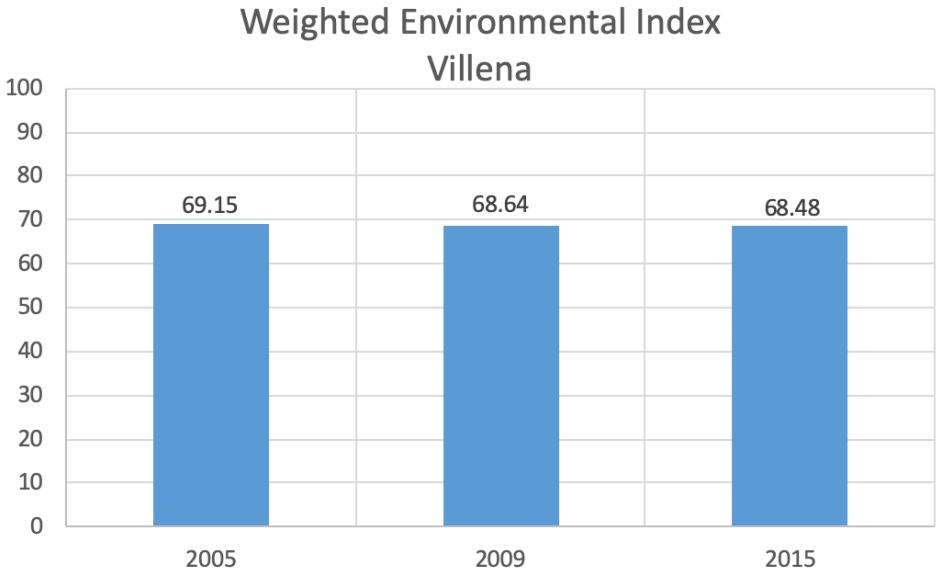
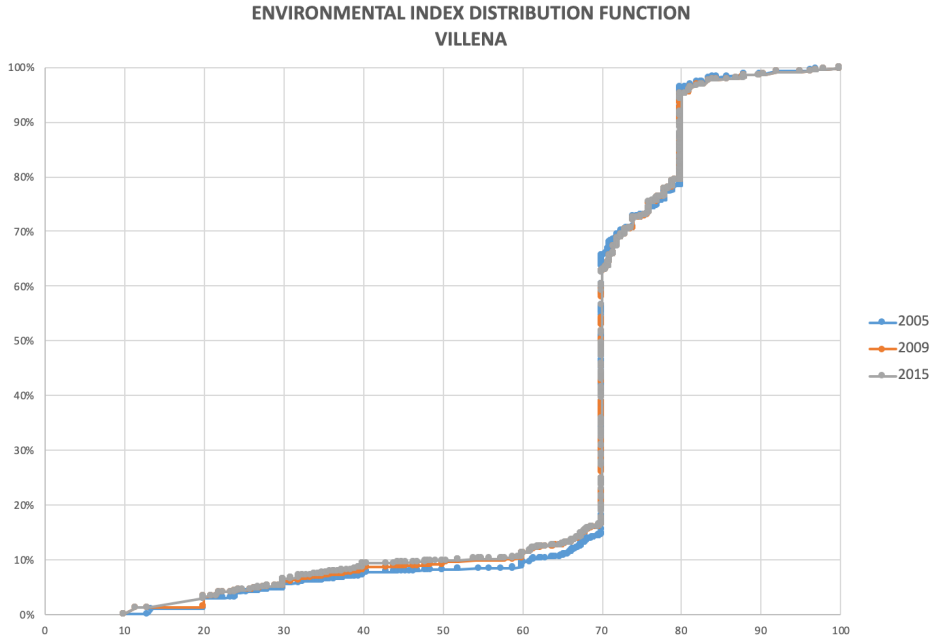
Application of WEI





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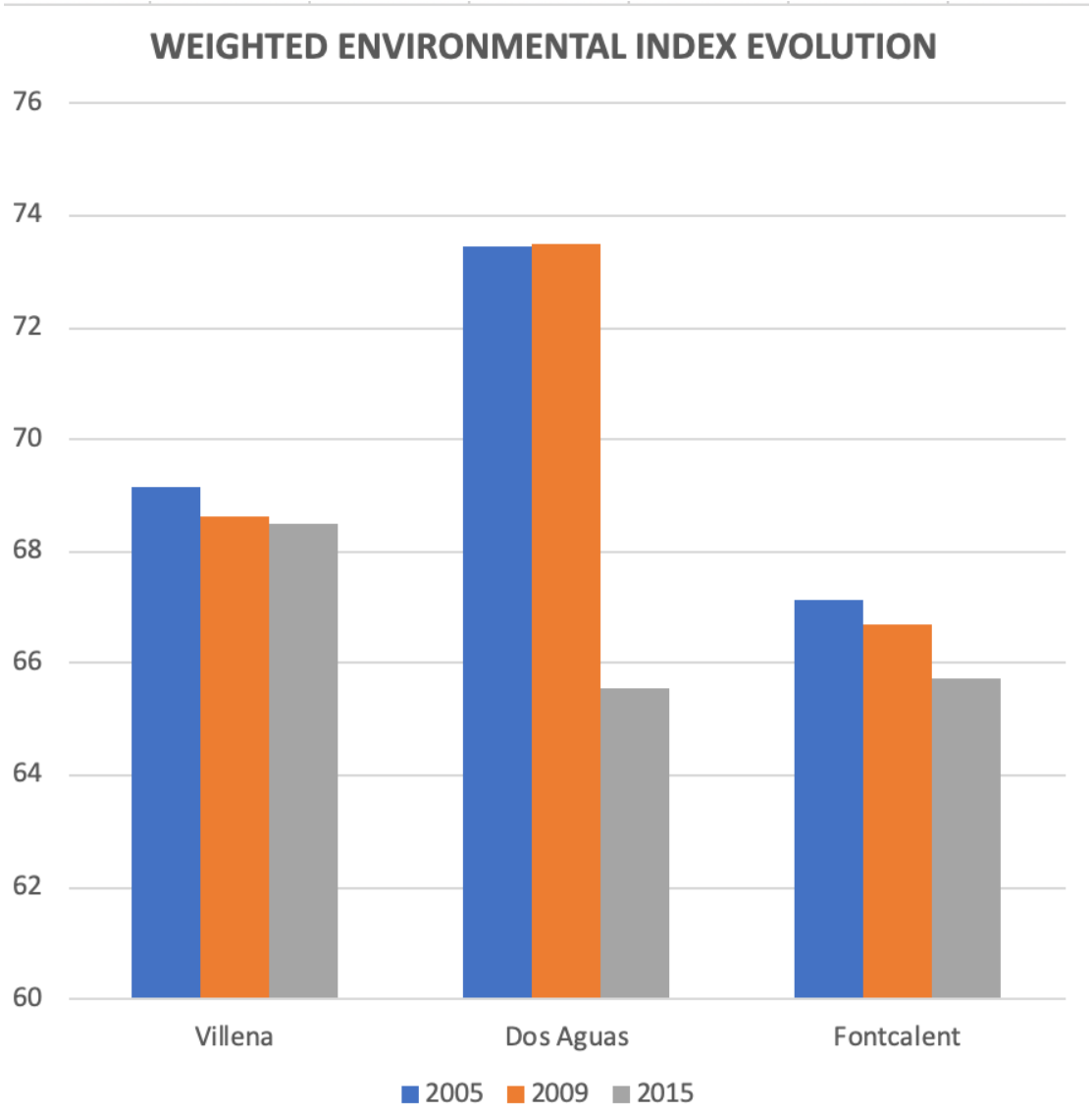
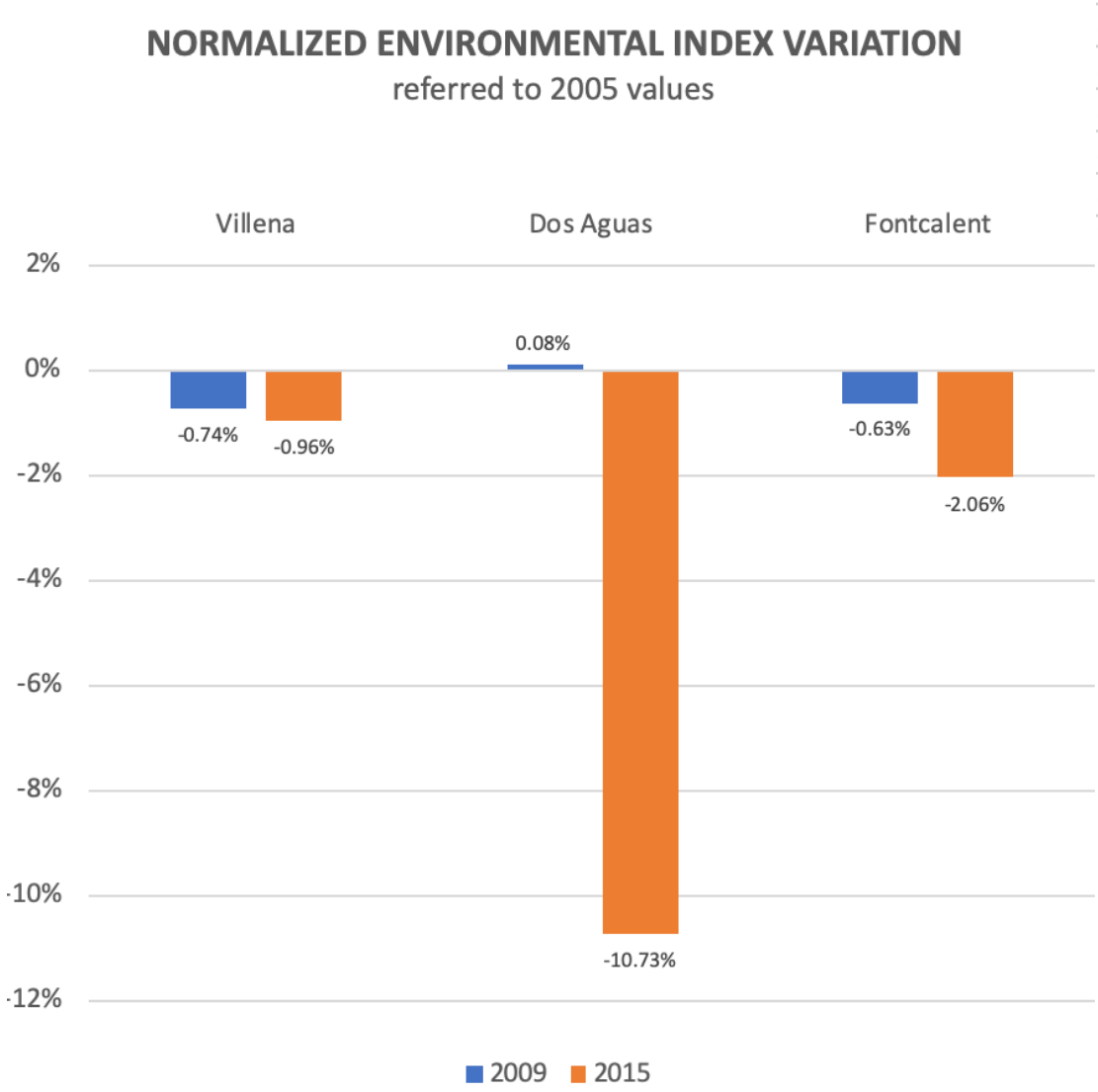
Results



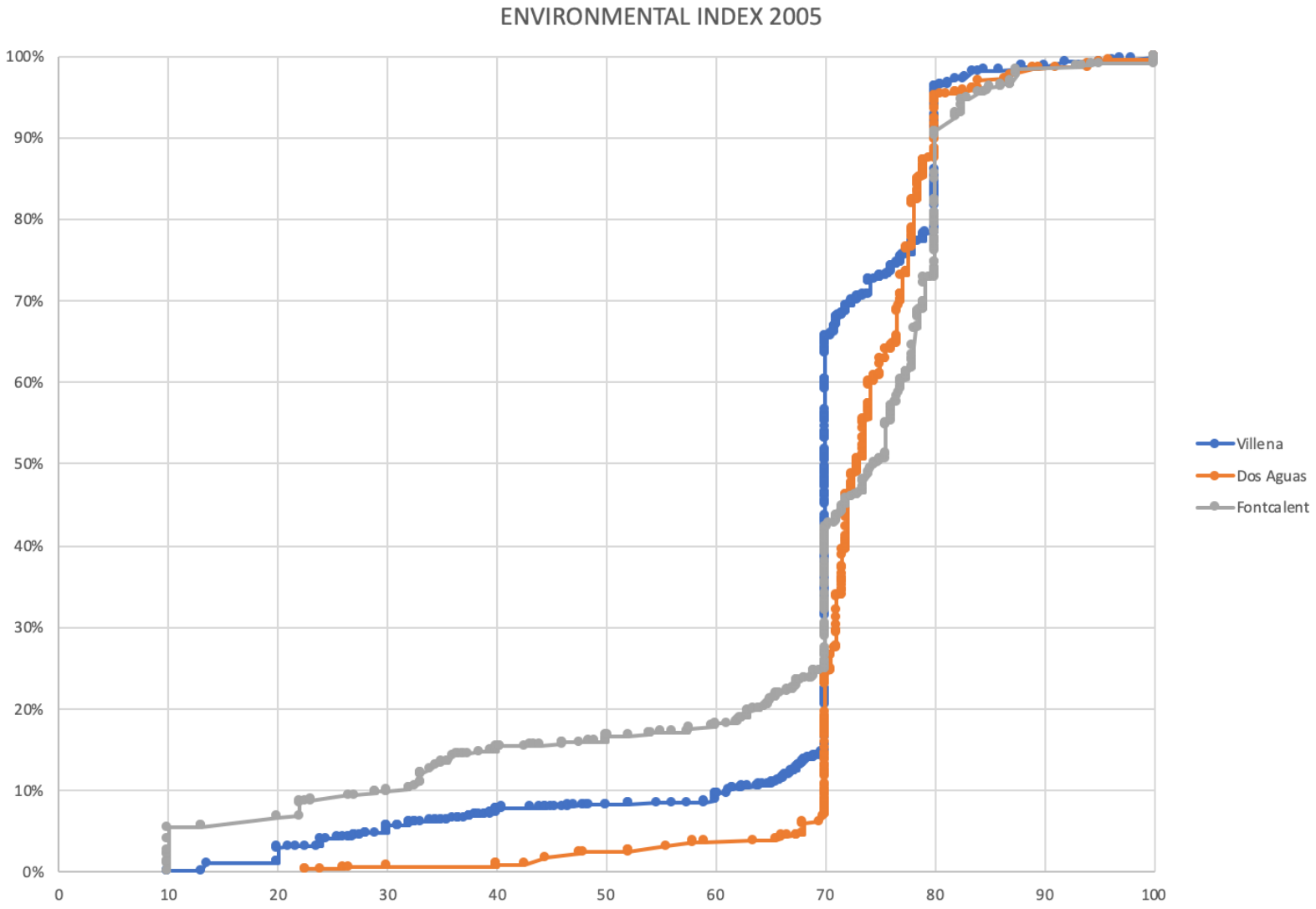
	Weighted Environmental Index		
	2005	2009	2015
Villena	69.15	68.64	68.48
Dos Aguas	73.45	73.51	65.57
Fontcalent	67.12	66.7	65.74

Results

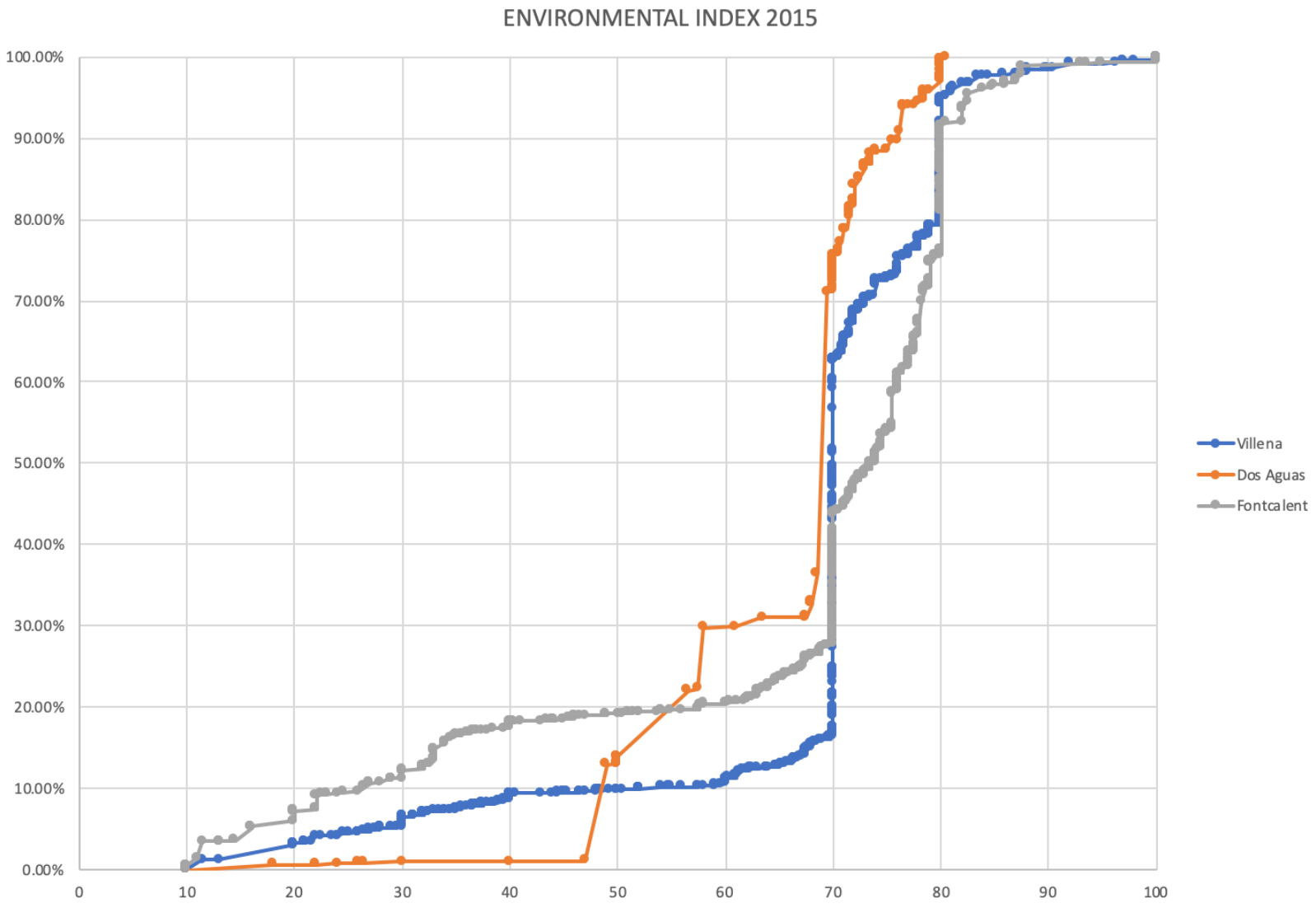


	Normalized Environmental Index Variation		
	2005	**2009**	**2015**
Villena	0.00%	-0.74%	-0.96%
Dos Aguas	0.00%	0.08%	-10.73%
Fontcalent	0.00%	-0.63%	-2.06%

Results

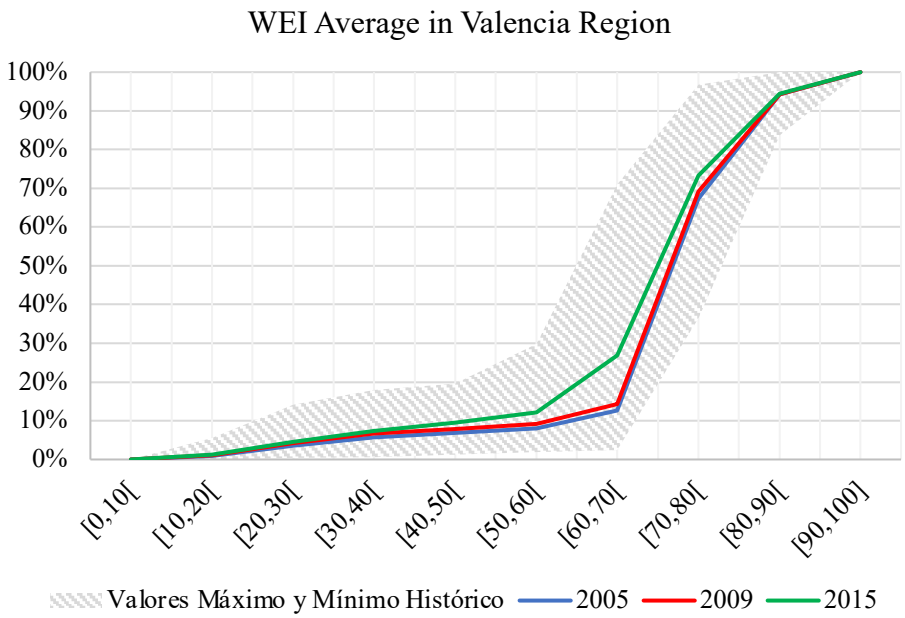

ENVIRONMENTAL INDEX 2005
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0
10
20
30
40
50
60
70
80
90
100
Villena
Dos Aguas
Fontcalent

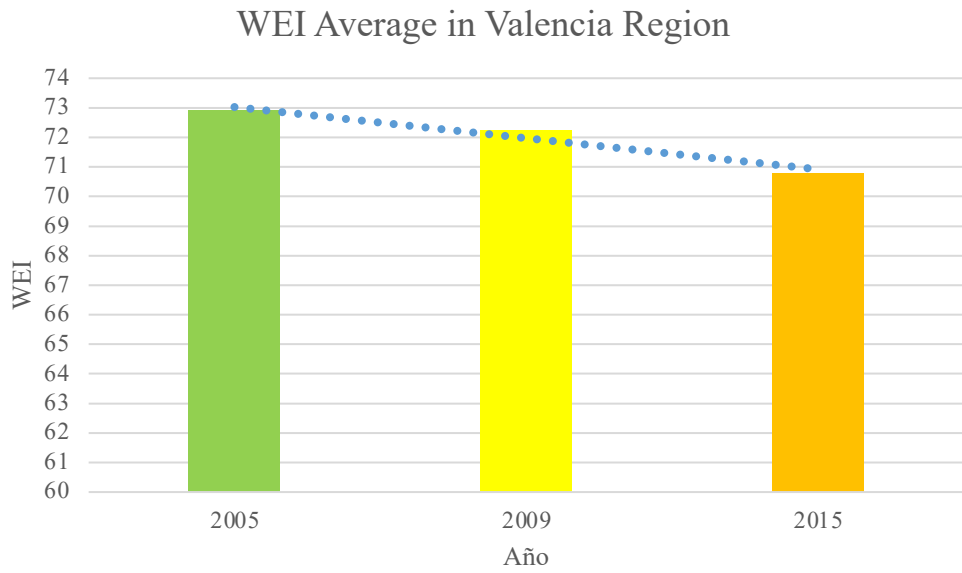
Results


ENVIRONMENTAL INDEX 2015
100.00%
90.00%
80.00%
70.00%
60.00%
50.00%
40.00%
30.00%
20.00%
10.00%
0.00%
0
10
20
30
40
50
60
70
80
90
100
Villena
Dos Aguas
Fontcalent

Some preliminary results

	WEI			Evolución		
Ubicación	2005	2009	2015	2005-2009	2009-2015	2005-2015
Algimia	79.45	79.60	79.01	0.19%	-0.74%	-0.55%
Campello	77.71	76.61	76.46	-1.42%	-0.19%	-1.61%
Caudete	74.21	73.82	73.06	-0.52%	-1.03%	-1.55%
Cervera de M.	71.63	71.49	71.04	-0.18%	-0.63%	-0.81%
Dos Aguas	73.31	73.35	65.54	0.06%	-10.65%	-10.59%
Elche	70.69	69.76	69.16	-1.31%	-0.87%	-2.17%
Font Calent	66.91	66.21	65.26	-1.05%	-1.42%	-2.46%
Onda Castellon	69.05	68.50	67.48	-0.80%	-1.49%	-2.28%
Villena	69.15	68.24	68.08	-1.32%	-0.23%	-1.54%
Xixona	76.86	74.70	72.81	-2.81%	-2.53%	-5.27%
PROMEDIO	72.90	72.23	70.79	-0.92%	-1.99%	-2.89%





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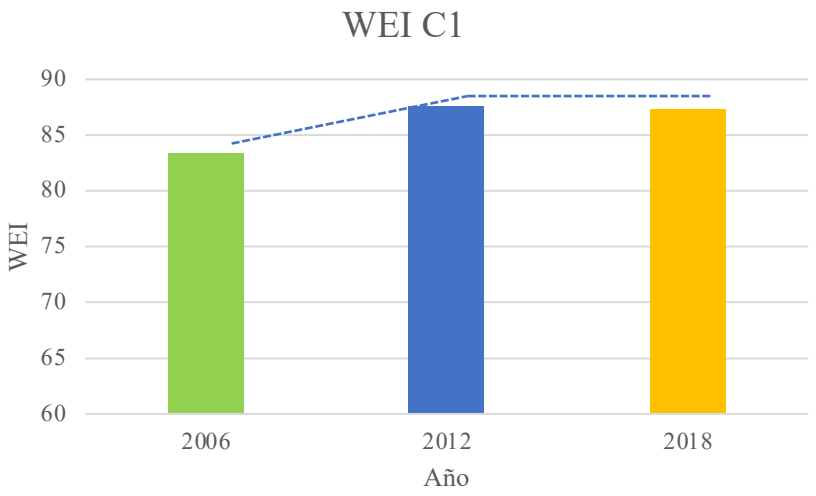
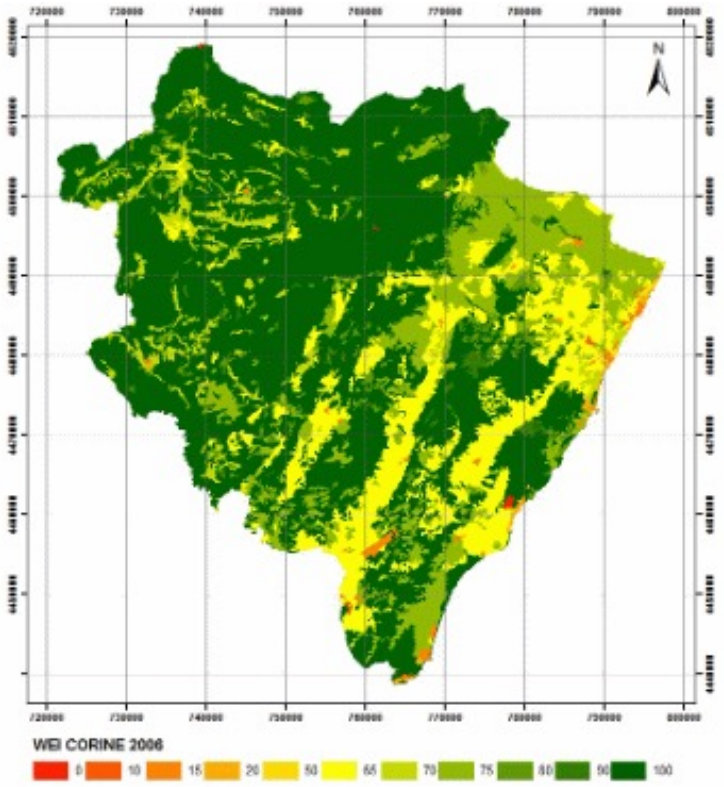
WEI Application to Area Castellón-1

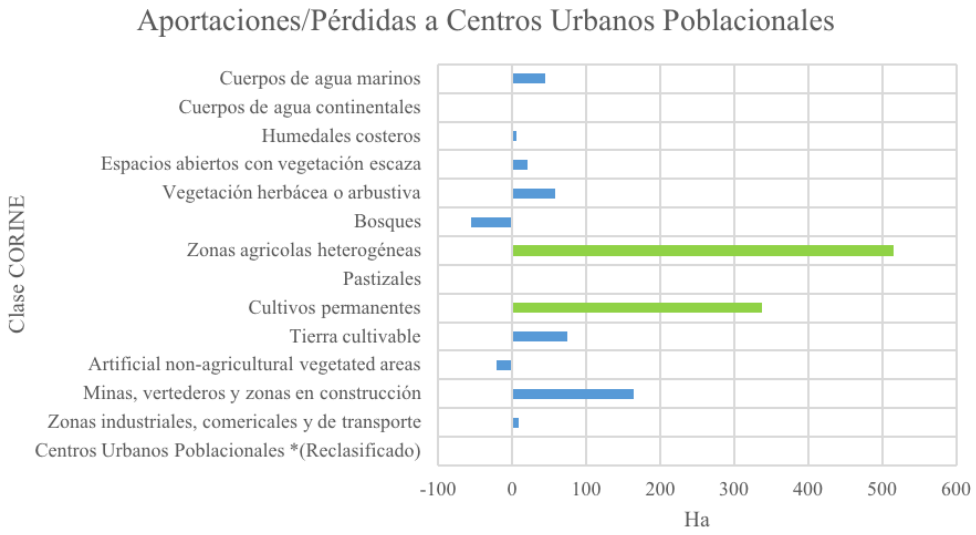
WEI is a useful tool to analyze the effects of sustainable development policies on the territory



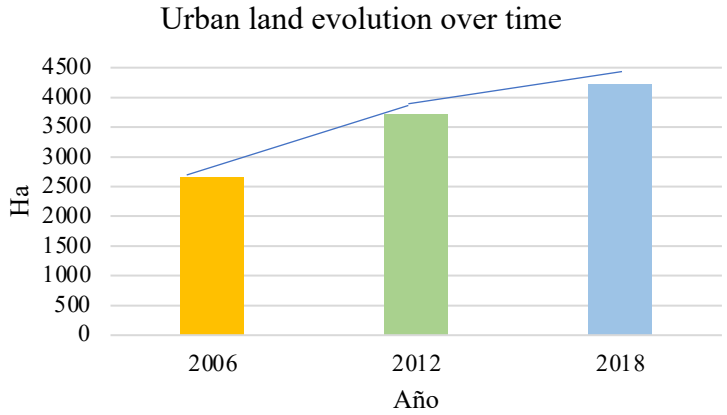
WEI C1			
Año	WEI	Evolución	Periodo
2006	83.4022621	-	-
2012	87.583242	5.0%	2006-2012
2018	87.3241108	-0.3%	2012-2018
-	-	4.7%	**2006-2018**



LCM application to Area Castellón-1



2006-2012:
Agriculture land is changed into urban land -
→ Increase in the production of MSW



2006-2012:
40% increase of urban land

2012-2018:
14% increase of urban land

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Land Use/Land Cover Assessment Over Time Using a New Weighted Environmental Index (WEI) Based on an Object-Oriented Model and GIS Data

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check for updates

Abstract: For the first time, this paper introduces and describes a new Weighted Environmental Index (WEI) based on object-oriented models and GIS data. The index has been designed to integrate all the available information from extensive and detailed GIS databases. After the conceptual definition of the index has been justified, two applications for the regional and local scales of the WEI are shown. The applications analyze the evolution over time of the environmental value from land-use change for two different case studies in Spain: the Valencian Region and the L'Alcora municipality. Data have been obtained from the Spanish Land Occupation Information System (SIOSE) public database and integrate GIS information about land use/land cover on an extensive, high-detailed scale. Results demonstrate the application of the WEI to real case studies and the importance of integrating statistical analysis of WEI evolution over time to arrive at a better understanding of the socio-economic and environmental processes that induce land-use change.

Keywords: land use; indicator; GIS; assessment

International Journal of Environmental Research and Public Health

MDPI

Article

Analytical Methodology for the Identification of Critical Zones on the Generation of Solid Waste in Large Urban Areas

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Abstract: One of the main environmental issues to address in large urban areas is the ever-increasing generation of municipal solid waste (MSW) and the need to manage it properly. Despite significant efforts having been made to implement comprehensive solid waste management systems, current management methods often do not provide sustainable alternatives which ensure the reduction of solid waste generation. This paper presents an analytical methodology that employs a combination of geographic information system techniques (GIS) along with statistical and numerical optimization methods to evaluate solid waste generation in large urban areas. The methodology was successfully applied to evaluate MSW generation in different exclusive service areas (ASES) of the city of Bogotá (Colombia). The results of the analysis on the solid waste generation data in each collection area in terms of its socioeconomic level are presented below. These socioeconomic levels are explained by defining different strata in terms of their purchasing power. The results demonstrate the usefulness of these GIS and numerical optimization techniques as a valuable complementary tool to analyze and design efficient and sustainable solid waste management systems.

Keywords: solid waste; geographic information systems; solid waste management; minimization; collection; final disposal

DO SOLID WASTE LANDFILLS REALLY DECREASE THE ENVIRONMENTAL VALUE?

THE CASE OF THE VALENCIA REGION (SPAIN)

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