

# Evaluation of wastewater treatment plants of the province of León.

The role of GIS as a tool for efficiency  
improvement and territory management.

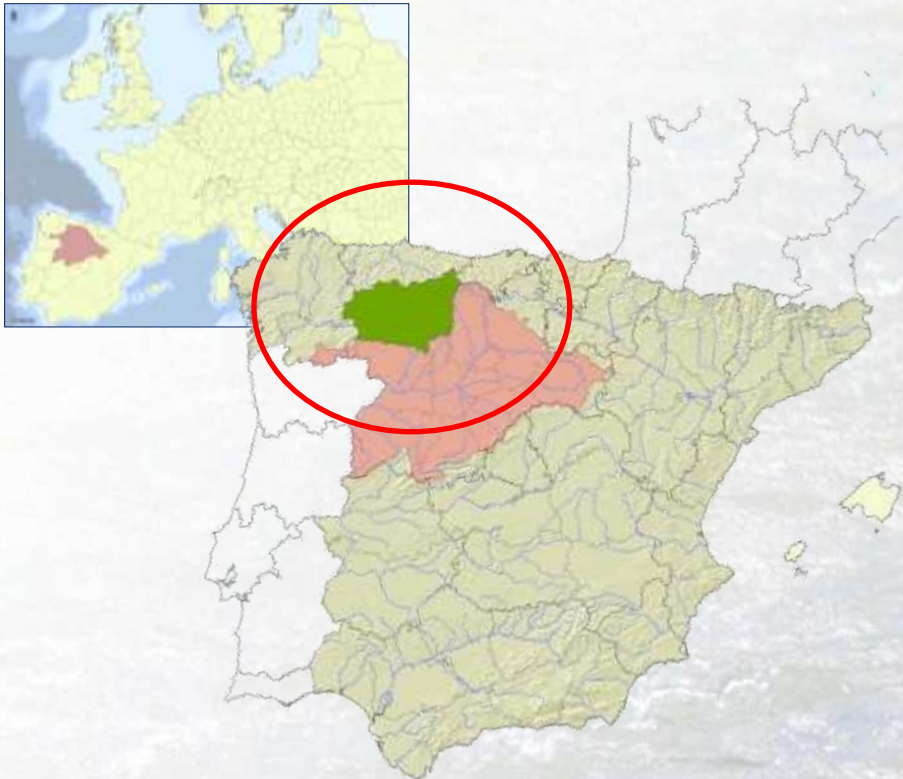
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J. Falagán, J. Martino, E. de Luis  
and G. Ansola**



Universidad de León



# INTRODUCTION



Flatter areas in the South

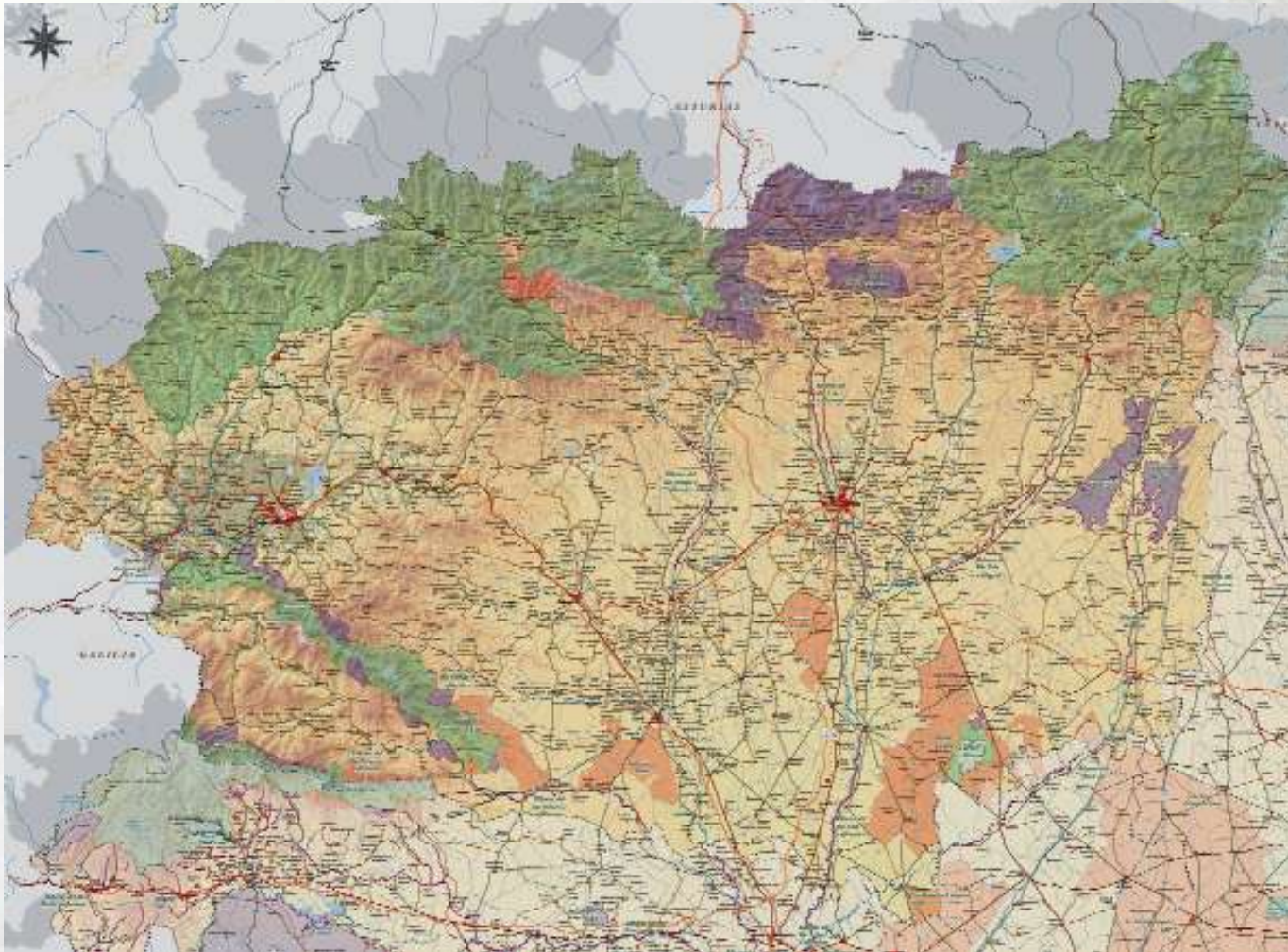
Steep relief of the Cantabrian Mountains in the North





# INTRODUCTION

Protected areas: network of nature reserves in the Province of León



# INTRODUCTION

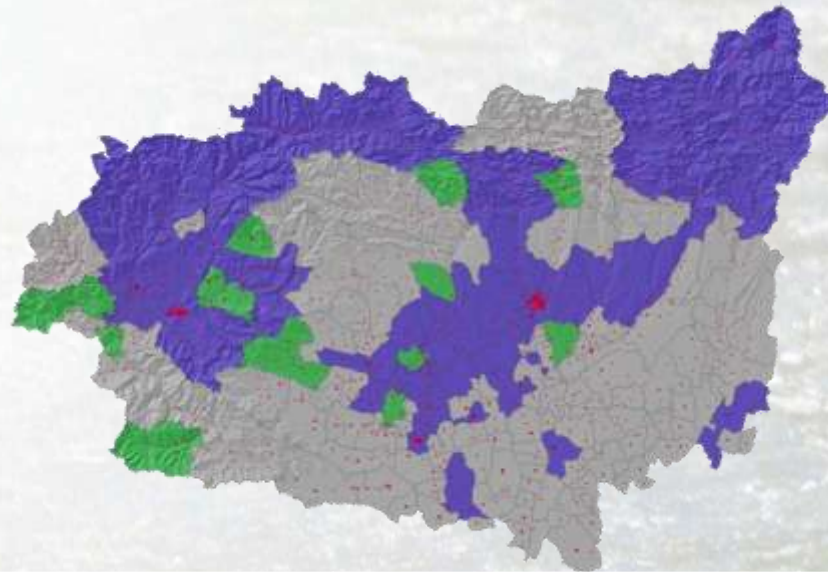


Small populations have scarce economical and technical resources for undertaking the legal requirements, Directive 91/271EEC.

## METHODS

## THREE STAGES

-  Stage 1
-  Stage 2
-  Stage 3



	Summary	Methods
<b>Stage 1. Small villages.</b>	Situation of the wastewater treatment plants and collecting systems in villages with a population smaller than 2000 inhabitants	Fieldwork to all localities included in this Stage 1. Analysis and assessment of collecting systems and wastewater treatment plants. Field and lab analysis of water quality.
<b>Stage 2. All villages</b>	Situation of the wastewater treatment plants and collecting lines in villages bigger than 2000 inhabitants, and also those included in public specific wastewater programs	Fieldwork to all localities included in this Stage 2. Analysis and assessment of collecting systems and wastewater treatment plants. Field and lab analysis of water quality.
<b>Stage 3. GIS tools</b>	Database and Geographic Information System	Digitalizing and homogenizing all the information available. Constructing and standardized database and connection to a GIS (ArcGIS 9.2, ESRI, 2008). Web publication of the information gathered.

# METHODS

## Sampling data

### Photographic reporter



### Information gathering:

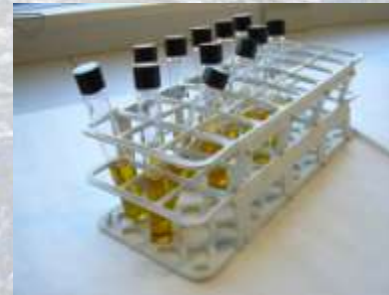
-Population, economic activity, industry, effluent and influent flows, the systems themselves, maintenance, management, sludge, etc.

### Geolocation:

- Wastewater treatment plant
- Collecting lines (problems)
- Discharge point

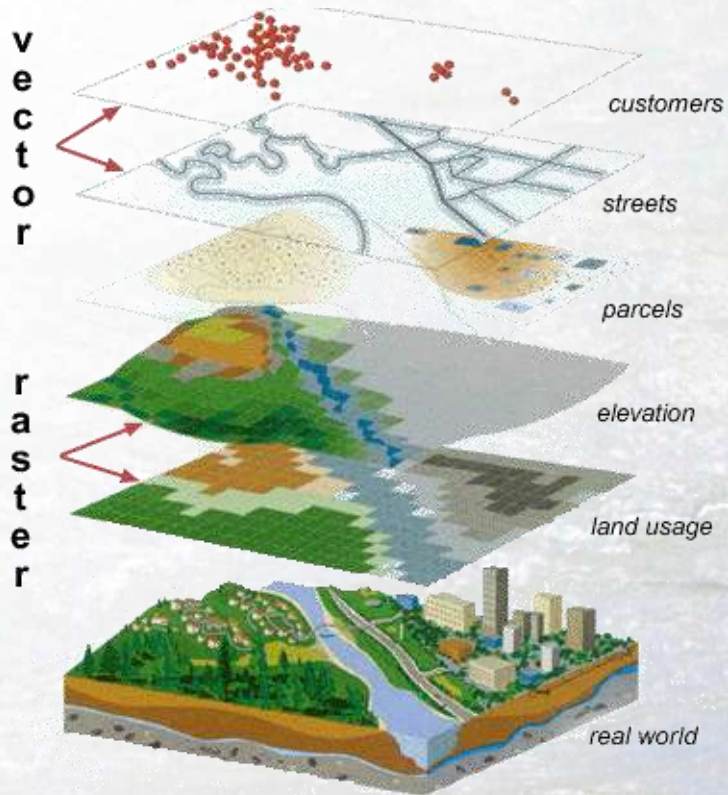


### Water and sludge analysis:



## METHODS

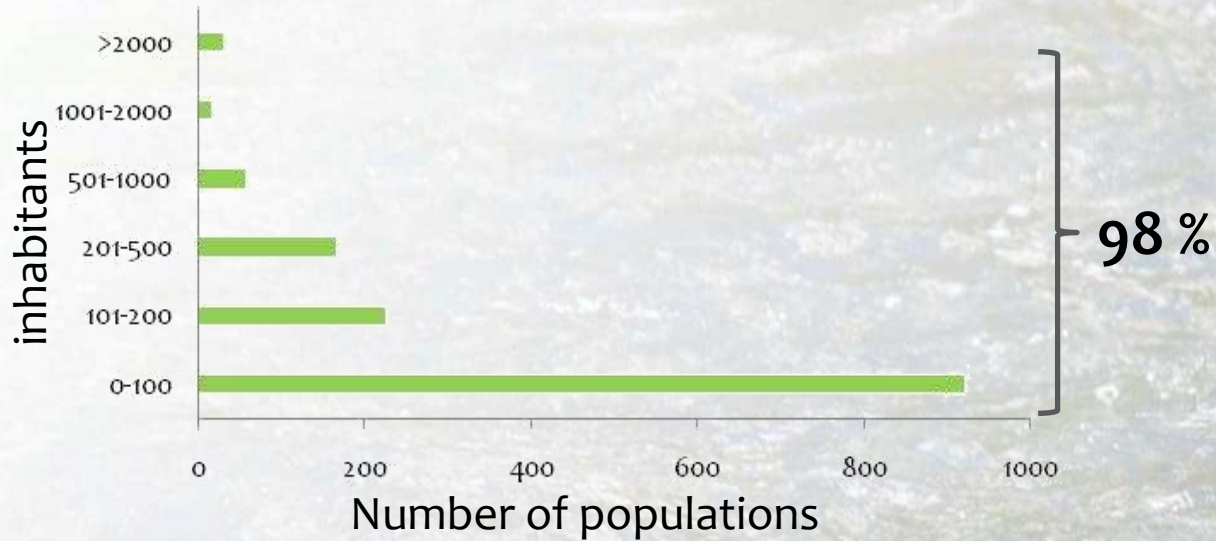
## Databases and Geographic Information Systems (GIS)

DATA ABOUT THE COLLECTING SYSTEMS AND  
WASTEWATER TREATMENT PLANTS

The quality of the input data will condition the effectiveness and accuracy of the subsequent analysis undertaken with GIS tools.

# RESULTS

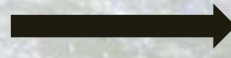
## Population and economy



## Industrial dumping



- Industry dumping
- Whitout industry dumping



27 % consider as dangerous for the aquatic ecosystems

## Livestock farming

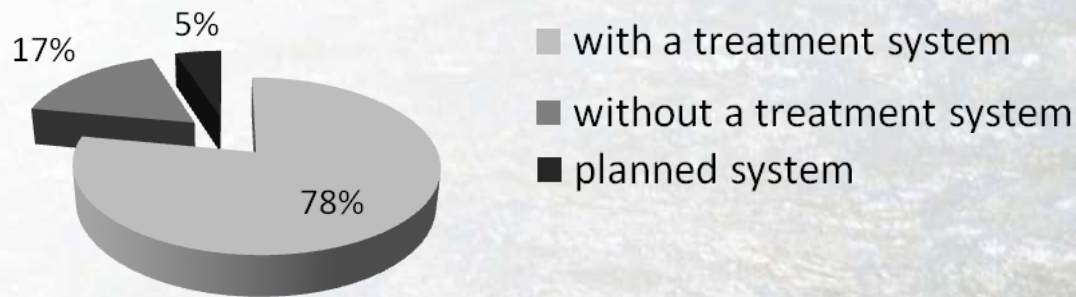
Small explotations connected to collecting lines



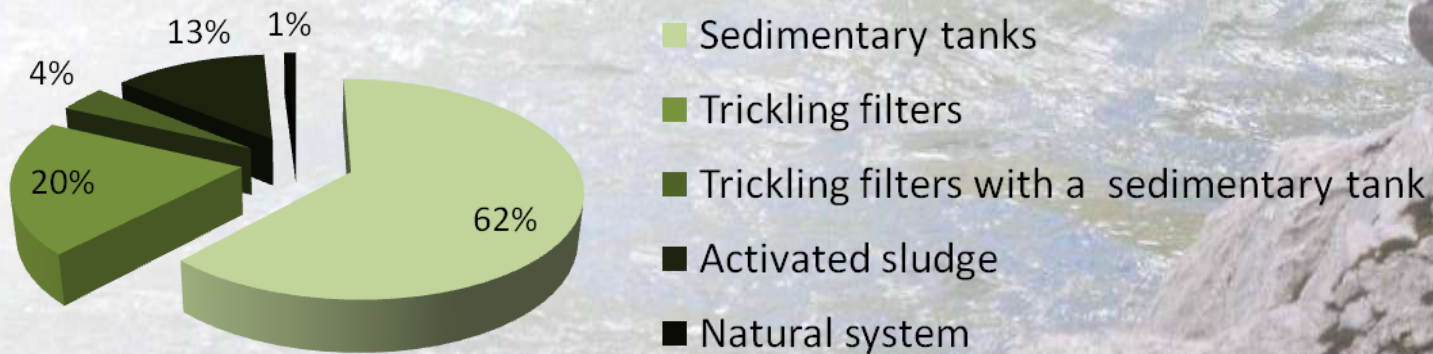
# RESULTS

## Wastewater treatment plants

There were inventoried a total amount of 1678 discharge points



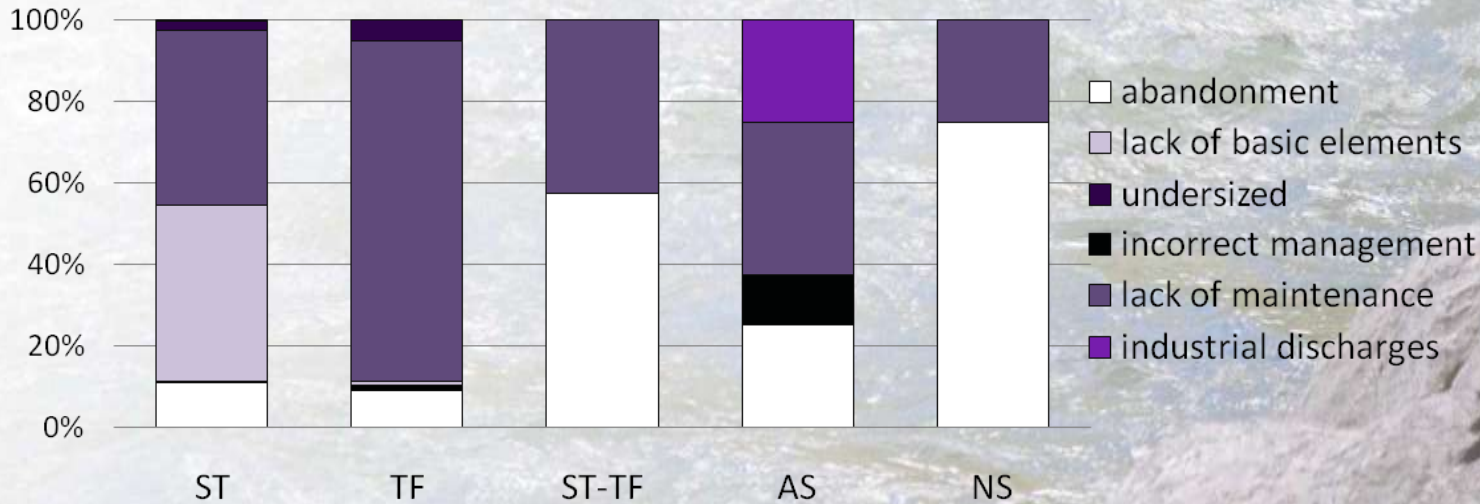
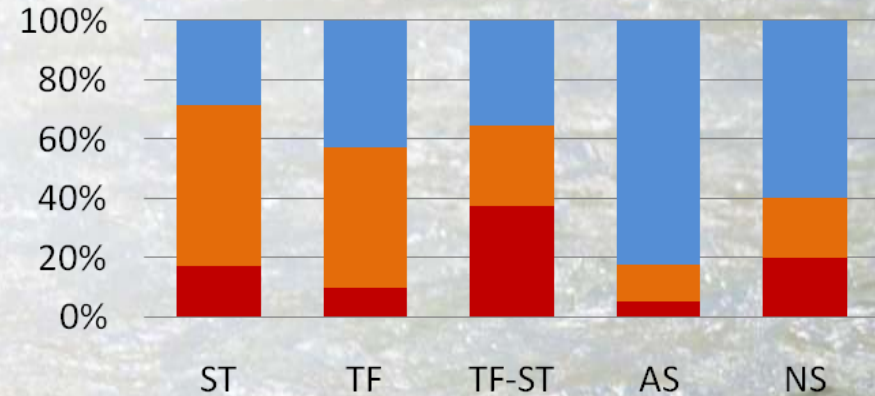
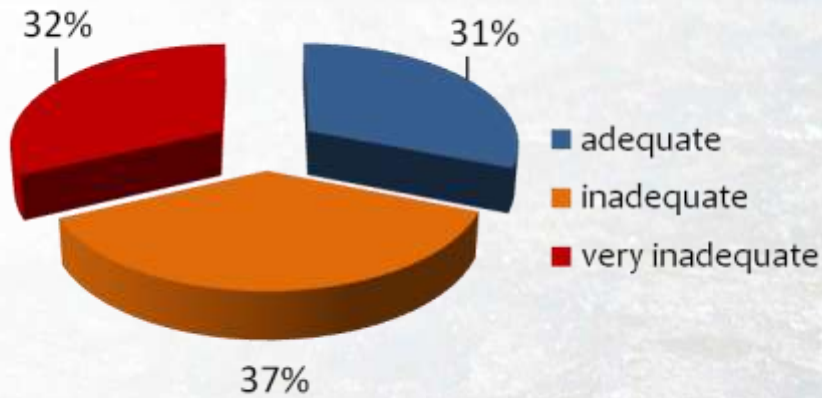
## Variability in the treatment systems



# RESULTS

## Legal and environmental requirements

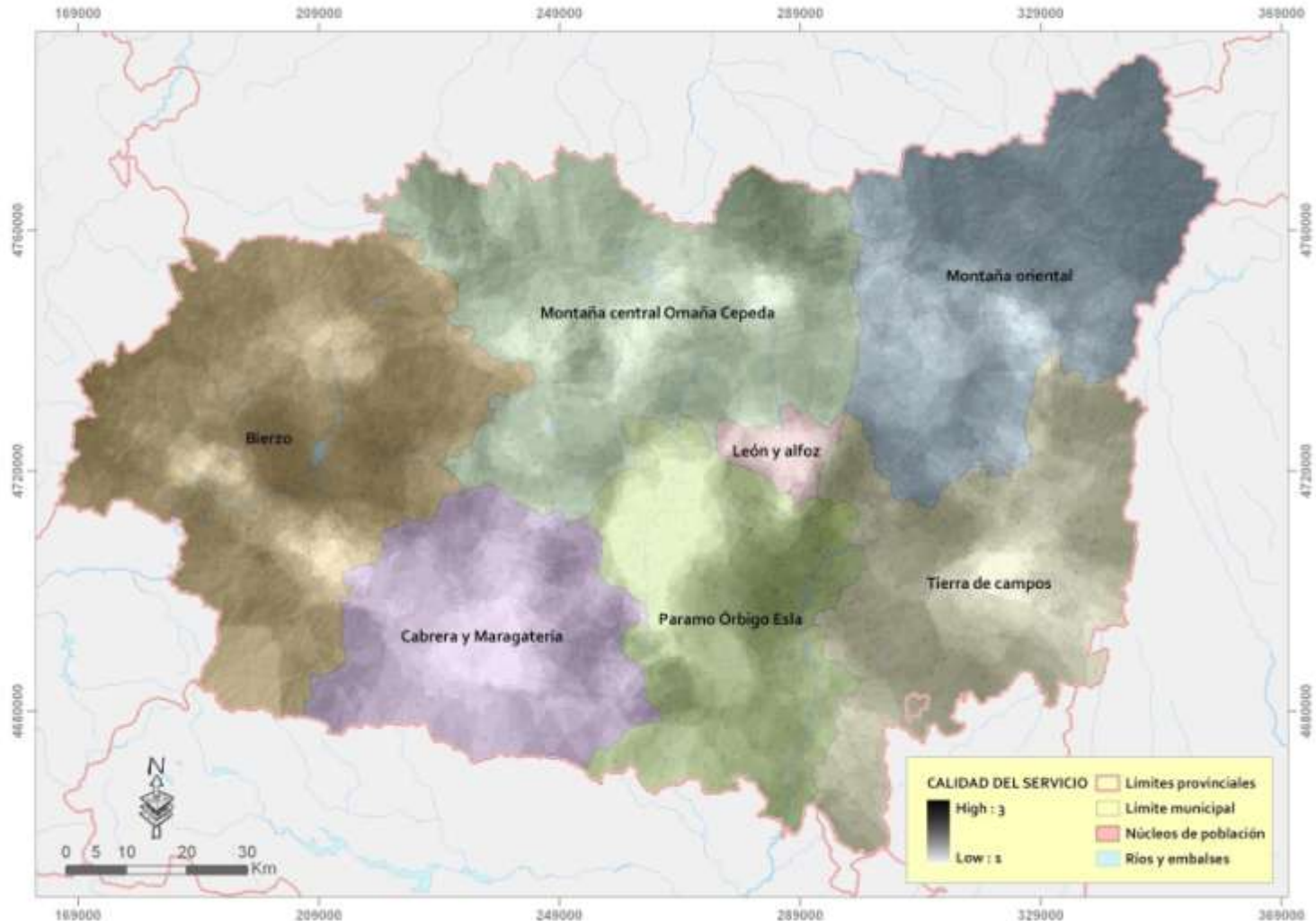
### Quality of sewage management





## RESULTS

## Legal and environmental requirements

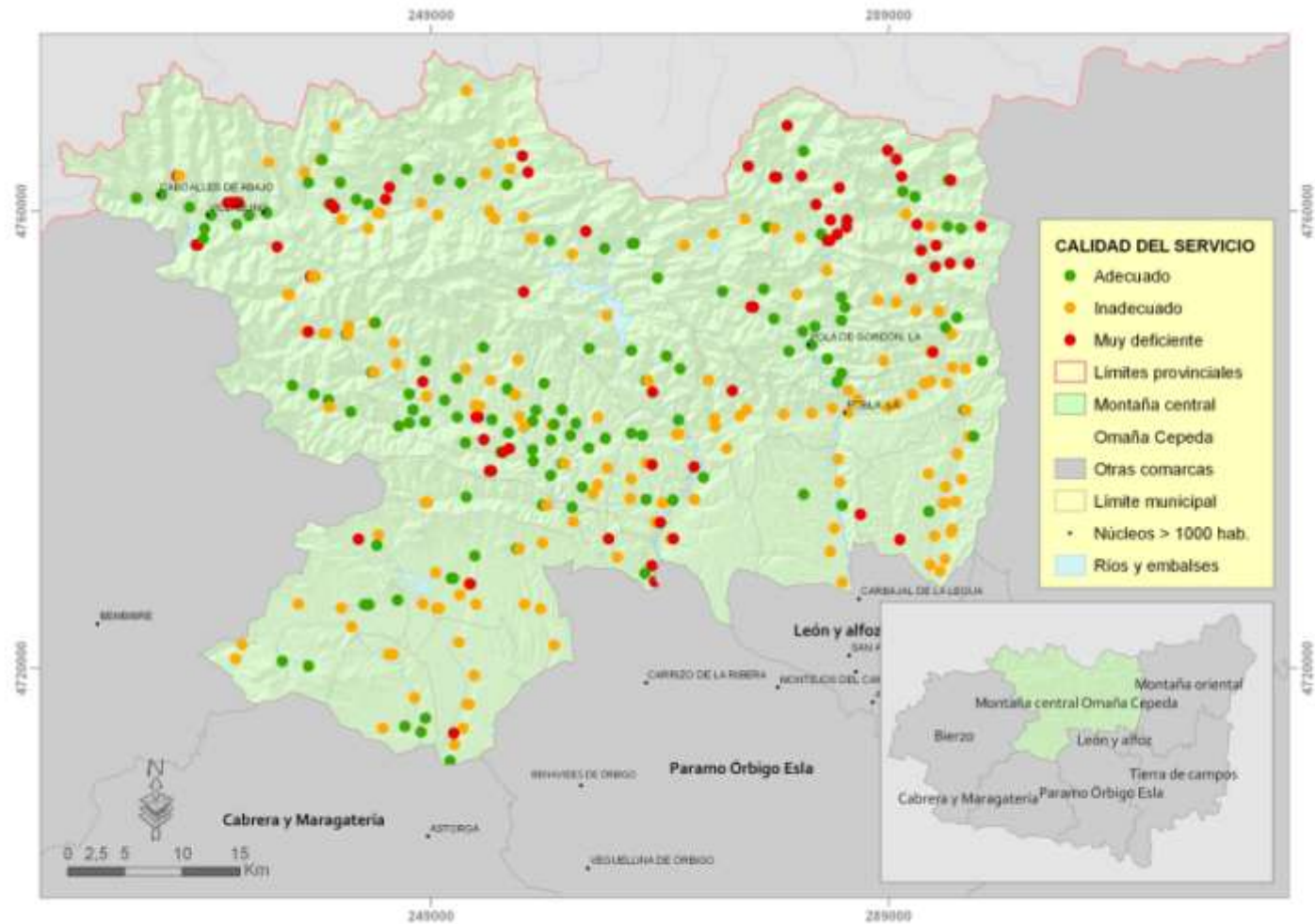


PROVINCIA DE LEÓN. Comarcas (Agenda 21 provincial). Calidad del servicio de depuración de aguas residuales.

Fuente: Junta de Castilla y León, Servicio de Cartografía de la Universidad de León y elaboración propia

# RESULTS

## Sub-regions



**PROVINCIA DE LEÓN. Comarca de Montaña central Omaña Cepeda. Calidad del servicio de depuración de aguas residuales por localidades.**

Fuente: Junta de Castilla y León, Servicio de Cartografía de la Universidad de León y elaboración propia

# RESULTS

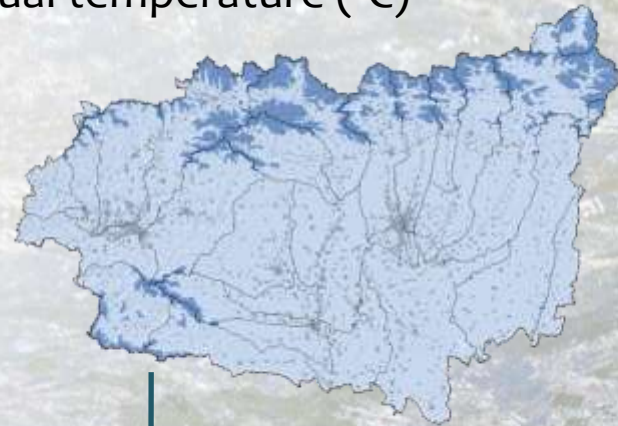
GIS technology has been used in environmental sciences for siting landfill facilities using exclusionary and non-exclusionary criteria

## Green filter

Annual pluviometry (mmHg)



Annual temperature (°C)



Slope (%)



**Geo-Statistics analysis:**

**Final Suitability Maps for each treatment system**

## TO CONCLUDE

After the three stages of the study all information has been gathered and included into a specific GIS, which allowed to manage and improve the efficiency of the systems.

The 78% of the discharge points have been treated being dominant the septic tanks and other sedimentary tanks.

The quality of the service is satisfactory for around 30% of the localities, while almost 70% showed non-satisfactory treatments of wastewater.

Activated sludge and natural systems were the most efficient and showed the best results.

The most important problem encountered was the lack of maintenance, followed by the abandonment and the bad technical design of the plants (dimension, volume and others). Although not all the plants work efficiently, around 50% of them showed a good state of conservation of their physical structures.

The application of GIS allow to characterize those areas with the higher priority for undertaking management actions or new constructions of wastewater plants, as well as to determine which systems are the most suitable ones for each particular location (considering all environmental factors which may drive their efficiency).

Thanks for your attention



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DIPUTACIÓN  
DE LEÓN

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