Implementation of Bioenergy Districts: Evaluation of biomass sustainability and logistic using GIS tools in a pilot area of Murcia

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Overall objective

To develop a methodology to create biomass districts we need to know:

1- Type of biomass sources and where is located the biomass.

2- Communication infraestructures distribution.

3- Biomass cost transport.

4- Example maps produced.

5- Conclusions

1- Type of biomass sources and where is located the biomass.

Biomass cartography

2 different landuse cartography scales:

Landuse cartography

Information system of land use in Spain (SIOSE) 1:25000

Geographic Information System of the Common Agricultural Policy (SIGPAC) 1:5000

accuracy is very important

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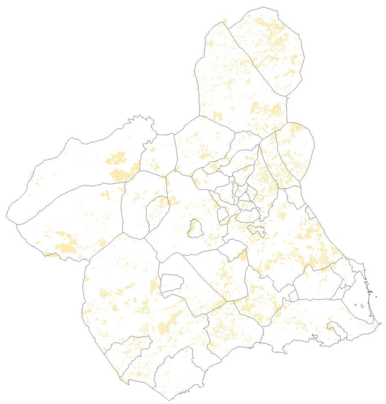
1- Type of biomass sources and where is located the biomass.

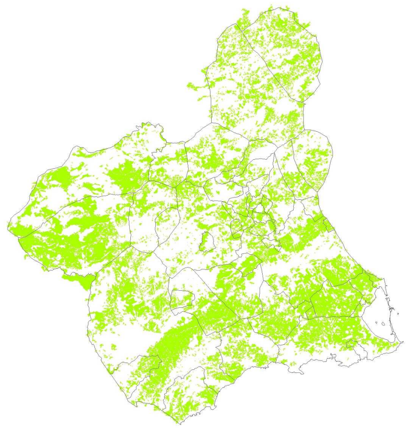
SIOSE interesting landuses for biomass production

Woody crops

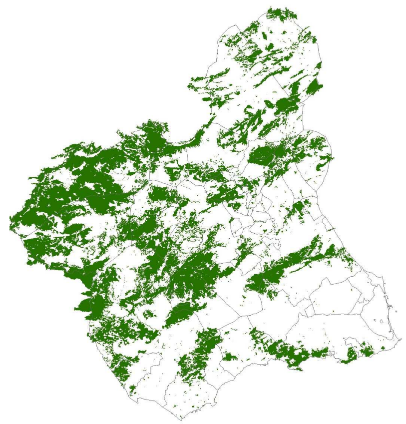
Pastures



Herbaceous crops



Forest



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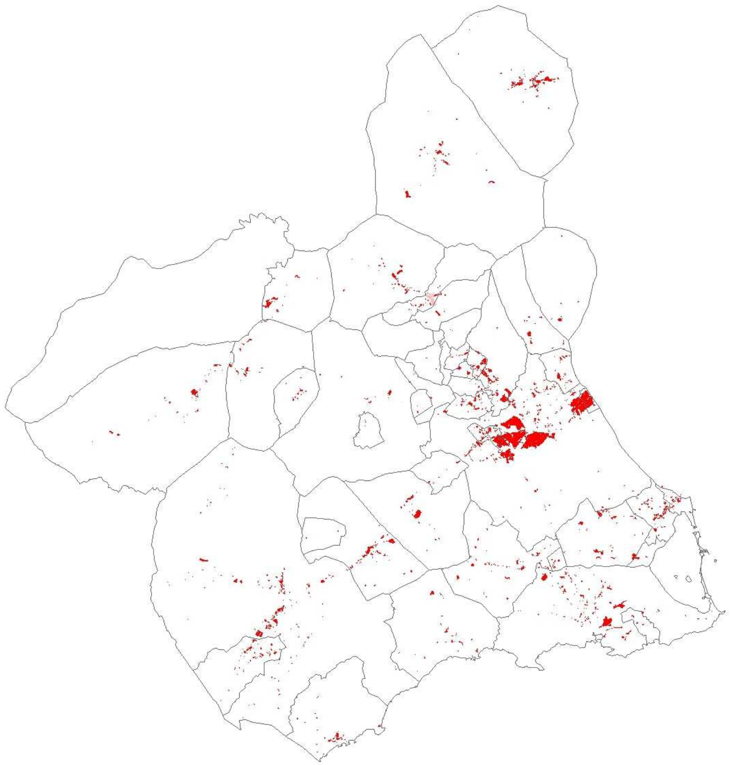
1- Type of biomass sources and where is located the biomass.

SIOSE interesting landuses for biomass consumption



Industrial and urban areas

1- Type of biomass sources and where is located the biomass.

SIOSE interesting landuses for biomass production

Landuse	Area (Hectares)	Biomass production (Tn/Hectare)
Irrigated not citrus fruit	39.319	5
Non irrigated not citrus fruit	105.550	1,6
Citrus	43.827	1,6
Vineyard	39.698	1,5
Grapes	6.140	2,5
Olive	23.158	1,6
Irrigated herbaceous	32.424	1,5
Non irrigated herbaceous and cereals	122.830	1,5

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1- Type of biomass sources and where is located the biomass.

SIGPAC interesting landuses for biomass production

Landuse	Area (Hectares)	Biomass production (Tn/Hectare)
Citrus	39679	1,6
Fruit - Citrus asociation	94	3,3
Husk Fruit - Citrus asociation	5	1,6
Vineyerd-Citrus asociation	0	1,55
Husk Fruit-Fruit asociation	5	3,3
Husk Fruit-olive asociation	161	1,6
Forest	26268	1,4
Husk Fruit	78748	1,6
Husk Fruit-Vineyard asociation	58	1,55
Fruit (apricots, plums and peaches)	27502	5
Fruit (rest)	47890	1,6
Olive-Citrus asociation	3	1,6
Olive-Fruit asociation	48	3,3
Olive	24924	1,6
Fruit-Vineyard asociation	106	3,25
Vineyard	35117	1,5
Olive-Vineyard asociation	15	1,55
Table grape	3384	2,5

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1- Type of biomass sources and where is located the biomass.

Biomass concecpts used

- Potencial Biomass (PB): all the biomass that it produces in an area

- Potencial Biomass Available (PBA): the biomass that it produces in an area and can be use. Is the potencial biomass area with zonal restrictions, like slope, proximity to a road, etc…

1- Type of biomass sources and where is located the biomass.

Data source	Potencial Biomass Available [PBA] Area (Hectares)	Forest PBA (Tn/Year)	Crops PBA (Tn/Year)	Total PBA (Tn/Year)
SIOSE	1015806	37694	401448	439142
SIGPAC	1015806	36774	505843	542617

The diference between this two data sources with diferent scales is **103.475 Tn/year**

accuracy is very important

1- Type of biomass sources and where is located the biomass.

Ok, now we know what type of biomass sources are in the area and where is located the potencial biomass, and the importance of the accuracy and the fiability of the geodata.

What's the best geodata type to make a real model for transport and cost for Biomass?

Raster or Vector.

It depends of: geodata scale, number of parcels, information actualization, process time, etc..

In this case we do it with an hybrid model, raster and vector data.

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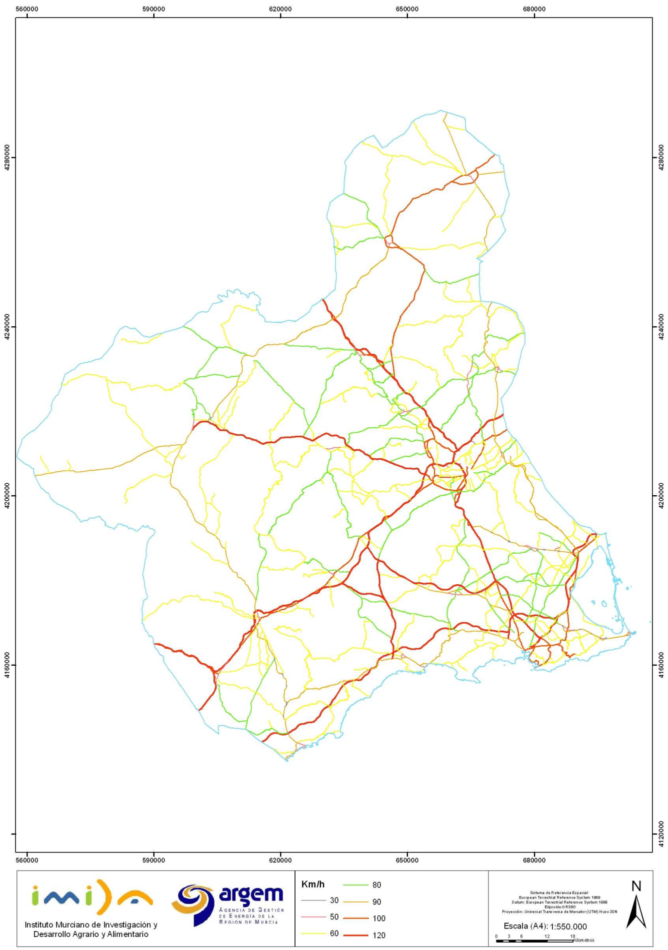
2- Communication infraestructures distribution.

Type of communication infraestructure and maximum speeds permitted.



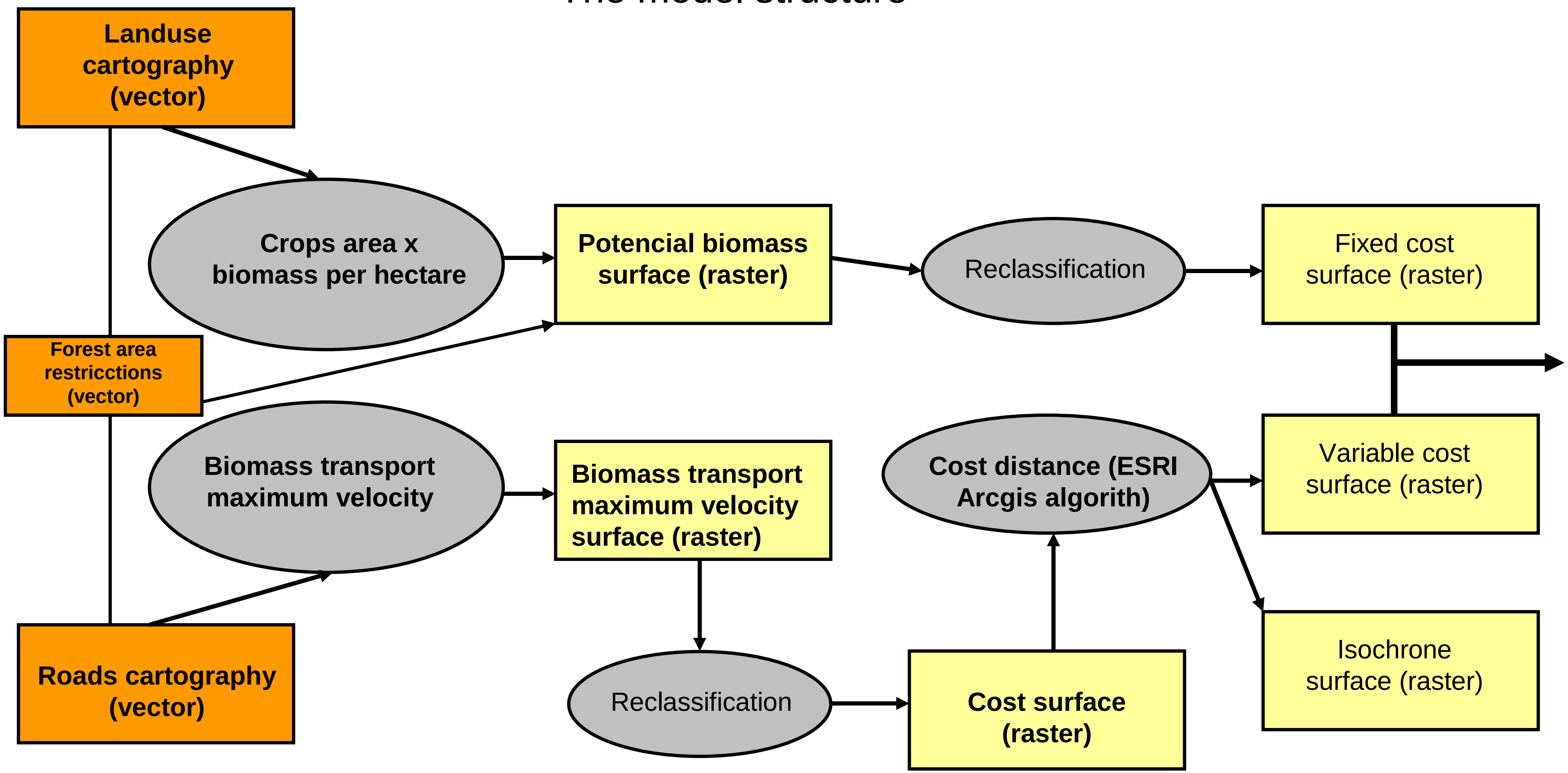
2- Communication infraestructures distribution.

Type of communication infraestructure and maximum speeds permitted.

Type of road	Máximum speeds permitted (Km/hour)	Calculated biomass transport maximum speeds (Km/hour)	% of the maximum speeds permitted
Toll highway	120	100	100
National highway	120	100	100
Autonomic highway	120	100	100
National road	100	90	100
Autonomic road: First level	90	70	100
Autonomic road: Second level	80	64	80
Autonomic road: Third level	60	48	80
Urban hiking	50	40	80
Link road	30	24	80
No road, land.	5	4	80

3- Biomass cost transport.

The model structure



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3- Biomass cost transport.

The model utility

With this model we can:

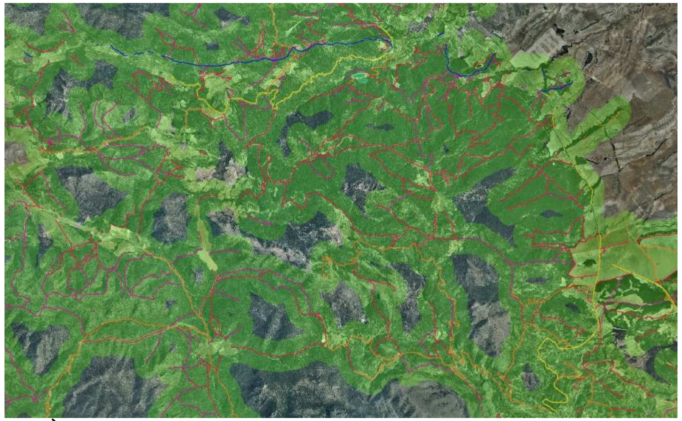
-Calculate the total cost (production cost of the biomass and accumulative cost distance to transport it to the comsuption place, in this case an energy plant)
-Calculate the quantity of potencial biomass available in all of the area or only in a isochrone surface, or in a isocost surface.
-Use the cost and the potencial biomass available values to determine the Bioenergy districts.

→ **Total biomass cost surface (raster)**

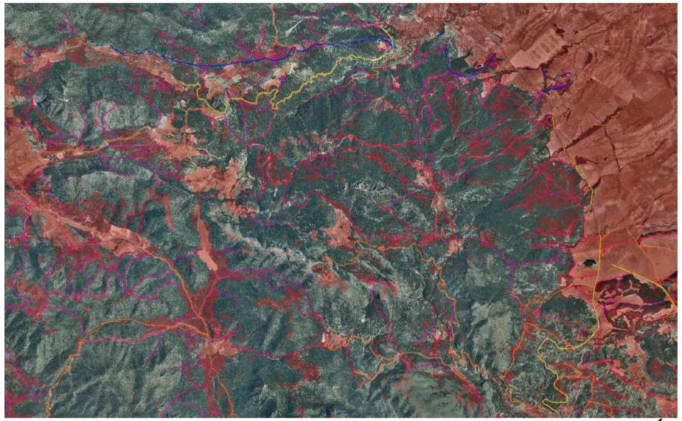
3- Biomass cost transport.

The model structure (details)

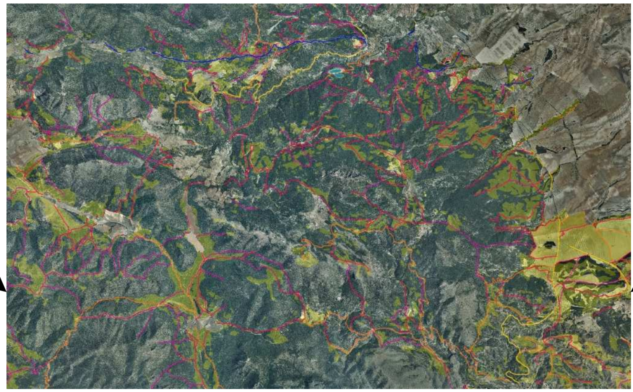
Forest area restrictions to be a usefull biomass area



300 meters from roads area



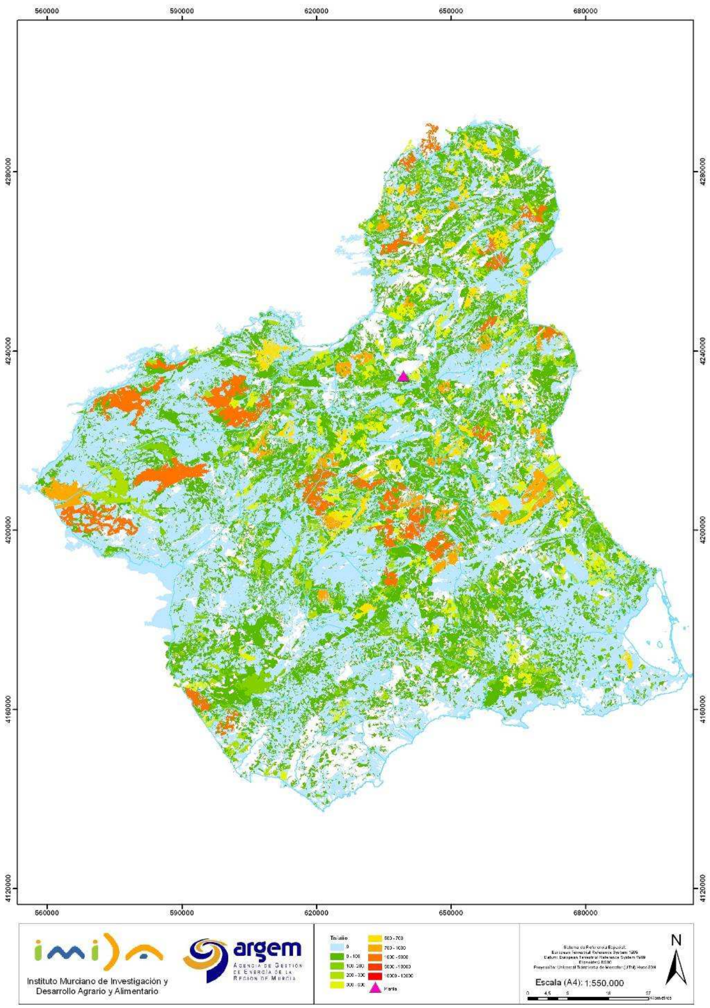
Under 20% slope area



Intersection usefull area

4- Example maps produced.

Potencial Biomass Available per parcel (Tn/year)



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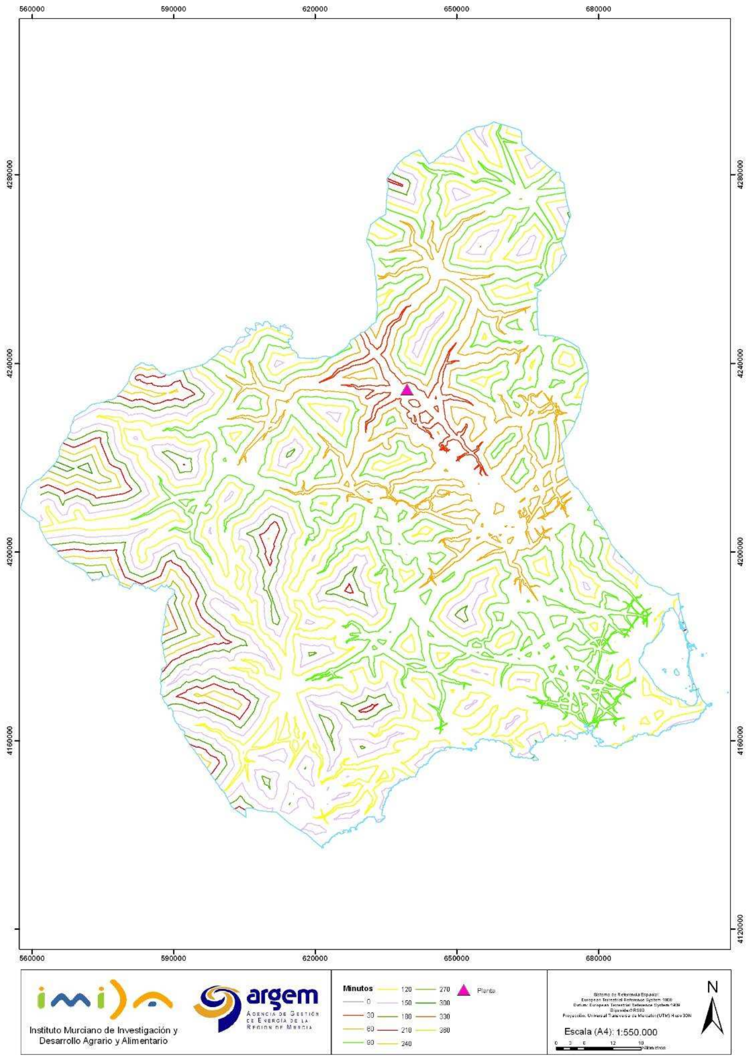
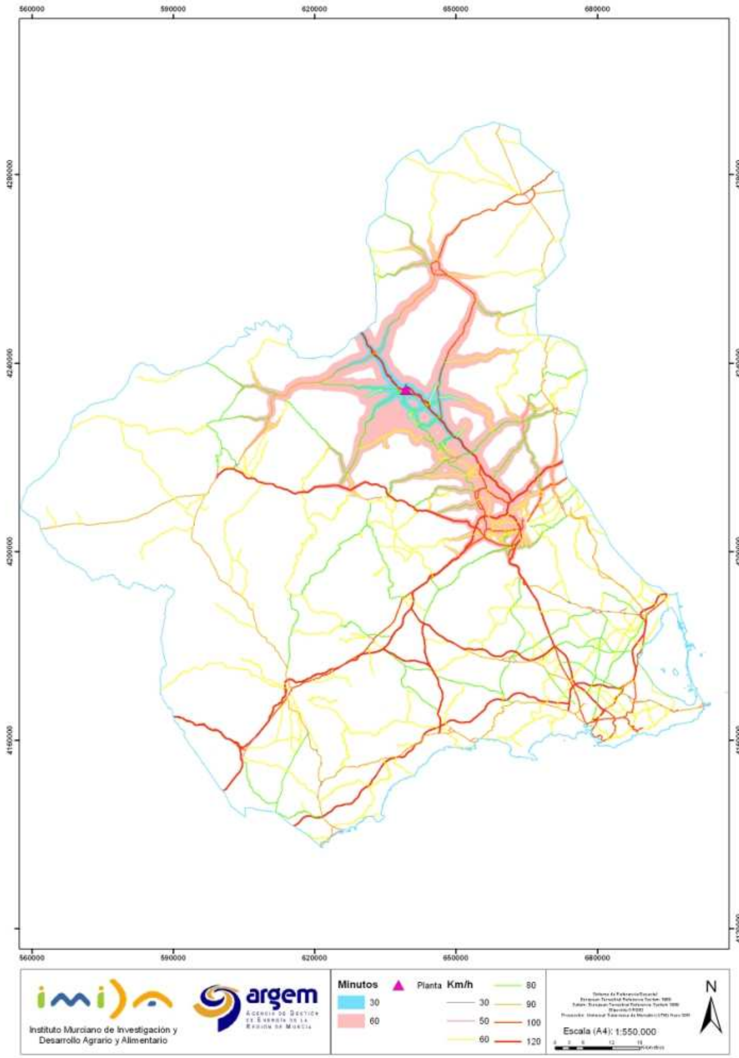
4- Example maps produced.

Isochrones every 30 minutes
from the energy plant



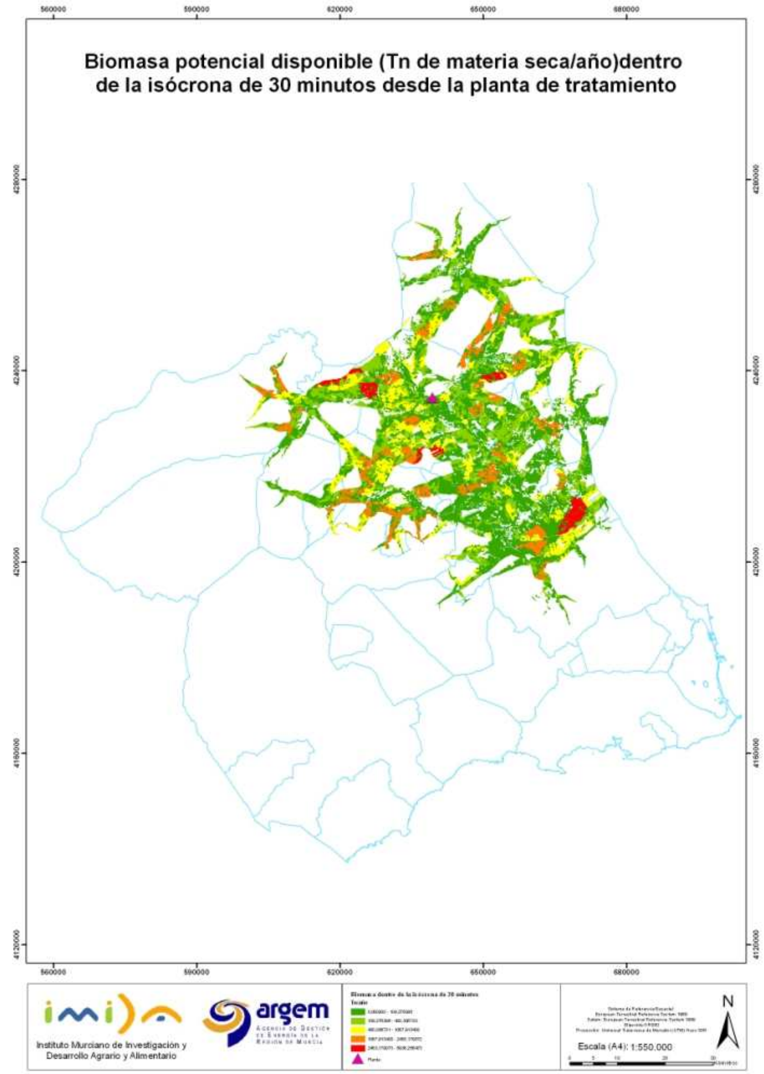
4- Example maps produced.

Isochronous (30 and 60 minutes) and maximum speeds permitted by road type



4- Example maps produced.

Potencial Biomass Available per parcel (Tn/year) into the 30 minutes isochrone from the energy plant



5- Conclusions

- GIS is an essential tool for logistics.

- GIS allows us to study the relationships between different elements of the territory, as the location of the producing and consuming areas of biomass, and spatial relationships between them.

- Geomarketing and GIS can be used to define energy districts.

- With sufficient information, the GIS can use a network analysis and provide a dynamic and updated system, allowing the management of energy consuming plant or group of them.

Thanks.
Any questions?

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