Investigation of the impact of some European Desertified Areas in departmental development according to EURURALIS.2 model

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INTRODUCTION

Integrating political decisions and their impact on land processes (like erosion) and characteristics (like biodiversity) while at the same time it is estimated productivity and money flow of the agricultural sector has been a very demanding task. Besides the difficulty in describing appropriately conditions and properties involved there are also problems of scale and boundaries of physical entities onto which political and administrational decisions are applied.

In this aspect and without been modellers but rather survey and empirical scientists we have selected the EU-ruralis model (Verburg, Eickhout & Van Meijl 2008) to test possible impacts of desertification in future development of some departments including such type of areas in their territory although such an item seems out of the scope of the model.

Of particular importance to us has been the problem of scale and administrational boundaries. The fact that the base unit of EU ruralis model is **the department** offers the advantage of being close to a unit that can be understood both at its physical parameters (climate, vegetation, soils), processes (erosion, exchanges between land-surface –atmosphere) but also on the human dimensions (like gross economic out put enterprises number size and kind of activity) plus the fact that reasonable statistics exist at this level for such social-economic factors. More than this, each department's area without been checked at the present study, seems comparable all over Europe.

South European departments include in their territories a variable amount of desertified land. These desertified surfaces with their specific characteristics such as low primary productivity, negligible agricultural or husbandry production, great erosion might act as a repressor to the development of the departments to which belong.

The aim of the present study is to assess if according the EU ruralis model hypotheses and the examined scenarios show specific grouping characteristics or emerging parameters that could be used or further be developed for future political decisions.

MATERIALS AND METHODS

The departments selected for this study are:
Lesvos (Lesv) island: Lat 39° 30 inludes large desertified area in western part over volcanic rocks

- Kiklades (Kikl): Group of islands with semi-arid climate Lat 37° 30
- Chania (Chan), Lasithi (Lasi): Two departments belonging to Crete at lat 35°

- Florina (Flor), Kozani (Koz): The peculiarity of these two departments of Western Macedonia (Northern Greece) is that though under temperate climate the include desertified areas categorized as grazing lands
- Attiki (Att), Thessaloniki (Thes): These two departments have been included as comprising the 2 main urban areas in Greece (Athens and Thessaloniki) so their impact should be big in economic performance indicators and minimal in environmental indicators such as biodiversity and erosion
- Serres (Serr), Larissa (Lar), Messenia (Mess): are three departments referred here with a latitudinal gradient from North to South in which dominates agricultural activity.
- Almeria (Alm), Murcia (Mur) and Alicante (Ali) are three Spanish departments selected both because they include known areas presenting desertification and been under a different European setting than the Greek one

Desertification prone departments are considered the Spanish ones and from Greece Lesvos, Kiklades, Chania, Lasithi, Kozani and Florina

Parameters of the model, characterised for the broad category to which they belong are:

People:Employment and Self sufficiency-

Land use:Agric Land/Arable land,/Pasture Land, /Semi-natural land,

Profit:GDP,

Planet: Nitrogen surplus, Biodiversity ,Carbon sequestration, Erosion

Scenarios for which the model is run according Westhoek et al 2006 are:

A1-scenario A: Global economy Marked Solutions are considered the most efficient to achive strong economic growth optimise equilibrium between demand and supply of goods services and environmental quality.

A2-scenario B: Market based solutions among like-minded countries, but shielded from countries with different values and standards. Cultural identity ,strongly anchored in the countryside ,must be preserved.

B1-scenario C: Global co-operation Market-based solutions to exploit comparative advantages, but strong internationally coordinated-efforts are needed to address wealth distribution, social justice and the environment

B2-D: Regional communities Self reliance, environmental stewardship and equity are the keys to sustainable development. Local communities are the cornerstones of society.

In the analysis have been included the values of the eleven parameters mentioned earlier in this text for the years 2010, 2020, and 2030. So results obtained reflect rather permanent characteristics of department area than evolution in time .

Statistical analysis
To assess how well samples from different departments can be separated on the basis of multivariate data set and to find which variables exert the strongest impact on the discrimination, a generalized linear model (GLM) discriminant analysis was used. The GLM models are more robust against departures from normality in data distribution.

RESULTS AND DISCUSSION

Figure 1. Discrimination of departments in the Root1xRoot2 biplot according to the parameters of the model in the four scenarios. Error bars indicate ± SE.

The discrimination of samples on the Root1xRoot2 biplot in relation to the variables of the four scenarios 1 is presented in fig 1. Although six to eight discriminatory functions were revealed significant for the separation of samples in all scenarios, the first two functions explained 80.7-91.2% of data variation depending on the scenario. In scenario A, along the first axis, the departments of Thes and Lari were classified towards the right end of the first axis exhibiting higher values of employment, while those of Lasi, Chan and Lesv towards the left end having greater values of GDP. Along the second axis the departments of Koz and Flor were characterized by higher values of arable land and were discriminated from the departments of Murc, Alic that had the highest values of agricultural land variable. In scenario B the department of Thes had the highest values of GDP and was classified towards the right part while in the second axis the department of Alm was ordinated in the upper part of the axis exhibiting the high values of pasture land, while in the lower end of the axis the department of Lesv was classified having high values of the erosion variable. In scenario C the departments of Chan, Lesv and Lasi were classified at the right part of the first axis showing high values of GDP while the departments of Thess and Lari towards the left side characterized by higher values of self sufficiency. In the second axis the departments of Att and Lesv were discriminated. The first one was

127

characterized by high values of pasture land while the latter was distinguished due to GDP. Finally, in scenario D along the first axis the departments of Lasi and Chan were once again discriminated from the department of Thes. Lasi and Chan were characterized by the high GDP values while Thes was discriminated due to the high self sufficiency values. Along the second axis the three Spanish areas (Alm, Alic, Murc) were ordinated towards the upper part of the axis characterized by high values of agricultural land while the departments of Thes, Lari, Koz, Lesv were distinguished due to arable land.

DISCUSSION

Landscape characteristics due to desertification results tend to differentiate departments including such areas. (Feoli, Giacomich and Mignozzi, 2003). Though not directly but modifying the secondary even tertiary outcomes such as GNP, self sufficiency, grazing lands or arable lands.
In all cases GDP is the main discriminating factor in the first axis, coupled with employment in Scenario A, Biodiversity in scenario B, self sufficiency in scenarios C and D.

As far as it concerns grouping of areas, geographic location (something that facilitates market solutions), brings neighboring areas together such as Chania with Lasithi,in Crete, Florina and Kozani in Northwestern Greece. An interesting outcome appears to be the joining of the Cretan sites by Lesvos in all scenarios and Florina _Kozani by Attiki except scenario C . In scenario C also all Nothern Greece departments are grouped together i.e. both the ones been mainly agricultural but also the departments of Florina Kozani which include desertified areas. A possible explanation for this, might be that desertified areas in those departments occupy less than 10% of their surface so the agricultural (and maybe industrial character for Kozani) prevails.

The Greek department of Messenia remains ungrouped in any scenario.
Spanish sites not only they form a group apart but they split also between themselves with Alicante and Murcia forming a group and Almeria taking a separate place.

Results of such a classification provided that grouping is proved not to be a simple statistical correlation without cause-effect links and that model mechanics are correct, can help in the design of better actions to address the problem in a sustainable way (Groot et al 2004)

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