Chapter 3.5

Geographical Information Systems for Biomass Estimate and the Search for Renewable Energy Sources

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ABSTRACT

In this paper the attention is drawn on GIS as a support for energy choices for a sustainable development. Given the growing pressures for respecting the environment on one side and on limited non-renewable energy sources, mainly oil-based, on the other side, there is a need to evaluate different alternative sources for integrating those already available and to foster energy saving. This paper is focused on biomasses, and particularly on those originating from cattle and swine breeding. An example is given of localization and quantification of energy potential deriving from animal breeding in Friuli Venezia Giulia Region (North Eastern Italy), focusing on cattle and swine ones, from the analysis of local units and animals registered at municipality level. In this stage of the research, the GIS environment is used to analyse statistical data at municipality level and for computing the theoretical output in energy terms, hypothesising different scenarios.

1. GIS AND SUSTAINABLE DEVELOPMENT

Sustainable development foresees the balance between the present needs of human race and the management of resources in order to allow future generation to meet their own needs (Brundtland,

1987). Sustainable development as a concept requires the harmonization of human development, the conservation of resources and co-existence with nature. Two important concepts are included in the definition, both related to the term 'equity'. We talk in fact about intra-generational equity, as the need of limiting the differences in development currently existing in different groups of the human race, while we consider an intergenerational equity

aimed at avoiding the destruction of resources allowing future generations to develop themselves. Sustainable practices become necessary when the pressure exerted by the human population on resources grows, in terms of new needs of development and changes in society. An implication is that both technological and social settings should be organized so that human activities allow the biosphere absorbing their impacts. However, as Campagna (2005, p. 6) recalls, "Economic, social and environmental process are spatial and can be hardly understood without considering their spatial dimensions. The man-environment relationship can be represented relying on spatial locations, as both the environment implies a topological relationships among physical objects, and human actions take place and have spatial impacts on the environment" that said, there is space and need for methods, technologies, procedures and to address the geographical aspects of sustainability, particularly to "support analysis, problem solving, planning, decision making and management of the processes required to pursue these common objectives" (Campagna, p. 6).

Geographical Information Systems allow user to share ideas and procedures on how to face the need for resources, plan efficient land uses and protect the environment in order to allow future generations to survive. The recent WSSD - *World Summit on Sustainable Development* - highlighted GIS as an important instrument to manage land resources and for the geographic education in developing countries.

In an operational context, GIS can help in estimating local economic availability of resources, as well as acquiring socioeconomic, physical, and environmental data inputs from different national, state, and local government agencies to produce strategic planning scenarios. In fact, "GIS offers a wide range of reliable tools to support sustainable development-led activities, such as problem setting and solving, planning, decision making and management" (Campagna, 2006). Also, Geographic Information System technology can

help in the communication and dissemination of geographical information, "by providing not only tools for storage and analysis of multisectoral spatial and statistical data, but also by integrating databases of different sectors in the same format, structure and map projection in the GIS system" (FAO, 2004). More importantly, GIS can act as knowledge systems to support spatial planning in order to allow measuring contents and evaluation processes (Prezioso, 2003).

2. RENEWABLE ENERGY SOURCES: BIOMASSES

Renewable energy sources represent high potentials in reducing the dependency from fossil fuels. Such sources can be inserted into different 'energy families', as the solar one - thermal and photovoltaic - hydroelectric, wind farms, geothermic and from biomasses. These latter are characterized by being organic elements from vegetal and animal sources not used by humans neither as food nor as raw industrial materials (Favretto & Santoprete, 1994), although sometimes also maize is used as organic matter to produce biogas, even if maize could also be used as food.

Vegetal biomasses represent the most refined means of collection of solar energy as vegetal plants by means of chlorophyll photosynthesis convert the energy radiated by Sun into chemical energy with high potential. In such sense biomasses are considered as renewable and long-lasting resources, limited only by the respect of their regeneration pace. Furthermore biomasses are considered neutral in terms of the CO_2 emissions in the atmosphere.

To-date biomasses are considered central in post-Kyoto treaty development policies. The Italian Law[1] defines biomasses as "the biodegradable part of products, wastes and residuals deriving from agriculture – including vegetal and animal substances – and from silviculture and connected industries, as well as the biodegradable part of

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