An Emergy–GIS Approach to the Evaluation of Renewable Resource Flows: A Case Study of Campania Region, Italy

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ABSTRACT

Natural resources are not uniformly distributed over the landscape and, as a consequence, different areas support different social and economic development challenges. In this context, geo-referred information plays a paramount role in the dynamics of economies and their interaction with the environment. Synergic use of geographic information system (GIS), spatial planning (i.e. land use, urban, regional, and environmental planning) and emergy assessment may provide a very meaningful framework toward sustainability. Measuring resources in emergy terms means to quantify their environmental worth to all species in a given area: the integration of emergy and GIS allows the description of the spatial distribution of these resources and consequently the assessment of land's intrinsic environmental value, in support of land use planning policies. Thematic maps showing the distribution and environmental quality of renewable emergy flows (solar radiation, rainfall, wind, and geothermal heat) in Campania Region (Southern Italy) are presented in this work, all converging toward the generation of an annual renewable areal empower density (seJ ha$^{-1}$ year$^{-1}$) map. These maps are useful to identify the primary resource flows that are locally available in support of sustainable land use and production patterns. The main results show that natural areas have the highest annual renewable areal empower density (11.30E + 14 seJ ha$^{-1}$ year$^{-1}$) among all the different regional land use patterns, much higher than the average value of Campania Region (7.22E + 14 seJ ha$^{-1}$ year$^{-1}$). The 59.64% of the total annual renewable emergy converges to natural areas although they are only about 38.15% of the total regional land use. The proposed approach allows classification of regional areas according to their environmental value, thus providing useful policy information oriented toward supporting and conserving environmentally valuable land and natural resources.

Citation
