The structure of rural Greece through a prism of social – ecological interactions

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ABSTRACT

There is a flux associated with rural spaces and that is the constant reshaping of their structures through interactions between socio-economic and environmental processes. These processes, which are driven both by internal and external forces, affect the sustainability of rural livelihoods. Furthermore, reforms on the Common Agricultural Policy have always been pushing changes in rural activities which, combined with the effects of the economic crisis and the policy reforms that come along, introduce rural areas to an era of high instability. In terms of natural processes, the effects of climate change also put their toll on rural functions, especially where agriculture is concerned. Moreover, it is natural that different rural areas are experiencing these forces of change in diverse ways whilst the capacity of a rural region to maintain a satisfactory standard of living, under these circumstances depends on the balance between its ecosystem, economic and cultural functions. Thus, the study of this capacity requires an interdisciplinary approach and the work presented here involves issues traditionally approached by different disciplines, each using different scientific terminologies and methodologies, running in parallel and with no association to one another. As a result, a combination of theories, concepts, techniques and tools within an integrative framework is required. Drawing on literature research from the social and natural sciences, as well as systems theory, such a framework has been developed in order to study the ability of rural areas to adapt whilst maintaining their rural livelihoods. This framework is used to identify the social and ecological characteristics of the study areas, as well as the activities taking place within that space and identify influences from external activities. It aims at contributing to the study of these interactions, first at regional and then at localised scales, using Geographical Information Systems (GIS) as a means to bridge across the disciplinary boundaries and scales.

Keywords: Rural areas, Social – Ecological Systems, Sustainability, Framework, Peloponnese

Introduction

Rural areas in Europe cover 57% of the territory (90% if we take into account the intermediate regions) and this corresponds to 24% (or 59%) of the population. In Greece, predominantly rural regions cover approximately 82% (this number raises to 94% when considering the intermediate regions) of the territory, which is one of the highest percentages among the EU-27 Member States (EC, 2011). What is more, there is considerable spatial differentiation of rural areas in Greece in terms of their dependence on agriculture and/or on tourism, their proximity to urban centres, their geographical features and their natural resources endowments (Efstratoglou, *et al*, 2001). Overall the spatial organisation is determined by large and small urban centres and rural areas are seen as lagging in development.

In Greek the term rural is *αγροτικός* (deriving from the term *αγρός* which means field i.e. a manmade environment). As a result it is understandable that the natural environment is not seen as an asset, but more as a blank canvas that needs to be developed. This notion of rurality is closely associated to the traditional ideas, where an aesthetically pleasing view does not correspond to a natural landscape but to one that has been mastered by humans, which is a characteristic of the Mediterranean tradition of rurality (Hoggart, 1995). Overdependence of rural local societies on agriculture and the exploitation of natural resources is a characteristic of less developed economies. Maintaining this kind of attitude has resulted in a bias of rural development policies towards activities that alter the natural characteristics of the landscape.

In the years prior to the current economic crisis, there was evidence that this attitude towards the natural environment was changing. Large spaces in the countryside, especially in the most remote areas, were allocated protected area statuses in all European Mediterranean countries (Figuereido E., 2008). For instance, In Greece, approximately 21% of the Greek territory has become part of the NATURA 2000 network). At the same time, previously untapped rural areas were now being developed, by exploring their natural assets. (e.g. Upland areas with the creation of tracking routes, eco-tourism, adventure tourism, Stymfalia Museum -2010 etc)

However, the economic crisis seems to have reversed this trend with a return to more “traditional” routes of

resource exploitation, which are being promoted by the agency *Invest in Greece*. One such example is the interest to re-open and expand the gold mines in the north of Greece in areas that were previously valued for their pristine forests and landscape amenities (http://www.investingreece.gov.gr/default.asp?pid=127&nwslID=24&sec=7&la=1). Still, even under this light, environmental characteristics continue being promoted as an asset for the development of thematic tourism activities or in combination with cultural and agricultural aspects. Such are the projects *Mythical Peloponnese* and the Agro-food Partnerships that are being created by regional national and private institutions. At the same time, it has been noticed that different rural areas are experiencing the economic crisis in diverse ways. While recent reports from the Pan – Hellenic Confederation of Unions of Agricultural Co – operatives (PASEGES) show that agricultural employment is increasing and a number of people are returning to rural areas from the city, other places are losing their young population faster than in the previous years, with the majority of them leaving the country altogether to look for employment abroad. Similarly, Common Agricultural Policy-induced reforms are pushing for ever more changes in rural activities that affect rural areas diversely and at different degrees. Adding to that the effects of climate change, with increasing periods of draught and extreme flooding, rural areas are facing an era of high instability. If we are to accept that sustainable development remains a goal of Greece (ESSAA) and the European Union (Lisbon strategy), we need to be able to know how sustainability can be maintained under such unstable conditions. Sustainability is maintained and not achieved because it is considered to be a process rather than a goal – it is a process that creates a continuum, a process that maintains a quality of life by allowing the environment and the society to continue to function, a process that in systems language is connected to the resilience of the system. Resilience is used here in its broadest sense as the maintenance of functioning in the face of disturbance (Levin and Lubchenco, 2008). Note that resilience and sustainability are both very general and fuzzy concepts that are often used to describe the same things (Cumming, G. S., 2011), however, the former is considered to be a property of the system (Gunderson and Holling, 2001) whereas the latter can be used to describe a course or a method of action. The two concepts are interlinked and Walker and Salt (2006) have identified that the key to sustainability lies in enhancing the resilience of a social – ecological system and not in optimising its isolated components.

Still, most sustainability assessments often concentrate in assessing socioeconomic and environmental attributes in parallel rather than in conjunction. As a result, the decision of whether or not the conditions suggest sustainability is derived by combining the outcomes, and without considering the interactions among the two, which would provide an indication of the system's resilience. The study of Social – Ecological Systems (SES), on the other hand, aims at providing a better understanding of sustainability by assessing the factors that drive those interactions, the interactions themselves, as well as their outcomes.

Hence, although a complete understanding of the complex interrelations can only be achieved through qualitative research, the connections between environmental and socioeconomic conditions can be approached and visualised through the use of GIS as an analytical tool. GIS are a valuable tool for recording and analysing different sets of data (empirical, statistical, spatial etc) for the creation of composite criteria in order to describe the differentiations of rural Greece (Papadopoulos et al, 2008). The aim of this paper is to propose a framework to study these interactions, using the principles of Social – Ecological Systems (SES) and thus creating a structure of criteria that can be used to visualise the processes occurring in the Greek countryside. The two questions that govern the criteria selection are:

1) Are the rural services sustainable?
2) Is the system likely to continue to function under external/internal pressures?

Rural Social – Ecological Systems

Rural areas, although existing as images in people's minds, as Michael Woods illustrates in the introduction of his book Rural Geography (2005), are associated with different beliefs as to what constitutes rurality. The different approaches on what constitutes "rural", stem from the historic, socioeconomic and cultural characteristics of the rural communities (Hoggart, 1995), as well as the researcher's background and the reasons for wanting to study *rural areas*. As a result, there is no internationally-accepted definition for researchers of all disciplines. In studying rural areas as social – ecological systems we can spatially define rural territories as social systems embedded in their ecological surroundings and whose survival depends, among others, on their interrelations with the system of natural resources (Ambrosio – Albala and Delgado, 2008). Thus, rural spaces can be defined in relation to the land uses within a specified territory. This definition of rural areas indicates that

rural locales can be conveyed as social – ecological systems, comprised of socioeconomic and ecological characteristics (Schouten *et al*, 2012).
Typologies of rural areas using land cover information shift the focus from population density and are a step closer to the everyday sense of rurality (Johansen and Nielsen, 2012), which relates to the openness of land. This is in accordance with recent developments in rural areas typology agreed for by the European Commission in order to provide a consistent basis for the description of *predominantly rural*, *intermediate* and *predominantly urban* regions in all Commission publications (EC, 2010). The openness of land is important when considering rural areas as SES because it is important to include spaces where the environment and natural resources are conditioned whilst simultaneously conditioning themselves the actions of the local population (Ambrosio – Albala and Delgado, 2008)., i.e. spaces where nature – society interactions can be identified. Nature here is defined through a four legged relationship between the individual, and the human, animal and plant societies which are interconnected through biophysical processes. This definition is an expansion of the one used by Berghoefer *et al* (2010), according to which there is a triangular relationship between the individual, the human society and the physical processes. The involvement of humans (as individuals or as societies) is quite important in shaping this relationship and to the extent that the physical processes will participate in creating a space with more or less natural characteristics. Consequently, it can be assumed that human societies have the ability to be engaged in a positive synergy with the natural environment as well as a negative one. This positive or negative synergy is what drives (un)sustainability. Identifying these positive/negative synergies through the social – environmental interactions that occur in rural locales is the focus of the proposed framework.
Central to the study of SES is the notion of *resilience*. Rural resilience has been defined by Heijman *et al* (2007) as the capacity of a rural region to adapt to changing external circumstances in such a way that a satisfactory standard of living is maintained. They also suggest that it can be described by how well a rural area can balance its ecosystem, economic and cultural functions. Although the entanglement between the ecological, economic and cultural characteristics of rural areas is recognised, these are presented as three different systems and not as components of a single Rural SES. In the same work, it is suggested that rural space can be compartmentalised in areas fulfilling one of three groups of *rural functions*, i.e. *Agriculture*, *Rural services* and *Nature*, and propose that the concept of rural resilience is applied to the first two functions. Nevertheless, by doing so, essential benefits that are attained due to certain areas having a "*Natural function*" are being overlooked. In this paper we support that these "Natural functions" are essential to all rural areas and that in reality the three rural functions that Heijman *et al* (2007) propose do not occur in compartmentalised rural areas but rather co-exist in space and time. In a sense the *Rural Services* function can be used to describe this multifunctionality and co-existence and it can be further divided into more categories in order to acknowledge the majority of the activities that take place in rural areas. Some of these are:
-Agricultural Activities
-Natural Activities
-Social/Cultural Activities
- Mining Activities and
-Tourism Activities
As acknowledged by Heijman *et al* (2007) rural services can be further distinguished in public and private ones.

Developing a Social – Ecological Systems framework for sustainability assessment of rural areas

In the last decade there have been a series of frameworks aiming at analysing social – ecological systems. These tend to be either anthropocentric or ecocentric, depending on the background of their developers or the reasons for which they were created. A good analysis of the most commonly used ones is presented by Binder C.R. *et al* (2013). In this work, the frameworks differ significantly in the way they address the issues at hand, depending on their goals, which range from poverty reduction (Sustainable Livelihood Approach) to corporate sustainability (The Natural Step), and everything else in between. The scales which they target range from global down to community level. Some of the frameworks are anthropocentric, while others tend to be ecocentric, some consider the unidirectional dynamics (i.e. from social to ecological) whilst others conceptualise a bidirectional dynamic relationship.
In order to study rural Greece we needed a framework that could be used both at regional and local scales, and since it is our belief that the dynamics are bidirectional, the framework should reflect that. Of the available frameworks, the one closest to our needs was the SES Framework developed by Elinor Ostrom (2009) in order to provide a common language for analysing SESs and facilitate in variable selection. However, this framework

was developed mainly for natural resource management and, as a result; it focuses on sustainable management of natural resources. In reality, the majority of the frameworks that aim at regional or local scales derive from natural resource management practices, especially in areas of high natural value (Machlis *et al, 1997;* Picket *et al* 1997; LTER, 2000; Lopez-Ridaura *et al*, 2002; Ostrom, 2007, 2009). Hence, they are in a way limited to providing assessments around single resource usage and have, in most cases, been created to assess the sustainability of social – environmental interactions in environmentally sensitive areas, with very specific characteristics or in some cases they have been created to understand the relationship of indigenous peoples with nature, and the importance of Traditional Ecological Knowledge (Berkes *et al*, 2003). On the other hand, the Sustainable Livelihood Approach framework which targets rural societies has been developed mainly for use in developing countries, in order to understand poverty issues and as such it cannot be used for the assessment of rural Greece. Consequently, it was considered necessary to create a new framework that would cover the needs of this study. In this context, the frameworks developed for natural resource management studies, although limited in what has been characterised as neat SES (Alessa *et al.* 2009), do provide valuable insights on the information necessary to be included in any attempt to assess their sustainability.
Taking these under consideration a framework was created that could be used for assessing the sustainability of rural areas, using Ostrom's (2009) SESF as a guide.

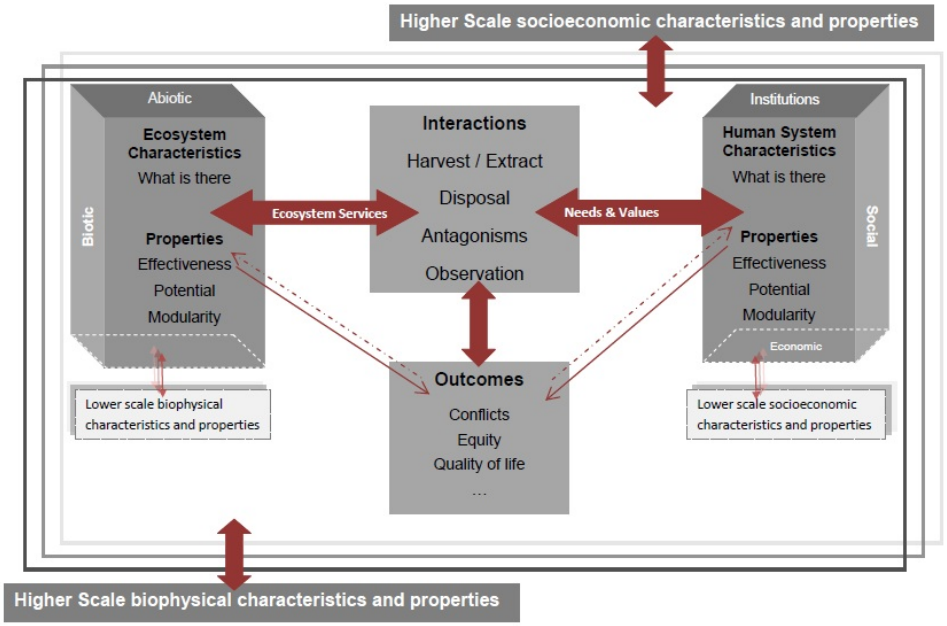

Figure 1: Schematic representation of a rural SES framework

Figure 1 shows the schematic representation of the proposed framework for assessing the sustainability of rural areas. The large *squares* represent the different municipality departments which form the base unit of the study and each is considered as an SES. The two large grey *cubes* represent the two subsystems, i.e. Ecological (termed ecosystem) and Human System, whose characteristics and properties form the baselines on which the current interactions are performed but which have also been shaped by past interactions. The labelled sides of each cube relate to the different aspects (or elements) of each subsystem which play a part in shaping the characteristics not only of each subsystem but of the SES as a unit. At the core of the system lay the interactions which depend on ecosystem functions for the supply of goods and services to the human system, whose needs and values determine the uses of these services. Finally, the framework takes into account the socioeconomic and biophysical processes occurring at lower or higher scales than the chosen one Conflicts, equity or even and quality of life are some of the outcomes of these interactions, but because they are also affected (and affect) by other characteristics (such as the political settings or the topography of the land) beyond the social – ecological interactions, there are direct links (arrows) to both the ecosystem and the human system characteristics. Our initial aim was that both the ecosystem and the human system would have an equivalent representation, still since we are studying rural areas the whole of the system is mainly governed by human actions. Consequently,

the ecosystem is assessed through its ability to offer services, which is a highly anthropocentric way of viewing it.

Breaking down the components (and their links)

Characteristics

The *"What is there factor"* is used to determine the components that make up the system or subsystems in socio-ecological terms but also to identify which units can be considered rural and which not. In terms of the ecosystem, we are interested in information concerning the topography and land cover which determine landscape characteristics, the climatic conditions, the presence of areas of High Natural Value, wildlife habitats and the main ecosystem services that are provided by the space of interest. For the human subsystem information related to the social structure, the Institutions and the facilities available to the population are of interest since they shape the conditions under which the interactions take place. In terms of institutional authorities, those relating to the environment are of particular interest but other authorities responsible for monitoring the living conditions or regulating activities are also important. Equally important are specific cultural elements as they are connected to local identities and participate in shaping the landscape. Heritage sites in particular indicate past interactions, and can also be related to an increased sense of responsibility. They are also connected to tourism activities, which, if the sites are mixed (cultural and natural elements), it also affects the values put on the ecosystem (economic, ethical and aesthetic). Finally, the economic structure and organisation is also important but economy is created and maintained by the population in an area, and, therefore, relates to the structure of the other essential components of the human system (population, infrastructure, facilities, institutions, networks). The presence of all these characteristics does not in itself create the conditions for sustainable SESs, but, they create the identity of the system. According to Cumming *et al* (2005) identity emerges from the *key components* (of a system), *their relationships (networks) and their continuity through space and time* and a resilient system is one that is able to maintain this identity.

Properties

Having identified the components that make up each of our subsystems (ecological and human) we need information relating to the **properties** of the system. According to SES literature, there are three basic properties that define the continuation of the functional ability of the system. These are named *Potential*, *Connectedness*, and *Resilience* (Gunderson and Holling, 2001). *Potential* relates to what is *stored* in the system and will be available for future changes. In a way, it can provide an indication of the effects of past actions while at the same time providing information for future capabilities. Connectedness relates to the adaptation mechanisms of a system and it is a measure of its flexibility or rigidity (Gunderson and Holling, 2001). Alternatively, it is related to the density and communication of the characteristics of the system and reflects the ability of the system to control its destiny. However, everything should not be connected to everything else. There is a need for a diversity of activities and their fragmentation as overconnencted systems can transmit shock very rapidly through the system and cause collapse (Walker and Salt, 2006). Therefore, another property of a resilient system that controls overconnectedness is *Modularity* and is defined by the different functional parts or modules of the system that can evolve independently (Berkes, 2007). It is usually associated with diversity – biodiversity or diversity of activities and the fragmentation of these. In other words a variety of activities is good but there must be effective communication in place.

Resilience is a "higher" level property emerging, among others, from connectedness and potential, and is something that cannot be assessed for each subsystem separately but is an outcome of the total workings of the system. Finally, in order to study the sustainability of the system it was decided to include *Effectiveness* as the third property of the system. *Effectiveness* was identified by Bossel (1999), as the ability of the system to complete a task with the available resources. Within this framework, as *a task* we consider the different rural services and as a result *Effectiveness* is identified as the ability of each subsystem (ecological or human) to maintain its main functional services.

The properties of the system are outcomes of past interactions and can be related to the state of the human and ecological subsystems. Possible variables that can be used as criteria to assess the condition of these properties for each subsystem are presented in TABLE 1.

Table 1: Ecosystem and Human System Criteria Variables

Criteria	Possible Ecosystem variables	Possible Human System variables
Effectiveness	Ecosystems services diversity (Depends on which is the main functional service of SES and which ecosystem attributes is related to them)	Ageing / institutional effectiveness
Potential	Abundance and distribution of services (eg. Water levels – quantity of water available – supply demand analysis) Potential of ecosystems to supply services	Education/ local tradition and history/ information technology and innovation / infrastructure
Connectedness	Fragmentation of Ecosystem types	Local networks/ Global links /internet usage/ institutional cooperation
Modularity	Functional diversity of ecosystem types	Multiple types of organizational structures and farm types / Branches of economic activity

Interactions

The notion of sustainability includes a vague connotation of time. It is the idea of whatever we do (as species) we have to be able to continue to do it in the future. If the state of the system reflects the outcomes of past interactions then current interactions will be able to provide us with a useful insight to the future state of the system. But to which interactions can we refer to? If the number of possible interactions among species is astronomical as Slobodkin (1994) claimed for ecosystems, then we can imagine that this number can only increase when humans and human societies are included in the picture. But *as we need not consider all possible species interactions whenever we discuss ecosystems* (Slobodkin, 1994), similarly, we need not consider all possible human – ecosystems interactions when we discuss SESs. Considering that the interactions occurring within the spaces of interest (rural locales) are dependent upon the supply of goods and services by the ecosystem, then the variability of ecosystem services can provide an insight to the types of interactions that are important when studying social – ecological systems In specifying which interactions are of interest for each system we need to know which factors are most likely to cause change, which relates to the question of *"To What kind of disturbance does the system need to be resilient to"* (Brand, 2009). Cumming *et al* (2005) approached this question through identifying the system's identity, i.e. the maintenance of all elements (actors, components and interactions) through space and time, and stated that the identity of an area includes a statement of components, interactions continuity and innovation. The "identities" of rural areas can be acknowledged through the variety of functions that they fulfil which, according to Heijman *et al* (2007), can be grouped into three main categories, i.e. Agricultural, Rural and Natural Services. Each rural SES may be able to fulfil all these functions simultaneously within its boundaries, or only one. In addition, because all these rural locales are not isolated from one another, some ecosystem services often serve the needs of rural SESs outside their defined rural boundaries, differentiating the rural SESs to producers and beneficiaries of different ecosystem services (Fisher *et al*, 2011). Their sustainability then depends not only on characteristics found within their boundaries but also on the spatial relationships between the different rural SESs, as well as relationships formed at regional, national or international scales.

Current interactions include information on extraction and disposal rates, the kind of monitoring systems in place, the aesthetic and cultural values imposed by the local (and non-local) communities and users (observation), and the antagonisms created between the various beneficiaries of the ecosystem services. These antagonisms might be between the ecosystem and the human system, but might also be amongst the different human actors or even the different rural locales. Some of the variables that can be used as criteria for these interactions are presented in Table 2.

These aspects shape the conditions within each rural locale which in turn are described by the outcomes, which form the final step in the characterisation process. These are largely non – tangible aspects that, for the most part, can only be assessed qualitatively and by comparison of the different locales and whose positive outcome depends on the synergist effects between the two subsystems in the form of the interactions.

Table 2: Criteria and possible variables for assessing the rates and the conditions of current interactions

Criteria	**Possible Variables**
Harvest/Extract	Water consumption per hectare and per head
Disposal	Point & non point pollution sources/ pesticide & fertilizer consumption rates / water quality
Antagonisms	Source or Sink of ecosystem services / Human appropriation of land or water
Observation	Aesthetic valuation / monitoring mechanisms in place

Implementing the framework: the case study of the Peloponnese

The Peloponnese was chosen as the geographical region where the framework could be implemented for a number of reasons. First, it has a clear geographic boundary with mainland Greece but it is not an island. Second, it has a varied but largely mountainous topography, similar to the rest of the country, and third, it contains a plethora of ecosystems and variable socioeconomic conditions. The Municipality Departments (MDs) were considered to be the best choice of analysis as they have clearly defined spatial boundaries for which statistical information is being published, which have often been delineated using physical characteristics, such as banks of rivers. MD is the European LAU2 level of analysis and provides an interesting analytical framework for either urban – rural distinction or placement in the urban rural continuum (Johansen and Nielsen, 2012). In order to identify which MDs would be considered in the analysis as rural SESs we used land cover data and population data. Land cover types were divided into two categories of *built* and *open* areas. The location of settlements was also considered so that only the built areas associated with habitation would be regarded as part of an urbanised area. The degree of rurality was then assigned using fuzzy logic GIS, based on the percentage of built up areas and the population size of each settlement (Fig. 2).

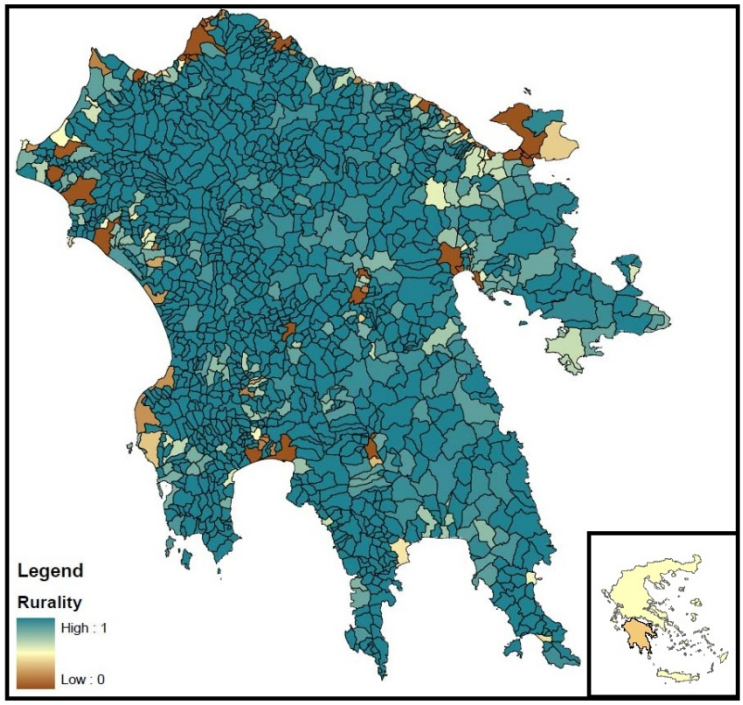

Figure 2: Rurality of the Municipality Department in the Peloponnese

Next, we focused on identifying the appropriate criteria for analysis according to the guidelines of the framework. The choice depends upon the research question and area specifications. What we are interested in is whether the rural services are sustainable and whether these services are likely to continue to be available under external/internal pressures. Fundamental is to recognise which interactions are important in maintaining the identity of the system, and which activities are most likely to be affected in the future. The use of resources represents the most straightforward interaction between humans and nature, therefore, a type of resource can be

used as the platform of interactions. In the case of Mediterranean rural SESs, one resource that is vital for all three categories is water. Proximity to water resources has determined the location of cities and settlements since antiquity and has also determined other human activities such as agricultural production, energy production and others.

Furthermore, in the Mediterranean region it is often a source for conflict too, more so in the southern countries, but also in the north (Kallis et al, 2005). The building of dams especially, not only due to the great environmental destruction they cause, but also due to water being selectively allocated to specific groups of people or areas is causing conflict between different regions in Greece. One such notable conflict has been caused between the city of Patras and the rural municipalities of the West Achaia and Erymanthos with the building of a dam on Peiros-Parapeiros Rivers. The reservoir, although created within the latter two municipalities, will be used to cover the drinking water and industrial needs of Patras.

Rural regions are more threatened by water shortages than urban, not only because agriculture is the biggest single consumer but also because the reservoirs and aquifers are located in rural areas. For rural regions that are nearby natural or manmade reservoirs they benefit as tourist spots, especially in relation to sport activities but also natural tourism, such as bird watching or landscape photography. One such case is Stymfalia Lake, which in addition to being a NATURA 2000 site, provides water for irrigation for the municipalities of Korinthos, Velo-Voha and Sikionia, as well as drinking water for the city of Korinthos.

At a period of climatic changes, and in a drought prone Mediterranean, water availability may be the weakest link for a sustainable future for rural areas, i.e. it could be the factor making the system to collapse. As a result, studying the interactions surrounding water resources can provide a good guide for the sustainability of the interactions within that region in general.

Fieldwork research was considered necessary prior to finalising which variables to use. The fieldwork included participation in public consultation meetings that occured as part of the implementation of the Water Framework Directive, and a number of interviews targeting local people at key institutions, with special knowledge of the area and the issues of concern.

Preliminary results affirm the choice of water resources as the medium through which the sustainability of local livelihoods can be examined. Fresh water is often considered as the most valuable benefit rural societies gain from their surrounding environment and the quantity and the quality of water are often considered to be the most important environmental characteristics for the sustainability of rural societies.

In terms of identifying the functional services, agriculture and tourism are considered as the main productive activities by the majority of the interviewees. Both of which impose great pressures on available water resources especially during the summer months. The importance of agriculture is also evident in the statistical (40% of the population in rural areas is employed in agriculture) as well as land cover data (Fig. 3) from the area.

The public consultations provided an interesting platform on which the relationships between higher and lower level institutional governance could be studied. The meetings were also an opportunity to assess whether effective participatory mechanisms exist. In both cases, the outcome is not promising. Regional government does not seem to respond well to the needs of local government and, where local population is included in a type of consultation, they are allowed to talk but are rarely heard of. These observations are also being confirmed by the initial interview results, which were focused in the North Peloponnese.

A regional description of the Rural Social – Ecological Systems of the fieldwork area along with a discussion of the components and factors that affect its resilience is presented in Table 3.

In conclusion, this paper discusses rural areas as social ecological systems and presents a framework for studying the structure of rural Greece through this prism. The framework gives guidelines for the selection of the appropriate variables for different case studies. However, since new concepts are being addressed there are no readily available indicators and the implementation requires fieldwork research.

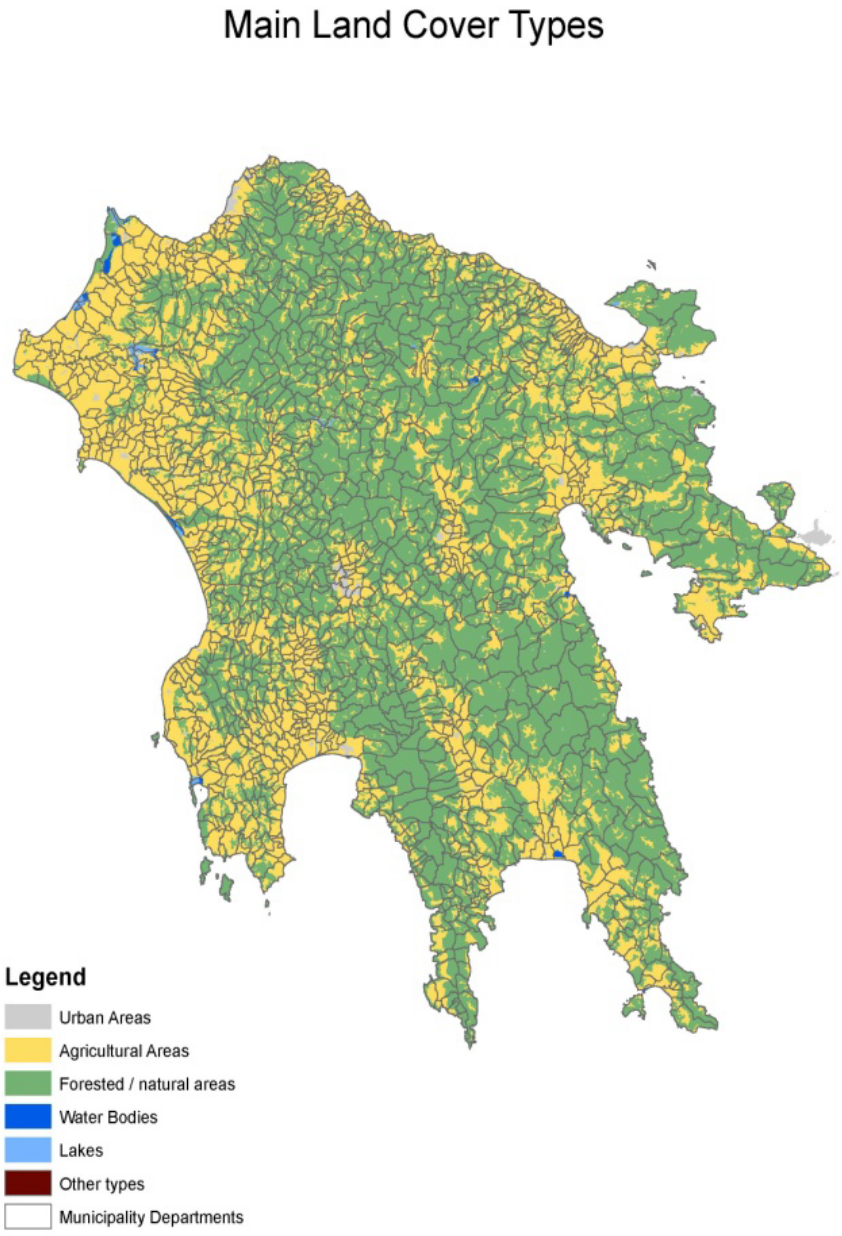

Figure 3: Main Land cover types of the Peloponnese

Table 3 SES components and factors influencing resilience in the North Peloponnese

Criteria	Ecosystem	Human System
What is there	Strong morphological relief with varied landcover characteristics. There are 10 areas that are part of the NATURA 2000 network and one National Park. 15 river subbasins and 2 lakes.	There are 10 municipalities within the Water Basin District, which are part of 3 different regional units and 2 regions. Agriculture and Tourism form the most important economic activities. The most important agricultural areas are composed of olive groves, vineyards and fruit trees mainly lemons and apricots.
Effectiveness	Provisioning services (food and water supply) are in demand and this affects regulating services such as flood control and erosion. Drinking water quality has also been affected in some coastal municipality departments. Recreational/ cultural services are provided both in upland and coastal areas, but in some coastal areas it has been affected by erosion.	Most upland areas have ageing population as well as some coastal areas. There is lack of trust in government institutions. Majority of people unwilling to report private water wells.
Potential	The recently composed River basin management plan revealed a lack of information related to water quality and quantity in the area.	Lack of interest for continuation of agricultural activities although in some areas there are reports of the economic crisis changing this trend. Gap in traditional knowledge. Population is better maintained in areas where there is possibility of engaging in tourism activities.
Connectedness	Rivers appear fragmented with the presence of dams or irrigation networks. Natural habitats on the other hand are less so due to the effect of the landforms.	Institutional connectedness follows vertical links, with very few cases of collaboration across administrative borders. There is a limiting sharing of knowledge.
Modularity	Coastal areas are less heterogeneous compared with upland areas. Some E.S. appear to coexist where others occur as trade-offs.	Differentiation of economic opportunities is greater in coastal areas but it is also increased in some upland areas with increased cultural services. There are poorly defined responsibilities between institutions
Interactions	Provisioning services are more readily recognised, resulting in increased human appropriation of water resources, although the recently established river basin management plan does establish an ecological flow of rivers. There is dissatisfaction in the availability of water, both in terms of quality and quantity. Environmental issues appear high in the list of interests of local communities however this is not reflected in participating in actions aimed at solving these issues. There are conflicts between (area) providers and (area) users of E.S. There is a need for a more effective monitoring system.	

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