Sustainability patterns and policy fit: evidences from a mixed approach applied in a Euro-Mediterranean area (Alento basin, Campania region, Italy)

Introduction

As many scholars have pointed out (Plieninger *et al*., 2006; Kizos & Koulouri, 2006; Soliva, 2007; Zakkak *et al*., 2014), European rural areas have been shaped throughout history by the needs of traditional land users, most dramatically in the post-war period when farming became increasingly intensive to meet rising demands for production. As this process of intensification continued, areas of relatively low productivity which were better suited to extensive farming practices, such as inland mountain areas, became increasingly vulnerable to marginalisation and abandonment. This is particularly true for the Mediterranean basin, where important socio-economic changes over the course of the twentieth century, particularly in terms of tourism and industrialisation, fostered the expansion of intensive, cash-crop agriculture on the plains and the abandonment of marginal terraced hillside land (Puigdefábregas, 1998; Dunjó *et al*., 2003). Five main problems are linked to the abandonment of agricultural land (Benayas *et al.*, 2007): (1) reduction of landscape heterogeneity and subsequent homogenisation of vegetation, often associated with increased fire frequency; (2) soil erosion and desertification; (3) reduction of water reserves; (4) biodiversity loss and reduced population numbers of adapted species and; (5) loss of cultural and aesthetic values.

However, rural areas also fulfil a multiplicity of functions that go far beyond their productive role. Using the heuristic lens of multifunctionality, rural spaces also change in response to three stressors; production, consumption and protection (Holmes, 2006; Wilson, 2010), reflecting the mixed way that rural resources are used and occupied. In other words, rural areas change in response to the different functions of the ecosystems of which they are part. The evolution of post-productivist agricultural activities, which continues to substantially determine the character of rural areas, has also been shown to be characterized by the fact that individual farms can choose between multiple paths and adaptative strategies, aimed at different choices of specialization; differentiation, de-intensification, through to the partial or total decommissioning of production (Ilbery & Bowler, 1998). Farms in the same landscape may opt for different adaptation strategies, and this is reflected in the dynamics of land use / land cover (Ilbery & Bowler, 1998). The result is increasing diffusion, especially in many Mediterranean landscapes, of complex rural mosaics, made up of a 'patchwork' of land-use with varying degrees of agricultural intensity and semi-natural spaces as a result of the dynamics of re-colonization following agricultural abandonment (Di Gennaro & Innamorato, 2005). Land cover and land use then become crucial elements in the analysis of spatial resilience because they synthesise two different aspects; the environment and the socio-economic development of a particular rural area. Land cover and land use, therefore, create a dialogue between these different perspectives, rendering the spatial aspects of ecological and social dynamics as crucial components in trajectories of change (Cumming *et al*., 2005). Understanding these changes and their drivers requires critical reflection across a range of temporal and spatial scales: high spatial heterogeneity in the dynamics of land use is already present at the local level (Lambin & Geist, 2001; Lambin & Meyfroidt, 2010) creating situations where abandonment or intensification of land-use can co-exist in the same locality, or even on the same farm (Schröder, 2011). Similarly, it is also important to consider a long enough timeframe (Crumley, 2007) in order to distinguish between short-term changes and longer-term trends. This means that the analysis of these areas must tease out the multiple and complex co-existing path dependencies, equilibrium states, as well as development trends in order to fully understand their impacts on the area (Turner *et al*., 1995; Turner *et al*., 2008).

The existence of these rural mosaics therefore demands a somewhat 'holistic' approach, aimed at understanding the mechanisms of operation of each part of the mosaic, which can then be considered together as a complex system (Hansson *et al*., 1995; Bennet *et al*., 2006). Consideration also needs to be given to the different processes that influence key aspects of the area, such as the ability to conserve the stock of basic resources (water, soil), biodiversity, landscape quality, the level of socio-ecological resilience in each part of the system and the operation and impact of land degradation processes. Rural mosaics can be studied from their structural, evolutionary and dynamic perspectives using different approaches developed in the context of sustainability science. One of the objectives of such an analysis is to produce synthetic indicators derived from ecology that are able to highlight the specific evolutionary trajectory of each rural mosaic (Turner *et al*., 2001).

The objectives of the analysis are therefore descriptive, interpretative and prescriptive in that they support the establishment of sustainable management systems as well as the design of rural development and environmental protection policies (Di Gennaro & Di Lorenzo, 2012). In this operating environment, synthetic ecological indicators prove effective for integrating the bases of socio-economic data, routinely used in policy development and refinement.

From the point of view of the design of rural development policies, the growing characterisation of many Mediterranean landscapes in terms of mosaics with varying degrees of complexity poses new challenges, for example in the geographic territorialisation of the various regional policies measures and actions.

As will be highlighted by the case study of the Alento basin presented in this paper, the dynamics of differentiation in landscapes operating at different scales make it difficult to identify 'homogeneous' areas for the purpose of rural development planning. Yet the presence of farms implementing very different adaptation strategies within the same landscape means that the same territory can simultaneously express multiple needs and manifest, more or less explicitly, different support requirements, which may appear contradictory or be in conflict with one another. Moreover, the measures implemented can, in some cases, produce quite the opposite effects than those intended under the measure.

The hypothesis which forms the basis of the study is, therefore, that the socio-economic and environmental mosaics that can be found within rural areas at a particular point in time are the result of multiple actions and interactions; and of the different adaptation strategies used by communities to cope with changes under the influence of prevailing environmental conditions. The purpose of the work discussed in this paper, therefore, is to propose a method which is capable of understanding this complexity and enables the development of locally tailored and adaptable policies, measures and instruments. The remainder of this paper is divided into four sections. After a brief description of the study site, the first part focuses on the proposed method and its implementation. The second and third sections discuss the application of the method and the resulting findings. The study finishes with some concluding remarks.

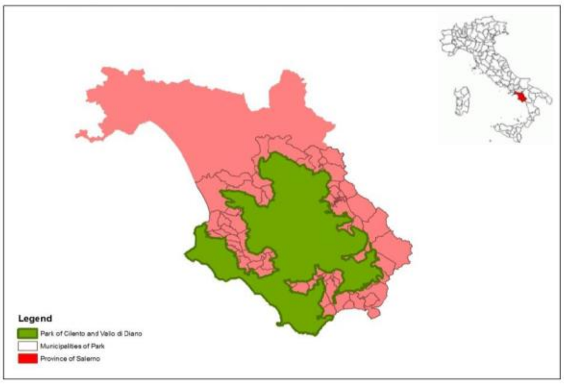
Study area and methods

Study area

The Alento basin, covering an area of around 55,000 ha, is located in the region of Campania, Southern Italy and included in the National Park of

Cilento and Vallo di Diano, a UNESCO World Heritage Site comprising Sites of Community Interest and Special Protected Areas (fig. 1).

Fig. 1 – Study site location



The Alento basin is a socio-ecological system (SES) which has been profoundly shaped by the relationship between its component ecological and human subsystems (Anderies *et al*., 2004; Quaranta & Salvia, 2012) and where the patterns of settlement and exploitation reflect the impact of human actions on the natural resources and vice versa, the impact of the natural environment on the local human population (Ambrosio-Albalá & Bastiaensen, 2010).

The Alento SES is part of the macro area of the Campania Rural Development Plan 2007-2013 which, as a whole, is characterised as an area affected by processes of abandonment and de-activation, with potential for development linked to the tourism industry, and diversification of agricultural activities. Employment and the economic performance of agriculture in the study site has been in constant decline for the last forty years, despite vast investment into the local area through the construction of a series of dams designed to expand the water resources available to the local agricultural sector. The characteristic feature of the study area is, in fact, the consistent reduction of Utilized Agricultural Area (UAA), both in terms of arable farming (-20%,) and pasture cover (-75%), and diffuse phenomena of scrub and woody encroachment. This reduction in UAA is closely linked to macro-economic changes within Italy occurring since the post-war period and which have led to dramatic changes in crop production in the study area. Labour intensive crops have been replaced, principally, by permanent cover crops such as olives and by increased intensity of farming on the lowland plains.

The predominance of terraced olive groves in the study area has left the local rural economy particularly vulnerable to economic vicissitudes, such as the crisis in the olive industry in Italy following the entrance of new competitors. In a bid to remain competitive, olive farmers in the study area have had to severely reduce production costs, whilst some producers have ceased production altogether and abandoned land in those areas already affected by depopulation.

Land abandonment in the rural areas of the study site has also been strongly influenced by European agricultural policy, which all but substituted Italian national policies for the agricultural sector from the late 1970s onwards. The continual reform of the CAP (MacSharry reform, Agenda 2000, Fischer reform of 2003) has translated into a progressive reduction in terms of the actual amount of subsidies that farmers receive. The effects of this progressive dismantling of public funding, coupled with the increased liberalization of agricultural markets are clearly seen across the sector in terms both of farming intensification and land abandonment.

Although the trend of abandonment is partly counter-balanced by economic diversification in the area, signs of the abandonment of olive groves and traditional, labour intensive practices such as dry stone wall construction and terracing can be seen in the study site in large areas of degraded land and poorly maintained terraces, which create increased soil erosion and landslide risk. Another principal driver of erosion in the study site is fire. The area suffers from a high incidence of non-wooded areas being affected by fire, with levels as high as 70% in 2003 and 2007 of total fires registered in the area (State Forest Fire Agency, Service Archive AIB). A possible explanation for this phenomenon is the fragmentation of cultivated land in hilly and mountainous areas and landscape homogenization, as forest fires that begin in wooded areas often spread to the nearby shrubland and grassland, leading to extensive areas being burned.

Methods

The integrated methods developed for the analysis of rural systems consisted of the following steps:

1) Physiographic characterisation of the Alento SES using the Land System approach, where systems are characterized by a defined set of physiographic aspects (climatic, morphological, hydrological, pedological, land use pattern, permanent changes of anthropogenic nature, etc.) (Dent & Young, 1981; FAO, 1995; FAO, 1998; Dalal-Clayton & Dent, 2001; Di

Gennaro, 2002) and by characteristics and qualities related to these aspects which specifically influence the capability and aptitude of land use (land capability, land suitability).

2) Analysis of dynamics of land cover

This analysis was carried out by adopting an approach based on cross referencing, using GIS, two land use maps (Map of land use, 1960 -CNR-Touring Club of Italy- and Map of land use 2004 - Regione Campania, CUAS, 2005) (Di Gennaro & Innamorato, 2005; Di Lorenzo & Di Gennaro, 2008). The dynamics of land use have been characterized on the basis of a transition matrix where persistence, extensivisation, intensification and changes from one land use to another are identified in the different land systems by overlaying two maps from different periods (Di Gennaro & Innamorato, 2005).

3) Analysis of the dynamics of land use in the administrative divisions of the SES (municipalities). During this phase, GIS analysis of the physiographic aspects and dynamics of land use within the municipalities in the SES was carried out. The goal was to enable (with the aim of making comparisons between, and integrating, different data) an interpretation of the transformations in rural landscape applicable to ecological units (land systems) and also administrative units (municipalities), which have official historical series of socio-economic and census data and are normally used as 'elementary territorial cells' in programming and planning of rural development policies.

4) Analysis of the dynamics of socio-economic indicators in the administrative divisions of the SES (municipalities)

A number of inter-temporal socio-economic indicators have been developed with variables from the years 1971 and 2001. The mean percentage change in each indicator was then compared with the average of the SES for the same indicator. The indicators considered, shown in Table 1, reflect the dynamics of the main social and economic characteristics (demography, migration, employment).

Tab. 1 – Indicators used for characterising dynamics of economic and social component of the SES

COMPONENT	INDICATOR
Social	Population density
	Population ageing
	Total dependency rate
	Literacy rate
	Migration rate

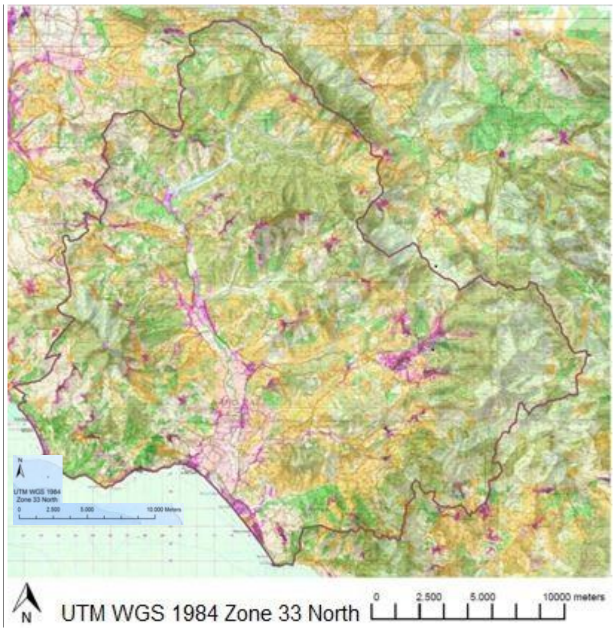
Economic	Employed in Agriculture/Total Employed
	Salaried/Total Employed
	Rate of Unemployment

In order to better understand the differences within the territory, the analysis of indicators was teamed with a diachronic interpretation of the main events that have characterized the area and its different socio-economic sub-systems over the last 60 years, reconstructed through interviews with stakeholders (farmers, tourism operators, administrators, intellectuals etc.) and three workshops held in the area (Summer 2012) (Leddris, 2014).

Results

Figure 2 shows maps of land use change in the study area whilst the data on land use are summarised in Table 2.

Fig. 2 - Map of land use dynamics in Alento river basin



Tab.2- Incidence in percent of different land use dynamics in the Alento Basin.

	Land Use Dynamics	**% of land surface of SES**
A	Persistent Forests and Pasture	13.2
B	Persistent Agriculture	16.3
D	Forestation	31.6
E	Extensification	4.9
F	Irrigate Intensification	8.0
G	Agricultural Intensification	19.9
C	Persistent Urban Cover	0.5
H	Urban Transformation	5.6

The key data on land use dynamics at municipal level, summarized in Table 3, combined with the dynamics of socio-economic indicators (Table 4) both validated by stakeholders, led to the division of the territory of the SES into specific sub-systems (SSTs), made up of groupings of municipalities which are reasonably homogeneous with regard to physiographic aspects, land use dynamics and socio-economic aspects.

Tab.4- Analysis of dynamics of socio-economic indicators in the administrative groupings of the SES (municipalities)

		SST1 -Velina		SST2 -S. Mauro		SST3 – Ceraso		SST4 - Stella Cilento		SST5 - Novi Velia		SST 6 - Orria	
Variables	average SES	average	difference	average	difference	average	Difference	Average	difference	average	Difference	Average	difference
Population density	-0.12	0.23	0.35	-0.23	-0.11	-0.07	0.05	-0.29	-0.16	0.02	0.14	-0.39	-0.27
Population ageing	2.50	1.82	-0.68	2.47	-0.03	2.16	-0.34	2.41	-0.08	2.19	-0.30	4.06	1.56
Total dependency rate	0.01	-0.18	-0.18	0.04	0.03	0.01	0.00	-0.04	-0.05	-0.10	-0.11	0.27	0.27
Literacy rate	0.46	0.49	0.03	0.40	-0.06	0.43	-0.03	0.52	0.06	0.68	0.21	0.35	-0.12
Migration rate	-4.00	0.60	4.60	-10.41	-6.41	0.50	4.50	-0.19	3.81	-19.15	-15.15	-3.42	0.58
Employed in Agriculture/Total Employed	-0.63	-0.64	-0.01	-0.55	0.08	-0.77	-0.13	-0.49	0.14	-0.64	-0.01	-0.62	0.01
Salaried/ Total Employed	0.17	-0.06	-0.23	0.52	0.35	0.21	0.04	0.08	-0.09	-0.01	-0.18	0.18	0.01
Rate of unemployment	-0.27	-0.25	0.03	-0.05	0.22	-0.26	0.02	-0.41	-0.14	-0.39	-0.11	-0.34	-0.06

Source: Authors elaboration on official statistical data (ISTAT)

The subsystems identified in the SES are shown in Figure 3. The most important aspects of land use in the subsystems are summarized in Table 5 and Figure 4 and are briefly described below.

Fig. 3 - Administrative groups of Alento river basin characterized by a prevalence of dominant trajectory

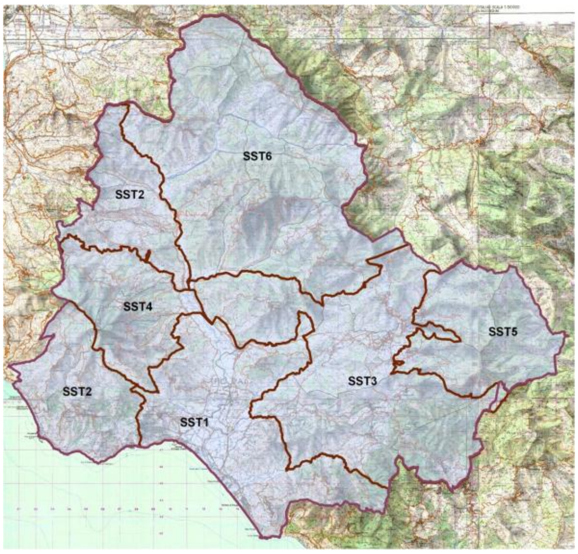
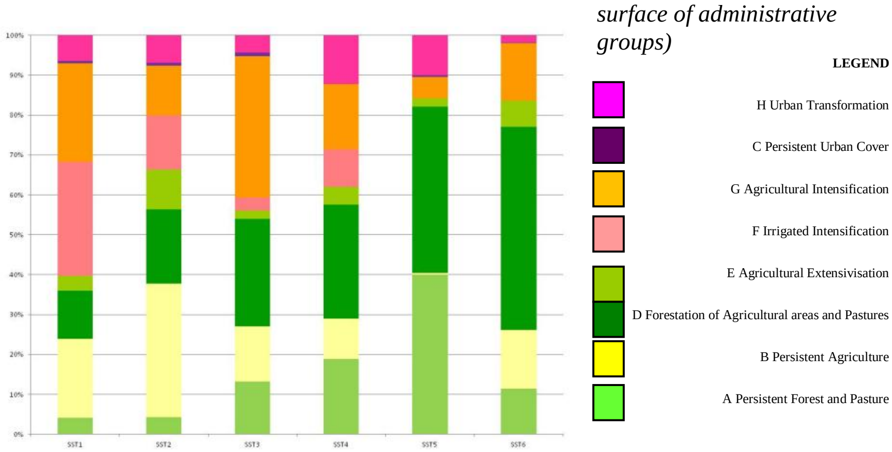


Fig. 4 - Incidence shown as percentage of land use dynamics in administrative groups (% of surface of administrative groups)



Sub-system 1 (SST1) 'Velina', which includes flood and coastal plains, together with coastal hills, is characterised by a high incidence of intensive

Tab. 3 - Principal land use dynamics in municipal subsystems in Alento Basin

Subsystem (SST)	Municipality	Abandonment of areas (% agricultural areas 1960)	Agricultural Surface 1960 (% surface of territory)	Agricultural Surface 2000 (%surface of territory)	Variation agricultural surface 1960/2000 (% surface 1960)	Pastures 1960 (%surface of territory)	Pastures 2000 (% surface of territory)	Variation in pastures (% surface 1960)	Forested surface 1960 (%surface of territory)	Forested surface 2000 (%surface of territory)	Variation forested surface 1960/2000 (%surface of territory 1960)
SST 1 – Velina	CASALVELINO	1.6	66.9	84.0	25.5	27.9	3.3	- 88.3	1.7	6.3	270.1
	ASCEA	6.2	58.1	71.0	22.3	40.4	9.8	- 75.7	0.2	11.2	5430.8
	CASTELNUOVO C.	13.3	41.8	63.3	51.3	57.6	6.0	- 89.6	-	24.1	-
	OGLIASTRO C.	17.0	92.6	83.7	- 9.6	-	-	-	3.9	16.3	313.4
	PRIGNANO C.	17.6	83.7	68.7	- 17.9	0.4	3.8	936.3	8.6	17.9	107.8
SST2 – S. Mauro Cilento	RUTINO	13.3	90.2	76.4	- 15.3	3.7	5.2	38.4	6.1	12.7	109.6
	TORCHIARA	10.8	100.0	79.7	- 20.2	-	0.0	-	-	10.8	-
	LUSTRA	19.4	57.3	57.2	- 0.1	30.1	6.3	- 79.1	12.6	28.8	129.1
	POLLICA	20.5	80.3	55.0	- 31.6	16.0	19.6	22.7	0.2	19.9	8456.5
	S.MAURO C.	17.2	82.2	55.7	- 32.2	13.3	16.8	26.7	-	22.2	-
	VALLO DELLA L.	22.7	34.4	51.6	50.1	62.4	8.9	- 85.7	-	28.3	-
	SALENTO	14.8	25.9	59.4	129.6	63.7	11.6	- 81.9	9.2	23.7	158.0
SST3 – Ceraso	CERASO	25.1	24.6	57.9	135.5	65.8	8.9	- 86.4	9.4	31.3	231.7
	MOIO DELLA C.	27.7	30.6	38.6	26.3	57.8	15.1	- 73.9	10.0	40.7	307.8
	CUCCARO VETERE	31.5	58.5	45.5	- 22.2	22.0	-	- 100.0	19.5	52.4	168.1
SST4 – Stella Cilento	SESSA CILENTO	41.1	50.4	35.8	- 29.0	12.9	6.0	- 53.5	36.7	56.8	54.7
	STELLA CILENTO	31.1	42.2	47.6	13.0	44.2	13.0	- 70.6	13.6	35.5	160.1
	OMIGNANO	51.8	72.7	28.5	- 60.8	4.6	9.1	96.5	22.7	52.2	129.7
SST5 –	CANNALONGA	80.3	15.7	4.3	- 72.5	57.7	5.9	-89.7	25.6	84.2	228.2

Novi Velia	NOVI VELIA	87.1	21.8	3.1	- 85.9	22.3	6.3	- 71.6	55.1	88.3	60.2
	PERITO	46.2	58.1	31.4	-46.0	38.9	6.2	-84.2	0.7	54.9	7587.7
	ORRIA	57.8	65.0	24.4	- 62.4	33.8	7.7	- 77.3	-	63.8	-
	CICERALE	48.6	63.5	28.2	-55.6	35.4	12.6	- 64.3	0.8	52.2	6307.7
SST6 – Orria	STIO	52.9	67.7	30.2	-55.4	29.5	1.9	- 93.6	2.0	65.6	3172.9
	MAGLIANO V.	30.2	58.2	46.1	-20.7	35.2	7.5	- 78.8	2.6	43.9	1611.1
	GIOI	41.9	47.1	32.3	- 31.3	43.3	13.8	- 68.1	8.1	51.0	530.9
	MONTEFORTE C.	28.9	28.4	28.0	- 1.5	48.3	14.9	- 69.1	23.2	54.5	134.7
	TRENTINARA	49.5	40.8	17.7	- 56.6	29.9	23.4	- 21.6	29.4	58.9	100.5

Tab. 5- Aspects of land use in municipal subsystems identified in study site

Subsystem	Municipality	Surface area (ha)	Surface territory (% total surface in Alento Basin)	Total surface agricultural crops 2000 (arable and permanent crops, % territory surface)	Permanent crops 2000 (% agricultural crops)	Variation agricultural areas 1960/2000 (%)	Turn over agricultural areas 1960/2000 (% territory surface)	Woods and Shrub land (% territory surface)	Urbanisation (% territory surface.)
SST 1 – Velina	Ascea, Casalvelino, Castenuovo Cilento	8678	15.8	76.8	52.2	28.0	17.4	16.1	7.0
SST2 – S. Mauro Cilento	Pollica, S. Mauro Cilento, Prignano Cilento, Rutino, Lustra.	7860	14.3	70.2	87.6	-22.5	37.5	23.6	5.9

SST3 – Ceraso	Ogliastro Cilento, Torchiara Ceraso, Cuccaro Vetere, Moio della Civitella, Salento, Vallo della Lucania	12944	23.6	54.9	65.1	64.2	50.0	40.2	4.4
SST4 – Stella Cilento	Omignano, Sessa Cilento, Stella Cilento	4253	7.8	44.3	76.2	-28.1	63.8	51.4	4.4
SST5 – Novi Velia	Cannalonga, Novi Velia	5204	9.5	8.6	57.1	-82.2	98.2	88.1	3.2
SST6 – Orria	Cicerale, Gioi, Monteforte Cilento, Orria, Perito, Stio, Trentinara	14900	27.2	34.0	75.8	-47.3	65.8	61.7	2.0

irrigated and non-irrigated agricultural practices as well as protected cultivation and a low rate of abandonment and spontaneous reforestation of agricultural areas and pastures (agricultural areas > 75% of the territory's surface). Agricultural areas show an increase in surface compared with 1960 (+28%) at the expense of pastures which are under threat from urban expansion related to the growth of the tourism industry. Forest cover is 16.1%. The area has seen an increase in population with a higher than average percentage of the population made up of young people compared to the rest of the study site, although the elderly index has increased in the period of time considered. The total dependency index has also reduced, unlike in the other areas of the study site, where it has remained stable. Literacy rates and migration rates have also increased. In fact, the area attracts new residents in contrast to the rest of the SES, where outmigration is prevalent. The percentage employed in agriculture compared to the total number employed has fallen drastically, as it has in the SES as a whole. Numbers of salaried workers also reduces slightly in the time period considered as compared to the rest of Alento as a whole. Employment rates go down, in line with the SES.

Sub-system 2 (SST2) 'San Mauro' includes areas of inland and coastal hills and is characterised by greater stability and persistence of agricultural areas (which cover around 70% of the surface area) over the last forty years than other municipalities, and a lower rate of abandonment of cultivated land. This area is dominated by olive farming (olive groves make up 80% of the agricultural surface), aided by well-developed olive growing associations and co-operatives in the local area. Forest cover is 23.6%. In this subsystem, turnover of agricultural areas between 1960 and 2000 is relatively lower than that of the other townships, with the only exception being those found along the coast. The same is true for the rate of land abandonment and spontaneous reforestation. Population size and density, however, have decreased, more so than that in the rest of the study site. The elderly index remains high, dependency rates remain stable and literacy rates have increased. All three of these indicators are more in less in line with the Alento area as a whole. The numbers employed in agriculture have dropped but to a lesser extent than other areas and the number of salaried workers has increased in the period. The rate of employment has decreased, although the decrease is less marked than in the study site as a whole.

Sub-system 3 (SST3) 'Ceraso' includes hilly areas dedicated primarily to cereals and forage crops, established over the last forty years as a result of the tillage of previously extensive pastureland. The area under arable production has significantly increased by 64% since 1960. This also includes mountainous, hilly areas where rates of land abandonment and spontaneous reforestation are higher. The agricultural sector is strong in Ceraso, with over half (54.9%) of the area dedicated to farming, with a predominance of farming strategies aimed at the conservation of traditional cropping systems, based on an equal mix of non-irrigated arable crops and olive crops. Population density appears to be stable, although it is buffered by the proximity of the town of Vallo della Lucania (the only municipality to see population growth). The population in this area is an aging one; the rate of dependency is basically stable and the literacy rate is in line with the rest of Alento (increasing up to 95% in Vallo della Lucania). Numbers employed in agriculture have declined in line with the rest of the SES, whilst the proportion of salaried workers has increased. The rate of employment has decreased in line with that in the study site as a whole.

Sub-system 4 (SST4) 'Stella Cilento' includes hilly and mountainous areas where agriculture is generally in decline, with relatively low values of agricultural persistence and intensification. In this subsystem, agricultural areas cover 35-50% of the territory's surface, in a complex mosaic of active agricultural areas and newly formed semi-natural spaces. Population density is in dramatic decline whilst population ageing is in line with that of the SES. The dependency rate is more or less the same as that of the SES as a whole. Literacy rates have significantly increased (levels were initially lowered than other areas of the SES). The rate of out-migration is in decline. Numbers employed in agriculture have dropped less than in other areas of the SES. Unemployment rate has also significantly reduced (more so than in the SES as a whole).

Sub-system 5 (SST5) 'Novi Velia' includes mountainous and hilly areas which are mainly covered by forests and agricultural land covers less than 5% of the total territory's surface. Population density is stable. The population is ageing but the dependency rate is lower than in other parts of the SES (a clear sign of a demographic structure made up of an active population). The literacy rate is much higher than the rest of the SES. Migration rate is also positive. Agriculture has declined more or less in line with that of the SES and the number of salaried workers has remained stable. The rate of unemployment is lower than that of the SES as a whole.

Sub-system 6 (SST6) 'Orria' includes mountainous and hilly areas where the agricultural sector has all but collapsed over the last forty years. Active agricultural areas cover 20-30% of the land area and can now be considered as a system of poorly connected 'islands' within an area now prevalently covered by newly formed forests. Population density is much lower in this subsystem than the average for the SES (-0.39% against -0.12%) and total population figures are in serious decline, making the elderly rate for this subsystem particularly high (1.5% percent higher than the SES average). The total dependency index is, as a consequence, also particularly high with a total increase of 0.27% (against an average SES value that remains stable at 0.01%). Literacy rates are low when compared to the SES as a whole because the initial level of education was higher. Migration rates show greater numbers of emigrants than immigrants. The number of people employed in agriculture has reduced in line with the SES. The number of salaried workers is also in line with the SES as a whole and has increased in the time period considered. The unemployment rate is falling.

Discussion

The drivers of change and the events that have occurred over the last 50-60 years have profoundly shaped the Alento SES. The detailed analysis of the study area has revealed different rural mosaics in an area assumed to be homogeneous by regional planners and policy makers. There are clearly a number of sub-systems which are significantly differentiated in terms of structure and dynamics. These findings allow the identification of differentiated territorial types in the Alento basin that are the product of accumulated actions and of different adaptation strategies under the influence of specific ecological conditions and socio-economic and environmental factors. In the same SES sub-systems which have seen, and continue to see, an intensification of land use, also in terms of agriculture, coexist with other subsystems which have seen a consolidated trend towards an integrated and sustainable use of resources and processes of extensivisation of agriculture. Alongside these areas where different forms of agricultural activities continue there are others, instead, where the abandonment of farming and land is becoming increasingly prominent and is accompanied by the spread of woods and the progressive re-naturalisation of entire areas of the territory. Figure 3 shows how the SES can be clearly divided into two sections. In the first section which is predominately along the coastline of the study site, there are essentially three adaptation strategies in action. A first subsystem, in fact, is characterised by the **introduction and diffusion of intensively irrigated horticultural crops in open fields and under protected cultivation (SST1** 'Velina'). This intensification, together with increased value added from agriculture, and increased integration with local and regional markets has been based mainly on the substitution of labour with technology. The needs of this area are, therefore, closely tied to increasing competitiveness and the adoption of technologies able to optimize the use of resources and, at the same time, minimize impacts on the environment. A second identifiable strategy is the **reorganisation/adaptation of traditional cropping systems (olive farming)** (SST2 'San Mauro Cilento')**.** This subsystem proves to be an example of a well-established agricultural system which has responded to the post-productivist phase by reorganizing its traditional olive farming systems and introducing new organizational models, with a rate of deactivation that, although still present, is relatively low compared to the average for the SES. Traditional agricultural production has achieved a higher integration with the processing sector but product specialization does, however, leave the area more vulnerable to price fluctuations. This strategy does prove successful at reducing erosion processes and contributes significantly to the maintenance of the landscape (terraces are well maintained) but it needs to be supported by policy to enhance the capacity to diversify products and increase integration with other economic sectors in the area (mainly tourism and handicrafts). Finally, the third adaptation strategy that can be depicted is the **maintenance of traditional cropping systems (olives, forage crops, cereals)** (SST3 'Ceraso')**.** This strategy seems to be defined as the re-organization of large cattle farms towards cereal-olive cropping systems requiring less intensive management (although this subsystem is also experiencing processes of deactivation of farming and land abandonment) and is characterised by a low rate of investment both in physical and labour terms, and by the decline of agricultural employment opportunities. This area, therefore, seems to be increasingly directed away from the production of agricultural goods and, as such, needs policy support to identify alternative strategies such as those based on making the area an attractive tourism destination (there have been some small positive steps taken already in this regard).

The second section of the SES, comprising subsystems SSTs 4, 5 and 6, can be considered as different points in a progressive processes of abandonment and separation from agriculture, with agricultural cover accounting for a decreasing proportion of land use in the area (below 50% of the total surface, whilst forest cover increases significantly, varying between 51% and 88%). In all three subsystems, which make up 45% of the Alento basin, agricultural areas are poorly connected 'islands' within vast semi-natural areas, passing from a dynamic of **decline of traditional cropping systems** (SST4) and **crop abandonment** (SST6) to areas characterised by the **persistence of forests** (SST5). These areas need adequate forest management and scrub vegetation control given that a large part of the area is prone to forest fires.

Looking at the data available on the implementation of the Rural Development Plan 2007-2013 in the Alento territory, and focusing on Axis II which is directed towards the valorisation of the environment and rural areas through land management, it becomes clear that the exclusive use of socio-economic indicators (even when considered in inter-temporal terms) does not permit all the diverse strategies that emerge in the socio-economic system under study to be taken into consideration. An analysis of the implementation of Measure 221 (Afforestation of Agricultural land) and Measure 223 (Afforestation of non-agricultural land)[1], for example, shows how these measures have been concentrated in Subsystem 3**.** Through these two measures 302.47 hectares of land have been afforested (42.56 under measure 221 and 259.1 under measure 223[2]- Regione Campania, 2014) in the subsystem, thereby deepening the economically agricultural productive decline of the landscape surrounding the subsystem of Ceraso.

The implementation of the two measures noted above has, in practice, supported the current trend in the area towards the dismantling and deactivation of farming activities. The strategy of Subsystem 3 is, in fact, strongly characterised by the process of adaptation by the owners of the largest farms and which has, over time, led to increased extensification of cultivation and livestock farming. Incentivizing the diffusion of woods in that subsystem surrounded by other subsystems (Subsystem 4, Subsystem 5, Subsystem 6) where the spread of wooded areas is already a consolidated trend (both because it is a traditional land-use and as an effect of abandonment and subsequent re-vegetation) proves ineffective in socio-economic terms, given that it discourages alternative uses of the territory's assets, and in environmental terms, given that it contributes to the simplification and homogenisation of the landscape which, as previously discussed, impacts the spread of wild fires and contributes to the loss of traditional landscape value. Furthermore, it is important to take into account the fact that the work required for planting under the measures often entails the removal of terraces which, at least in the initial stage, causes an increase in phenomena of erosion. Recognising the different strategies in place during the definition phase of the rural development measures could have produced different criteria/weighting in the SSTs identified, aimed towards fostering the adoption of measures better suited to the dynamics in play in these areas. In the case of Alento this could have avoided the cost of interventions which, despite aiming to improve

[1] Measures 221 and 223 finance direct payments for the afforestation of agricultural and non-agricultural land in order to foster greater environmental protection, the preservation of agro-forest habitats and, mitigate climate change.

[2] Representing the 55% of all afforested non agricultural surface of the Campania Region

environmental conditions, have in fact ended up increasing risks associated with erosion and the spread of fires as well as contributing to the loss of landscape value.

Conclusions

The different dynamics of the various components of the landscape of the SES operating at different temporal and spatial scales, as shown in the analysis of the Alento study site, make the identification of 'homogeneous' areas for the purpose of rural development programming a difficult task. In such contexts, the ability to implement and carry out effective rural development policies needs to be more closely tied to promoting the ability of communities and municipalities to modulate and creatively integrate a wide range of local factors, with the aim of enhancing the multi-functionality of each specific rural mosaic, whilst managing its development trajectory and strengthening specific aspects of resilience.

Current approaches tend to consider rural areas such as that of the Alento basin, as a single, homogeneous area and characterized by a set of core socio-economic indicators. In reality, as the analysis discussed above shows, this clearly not the case and there are significant differences at municipality, community and even at farm-level. Traditional socio-economic indicators struggle to distinguish these differences, which do, however, emerge through the methods highlighted in this study.

The consequences of the shortcomings of traditional socio-economic indicators are an over simplification of an area's state (the whole Alento basin would be seen as an area of agricultural decline), which would mask important differences and hamper the development of reflexive and responsive, context-specific policies which would be better able to respond to the different strategies that local actors use to cope with local land-use challenges. The policies needed to support the multiple and diverse components of the olive sector, which are reorganising (as seen in S. Mauro), and for the management of intensive farming along the coasts are not the same as those needed for the areas of the systems which are undergoing processes of deactivation and abandonment. As has been highlighted for afforestation measures, in some cases the policies adopted exacerbate or undermine the positive processes occurring elsewhere and leave the area at greater risk of environmental degradation.

From this perspective, it would be better to integrate the data from multiple disciplinary sources (economic, environmental and social data sets, as well as quantitative and qualitative methodologies), in order to develop a more holistic and multi-dimensional understanding of the SES, from which responsive and adaptable policy-making can emerge.

The method proposed in this paper offers one way to do that, by interpreting rural systems as complex mosaics of land use and change. Although this type of approach is clearly difficult to implement and requires deep understanding of complex data sets prior to the development of rural development programmes, it nevertheless offers a powerful tool to better calibrate the various policy measures, significantly increasing their potential effectiveness. Furthermore, although its applicability is currently confined to European regions where consolidated rural development measures are regularly adopted, nonetheless it can be adapted to make it relevant for other institutional areas, especially in developing countries where programs targeted at increasing community resilience and reducing poverty and land degradation are being adopted.

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Abstract

Le aree rurali sono caratterizzate da paesaggi fortemente eterogenei, veri e propri mosaici rurali, all'interno dei quali coesistono forme di uso del suolo a diverso grado di intensità e processi di disattivazione e abbandono.

Il lavoro propone una metodologia per l'analisi integrata del territorio rurale che combina tecniche di analisi delle dinamiche di land cover in ambiente GIS con la valutazione delle dinamiche socio-economiche ricostruite attraverso l'uso congiunto di indicatori e di elementi della storia dei luoghi. La metodologia, applicata ad un sistema socio-ecologico rappresentativo del bacino del Mediterraneo, il bacino dell'Alento, si propone come strumento capace di favorire processi di sostenibilità e supportare la territorializzazione delle policies di sviluppo rurale.

Abstract

Rural areas are characterized by highly heterogeneous landscapes; rural mosaics, which are home to varying intensities of land-use and processes of deactivation and abandonment. The study discussed in this paper proposes a method for the integrated analysis of these rural areas which combines the analysis of land cover dynamics, using GIS, with an assessment of socio-economic dynamics, reconstructed through the combined use of indicators and local history. The method, applied to a socio-ecological system which is representative of the Mediterranean basin, is proposed as a tool to support sustainability processes and the territorialisation of rural polices.

Keywords: landscape dynamics; land use change; rural development; rural socio-ecological systems; rural policies; rural resilience; land degradation; scrub encroachment