Recent Land Abandonment Drivers in the Agro-Pastoral Areas of Apulia

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Abstract

Apulia is one of the most important agricultural regions in Italy, and its primary sector is the repository of important historic and cultural heritage. However, at present, in particular in the inner agro pastoral areas of the Murgia upland and the Gargano promontory, two serious threats risk to generate irreversible damages to local population, ecosystems and economic sector. The first one concerns the spread of paratubercolosis in semi-extensive dairy sheep and goat farms, with a positivity in the flocks of 60.5% and a seroprevalence of 3.0% for sheep and 14.5% for goats, with peaks of 50%. In economic terms, the uninfected farms had a mean profit efficiency of 84%, which dropped to 64% in the presence of this bacterium that reduces the productivity of feeding, veterinary services and labour. The second problem concerns the wine sector in the northern Apulia, and regards the greater profitability of non-autochthone varieties in comparison with typical ones, in intensive and semi-extensive cultivation systems. This phenomenon is causing an intensification of wine growing also in the areas next to the agro-pastoral and inner territories of the Murgia highland, with significant pressure on its fragile ecosystems. These recent findings should be properly considered by decision makers in order to plan strategies for the restoration of more sustainable dairy and wine-growing sectors in these areas, so helping to increase farmers' profits, improve environmental conditions for the community and ensure higher food quality, security and safety for consumers.

Keywords

Land abandonment, Paratubercolosis, Vine landraces, Apulia

[*]Università degli Studi 'Aldo Moro', Bari, Italy. The researches reported in this paper were funded by:

- the 2007-2013 operative national project 'EPISUD' (MIUR - Italian Ministry for University and Research);
- the 2007-2013 RDP of Apulia Region, Council Regulation (EC) no. 1698/2005, Axis II 'Improvement of environmental and rural areas', Measure 214 'Agro-environmental payments', Action 4 Sub-action a): 'Integrated projects for biodiversity' – Project for the recovery of Apulian vine germoplasm Re.Ge.VI.P.

1. Drivers of farmland abandonment

European agriculture ensures a wide range of valuable habitats, as well as the maintenance of ecosystems emerged from agricultural practices, so that this sector plays an important role in the conservation of the EU's environmental resource (EC, 2006), whose survival depends on the continuation of appropriate land management practices. On the contrary, the abandonment of agricultural land may threaten: farmland biodiversity (Plieninger *et al.*, 2014; Zakkak *et al.*, 2014); anthropogenic landscapes of high natural values; provision of ecosystem services (Benayas *et al.*, 2007); food, feed, fiber and biomass production (Kastner *et al.*, 2012); landscape heterogeneity and consequent increase of vegetation homogenization; soil erosion and desertification; historic, cultural and aesthetic value (Benayas *et al.*, 2007). Hence, drivers of farmland abandonment are multidimensional, and concern natural constraints, land degradation, socio-economic factors, demographic structure, institutional framework, unadapted agricultural systems (Moravec, Zemeckis, 2007; Terluin *et al.*, 2010). On this last question, low soil productivity, poor climate, and significant altitude are important natural constraints to an agriculture that increase the risk of farmland abandonment (Müller *et al*., 2009). Besides, climate change, by exacerbating low temperature or dry conditions, limits crop growth (Fischer *et al*., 2007) and affects crop physiological processes (Le Houerou, 2004).

Concerning the economic drivers, farmland is typically abandoned if difficulties in generating a sufficient income emerge (MacDonald *et al*., 2000). Besides, low investments on the farm might indicate absence of dynamism, adaptation capacity and forward-looking strategy, hence a declining farming activity and a scarce willingness to continue it (De Stefano, 1985). Farmers' age is a further important driver for land abandonment (Mishra *et al.*, 2010), as younger farmers tend to manage farms with a greater economic size, utilizing larger agricultural areas and labour force than the older ones. Furthermore, other factors being constant, extensification, inappropriate structure, low economic viability and scarce investments, are more likely to occur in the presence of old and close-to-retirement farmers (Kristensen *et al*., 2004), with consequent high risk of abandonment.

Lack of training and information make very difficult the adaptation of the farm strategies to the changing economic and market tendencies (Labarthe, 2009), whose success is strictly related to the use of farm advisory systems, to an higher professionalism of the farm, and to the willingness to invest in human capital and knowledge.

In absence of these interventions, risk of abandonment tends to increase. At regional and national levels, imbalanced economic development of the economic sectors (agriculture, industry and services) may favour the transfer of labour forces from the primary sector, in particular when agricultural income is below the regional or national one. This tendency, which is reinforced by opportunities outside the agricultural sector, increases the probability of abandonment (Rickebusch *et al*., 2007).

Remoteness from settlements, roads, agricultural (*e.g*. retailers, inputs suppliers, slaughterhouse) and social (*e.g*. schools and hospitals) infrastructures increases the risk of farmland abandonment (Corbelle-Rico, Crecente-Maseda, 2014), and distance from urban centres hinders the possibility of combining farming activities with part-time jobs (Terluin *et al*., 2010).

Finally, the price of the land can also be considered as an indicator of marginalization, so that a low demand for land usually generates low transaction prices, hence a weak land

market, with consequent higher risk of land abandonment (Ciaian, Swinnen, 2009).

Over the past decades, the aforesaid drivers are acting in the inner and agro-pastoral areas of Apulia region. However, in the last decade, two further serious threats are accelerating the land abandonment phenomena in these territories, so as to request urgent interventions by decision makers.

2. Paratuberculosis in the Apulian sheep and goat farms

Apulia is the country's fifth region for the dimension of the dairy sheep and goat sector, with about 3,000 farms and 300,000 animals (ISTAT, 2010). In addition to productive (mainly meat and dairy products) and economic elements, the sector also affects social and environmental aspects in the internal and disadvantaged territories of the region (Gargano, Murgia, North Salento). Due to their particular socioeconomic dynamics (aging population, marginal productive activities, lack of infrastructure, etc.), these areas are at risk of abandonment, and the sheep and goat sector is held back by structural, managerial and market weaknesses. Indeed, despite several high-quality typical products, production occurs almost entirely in a great number of small family-run farms, often managed by elderly farmers. Such structural production characteristics generate short and local market channels that are not underpinned by suitable strategies capable of countering the problems of market globalisation, with consequent high productions costs and low profits.

Another serious problem is troubling the Apulian sheep and goat farms, i.e. paratubercolosis (PTB), also known as Johne's disease. It is a contagious, chronic and sometimes fatal bacterial infection that primarily affects the small intestine of ruminants (Pistone *et al.*, 2012). The disease leads to economic losses (Winterhoff *et al.*, 2002) due to decrease in milk production, costs involved in diagnosis and disease control, culling of affected animals and low carcass value at slaughter (Mendes *et al.*, 2004). The infection is distributed throughout the world (Nielsen and Toft, 2009; Attili *et al.*, 2011) and its prevalence tends to increase (Winterhoff *et al.*, 2002). The etiologic agent, *Mycobacterium avium* subspecies *paratuberculosis* (MAP), is believed to be capable of infecting and causing disease in all ruminants (*e.g.* cattle, sheep, goats, llamas and deer) both in captive and free-ranging living conditions.

Recent studies have highlighted a strong spread of *paratuberculosis* (PTB) on dairy sheep and goat farms in Apulia (Scaltrito *et al.*, 2015). The epidemiological results showed that 60.5% of flocks, 3.0% of sheep and 14.5% of goat are positive to MAP. The number of positive animals per farm ranges from 0 to 49, with a mean of 3.48. Among the risk factors, biological (age of the animal), structural (number of goats in mixed flocks, number of species on small farms, flock size and stagnant water in the fold) and managerial aspects (faecal contamination of water and food, farmer experience, management of births in individual boxes, confinement of the purchased animals in separate pens, partition and rotation of pastures) proved to affect seroprevalence in the sampled farms (Sardaro *et al.*, 2015).

In order to ensure suitable monitoring and surveillance of infection so to reduce the impact of PTB, economic studies are also crucial, in order to provide appropriate information for the development of suitable control strategies, prophylactic programs and economic aid plans (Kahrs, 2008).

In particular, profitability and efficiency in dairy farming depend on a combination of structural, productive and managerial factors, coordinated through decision-making in the long, medium and short run (Rougoor *et al.*, 1998). In this context, MAP infection could negatively affect a non-optimal combination of structural, managerial and productive factors, thus generating inefficiency, in terms of lower outputs and/or increased production costs. Should this be the case, the inefficiency factors need to be identified and a strategy developed for farms to improve their efficiency levels whilst controlling the infection.

A recent research (Sardaro *et al.*, 2017b) highlighted that dairy sheep and goat farms in Apulia were affected by profit inefficiency, and such a phenomena was worsened by MAP. In particular, in uninfected farms, capital and feeding investments facilitated profit increases, while labour, cultivation, veterinary and other costs caused profit contraction which could derive from an increase in costs and a contemporaneous reduction, or a constant trend, of milk prices. This trend substantially undermines the competitiveness of Apulian sheep and goat farms.

In the infected farms, instead, only capital costs generated greater profits, and the infection exacerbated the negative impact of a non-optimal combination of production factors. Feeding, veterinary and labour costs had the greatest negative effect on profitability. Therefore, decision-makers should seriously consider implementing proper actions to increase investments, for example through a reduction of feed prices, veterinary fees and taxation for employers.

Several farm characteristics were involved in this dynamics in the infected flocks, namely the farmer's experience and schooling, access to credit, participation of family members (and women in particular) in the farm's activities, density of animals per hectare, number of goats in mixed flocks, confinement practices for young and purchased heads and pasture rotation. In particular, a farmer's long years of experience can help to adopt useful measures to improve flock management, and high school education is a further added value. These two elements tend to increase their positive impact in the presence of PTB, streamlining structural and management innovation and bolstering efficiency levels. Easier access to credit could favour the adoption of new structural solutions, such as confinement structures for young and purchased animals and pasture rotation, countering the increase in the related cultivation costs. Also family members play a positive role on profit efficiency. Their activities can reduce labour costs and foster the implementation of innovative short food supply chain strategies, developing autonomous marketing strategies based on the differentiation of dairy products, so to increase the added value of production within the farm, hence profit. However, difficult working conditions and low revenues drive the new generations away from farming to look for more remunerative and comfortable jobs, often in urban areas. This is why decision-makers are called upon to enact proper policies for the generational turnover in the Apulian livestock sector, in order to exploit the positive impact of this important efficiency factor.

The positive impact of women's activities in the presence of MAP was an interesting result of the analysis. The involvement of women led to a reduction of profit inefficiency, probably because of their greater attention to sanitary aspects, especially in the birth and milking phases. Indeed, the role of women in a prevailing agricultural model in crisis fosters a reformulation of socioeconomic development priorities. In this context, recent studies highlighted that, in the short food supply chain, female entrepreneurship is often a reaction to the crisis of intensive agricultural models, promoting cultural and economic

development of a specific area by leading the agricultural system towards well-being and sustainability. In the agricultural sector, farms managed by women tend to be multi-functional and to increase their production in quantitative and qualitative terms (Zirham, Palomba, 2016). Besides, women are more likely to undertake, innovate and diversify business activities, strengthening the business structure and supporting the local economy through alternative strategies. Hence regional policy makers are called upon to consider that a greater involvement of women in the breeding businesses could favour higher efficiency levels in the Apulian sheep and goat farms.

The high density of animals per hectare reduces efficiency levels probably for feeding inefficiencies and sanitary issues; however, efficiency levels are similarly impacted by a small number of animals in the flock, maybe due to the inability of exploiting economies of scale. In other terms, large flocks increase efficiency on condition that the area of the farms is proportionate to the number of animals. Finally, the presence of a high number of goats in mixed flocks affects inefficiency probably for sanitary issues.

Overall, the results point to the impact of MAP infection on the profitability of sheep and goat farms in Apulia, providing useful information for economic intervention programmes. The sector is important not only for private farmers' profit, but because it encompasses a wide set of positive externalities including the environment, agro-biodiversity, food safety and cultural heritage. Therefore, a broad policy agenda is needed in order to face the epidemiological and economic problems of infection.

3. The abandonment of historic vine varieties by Apulian farmers

In the past, the large number of farmers and the limited availability of land led to a significant number of small-sized farms in Apulia, with an area of less than 1 hectare (ISTAT, 2010) and often based on family management. This structural characteristic, also common to other productive sectors such as olive and fruit growing, fostered vine production mainly based on local and historic varieties (landraces) and contributed to the maintenance of agro-biodiversity in Apulia (Sardaro *et al.*, 2016).

Over the last decades, agricultural ecosystems increasingly lost their biological diversity based on local landraces, and modern intensive cropping systems are now based on monoculture farming in order to increase the global food supply by using genotypes with high yields, but also requiring high levels of inputs (MEA, 2005). In Apulia, the market forces over the last fifty years gradually caused the replacement of the local vine landraces used

for winemaking (*e.g.* Somarello rosso, Minutolo, Moscatello selvatico and Ottavianello) with more productive varieties, also imported from northern Italy (*e.g.* Trebbiano, Montepulciano and Sangiovese). Moreover, farmers widely replaced the traditional and extensive *alberello* and espalier plants with more intensive structures (*tendone*), which, being based on several vine-shoots per vine (even more than four), allowed yields to increase (even four/five-fold). These varietal and structural changes led to a modern approach to wine growing that uses higher levels of inputs (i.e. fertilizers, water, power and pesticides required because the new varieties are less disease-resistant), with a consequent reduction in production quality and the loss of local and historical traditions.

In order to prevent the extinction of these local vine ecotypes, Apulia Regional Government introduced several regulations aimed at encouraging their restoration by

reducing the planting and operating costs. The success of this strategy was rather uncertain and farmers in several areas of the region did not demand at all the aids, but continued their intensive wine growing based on non-autochthone varieties, high yields and massive use of inputs. Moreover, in these areas, grapes are sold to wholesalers for winemaking. Possible reasons could be the following: farmers' lack of awareness about the difference in costs and revenues among the several production systems; their lack of knowledge about the technical, economic and administrative aspects of wine-making; the high investment costs involved in the construction of new private wineries; the difficulties inherent in the social fabric, which does not allow the implementation of cooperative strategies in the stages of wine-making, so to reduce the aforesaid costs. Hence, along the entire supply chain, the available economic information concerning the regional vine landraces is insufficient.

In order to fill this gap, a recent study (Sardaro *et al.*, 2017a) compared the financial sustainability of the following varieties: a) a non-autochthone variety (Sangiovese) in an intensive system (tendone); b) a typical regional variety (Uva di Troia) in a semi-extensive system (espalier); c) a vine landrace listed in the regional regulations (Somarello rosso) in a semi-extensive plant (espalier). This approach was chosen in order to understand the market drivers of wine growing in the area, and consequently to evaluate the existence of concrete economic possibilities to preserve the regional vine landraces.

To sum up, the results showed that, in the study area, landrace and typical varieties had lower levels of economic sustainability than the non-autochthone variety, mainly due to lower yields and despite lower costs and higher production values. This entailed the progressive replacement of landrace-based plants and the spread of intensive wine growing, with negative impacts on the environment and on the general quality of production, thus contributing to the near-extinction of the local ecotypes.

In general, the results reflected the weaknesses of the wine sector in several areas of Apulia. These weaknesses are due to fragmentation of the productive sector, intensive wine growing, high profitability from high yields, low wine quality, sales of grapes by farmers to wholesalers, lack of farmers' involvement in winemaking and sales, absence of a dedicated supply chain for the local varieties. In such a framework, where classic production is connected to highly productive non-autochthone varieties, and farmers are not involved in high-quality winemaking, the lower production levels of the local ecotypes mean that they are not profitable, despite their higher production value. Furthermore, it is difficult and complex to begin and to manage winemaking in the considered area, due to administrative issues and lack of technical knowledge by winegrowers. Although the regional RDP contains measures aimed at helping farmers in wine production, mainly with financial support for suitable structures and machinery, more assistance is needed in connection with technological, managerial, economic and administrative aspects of winegrowing and winemaking.

If these issue are addressed, the outcome could favour the preservation of Apulia's wine growing and a shift towards a more extensive approach, based on the promotion of local vine landraces and related high-quality wines produced by farmers themselves. This would lead to a consequent reduction in environmental impacts and favour the transmission of local cultural values to future generations. With a new approach to planning of subsidies, the benefits of avoiding genetic erosion will increase the welfare of all actors in the supply chain, generating higher profits for farmers, improving

environmental conditions for the community and providing higher levels of quality, security and safety for consumers.

4. Conclusions

The paper concerns two recent phenomena, which, jointly with those widely highlighted through the scientific literature, are accelerating the abandonment of the internal agro-pastoral areas of Apulia. Therefore, concrete interventions by decision-maker are desirable.

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