

Variability of agro-silvo-pastoral systems in Tuscany, Central Italy

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Abstract: The variability of climates, soils and management intensity present in Tuscany has favoured the development of diversified and sometimes complex agro-silvo-pastoral systems.

This research has investigated the variability of systems organized in all the Provinces of the regional territory. The number of resources that compose the systems is higher in farms located on mountains and high hills than in farms of plains, and it is higher in large farms than in little units.

The variability of resources favours the maintenance of landscape beauty and the integration of rural economy with farm services offered to tourists. The conservation of resource variability and their valorisation by integration of rural activities and town economy can be advised also in developing countries in order to increase farmers incomes.

Keywords: resources diversification, sustainable development, economical integration

Introduction

Tuscany is located in Central Italy, the territory has enhanced topographical variability, hills cover 66.5% of the regional area, mountains are 25.1% and plains only 8.4%. The high proportion of hills and mountains makes difficult agricultural intensification in large areas, at the same time it favours the diffusion of environmental friendly farming systems and the conservation of native crops and traditional foods. The high quality of the produce is guaranteed by certifications of organic agriculture, PDO (Protected Designation of Origin) and PGI

(Protected Geographical Indication). The climate of the region is Mediterranean or influenced by the vicinity of the sea.

Forests cover about 44% of the territory, broadleaf species are dominant (mainly is *Quercus* spp.) whilst *Abies* spp. are dominant among conifers.

The total cropped land is 39% of the territory. Agriculture and livestock are important activities and the quality of the produce is very high and well known on national and international market. Natural pastures are 5% of the territory.

The region is centre of origin of many livestock breeds: cattle (Chianina, Maremmana, Calvana, Garfagnana, Pontremolese), pigs (Cinta Senese), sheep (Garfagnina Bianca, Pomarancina and Zerasca) and horses (Maremmano and Bardigiano).

Unfortunately, livestock number has been reduced in the last 50 years and pastures abandoned due to industrialization and urbanization (Pardini *et al.*, 2002). Under grazing is the commonest condition at present, at the same time there are scattered cases of overgrazing due to abandon, shrubs encroachment and local reduction of pasture area.

Tuscany shares the problem of pasture degradation with all European countries (Rigueiro *et al.*, 1999) and many tropical countries (Carvalho *et al.*, 2008; Paciullo *et al.*, 2008; Faiello *et al.*, 2008). An estimated 20% of the world's pasture and rangelands (about 680 million ha) have been degraded (FAO/UNEP, 2000). Several aspects have been suggested for pasture/rangeland rehabilitation in developing countries, including public investment in infrastructure and access to local and global markets, promotion of self-organization and mobile services for pastoralists to adapt to current and future climate variability (Niamir-Fuller, 2008). In developed countries pasture management can increase further farmers incomes if based on the integration of pasture management with other economical sectors, like educational, recreational and tourism services. Indeed, several Italian farms have adopted integrate agricultural systems as an alternative to conventional systems (Pardini *et al.*, 2008). In general, many Tuscan farmers prefer low input techniques (Pardini, 2004) and complex systems with diversified resources in order to sustain pasture productivity and to conserve the variability of native vegetation.

Productivity and seasonal distribution of forage production are the two most important parameters of pasture management (Cereti and Talamucci, 1991).

The seasonality of pasture production is related to fluctuations of monthly temperature and rainfall. Cold winters and dry summers force many farms to keep the livestock in stables for many months and to rely on conserved forages. Winter and summer are the critical periods of forage production and, to balance the gaps of forage it is important to associate forage crops with complementary growth

rhythms and, possibly, pasture plants and forage shrubs or grazed forest (Talamucci, 1994; Talamucci *et al.*, 1996).

To overcoming the problem of seasonality of production, traditionally is done harvest and store of fodder crops. Other alternatives are:

- 1 - regularization of the seasonal distribution of forage during the year;
- 2 - introduction of temporary pastures or meadows;
- 3 - use of forage crops that produce mainly in summer or winter;
- 4 - utilization of forage shrubs (Talamucci and Pardini, 1999b).

Several researches were done in Tuscany to evaluate the seasonal productivity (Sarno *et al.*, 1989) and the diversification of resources in forage-pasture systems (Cavallero *et al.*, 1992; Talamucci *et al.*, 1995; 1996; Pardini and Rossini, 1997; Pardini, 1999; Talamucci and Pardini, 1999a). These researches showed a great variability of native resources, however there is not a systematic and detailed study about the characteristics of Tuscan pasture systems.

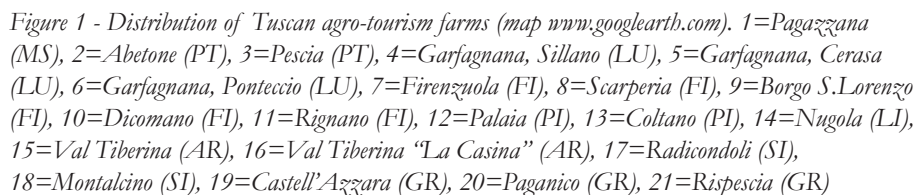
The objective of the present research was to assess the management of forage-pasture systems in Tuscan farms, in order to improve the efficiency and the sustainability of their systems. Special emphasis has been put on farms that offer tourism services (agro-tourism) as they appear more prompt to adapt to changing conditions of society and markets.

The assessment considered the following aspects:

- 1 - the forage resources present in each farm;
- 2 - the monthly management of livestock according to availability of forage and pasture resources.

Materials and Methods

A large number of Tuscan farms with pastures and livestock rearing have been selected from a data base *on line* produced by Regione Toscana (the Government of Tuscany, www.agriturismo.regione.toscana.it), 407 were selected from the 10 provinces that form the region: Florence (capital town, FI), Arezzo (AR), Grosseto (GR), Siena (SI), Livorno (LI), Pisa (PI), Lucca (LU), Pistoia (PT), Massa-Carrara (MS) and Prato (PO). The selected farms received a questionnaire that had been already used for similar investigations within the FAO-Ciheam network on '*Mediterranean Pastures*'. (Argenti *et al.*, 1999). Unfortunately most farms did not answer, or answered that they have no more or had never had pastures or livestock, at the end only 21 farms from 9 Provinces answered completely to the questionnaire (figure 1) all these farms offer also agro-tourism services. Their owners were further interviewed by telephone to complete the study.



There is big difference between the data base and the actual reality, this suggests that owners are rapidly changing their farming systems in order to better meet the requirements of a changing market. Moreover, all the farms that answered offer also services related to tourism, this suggests that conventional farms take in little consideration relationship with customers, whilst integrated farms with services give much importance to this.

The investigation pointed out 11 different forage resources: native pasture (never sown or sown over ten years ago then invaded by native pasture plants), sown pasture (usually mixtures of grasses and legumes including 4-10 different species), grazed sown meadows (single species or association of few grasses and legumes, highly productive, used for hay, new sprouts after mowing can be grazed by livestock), short term meadows (highly productive forage crops with growing

Table 1 – Farm number (corresponding to location in figure 1) altitude and forage resources: native pastures (NP), sown pastures (SP), grazed sown meadows (GM), short term meadows (ST), farm hay (FH), bought hay (BH), farm silage (FS), bought silage (BS), legume flours (LF), cereal stubble (CS), grazed forest (GF),

Farms	Altitude m asl	NP	SP	GM	ST	FH	BH	FS	BS	LF	CS	GF
Massa-Carrara	1	X		X	X	X	X	X				
Pistoia	2	X				X	X					
	3							X				X
Lucca	4		X			X	X		X			X
	5		X			X	X					X
	6	X			X	X		X				
Firenze	7	X		X		X						
	8			X	X	X	X			X		
	9	X	X		X	X				X		
	10	X	X	X		X	X					X
	11				X	X	X					
Pisa	12	X					X					
	13	X			X	X				X		
Livorno	14	X		X		X						X
Arezzo	15		X			X		X	X	X		X
	16		X			X	X		X			X
Siena	17	X	X					X	X			X
	18	X	X				X	X				
Grosseto	19	X	X	X		X	X					X
	20	X	X	X		X		X		X	X	X
	21		X		X	X	X					X

periods of 3-4 months, grasses are usually sown in autumn like oats, legumes and summer grasses in spring like bean and maize), hay and silage produced in farm or bought (common species are *Medicago sativa*, *Lolium multiflorum*, *Dactylis glomerata*, oats, forage mixtures), legume flour (usually *Vicia faba* Minor, *Pisum sativum*, *Glycine max*), cereal stubble (usually from summer wheat, winter wheat, barley) and grazed forest (very common these are oak forests with mixed species of other genus, sometime thinned out to make easier the passage of livestock). These resources are combined in several ways (table 1) to supply the necessities of the animals all through the year.

Grosseto is the region with the highest number of forage resources (average of 6.3 resources per farm), including a farm that combines eight resources. This province is the most southern and has a truly Mediterranean climate with 650 mm rainfall per year and very arid summer. Therefore, only the diversification of the resources makes possible to have forage during the critical season. Farms area is larger in Grosseto (average of 19.3 ha) than in the average of Tuscany (11.6 ha), this larger area contributes to the presence of diversified forage resources.

Farms located in Massa Carrara, Pistoia, Firenze (one farm) and Pisa, use only two forage resources. These farms are located in low hills (average of 395 asl) where soils are more fertile and there is possibility to produce sufficient quantity of pasture and forage during all year. In general, these farms bought hay to feed animals during the short period of summer and winter.

Some forage resources are more frequent than others: apart pasture, hay produced in farm is the most common forage resource, farms buy hay or silage only for winter months and, secondarily, some summer months. Among the 21 farms analyzed, 16 use farm hay, 13 use native pasture and 12 use bought hay from other farms as forage resources. Sown pasture and grazed forest are used by 11 farms. Cereal stubble is grazed only in one farm located in Grosseto, this is not common as farms are very specialized and those who produce cereals do not have livestock, moreover farms are little in Tuscany and the quantity of stubble available is not much, Grosseto has larger farms than average and the quantity available is more consistent.

Farms with little number of resources tend to use them for long periods of the year (figure 2) and give short rest to pastures, while farms with several resources tend to use each of them for short periods and each resource is never excessively exploited.

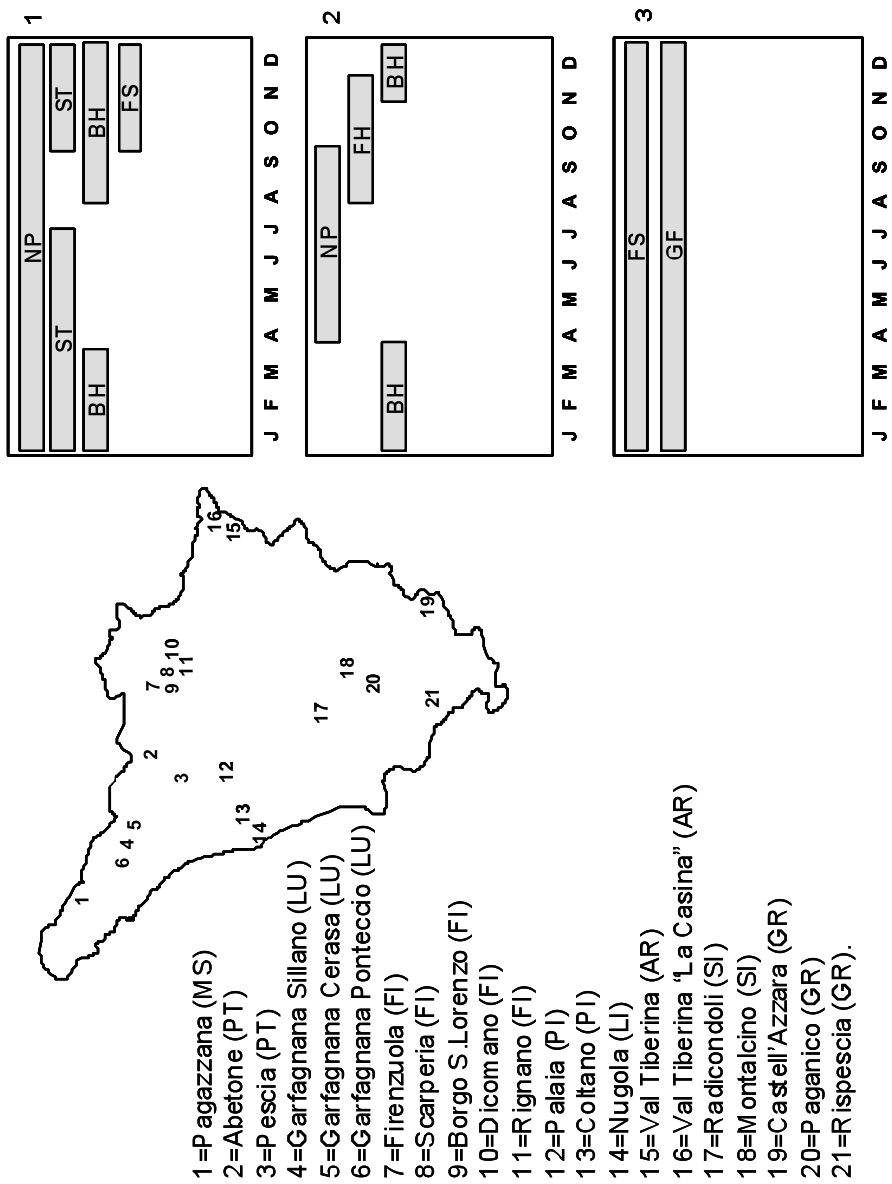


Figure 2 - Monthly availability of forage resources in 21 Tuscan agro-tourism farms (the number of the graphic corresponds to the location on the map)

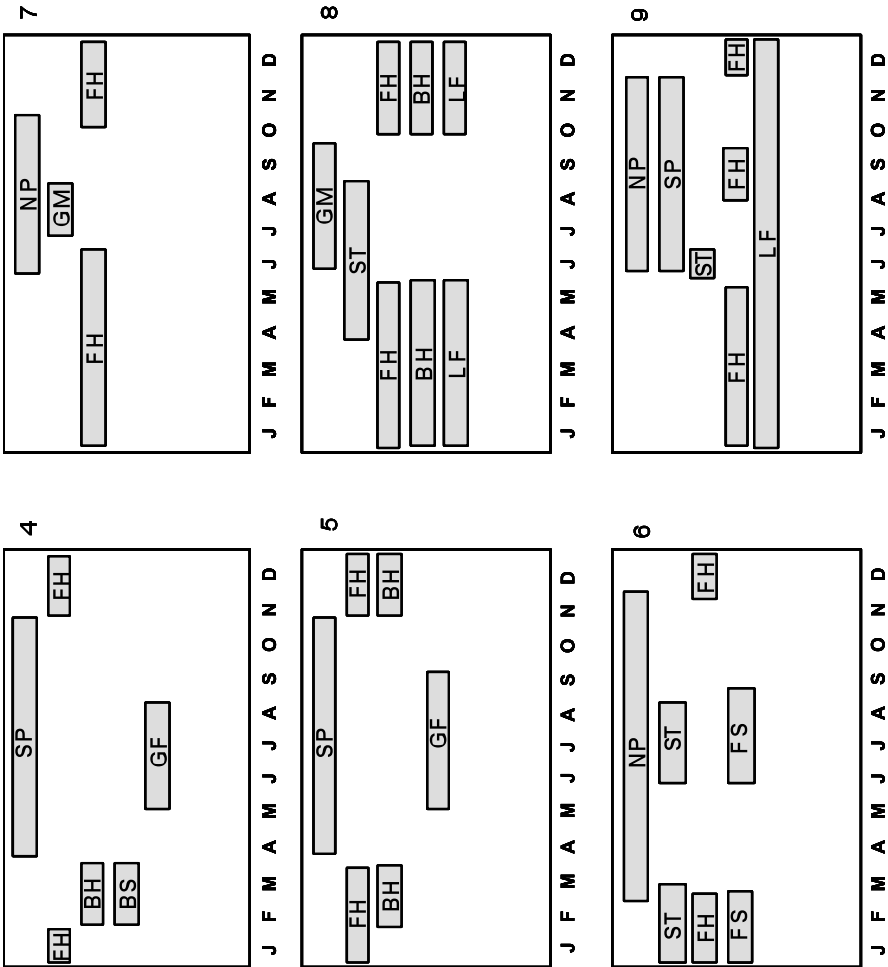


Figure 2 - continued

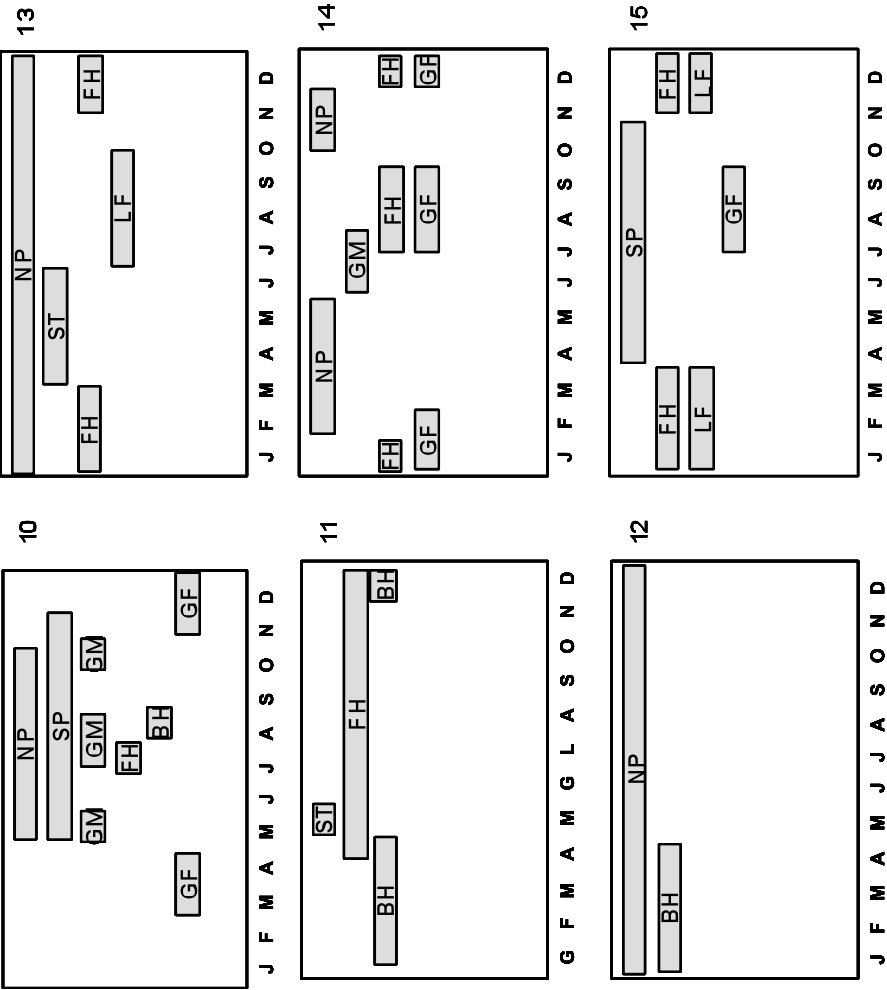


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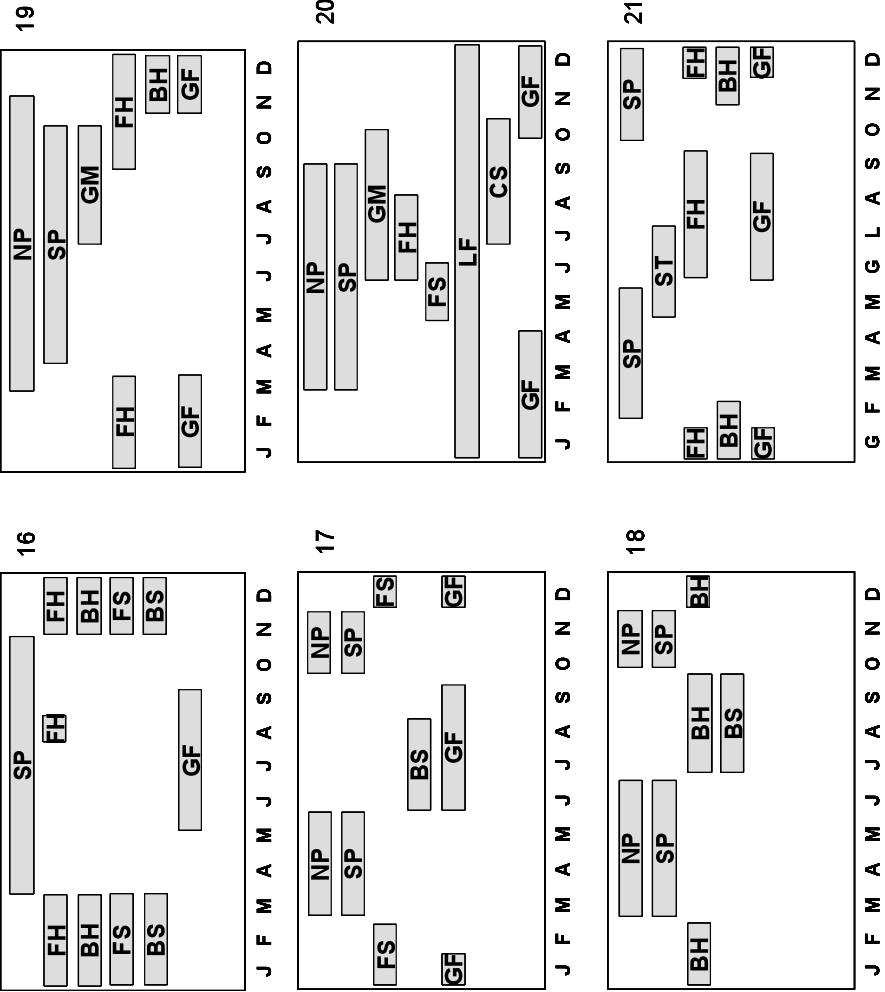


Figure 2 - continued

Conclusions

Tuscan farms have high variability of forage resources, this variability is higher than in intensive Italian farms and much higher than farms of developed countries with large pastures (like Australia, Canada, USA) that tend to base livestock foraging over one or very few intensive resources.

Each Tuscan farm combines the resources in singular system, according to peculiarities of the physical environment (climate, soil, topography) and the management conditions prevailing in each location.

Farms located at low height (plains, low hills) have simpler forage-pasture system than those in mountains, the simple systems are based on few intensive resources. In these cases, it is possible to advise further introduction of selected cultivars and, possibly, selection of new cultivars from native genotypes that should be diffused instead of foreign cultivars.

On the other hand, the farms situated in hills and mountains use a larger number of forage resources to overcome the environmental constraints and to have forage availability also in difficult seasons, especially winter. In these farms it is possible to associate the resources in a complex multipurpose system, and further improve the management with integration of conventional livestock rearing with services link to naturalistic tourism.

The research has pointed out a preference of Tuscan agro-tourism farms, to conserve natural resources (native pasture and grazed forest), in fact both these are very attractive for tourist customers.

The diversification of resources should be taken into consideration also in developing countries to improve monthly availability of foods, to diversify the offer, and also to start an overall economical diversification that can integrate rural and town areas.

Investigations such that proposed in this paper, with identification of the forage resources available and their monthly utilization, can be useful also in tropical countries in order to identify weak points of the local agro-silvo-pastoral systems and to propose management changes to improve productivity and sustainability of integrate systems.

Aknowledgements

This research has been done within a scholarship given from the “Programa UNESP-Banco Real de Estagio no Exterior”, by Universidade Estadual Paulista (UNESP), Brazil, that funded the work of Prof. Maria Lidia Stipp Paterniani during her research period in University of Florence.

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