

# Chapter 12

## Agroforestry Systems in Italy: Traditions Towards Modern Management

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**Abstract** The long history of civilization and the passage of several different cultures have produced slow changes in the Italian landscape. Changes in land use have created a large number of agroforestry systems, comprising natural or planted tree stands and shrub species with different densities in which botanical composition, productivity and management are much diversified. The traditional integration of pasture and woody plants has been disrupted by modern agriculture. However, this disruption did not spread in marginal areas and has never resulted in complete separation of the different resources. The result has been complex systems which are difficult, expensive to manage and non-competitive, although they are more resilient to environmental changes than specialized ones. The current concerns of people about their quality of life (including food quality and nature conservation) and the development of new economic sectors related to recreational activities (including farm tourism, game hunting, educational services and valorisation of local genetic resources) have opened up new opportunities for the integration of rural economies into the wider regional economy. Modern techniques for integrated, modern management of pasture, forest and cropped areas can be further integrated to increase multiple uses of the territory and integrated economic development. In Italy, landscape diversity can nowadays be valued more highly than in areas with specialized land uses. Some examples of agroforestry systems from mountains and plains are given and some opportunities for their integration in the developing economy are discussed.

**Keywords** Trees and pasture, land management, eco-tourism, natural resource tourism

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## Introduction

The countries around the Mediterranean Basin have about 121 million hectares of pastures and 88 million hectares of forest (FAO 2006; Pardini 2006). The area is home to over 450 million people and it is characterized by diversity of economic and social development. A large number of people have been living in rural areas and engaging in rural activities for over two millennia creating a continuing evolving natural landscape in Mediterranean Europe (Talamucci and Chaulet 1989). In Italy the areas of forest, pasture and cropped fields have undergone changes over time (Sereni 1987): forests were reduced and cropped fields increased until the 16th century, after this a new equilibrium was reached and maintained until the mid 18th century when a massive increase in population number resulted in land reclamation and crop growing spread into marginal areas. At that time farming was always linked to livestock production: cattle were reared for meat and milk, manure was used as fertiliser for cropped fields and draft animals used to plough the soil. Sheep produced meat, milk and wool and herds were reared mainly on family farms which depended on transhumance.

For a long time forests were harvested for wood, the understory vegetation was grazed and branches were cut to provide green leaves to livestock during summer. In Italy, at the beginning of the 20th century, forest contribution to livestock forage was around 50% of the diet (Pontecorvo 1933; Vignati 1936). This high stocking rate damaged the forest resource. However, forest grazing remained unregulated until a Forest Law of 1923 (GURI 1924), which finally legalized and set important limitations to this practice (Gambi 1982; Talamucci 1991).

## Current Types of Pastoral Systems in Italy

Many changes have taken place since the 1950s (Fig. 12.1): urbanization and reduced human birth rates have resulted in concentration of agriculture and animal rearing in intensive areas. The number of enterprises with extensive rearing decreased, consequently land conservation was reduced, pastures were encroached by shrubs and risk of fires were increased (Talamucci 1993). These problems led to the need for tree reintroduction in complex systems, and at the same time integration of conventional agriculture with modern ecosystem services were sought in integrated systems.

Currently, agriculture is subsidised in Italy to limit further land abandonment. At present it is estimated land abandonment (Fig. 12.2) is about 30–75% in different Alpine areas and 25–70% in the Apennines. Within the mosaic of diversified conditions, although pasture undergrazing is very common, there are overgrazed patches within undergrazed pastures. Damage to the nearby forest vegetation usually happens when grazing in nearby pastures exceeds the carrying capacity. The area of Italy is around 29 million hectares, of which two thirds are arable and the rest is rocky mountains or poor forests on steep slopes. Agricultural land has lost 5 million hectares from

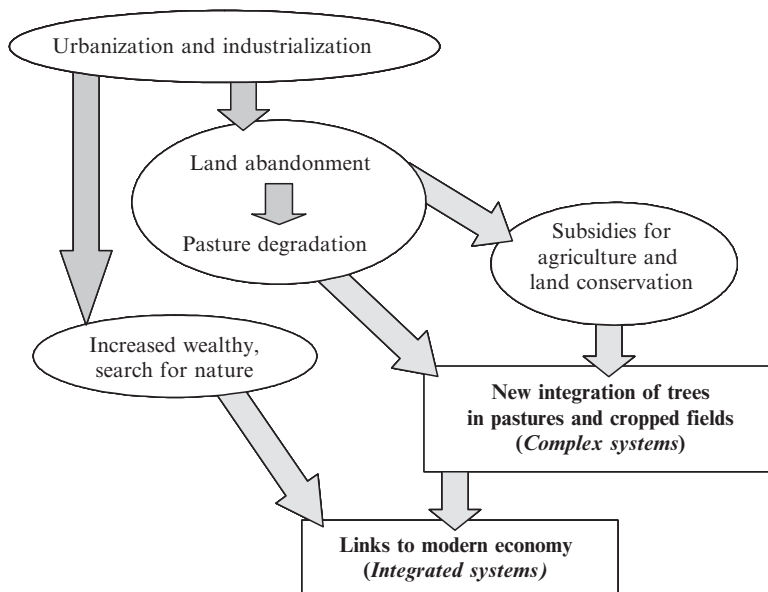


Fig. 12.1 Dynamics of recent changes in Italian pastoral systems

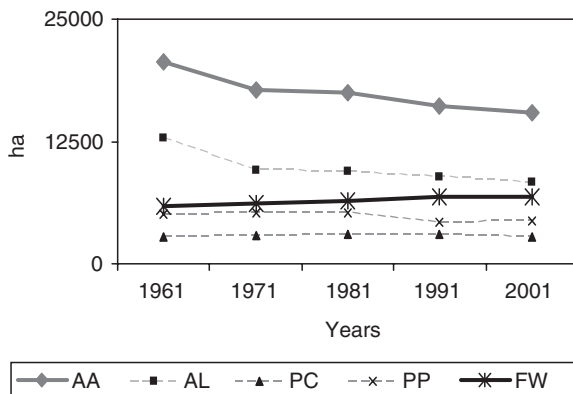


Fig. 12.2 Changes in agricultural area (AA, grey) and forests and woodlands (FW, black) area in Italy from 1961 to 2001. Agricultural area comprises arable land (AL) permanent crops (PC) and permanent pastures (PP). Hectares × 1,000 (FAO 2006)

1961 to 2006, in the same period the pasture area increased as a proportion of the agricultural area from 24.5% to 28.2%, but it was reduced as percentage of the total area. In the same period, the forest area increased by around 913,000 ha and the arable land was reduced by 8,000 ha (FAO 2006). The result of the expansion of pasture and forest land has meant the return of trees and shrubs in pastures and the new conversion of pastures and cropped fields to early stages of forest.

Environmental diversity as well as the different management systems introduced in different historical periods contributed to enhancing the variability of farming and of pastoral systems in Italy (Pardini and Rossini 1997; Pardini 2002). These systems are more extensive in Italy than in countries with shorter history. Examples are pastures with scattered trees (pastures with a few trees left, usually less than 50 per hectare), park-forests (forests managed for recreation, usually near to towns, thinned out and cleared of most of the understory), thinned out forests (forests cleared with selective or geometrical tree removal, with density reduced to also allow grazing), tree plantations (usually fast growing tree species or valuable hardwoods planted in rows, where the competition from pasture is reduced by periodical mowing or by grazing) and forage shrub plantations (usually in the form of alley-cropping). All these resources integrate trees, animal grazing and usually cropped fields depending on farm structure. Motor-vehicle transhumance with service herds that graze abandoned pastures in Alpine areas to maintain their beauty is a possibility to link traditional and modern practices. These integrations have resulted in conventional complex pastoral systems (Table 12.1) as well as integrated pastoral systems that comprise farm tourism, game hunting, and educational activities. Although both the traditional and conventional complex systems use the same resources as the integrated systems, the latter offers opportunity to diversify income and to make the survival of marginal farms possible. Hence, integrated systems need different overall management than conventional complex systems as their outputs are different.

The need for management changes is understood, and will benefit the increase of biodiversity and modern management by helping to develop links with the modern economy through in-farm sale of quality foods, farm-tourism and educational activities. In turn these changes will help develop new approaches to land care and to improve environmental protection.

In this classification, the agro-silvo-pastoral systems are found within traditional complex systems and in integrated systems. Complex and integrated systems have

**Table 12.1** Classification of pastoral systems on the basis of the level of complexity, according to number and type of resources in the system (Pardini 2005)

System	Complexity	Number	Number and type of resources	Examples of resources
Traditional	Simple	1	Pastures	Native and sown pastures, pasture mixtures with diversified heading dates
	Medium	2	Pastures, forage crops	+ Forage crops for hay or silage
	Complex	>3	Pastures, forage crops, resources else than forage	+ Forest, shrub plantations, sown firebreaks and ski lanes
Integrated	Very complex	+	Integration with different economic resources	+ Links to game hunting, farm-tourism, environmental education

**Table 12.2** Possible factors for improvement of the four types of pastoral systems

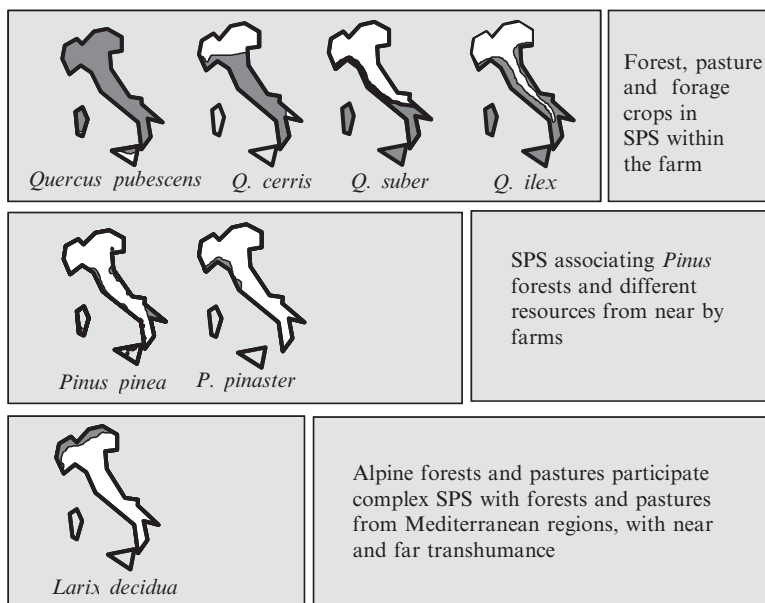
System type	Possibile interventions
Traditional	Simple    Traditional improvements to pasture management
	Medium    Traditional improvement to pasture and forage crops
	Complex    (Comprise agro-silvo-pastoral systems). Integration of pasture plants and trees, including resources placed in distant part of the territory by transhumance on motor-vehicles
	Integrated    (Comprise agro-silvo-pastoral systems) Development of links with other economic sectors

higher ecological stability and more sustainable productivity than simple systems; in fact their higher biodiversity buffers them against occasional fluctuations in climate and the economy (Pardini 2005). Considerable management input is necessary in both complex and integrated systems. Management does not mean reduced ecological stability. This depends on the ecological basis underpinning the management. A strong but sustainable management is preferable to a low input bad management. Integrated systems can be more stable than complex systems because all conventional systems are geared to the maximum productivity of the resource that consequently is managed at the limit of its sustainability. In contrast, integrated systems are aimed at sustainable productivity and diversified incomes through services that are favoured by the maintenance of natural conditions that reduce the exploitation of the vegetation. Different strategies for improvement apply to systems with different level of complexity (Table 12.2).

## Geographical Distribution of Agroforestry Systems in Italy

Oak, pine and larch stands are the most important existing complex and integrated systems which could support further development in Italy (Fig. 12.3):

1. *Quercus pubescens* Wild., *Q. cerris* L., *Q. suber* L. and *Q. ilex* L. are found in mixed forests in central and southern Italy and on the main islands. These forests cover about 279,263 ha (Bernetti 1995) and they frequently exist as components of silvopastoral systems that integrate several resources within the farm. Some of these forests are thinned out to allow cattle or sheep grazing, others are being converted to parkland forests. The understorey comprises many palatable species of small size like *Acer campestre* L., *Acer monspessulanum* L., *Alnus cordata* C. (Loisel.) Dub., *Crataegus monogyna* Jacq., *Quercus cerris* L. and some unpalatable shrubs (like *Cistus salvifolius* L., *Erica arborea* L., *E. scoparia* L., *Juniperus communis* L. and *Spartium junceum* L.) but, usually, not much herbage species as little light reaches the lowest layer. These forests are grazed in summer, when livestock seeks green leaves and shade, and in winter when the tree stands protects the animals from cold winds.



**Fig. 12.3** Area of the main forest species associated with different kinds of silvopastoral systems (SPS) in Italy

2. *Pinus pinea* L. and *P. pinaster* Ait. park forests. Pine species cover about 362,126 ha and are mainly distributed in Central Italy. The understorey normally consists of unpalatable shrubs (mostly the same species found in oak forests) and very little herbage. Hence they are visited only occasionally by livestock. These forests, owned either by private farms or public administrations, are part of silvopastoral systems as an external farm component. They support horse riding and trekking from nearby farms and, so generate important complementary incomes for local farms. Also public administrations benefit from tourism in their municipalities.
3. *Larix decidua* forests cover 102,319 ha mainly in northern Italy. Some of these forests have pastures under low tree density stands. Pastures are normally native, comprise 30–60 herbage species and so are very important for biological diversity conservation. These pastures are grazed in summer by cattle or sheep moving from the valleys or sometimes as part of mechanized transhumance from Mediterranean regions.

Despite the variability due to the physical environment, forage production of forest understorey remains low in all the forest types considered in this article (Table 12.3). The annual dry matter production of forage from the understorey is frequently between 0.1 and 4 t ha<sup>-1</sup> and consequently is too low to feed high stocking rates of

**Table 12.3** Productivity of the understorey (herbage and palatable shrub leaves) and periods of presence of animals (Pardini, unpublished data)

Species	Forage yield (DM t ha <sup>-1</sup> )	Type and periods of grazing
<i>Quercus pubescens</i> , <i>Q. cerris</i> , <i>Q. ilex</i> , <i>Q. suber</i>	3–6	Seasonal (summer, winter) and occasional
<i>Pinus pinea</i> , <i>P. pinaster</i>	0.1–1	Occasional
<i>Larix deciduas</i>	1–4	Seasonal (summer)

livestock all the year round (Pardini et al. 1987) The forest ameliorates forage availability in the hot and the cold season, provides shade in summer and shelter from wind in winter.

Pasture production in oak forests is low (1–2 t DM ha<sup>-1</sup>) but shrubs can contribute with 2–4 t DM of leaves per hectare which are palatable, especially for native cattle breeds (examples are *Chianina* and *Maremmiana*) while sheep eat only young and low-growing shrubs. The livestock spend most of the year on farm pastures and move into the forests in summer and winter. During these seasons they are also fed with hay and silage that is normally produced from forage crops on the same farm.

Pine forests are rarely grazed, however they are important for land conservation (reduction of soil erosion) and because they support rural tourism. They can generate important income for private farms and local administrations that have developed organized horse back riding and trekking. Livestock presence is only occasional, limited to tourists' horses, or to temporary visitors from herds of nearby farms. Tourists pay for the trekking service and they can stop and rest in the farm where they buy local products. A better integration of these forests in animal rearing systems, with periodical grazing, could limit the growth of the understorey and consequently reduce fire risk. On the other hand grazing could reduce the costs of periodical mechanical cutting that is done in some cases.

Larch forests frequently have sparse trees and productive pasture that is grazed in summer. Livestock move from the valleys (a short transhumance) to graze and sometimes there is also grazing by service herds from the Mediterranean regions (involving long transhumance in trucks). Service herds are needed by some Alpine municipalities to maintain abandoned pastures with minimal grazing (Staglianò et al. 2000).

In most of the described forest cases, timber, firewood and herbage alone cannot generate sufficient income to keep people on their land. Consequently, many managers have favoured the reduction of forest density (selective cutting or regular clearing) or the planting of trees into pastures (20–30% of soil cover) to develop new income sources from farm-tourism, educational services for school classes and game hunting. It is understood that new management plans for pastures and forests will be integrated and traditional practices will be linked to modern ones.

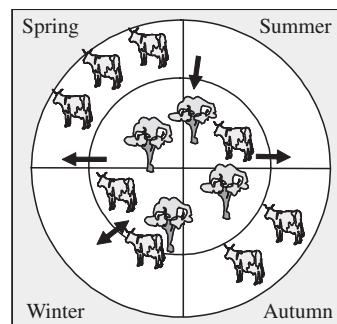
## From Traditional to Integrated Management

### *Oak Forests*

In the Mediterranean region of Italy oak forests are mainly *Quercus cerris*, *Q. ilex*, *Q. pubescens*, *Q. suber*. and they grow in mixed forest with other *Quercus* species and trees of many other genera. Except for the cork oak, the other oak forests derive from old coppices used for firewood up until the 1950s. Tall *Q. pubescens* trees were left to grow in coppices to provide acorns for grazing pigs. Nowadays these forests are home to species such as boar (*Sus scrofa* L.), red deer (*Cervus elaphus* L.), mouflon (*Ovis musimon* Schr.) and many other animals. Some forests are now being left to grow and convert to high stands and some will be thinned out to make parkland forests in which farm tourism with trekking and horseback riding can be promoted.

Many oak forests in private or public lands are grazed by livestock and wild game is common (Gambi 1982; Bagnaresi et al. 1984). Livestock is frequently cattle or sheep whilst mixed herds are rare. Forest grazing takes place in summer when animals seek shadow and green leaves and in winter when the trees provide shelter from cold winds (Talamucci et al. 1995, 1996b). During the highly productive seasons (spring and autumn) livestock graze on farm pastures or they stay part of the day in stables (Fig. 12.4). Livestock used are frequently native rustic breeds (Chianina is the most common, Maremmana is probably the most resistant, other native breeds can also be found) because these are better adapted to the harsh conditions of the physical environment in comparison to the breeds from northern Europe. However, other beef breeds can also be found. Sheep do not usually graze into the tree stand unless the forest has been thinned out and also the understorey density reduced in a high degree.

Traditional complex systems on the same farm are frequent and they are composed of pastures, forage crops, forest and sown firebreaks (Table 12.4). Modern integrated systems are already frequent as many farms have started nature-tourism activities which include horseback riding, four wheel driving, trekking and game hunting. In addition, some farms receive payment from regional institutions for



**Fig. 12.4** Livestock movements during the four seasons are shown clockwise. Livestock moves within the farm from pastures (outer circle) into forests (inner circle) during summer and winter and back to pastures in the milder seasons



**Table 12.4** Traditional and modern management objectives of Mediterranean oak forests

Forest	Traditional objectives	Modern objectives
<i>Quercus</i> spp.	Firewood + timber + extensive animal rearing during summer and winter	Links with on-farm sale of produce, quality products, links with other economic activities, (game hunting, horseback riding, trekking, farm tourism, educational activities
<i>Q. suber</i>	Cork, occasional grazing	Cork, occasional tourism

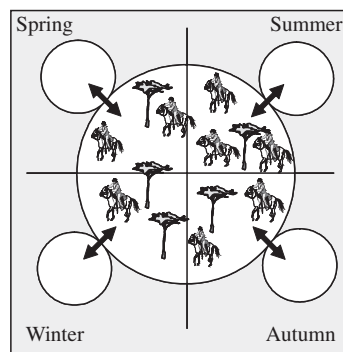
educational activities in which school classes participate in some of the farm work. These links can be further developed but there is a need for land management changes, mainly better nature conservation dealing with increasing biodiversity, increasing of land use diversity, increasing land care, paying special attention to tourism facilities and to the natural beauty of the territory (Pardini et al. 2002). Fortunately, the shift to integrated systems usually reduces the impact on the natural environment by creating better conditions for conservation of plant and animal diversity and for tree regeneration. Moreover, the reduced impact of these practices on forests should allow tall stands to grow, replacing younger and smaller trees derived from abandoned coppices, thus producing better timber products.

### *Pine Forests in the Mediterranean Italy*

Italian pine forests comprise *P. pinaster* and *Pinus pinea* stands along the coast and in hilly areas inland.

*P. pinaster* is native to the Western Mediterranean area and is nowadays naturalized in many parts of Italy, where it frequently forms the forests nearest to the sea due to its salt tolerance. However excessive salinity and air and aerosol pollution have caused consistent damage to this kind of forest which is also prone to wildfires (Mondino and Bernetti 1998). Moreover, *P. pinaster* is attacked by the parasite *Matsucoccus feytaudi* Duc. that has spread to Italy since the 1950s and is devastating this species to such an extent that *P. pinaster* could become just an occasional tree in mixed stand oak forests. *P. pinea* (stone pine) parkland forests are found more on the coast than *P. pinaster* and they are traditionally used for recreation tourism and pine nut harvesting (1 kg of pine nut costs about €50 in any local market). Stone Pine has been planted inland in pure stands or mixed with other coniferous species (*P. pinea*, *Cupressus sempervirens* L.) and several broad-leaves (*Quercus* spp.). The wood from these pines is used for woodchips, some timber is used to build facilities for the visitors to the forest itself (picnic tables, benches, paths, fences and information boards). The forest understorey is made up of shrubs (mainly species of *Erica arborea* L., *E. scoparia* L., *Juniperus communis* L., *Cistus* spp. *Spartium junceum* L., *Cytisus scoparius* L. W.D.J. Koch) rather than pasture or herbs, consequently no livestock is brought in except than for horse rid-

**Fig. 12.5** Livestock movements during the four seasons are shown clockwise. Occasional incursions of horses and herds of cattle or sheep coming from nearby farms (small external circles) cause moderate grazing into pine forests (large circle). This can happen in any season



**Table 12.5** Traditional and modern management objectives of Mediterranean pine forests

Forest	Traditional objectives	Modern objectives
<i>Pinus pinaster</i>	Woodchip	Environmental protection (mainly coasts). Links with farm tourism
<i>Pinus pinea</i>	Woodchip + pine nuts	Pine nut. Environmental protection. Links with farm tourism

ing. Wild game enters occasionally from nearby forests. However, these forests are part of a diversified economy of neighbouring farms that integrate agriculture, forestry and pastoralism with nature tourism (Fig. 12.5). Fire risks are usually higher in these pine stands than in oak or larch forests, mainly because pines contain lots of inflammable resins and grow in climates with dry hot summers more than larch or some oaks.

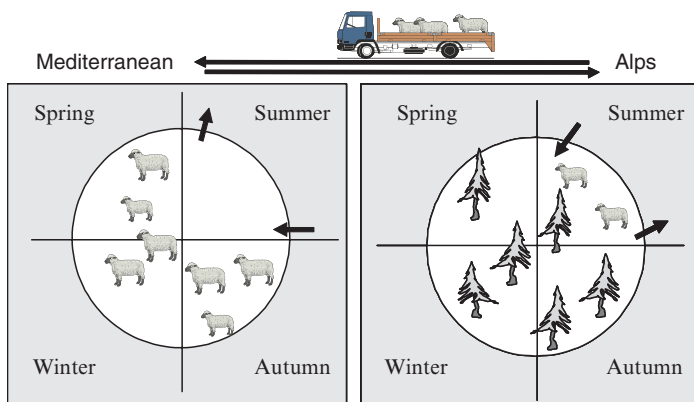
Traditional complex silvopastoral systems are not possible as these forests do not support animal grazing. However; there are opportunities for further development of modern integrated systems as these forests are beautiful and of value in supporting tourism on nearby farms (Table 12.5). Silvicultural practices (Bianchi et al. 2005) aim to eliminate the oldest trees (the average age of *P. pinea* in Tuscany is 85 years with some trees 140 years old) and favour progressive renovation of opened stands in which pine nuts can be harvested and farm tourism will contribute to diversification of the rural economy. The occasional presence of livestock from nearby farms can help to limit the growth of shrubs that could encroach and become obstacles to nut harvesting and to reduce risks of wildfires (Pardini et al. 1999).

### *Larix Decidua* Mill. Forest

Larch is found in the Alps, frequently associated with *Pinus cembra* L. at high altitudes or in pure stands grazed by dairy cattle or sheep at lower altitudes. Low forests can produce good timber, however there is also grazing where the understory

is rich enough to sustain herds (Giordano 1955) that move from the pasture valley during summer. Although *Larix decidua* is an Alpine species, some forests of this type are linked to the Mediterranean as part of the summer transhumance system (Fig. 12.6). Sheep herds are carried on trucks to graze on green pastures during summer and, in some cases, the Alpine Municipalities organize and pay to get the pastures grazed by Mediterranean sheep to limit shrub encroachment. The animals used for this practice are called “service herds” (Talamucci et al. 1996a) and their effect is to maintain short pasture, preventing the spread of fires. Most importantly, they prevent tall common species *Deschampsia caespitosa* (L.) Beauv. and *Trisetum flavescens* (L.) Beauv. competing excessively with smaller species such as *Trifolium repens* L., *T. badium* Schreber, *Lotus corniculatus* L. and other small species that are known as officinals (*Alchemilla vulgaris* L., *Gentiana* spp., *Campanula* spp.) many of which need high intensity of light.

In the traditional system sheep graze pastures at lower stocking rate than optimal and they frequently also enter *Larix* forests (Table 12.6). This kind of system comprises elements of the traditional complex system (integration of Alpine forest and Mediterranean pastures) and others of the modern integrated system (integration with on-farm sale of milk and cheese for tourists).



**Fig. 12.6** Livestock movements during the four seasons are shown clockwise. Summer transhumance from Mediterranean regions (left circle) bringing livestock to graze in forests of the Alpine chain (right circle), and back to the Mediterranean at the end of Summer. Black arrows show livestock arrival or departure from the system

**Table 12.6** Traditional and modern management objectives for mountain pine forests

Forest	Traditional objectives	Modern objectives
<i>Larix decidua</i> (Alps)	Timber + extensive animal rearing during summer	Links with on-farm sale of produce, quality products, links with other economic activities

The presence of small herds makes it impossible to attempt to increase pasture productivity for example by fertilising due to the low profitability of this management practice. This management – the lack of fertilization – does however help maintain higher levels of plant diversity.

One of the main problems of herd and pasture management in the Alps is the difficulty in finding shepherds. Even if they are offered lucrative payments, only emigrants from eastern Europe or north Africa are available for this specialized work that obliges people to remain a whole season in marginal areas far away from their own towns.

## Conclusions

The present condition of Italian forests is complex. Despite the many agronomic and pastoral tools available to increase productivity and quality of pastures, traditional animal rearing in Italy cannot generate enough income for rural people living in marginal areas. Land abandonment will occur unless new income sources are found by linking traditional activities with emerging sectors of the economy. It is important to highlight that rural economies are linked to regional and national development programmes. These links will cause management changes which will probably highlight the production of non-market goods and traditional production for timber, firewood, other forest products, forage and animal products as being secondary in many areas of the country. These changes are favoured by diversification of land uses and the integration of pastures, forage crops, forage trees and shrubs and forests to form complex agro-silvo pastoral systems. The organization of integrated pastoral systems can be a further step in the economic diversification of rural activities. Such integrated systems can embrace on-farm sale of quality foods, farm tourism, game hunting and the organisation of educational activities that will be carried out on farms by local schools. Many examples of these integrated management systems already exist in Italy and they can be developed further.

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