Sustainability **2013**, *5*, 654-663; doi:10.3390/su5020654

OPEN ACCESS
sustainability
ISSN 2071-1050
www.mdpi.com/journal/sustainability

Article

The Effects of Isolation and Natural Park Coverage for Landrace *In situ* Conservation: An Approach from the Montseny Mountains (NE Spain)

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Received: 3 January 2013; in revised form: 5 February 2013 / Accepted: 6 February 2013 / Published: 11 February 2013

Abstract: Human isolation in mountain areas has an extra cost for the people living there, because they occasionally have to face harsh environmental conditions. Such adaptation to the environment can be faced in several ways, and *in situ* landrace conservation is a proposed strategy that concerns food acquisition and maintenance. However, human isolation could also be affected as a result of residing inside a protected area. In this paper, we assess the correlation between the *in situ* landraces conserved by farmers and the location of the farms inside or outside of a protected area (Montseny Mountains Biosphere Reserve and Natural Park). The variables of isolation, calculated as the time needed to reach the nearest market and the effect of altitude, were also considered. We interviewed 28 farmers, 12 inside and 16 outside of the protected area, and identified a total of 69 landraces. Those farms located inside the boundaries of the Natural Park retained more landraces than those located outside. There was also a positive and significant correlation between the landraces cultivated and the degree of isolation. The effect of altitude did not appear to be a relevant variable. Finally, a total of 38 landraces were located only on farms inside the Natural Park, 13 were found outside and 18 were cropped in both territories.

Keywords: on-farm conservation; traditional varieties; Mediterranean mountains; protected areas

1. Introduction

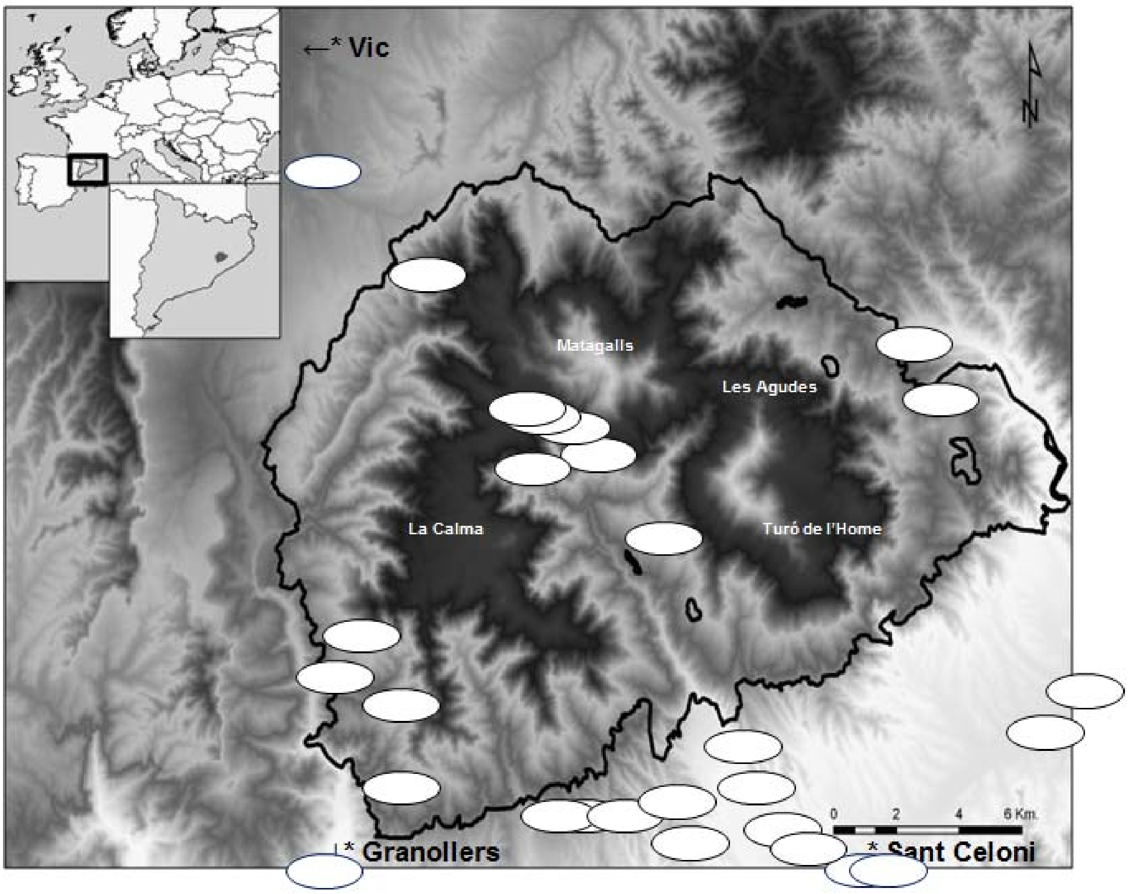
On geological and historical time-scales, the isolation of mountainous regions has functioned as a biological and cultural laboratory. Despite the harsh environmental conditions, human presence in mountain areas has a long history, indeed, millennia for some parts of the world, such as the Mediterranean Basin [1]. Living in mountains has an added cost for the community, due to the complication of acquiring resources when compared with other environments located on lowlands. Therefore, people living in mountains have to adapt to the environment in several ways. Due to the constraints on agriculture or the length of the growing season, one of the strategies for food acquisition and maintenance is *in situ* landrace conservation. This conservation model is considered interesting under a biodiversity point of view, due to the maintenance of the genetic diversity at the intra- and inter-specific level under a determined set of environmental conditions and the selective constraints of the farmers. In many cases, such landraces are better adapted to tolerate environmental changes [2,3]. The importance of the need for the *in situ* conservation of crop genetic resources is based on three major arguments [4]. First, maintaining genetic biodiversity to continue the process of crop evolution through the selection of farmer due to *in situ* selection enhances the crop's ability to adapt to changing conditions or requirements [2]. Second, adapted crops have a low dependency on input from outside farms, such that *in situ* conservation is related to yield security and sustainable production [2,5]. Third, *in situ* conservation ensures the maintenance of cultural information (knowledge and traditions) that might enhance crop productivity [6,7]. In general, the research on landrace *in situ* conservation has been based on the maintenance of crop genetic diversity in agricultural ecosystems [8] and home gardens [9] or on the value of agricultural diversity as a source of nutrition and health [10]. In contrast, little attention has been focused on the social aspects associated with the *in situ* conservation of crop genetic resources [4] or on the effects of isolation. Some mountain areas of the Mediterranean region, as in most mountain ranges around the world, represent some of the last refuges from the advance and spread of newer ways of life from the more populated and urbanized lowlands [1]. In some cases, the evolution of urbanization has been halted due the preservation of protected areas, as in the case of the Montseny mountains, which were declared a Natural Park in 1977 and a UNESCO Biosphere Reserve in 1978. Thus, the Montseny massif is a good setting to test the effects of human isolation and *in situ* crop conservation, because there are no villages or small population settlements inside of the Natural Park limits and the people living inside of the Park boundaries live on farms, some of which are isolated from the main villages/cities outside the boundaries of the protected area, including Sant Celoni, Arbúcies, Granollers and Vic.

Home gardens and small estates are the specific target of our study, due to the ability of maintaining plant genetic resources [11]. Moreover, recent studies have identified and characterized 19 ecosystem functions and related services (five regulating services, two habitat/support services, five production services and seven cultural services) of a home garden as a type of agroecosystem [12]. Accordingly, we attempted to correlate the presence of species *in situ* conserved by peasants living on farms and having home gardens and small developments, with the isolation of the farms calculated by the access time to the main markets and the effect of the altitude. In addition, we evaluated the correlation between the location of a farm inside or outside the boundaries of a protected area.

2. Study Area

The Montseny mountains are located 50 km north-northwest of Barcelona (Catalonia, NE Spain) in a Mediterranean region (longitude 2°16'–2° 33'E, latitude 41°42'–41°52'N) at a minimum distance of only 15 km from the sea and experiences a very definite Mediterranean influence. This area is the highest part of the Catalan coastal range, and the highest peaks are Turó de l'Home (1706 m), les Agudes (1705 m) and Matagalls (1697 m) (Figure 1). Because of the structure and hardness of the rocks, the topography is rather varied, with long rocky slopes. The high relief and deeply incised rivers have produced waterfalls and gorges. Because of differences in altitude and climate, the area contains communities, ranging from typically Mediterranean to subalpine. In the lower portion, holm oak (*Quercus ilex*) is abundant, together with other Mediterranean elements, such as cork oak and pines. In the upper part of the Mediterranean zone, holm oak gives way to the association of *Quercetum mediterraneo-montanum* on siliceous soils. Beech *Fagus sylvatica* forest occurs in the wet temperate zone of the mountains, typically above 1000 m a.s.l., where the climate is wet temperate. Due to its particular morphology and the presence of some slopes, highlighted by periglacial erosion, certain areas of the Montseny mountains act as an axilar refuge, maintaining vestigial species [13], such as the Montseny brook newt (*Calotriton arnoldi*), a case of the isolation of biota during the last glaciation. *C. arnoldi* was described by Carranza and Amat [14] and is restricted to a geographical area of <40 km^2 within the Montseny mountain massif [15].

Figure 1. Location of the Montseny Mountains, with the limit of the Natural Park and the farms where interviews were conducted (white dots).



The Montseny Mountains were declared a Natural Park in 1977 and a UNESCO Biosphere Reserve in 1978. The area of the protection strategies differs slightly: the Natural Park comprises 31,063 ha, whereas the Biosphere Reserve includes 30,120 ha. Within the protected area, there are 460 farms, with an estimated population of 1168 inhabitants. In terms of land ownership, 85.7% of the park comprises privately owned farms, and 14.3% are public areas [16]. The majority of the Park population lives on farms, most of them with medieval origin, where they cultivate small home gardens and small estates in an agrosilvopastoral system; these people occasionally receive grants from the managers of the Park to maintain the infrastructure of their farms.

3. Materials and Methods

Data were collected in an extensive area (approximately 900 km^2, corresponding to Vallès Oriental, Osona and La Selva counties [Catalonia, NE Spain]); the Montseny massif, the Natural Park and Biosphere Reserve (Figure 1), is located in this region. We selected several farms and agrarian developments located inside and outside of the Montseny massif to assess the differences in the number of landraces cultivated and the effect of the isolation of the inhabitants and their access to markets. The criterion used to select the farms consisted of whether the developments located outside of the boundaries of the protected area were similar to the common model created inside, *i.e.*, small developments or home gardens. We also selected farms that were close to the protected area, due to the environmental conditions. The data collection from the farmers was based on semi-structured and structured interviews.

3.1. Sampling

The survey was conducted on farms located inside and outside of the Natural Park, where we previously knew that farmers conserve landraces. A total of 28 farmers were interviewed: 12 (43%) inside the boundaries of Montseny Natural Park and 16 (57%) outside. Those living outside of the Natural Park were located between 0.27 km and 8.44 km from the boundaries, with a mean distance of 3.25 ± 2.89 km (n = 16).

3.2. Location of the Farms

For each farm on which interviews were conducted, we collected data about the elevation and time required to reach the nearest market (Vic, Granollers or Sant Celoni), *i.e.*, the time required to reach the economic and administrative hub "center"—market—in their area using a motor vehicle. On these markets, farmers sell a small part of their production, but get first necessity consumer goods. The time was calculated on the basis of the distance between the farm and the market using a geographic information system and the footpaths and roads in the area. Depending on the type of road and proposed average speed, the total distance of each (footpaths and roads) was travelled to obtain the total time in minutes. This measurement allowed us to ascertain the isolation of the farm, because several farms are located on the mountains, and the final access is sometimes by non-paved road.

3.3. Semi-Structured Interviews

We conducted semi-structured interviews concerning the socio-demography and management of the farm and developments. We then identified the landraces using a list provided by the local residents and through the advice of experts. We inquired about which landraces were currently conserved and about the market visited for reference purposes for calculating the travel time.

3.4. Data Analysis

Two-sample *t*-tests were performed to examine the differences between the number of conserved landraces by farmers located inside and those located outside of the Natural Park. Linear regressions were performed to correlate the number of landraces conserved, the distance to the nearest market and the influence of altitude.

4. Results

The farms located inside the boundaries of the Natural Park cultivated a mean of 10.83 landraces, whereas those located outside the boundaries cultivated a mean of 3.93 landraces ($t = 3.8967$, $df = 19.759$, $p < 0.001$). We also found a positive and significant correlation between the number of landraces cultivated and the degree of isolation, as calculated by the means of the distance to the nearest market for those farmers living inside of the Natural Park ($r_s = 0.29$, $p = 0.039$, $n = 12$); however, there was no correlation for those farmers living outside of the protected area ($r_s = 0.17$, $p = 0.059$, $n = 16$). The analysis of the effect of altitude for the pooled data, inside and outside of the protected area, showed a significant correlation between the number of landraces cultivated and altitude ($r_s = 0.34$, $p < 0.001$, $n = 28$); this correlation was not found when we only used the data of the farms located inside the protected area ($r_s = 0.015$, $p = 0.3042$, $n = 12$). In fact, there was a significant correlation between altitude and the time to the markets when the pooled data were used only for the farms inside of the protected area ($r_s = 0.51$, $p < 0.001$, $n = 18$; $r_s = 0.3369$, $p = 0.05$, $n = 12$, respectively). The number of landraces conserved *in situ* by the farmers ranged from zero to 19. A total of 69 landraces were identified; 38 were located only on those farms inside the Natural Park and 13 outside, and 18 were cropped in both territories (Table 1).

Several landraces of *Phaseolus* and *Lycopersicon* were found on the farms. *Phaseolus* is a member of the Fabacea family, which has been historically (after its European arrival) cultivated and diversified, because it is a species that only requires low agricultural inputs, particularly at times of scarcity of food resources. *Phaseolus* is easy to cultivate and produces high-quality proteins for animal and human consumption. Conversely, *Lycopersicon* requires careful attention and fertilization, but yields a higher production of high-quality fruit with a high organoleptic quality. This is a case of the cultural use of the variety.

Table 1. List of the 69 landraces found on the study area and the location with respect to the park (inside, outside and both).

Vernacular name (Catalan)	Scientific name	Family	Location
moniato blanc	*Ipomoea batatas*	Convolvulaceae	inside
col de paperina o de Pascua	*Brassica oleracea* L. vars.	Brassicaceae	inside
col de pell de galàpet	*Brassica oleracea* L. vars.	Brassicaceae	inside
col d'hivern	*Brassica oleracea* L. vars.	Brassicaceae	inside
col geganta	*Brassica oleracea* L. vars.	Brassicaceae	outside
escarola de cabell d'àngel	*Cichorium endivia* L.	Asteraceae	both
escarola perruqueta	*Cichorium endivia* L.	Asteraceae	inside
enciam de fulla de castanyer	*Latuca sativa* L.	Asteraceae	inside
enciam del sucre o del tou	*Latuca sativa* L.	Asteraceae	inside
enciam escaroler o català	*Latuca sativa* L.	Asteraceae	inside
enciam orella de ruc/d'ase	*Latuca sativa* L.	Asteraceae	inside
carxofa morada	*Cynara scolymus* L.	Asteraceae	inside
carbassa del bon gust	*Cucurbita maxima*	Cucurbitaceae	inside
carbassa rebequet o porquera	*Cucurbita maxima*	Cucurbitaceae	both
carbassa d'aigua	*Lagenaria sicerari*	Cucurbitaceae	outside
carbassa de cabell d'àngel	*Cucurbita ficifolia*	Cucurbitaceae	both
meló català o del sequer	*Cucumis melo* L.	Cucurbitaceae	outside
cogombre antic	*Cucumis sativus* L.	Cucurbitaceae	inside
blat de moro del queixal	*Zea mays* ssp. *Mays*	Poaceae	inside
blat de moro de la creu	*Zea mays* ssp. *Mays*	Poaceae	inside
ceba agra o de Molins de Rei	*Allium cepa* L.	Liliaceae	both
ceba babosa blanca d'hivern	*Allium cepa* L.	Liliaceae	inside
ceba d'Olot	*Allium cepa* L.	Liliaceae	inside
ceba viguetana	*Allium cepa* L.	Liliaceae	both
all vermell de Banyoles	*Allium sativum* L.	Liliaceae	both
all de Vilafranca	*Allium sativum* L.	Liliaceae	inside
all porrer	*Allium sativum* L.	Liliaceae	both
mongeta avellaneta rossa	*Phaseolus vulgaris* L.	Fabaceae	both
mongeta castanyera	*Phaseolus vulgaris* L.	Fabaceae	inside
mongeta de la floreta	*Phaseolus vulgaris* L.	Fabaceae	inside
mongeta de la neu	*Phaseolus vulgaris* L.	Fabaceae	inside
mongeta de mata del dia	*Phaseolus vulgaris* L.	Fabaceae	outside
mongeta del carai o del rector	*Phaseolus vulgaris* L.	Fabaceae	outside
mongeta del ganxet menut	*Phaseolus vulgaris* L.	Fabaceae	inside
mongeta del ganxet mig	*Phaseolus vulgaris* L.	Fabaceae	both
mongeta del ganxet terrer	*Phaseolus vulgaris* L.	Fabaceae	inside
mongeta del pic groc	*Phaseolus vulgaris* L.	Fabaceae	outside
mongeta garrofer	*Phaseolus vulgaris* L.	Fabaceae	inside
mongeta genoll de crist	*Phaseolus vulgaris* L.	Fabaceae	both
mongeta grogueta petita	*Phaseolus vulgaris* L.	Fabaceae	inside
mongeta llaminera aspre	*Phaseolus vulgaris* L.	Fabaceae	both
mongeta llaminera mata	*Phaseolus vulgaris* L.	Fabaceae	outside
mongeta menuda o maiona	*Phaseolus vulgaris* L.	Fabaceae	inside

Table 1. *Cont.*

Vernacular name (Catalan)	Scientific name	Family	Location
mongeta paretana	*Phaseolus vulgaris* L.	Fabaceae	inside
mongeta perona curta i llarga	*Phaseolus vulgaris* L.	Fabaceae	inside
mongeta rossa d'arbúcies	*Phaseolus vulgaris* L.	Fabaceae	inside
mongeta vallfornesa	*Phaseolus vulgaris* L.	Fabaceae	inside
mongeta del metro	*Phaseolus vulgaris* L.	Fabaceae	both
cigró mollar o del suc	*Cicer arietinum*	Fabaceae	outside
pèsol del ganxo	*Pisum sativum*	Fabaceae	outside
estirabecs	*Pisum sativum* ssp. *arvense* L.	Fabaceae	inside
cacauets	*Arachis hypogaea*	Fabaceae	outside
espinac gran d'hivern	*Spinacia oleracea*	Amaranthaceae	outside
bleda blanca país	*Beta vulgaris* var. *cicla*	Chenopodiaceae	inside
pebrot bitxo	*Capsicum annuum* L.	Solanaceae	inside
tomàquet 3 caires tardà de Riells	*Lycopersicon esculentum* Mill.	Solanaceae	both
tomàquet cor de bou	*Lycopersicon esculentum* Mill.	Solanaceae	both
tomàquet corn de bou o pebroter	*Lycopersicon esculentum* Mill.	Solanaceae	outside
tomàquet de penjar groc	*Lycopersicon esculentum* Mill.	Solanaceae	inside
tomàquet de penjar pometa	*Lycopersicon esculentum* Mill.	Solanaceae	inside
tomàquet de penjar tipus bombeta	*Lycopersicon esculentum* Mill.	Solanaceae	inside
tomàquet de penjar tipus tomacó	*Lycopersicon esculentum* Mill.	Solanaceae	inside
tomàquet penjar bombeta	*Lycopersicon esculentum* Mill.	Solanaceae	both
tomàquet penjar caçanelles	*Lycopersicon esculentum* Mill.	Solanaceae	outside
tomàquet penjar cirerol	*Lycopersicon esculentum* Mill.	Solanaceae	inside
tomàquet poma plé o palosanto	*Lycopersicon esculentum* Mill.	Solanaceae	both
tomàquet pometa	*Lycopersicon esculentum* Mill.	Solanaceae	both
tomàquet rosa de Montserrat	*Lycopersicon esculentum* Mill.	Solanaceae	both
tomàquet rosa ple gros	*Lycopersicon esculentum* Mill.	Solanaceae	inside
Safrà	*Crocus sativus*	Iridaceae	inside

5. Discussion and Conclusions

Protected areas are indisputably one of the main research ways for *in situ* biodiversity conservation around the world [17]. With approximately 12% of the world's land surface and 1% of the marine environment [18], protected areas are usually focused on species and habitat management, rather than considerations on the functioning of ecological systems [19]. In fact, in most protected areas, biodiversity is almost exclusively focused on species richness and the amount of the species living inside the boundaries, yet it should be taken into account that biodiversity includes various aspects of the diversity of life [20], such as *in situ* crop protection. Among others objectives, protected areas are sheltered from urban sprawl and urbanization. Currently, the Montseny Natural Park presents a mosaic of small patches of forests, farms and pastures, as a result of the intensive forest exploitation to obtain charcoal and to clear space for cultivation [21]. However, the changes in land cover of the last 50 years, as a result of the abandonment of traditional agriculture and forest activity, have resulted in a vigorous expansion of the forest cover and, as a consequence, the water-courses have become more dry, due to the increase of plant transpiration and the rise of temperatures [22]. In the last 50 years, approximately 700 farms have been abandoned, both inside and outside of the protected area, but specially those relating to exploitation involve forest products, e.g., Boada [23]. Despite these conditions, people continue to live on small developments and farms, a way of life that is based on agrosilvopastoral systems, a collective name for land-use systems that implies the combination or deliberate association of a woody component (trees or shrubs) with cattle in the same site [24]. As shown by our results, the people living inside of the protected area of the Montseny Mountains cultivated more *in situ* landraces than those living outside of the protected area. This aspect was correlated with the time required to reach markets and the degree of isolation, but not with altitude. Due to the unique nature of the Montseny Mountains, with the presence of some slopes highlighted by periglacial erosion, the settlement of farms is associated with the environmental conditions. Indeed, these periglacial areas were key for the establishment of farms due to the fragmented and earthy materials that allowed soil development and the onset of agrarian activities. Anyway, the farms located in elevated zones are more influenced by the weather, the number of cultivated species is smaller than those located on lowlands and farmers are prone to keep more landraces in order to ensure their subsistence. In fact, four of the 12 farms found inside the Park, are located over 800 meters, the maximum being 1000. There, the environmental conditions are quite different from those farms located in areas near the boundaries of the Park. Although there is no consensus on the effect or impact of protected areas on the people who live in these areas [25], it is clear that, in the Montseny Mountains, protection has led to people living inside the Park boundaries and away from peri-urban development. Therefore, the farmers inside the Park cultivate more landraces than those living outside the Park, due to the isolation provided by the fact that the protected area avoids new urban development and the associated infrastructures and that these farmers need more time to reach markets. So, they become more self-sufficient. It is clear that there are two scenarios inside the Montseny Natural Park: those farms located near the border and those within the inner core (Figure 1). The latter are more prone to isolation than the former, which are closer to the markets. Regardless, the coverage provided by the protection is the same, being less exposed to changes in land use and cover and, thus, protected from urban planning and development.

Acknowledgments

David Robson advised us on statistical analysis, and Rossend Pujolar reviewed the English.

Conflict of Interest

The authors declare no conflict of interest.

References

1. Vogiatzakis, I. *Mediterranean Mountain Environments*; John Wiley & Sons. Ltd., The Atrium, Southern Gate: Chichester, UK, 2012.
2. Altieri, M.A.; L. Merrick. *In situ* conservation of crop genetic resources through maintenance of traditional farming systems. *Econ. Bot.* **1987**, *41*, 86–98.

3. Altieri, M.A.; Anderson, M.K.; Merrick, L.C. Peasant agriculture and the conservation of Crop and wild plant resources. *Conserv. Boil.* **1987**, *1*, 49–58.
4. Calvet-Mir, L.; Calvet-Mir, M.; Vaqué-Nuñez, L.; Reyes-García, V. Landraces *in situ* conservation: A case study in high-mountain home gardens in Vall Fosca, Catalan Pyrenees, Iberian Peninsula. *Econ. Bot.* **2011**, *65*, 146–157.
5. Prescott-Allen, R.; Prescott-Allen, C. The case for *in situ* conservation of crop genetic resources. *Nature Resour*. **1982**, *231*, 5–20.
6. Cox, P.A. Will tribal knowledge survive the millennium? *Science* **2000**, *287*, 44–45.
7. Maffi, L. Endangered languages, endangered knowledge. *Int. Soc. Sci. J.* **2002**, *54*, 385–393.
8. Jarvis, D.I.; Hodgkin, T. The maintenance of crop genetic diversity on farm: Supporting the Convention on biological diversity's programme of work on agricultural biodiversity. *Biodivers.* **2008**, *9*, 23–28.
9. Eyzaguirre, P.B.; Linares, O.F. *Home Gardens and Agrobiodiversity*; Smithsonian Books: Washington, DC, USA, 2004; pp. 1–28.
10. Frison, E.; Smith, I.F.; Johns, T.; Cherfas, J.; Eyzaguirre, P.B. Agricultural biodiversity, nutrition and health: Making a difference to hunger in the developing world. *Food. Nutr. Bull.* **2006**, *27*, 167–179.
11. Agelet, A.; Bonet, M.À.; Vallès, J. Homegardens and their role as a main source of medicinal plants in mountain regions of Catalonia (Iberian Peninsula). *Econ. Bot*. **2000**, *54*, 295–309.
12. Calvet-Mir, L.; Gómez-Baggethun, E.; Reyes-García, V. Beyond food production: Ecosystem services provided by home gardens. A case study in Vall Fosca, Catalan Pyrenees, Northeastern Spain. *Ecol. Econ.* **2012**, *74*, 153–160.
13. Boada, M. La descoberta del periglacialisme al Montseny. Una aportació viva de Salvador Llobet al coneixement de la geografia ambiental del massís. *Doc. Anàl. Geogr*. **1997**, *30*, 139–148.
14. Carranza, S.; Amat, F. Taxonomy, biogeography and evolution of *Euproctus* (Amphibia: Salamandridae), with the resurrection of the genus *Calotriton* and the description of a new endemic species from the Iberian Peninsula. *Zool. J. Linn. Soc. Lond.* **2005**, *145*, 555–582.
15. Martínez-Silvestre, A.; Amat, F.; Bargalló, F.; Carranza, S. Incidence of pigmented skin tumors in a population of wild Montseny brook newt (Calotriton arnoldi). *J. Wildlife. Dis.* **2011**, *47*, 410–414.
16. Diputación de Barcelona. *Parque Natural del Montseny. Reserva de la Biosfera. Memoria 2010*; Diputación de Barcelona: Barcelona, Spain, 2011.
17. Ravenel, R.M.; Redford, K.H. Understanding IUCN protected area categories. *Nat. Area. J.* **2005**, *25*, 381–389.
18. Bishop, K.; Dudley, N.; Phillips, A.; Stolton, S. Speaking a Common Language: The Uses and Performance of the IUCN System of Management Categories for Protected Areas; IUCN, UNEP-WCMC: Cardiff, UK, 2004.
19. Mouillot, D.; Culioli, K.M.; Pelletier, D.; Tomasini, J.A. Do we protect biological originality in protected areas? A new index and an application to the Bonifacio Strait Natural Reserve. *Biol. Conserv*. **2008**, *141*, 1569–1580.
20. Purvis, A.; Hector, A. Getting the measure of biodiversity. *Nature* **2002**, *405*, 212–219.

21. Boada, M. *Montseny, Medi i Home*; Fundació Rectoria Vella, ICE: Barcelona, Spain, 2004.
22. Peñuelas, J.; Boada, M. A global change induced biome shift in the Montseny mountains (NE Spain). *Glob. Change Biol*. **2003**, *9*, 131–140.
23. Boada, M. *El Montseny, Cinquanta Anys d'Evolució dels Paisatges*; Publicacions de l'Abadia de Montserrat : Barcelona, Spain, 2002.
24. Russo-Andrade, R.O. Agrosilvopastoral systems: A practical approach toward sustainable agriculture. *J. Sustain. Agr*. **1996**, *7*, 5–17.
25. Wilkie, D.; Morelli, G.; Demmer, J.; Starkey, M.; Telfer, P.; Parks, M.; People: Assessing the human welfare effects of establishing protected areas for biodiversity conservation. *Conserv. Biol*. **2006**, *20*, 247–249.