1. **PUBLISHABLE SUMMARY**

Traditional agricultural activities have suffered a notorious recession in recent decades in many European mountain and other less favored areas. This recession has originated changes in the type and intensity of land utilization such as intensification of the management system, reduction of grazing and abandonment of remote rangeland areas. Consequently, a general process of vegetation encroachment, landscape closure and loss of biodiversity is happening. This project covers two contrasting case studies located in Mediterranean and Nordic regions.

The “Sierra y Cañones de Guara” Natural Park is a protected mountain area located in Northeast Spain that constitutes a representative example of this process. Today, about 50% of the park are private and communal shrub rangelands and the main agricultural activity is grazing livestock, with some agriculture (olive trees and cereals) in more favorable areas. The park constitutes a Special Protected Area (EU Birds Directive) that includes three Sites of Community Importance (EU Habitats Directive). Originally created to protect scavengers, which are highly dependent on carcasses of domestic animals for feeding, the park attracts many visitors due to its rich geological (canyons, caves, etc.), cultural (prehistoric and megalithic art, traditional buildings, villages) and natural (endangered species, diversity of landscapes, scavengers and other birds of prey, etc.) heritage.

The commune of Aurland in south-western Norway has a landscape dominated by mountains and fjords, including the Aurlandsfjord and the Nærøyfjord which are branches of the Sognefjord, the world longest and deepest fjord. The natural vegetation in the valleys ascends from southern boreal, with some oceanic climate influence, to middle boreal zones with coniferous and deciduous forests and the boreal zone located in the climatic treeline (around 900 m.a.s.l.). Grazing in the mountains lies between the northern boreal and the alpine zones. In 2012 there were 70 farms in Aurland, of which 14 had small-scale agricultural production (mostly berries) and 56 were livestock farms. The commune holds two of the major tourism attractions in Norway: the Nærøyfjord included in the UNESCO's World Heritage Site list; and the Flåmbana, a 20.2 km train line opened in 1940 with an elevation difference of 863 m that goes along the Flåmsdalen. Nearly 1 million people visit these two sites every year.

In highly multifunctional landscapes like these ones, the current debate is about shifting the emphasis of the agricultural policies toward the supply of public goods. Therefore, the efforts to quantify the biophysical effects of agricultural practices on the environment and to integrate relevant agri-environmental indicators into policy design are increasing. However, studies that simultaneously consider all ecosystem services delivered by agriculture and value them from different perspectives, are still missing.

In this project, we combined deliberative (focus groups and face-to-face questionnaires) and survey-based stated-preference methods (choice modelling) to, first, identify the perceptions of farmers and other citizens on the ecosystem services provided by mountain/ fjord agriculture and, second, to value these in economic terms according to the willingness to pay of the local (residents of the study area) and general (region where the study area is located) populations.

In a first stage, the deliberative research showed that some cultural services (particularly the aesthetic and recreational values of the landscape), supporting services (biodiversity maintenance), and regulating services (fire risk prevention in the Mediterranean region and conservation of soil fertility in the Nordic region), were clearly recognized by both farmers in the area of study and non-farming populations. The importance attached to the diverse ecosystem services (or functions) of agriculture varied according to particular interests and objectives. The availability of high quality food products linked to the territory was also highly valued in both case studies.

In a second stage, the local and general (mostly urban residents) populations were asked to choose their most preferred policy scenario among three alternatives. The status quo scenario corresponded to the current delivery of ecosystem services previously identified, whereas the liberalization (reduction of agri-environmental support) and targeted support (additional funding to agri-environmental schemes) scenarios represented different combinations of levels of ecosystem services delivery (Figure 1).

The analysis of responses allowed obtaining a ranking of ecosystem services, as well as the willingness to pay of the society for their delivery and the trade-offs among scenarios. In the Mediterranean case study, the prevention of forest fires (≈50% of total willingness to pay) was valued by the general population as a key ecosystem service delivered by mountain agroecosystems, followed by the production of specific quality products linked to the territory (≈20%), biodiversity (≈20%) and cultural landscapes (≈10%). The value given by local residents to the last two ecosystem services differed considerably (≈10 and 25% for biodiversity and cultural landscape, respectively) (Table 1). The authors were able to obtain the Total Economic Value of Mediterranean mountain agroecosystems that was ≈120€ per person per year, three times the current level of support of agro-environmental schemes.

In the Nordic case study, both local (rural) and general (urban) populations attached great importance to the production of quality food (≈33 and 28%, respectively) and little importance to the preservation of biodiversity (≈11 and 22%, respectively). Urban people showed very homogeneous preferences among ecosystem services, but rural people rated them very differently; rural people ranked a more agricultural landscape very high (≈36%) (Table 1). The Total Economic Value of fjord and mountain agroecosystems was 850 € per person per year.

We could conclude that there is a large underestimation of the socio-cultural and economic values of ecosystem services of Mediterranean and Nordic mountain agro-ecosystems, the welfare loss linked to environmental degradation in these areas and the cost of inaction. It is therefore necessary to value public goods in monetary terms to compensate farmers in an equitable way for their delivery. By individualizing support, monitoring and valuing objective indicators for ecosystem services and targeting particular agricultural practices, the so-called “green” subsidies may truly become Payments for Ecosystem Services.

- - -

Table 1. Perceptual importance and rank of ecosystem services for the general and local populations in Mediterranean and Nordic agroecosystems

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | Mediterranean | | | | Nordic | | | |
|  |  | General | | Local | | General | | Local | |
| ES | Value component of TEV | % | Rank | % | Rank | % | Rank | % | Rank |
| Landscape | Non-extractive direct use | 8.2 | 4 | 25.2 | 3 | 23.1 | 3 | 36.1 | 1 |
| Biodiversity | Non-use existence | 18.3 | 3 | 8.8 | 4 | 22.4 | 4 | 11.1 | 4 |
| Forest fires (Med)  Soil fertility (Nordic) | Indirect use | 53.2 | 1 | 40.3 | 1 | 26.9 | 2 | 19.3 | 3 |
| Product Quality | Extractive direct use | 20.2 | 2 | 25.7 | 2 | 27.6 | 1 | 33.5 | 2 |
| TEV (Euro) |  | 121.2 |  | 196.8 |  | 850.3 |  | NA |  |

Figure 1. Choice set in Mediterranean (a) and Nordic (b) case studies. For illustration, the attributes of policies A and B are represented with the levels corresponding to “liberalization” and “targeted support” policy scenarios. The actual choice sets presented to respondents use different combinations of attribute levels in policies A and B.

(a)



(b)

