

## **Ecosystem Services and Human Well-Being:**

### **A participatory study in a mountain community in Northern Portugal**

Elvira Pereira

Instituto Superior de Ciências Sociais e Políticas

Pólo Universitário do Alto da Ajuda, Rua G

1349-055 Lisboa, Portugal

Phone: +351 914723175, Email: [epereira@iscsp.utl.pt](mailto:epereira@iscsp.utl.pt)

Cibele Queirós

Centro de Biologia Ambiental, Faculdade de Ciências de Lisboa

Edifício C2, Campo Grande

1749-016 Lisboa, Portugal

Email: [ciqueiroz@clix.pt](mailto:ciqueiroz@clix.pt)

Henrique Pereira

Centro de Biologia Ambiental, Faculdade de Ciências de Lisboa

Edifício C2, Campo Grande

1749-016 Lisboa, Portugal

Email: [hpereira@fc.ul.pt](mailto:hpereira@fc.ul.pt)

Luis Vicente

Centro de Biologia Ambiental, Faculdade de Ciências de Lisboa

Edifício C2, Campo Grande

1749-016 Lisboa, Portugal

Email: [lmvicente@fc.ul.pt](mailto:lmvicente@fc.ul.pt)

## ABSTRACT

Ecosystem services are essential for human well-being but the linkages between ecosystem services and human well-being are complex, diverse, context dependent and complicated by the need to consider different spatial and temporal scales to assess them properly. We present the results of research being conducted at the rural community of Sistelo (Northern Portugal), a study case of the Portugal Millennium Ecosystem Assessment. The main purpose of our study was to assess the linkages between human well-being and ecosystem services at a local level, as perceived by the community. We used a range of tools from Participatory Rural Appraisal (PRA) and Rapid Rural Appraisal (RRA) and other field methods, such as direct observation, familiarization and participation in activities, semi-structured interviews, trend lines, well-being ranking, problem ranking and other ranking and scoring exercises. From the community perspective, some components of well-being such as material well-being have been improving, while some ecosystem services such as food production have been declining. Some of the local criteria for well-being are closely related to local ecosystem services but the majority are not. People recognize many services provided by ecosystems in particular provisioning, cultural and regulating services, although people stress particularly provisioning services as important for well-being. It is apparent that for the Sistelo community, there is an increase disconnect between local well-being and at least some local ecosystem services. This disconnect is associated to an enhancement of freedom of choice at the local level, linked to the other constituents of well-being, that gives locals substituting power for these services. The problem arising from this disconnect is how the deteriorating condition of some of these services will affect the well-being of people at other spatial and temporal scales, including the freedom of choice of future generations.

**Keywords:** Ecosystem services, human well-being, PRA, RRA, participatory study, biodiversity, rural community, mountain community.

## INTRODUCTION

Human well-being of present and future generations are dependent on the continuous flow of ecosystem services, which are the benefits people obtain from ecosystems (Daily, 1997). Nevertheless, links between human well-being and ecosystem services are multiple and complex. Improvements in human well-being of present generations can affect ecosystem services and the supply of those services to future generations, if for example, these improvements are based on unsustainable exploitation of the environment or if there are trade-offs between the flow of ecosystem services and other factors important for human well-being (Salzman 2001).

A key goal of the Millennium Ecosystem Assessment (MA) is the assessment of the linkages between human well-being and ecosystem services (MA 2003). Our study, is part of the Portugal Sub-Global Assessment of the MA (<http://www.ecossistemas.org>), and aimed at assessing the linkages between human well-being and local ecosystem services from the perspective of a rural community in Northern Portugal. There are three components of this assessment. The first component is the identification of local criteria for human well-being. The second component is the identification of the ecosystem services which are recognized and valued by the community. The third component is the assessment of the main changes perceived by the locals in both human well-being and ecosystem services and the linkages between them. In this paper we report the results we obtained in the first 6 months of the on-going assessment.

Well-being is multidimensional, dynamic, complex and context dependent (Narayan, 2000a; 2000b). To understand well-being in its context and its links to ecosystem services as perceived by the community, we decided that an in-depth local research was needed, using a participatory approach. Participatory approaches have been used frequently in the study of human well-being (PLA 1998-2001), but few studies look at the links between ecosystem services and human well-being. The use of a participatory approach was considered fundamental not only because the experience of well-being is context dependent, and conventional analyses tend to disregard aspects considered fundamental, but also because the local community is the main user and manager of many of the services from local ecosystems. Therefore it was essential to understand how people use, perceive and value different ecosystem services.

## STUDY AREA

Sistelo is a rural community located in the Peneda Mountain Range, in the northwest of Portugal (41° 58' N; 8° 22' W), and has an area of 26.2 Km<sup>2</sup> (Figure 1). Altitude ranges from 189m to 850m. In this region, mean annual temperature is 13° C, the risk of frost is high, except from June to October, and mean annual rainfall is 1284 mm, being considered a Maritime Mediterranean Climate (Rey, 2000).

Sistelo was proposed by one of the users of the Portugal Millennium Assessment, the National Park of Peneda-Gerês, as a study case for the assessment of the condition and the valuation of ecosystem services and biodiversity in a mountain system (Pereira et al. 2003). Sistelo borders the National Park, and it was recently included in the protected site of the Natura 2000 network which spans the National Park.

Sistelo is widespread over 5 small localities – Igreja, Estrica, Quebrada, Padrão and Porto Cova - isolated from each other considering the distance and the lack of public transportation between them.

<Figure 1>

In the beginning of the century, Sistelo was a rural community highly adapted to the mountain territory. The livelihood of the local population was based on agro-pastoralism and the restrictions imposed by the geography of the mountain, including the steep slopes and the extreme climatic conditions, led to a diversified use of the territory. Agriculture was made in terraces at successive heights in the mountain slope, the so called “socalcos” (Figure 2), and the main cultivated crops were, corn, potato and rye (Rey, 2000). Soil fertilization was assured by animal manure. Animal husbandry was mainly supported by the “baldio”, the common property area (Medeiros, 1984). The organization of pastoral life was based on the mobility of the livestock from the valleys in the winter “inverneiras” to the higher zones with better pastures in the summer, the so called “brandas” (Graça, 1996).

<Figure2>

After a demographic peak in the 50's, we assist in the 60's to the beginning of a growing emigration to other countries (Graça, 1996). The appropriation of “baldio” by the State in the 40's and the State managed afforestation of the “baldio” which drastically reduced the area for pasture, the lack of opportunities to life improvement, and the attractive situation of the labor market in foreign countries were strong

incentives to emigration (Medeiros, 1984). Emigration, particularly male emigration, became a livelihood strategy for families in Sistelo.

During the 70's, the number of animals was in decline and traditional seasonal mobility strategies were being progressively abandoned. With no hand labor due to emigration and insufficient income to pay for people to do agricultural work, there was a reduction of the cultivated area (Caldas, 1982), despite the return of the "baldio" to the community in 1974.

The trend for the depopulation and abandonment of the fields has continued to the present. Between 1960 and 2001, the population in Sistelo was reduced by 57% (INE, 1964; INE, 2001). With the abandonment of the fields, ecological succession is taking place, with the invasion of scrubs and wood, which increases the danger of fire occurrence. The agricultural terraces, an important patrimony of the humanized landscape and of the national cultural heritage is now threatened (CONFAGRI, 2002).

The total number of residents in the community is now 341 (INE, 2001). Sistelo has very low population density, a high proportion of women, an aged population and a very high illiteracy rate (Table 1). Pensions are the main mean of living (INE, 2001). 84,5% of labor force (61% of resident population) is employed in agriculture, animal husbandry and the forestry sector (INE, 2001).

<Table 1>

Concerning access to key facilities and services, in 2001, 10,6% of resident population lacked piped water in the household, 28,7% lacked a bath/shower installation in the household, 21,7% lacked a toilet in the household and 78,9% used hearth as the only heating system (INE, 2001). Health facilities are inexistent in the community. Igreja, the central locality, has the only primary school with five students.

## **METHODS**

In order to study well-being and links between well-being and ecosystem condition, a participatory approach was used. The participatory approach was based on behavioural and epistemological principles shared by Rapid Rural Appraisal (RRA) and/or Participatory Rural Appraisal (PRA): a reversal of learning, learning rapidly and progressively with flexible use of methods, appropriate imprecision, offsetting biases,

triangulating, seeking diversity, facilitating, self-critical awareness and responsibility, and sharing information and ideas (Chambers, 1992).

Participants in the study were selected using a non-probability sample of residents in the community, best suited to understand qualitative and relational issues (Narayan, 1996: pp. 104). We used snowballing, accidental, and common sense sampling. This last technique was used to ensure diversity and avoid non-sampling errors related to leadership, gender, age, visibility and wealth bias (Narayan, 1996). Although we tried to ensure diversity, we cannot claim that this sample is statistically representative.

Forty individuals participated in this study, including 34 residents (about 10% of the population) and six non-residents key informants. From the locality of Igreja, where the research was conducted in more depth in this first stage, a total of 25 in 127 residents participated in this study, 32% were men (men represent 34% of the resident population in this locality).

The field methods and tools employed in this research were chosen and adapted from different sources including Narayan, 1996; Rietbergen-McCracken and Narayan, 1998; SEAGA, 2001. The methods and tools included direct observation, semi-structured interviews, trend lines, ranking and scoring. Besides these methods and tools, familiarization with the community and participation in the community daily activities was considered important to learn more about the community and to establish a relaxed rapport and some measure of trust with the local people.

A review of secondary information was made before starting the fieldwork. We made four visits of 3 days each, from December 2003 to February 2004 (Table 2).

<Table 2>

We performed the semi-structured interviews using a flexible interview guide focused on four issues: Well-being, Ecosystem Services, Major Trends and Major Problems. These issues were presented in a conversational way. Following the interviews, collected data was organized into categories for each of these four issues. We then created graphs and cards with cartoons and photographs, to facilitate trend analysis, ranking, scoring and the discussion of different points of view.

Trend lines were introduced to understand the most important changes in the community identified during the semi-structured interviews. A graph was drawn for each trend. The idea was to encourage discussion on the perceived causes for each

trend, to find out linkages between trends, and elicit people's perspectives on maintenance or change of these trends in the future.

Problem ranking was introduced to know more about the priorities of the young members of the community. This exercise was introduced to the group of young people both using simple ranking and pairwise ranking.

Well being ranking was carried out using different kinds of approaches with the goal was of identifying local criteria for well-being. The most used approach was to (1) ask to identify and rank different groups of well-being in the community (2) ask the ranking of different localities in terms of well-being and (3) a simple ranking of rural and urban communities. In the end of each of these rankings we then asked for the criteria used by the participants to make the ranking. The well-being ranking, using card sorting with one card for each one of the 63 families living at Igreja separated in different piles corresponding to different well-being groups, was introduced to two informants in private because we considered that it would be a too sensitive exercise to introduce in a group. A ranking of criteria for well-being was also introduced to these informants.

Finally, we have performed a natural resources scoring and ranking exercise to encourage identification of ecosystem services by the community and to understand which ones are more valued in terms of well-being.

The fieldwork team included two researchers from different backgrounds, social sciences and biology. We have chosen not to tape record the application of tools, so one of the researchers played the role of facilitator and the other of note-taker.

To ensure the trustworthiness of our findings we triangulated the information sources, methods and people to assess reliability (constancy of findings) and community validation of findings to assess validity (closeness of a finding to "reality").

The analysis of data was mainly based on frequencies of references/responses within each of the categories created, including those made in the semi-structured interviews and visual tools, and the outputs of visual tools – trends, scoring and ranking. Key anecdotes and quotes were chosen to illustrate some findings.

## RESULTS

### *Local criteria for Human Well-being*

Near forty different criteria for human well-being were identified. We organized the most referred criteria (Table 3 and Figure 3) according to the constituents of well-being considered in Millennium Ecosystem Assessment Conceptual Framework (MA 2003).

<Table 3>

Material well-being, or criteria related to it, were always referred when speaking about well-being and quality of life improvements. Money income was universally referred as a component of well-being. However, it is important to note that local participants distinguished wealth and well-being: when speaking about well-being people always referred other criteria besides wealth. Access to goods and services is also very important for well-being. Participants consistently referred the importance of having better roads in order to have better access to goods and services from the outside. Access to services at the local level was also stressed. Assets were widely referred as important, in particular having a house and fields. Fields are not so important nowadays as before, but remain an important asset, giving people capacity for self-provisioning and complementing the food they purchase. Nevertheless, some people have considered that having fields was negatively related to well-being because having fields means more work and more preoccupations - “Before those who had fields were rich, today people that have fields are poor”. People referred the importance of food abundance but also of food quality. Some people have referred that although nowadays there is no shortage of food, the quality of food is worse.

Bodily well-being, or criteria related to it, was also universally referred. In particular, locals stressed health, age and leisure (not working so hard) as fundamental aspects of a good life. Capacity to work was also often mentioned.

Criteria related to social well-being were widely mentioned as a critical aspect of a good life. Locals emphasized mainly the problem of loneliness and the importance of living with family. Joy, conviviality and mutual help were also considered as aspects of a good life.

Security was less mentioned than material, bodily and social well-being, but some people referred aspects such as the security attained from retirement pensions and a safe environment. The importance of retirement pensions was particularly stressed for



security at an old age. The importance of a safe environment was mentioned by some people who presented air and water quality as an advantage of living in Sistelo.

Freedom of choice and action can be defined as “Freedom to lead the kind of lives people have reason to value” (Sen, 2000). It was widely referred, both directly and indirectly. Some locals, when justifying differences between people, stressed freedom of choice. For them, at least some of these differences, in particular aspects related to comfort, are the result of a choice.

Freedom of choice and action is closely related to the other four constituents of well-being, but people emphasized in particular the importance of having more money income and improved access to goods and services in the enlargement of choices when comparing to the past. The expressions “land of slavery” and “slave work” repeated by participants reflect the importance of choice brought by mobility and income sources unrelated to agriculture.

For the great majority of participants they are now generally better off because of improvements in criteria related to material well-being and the enhancement of choices. Nevertheless, people also reported a deteriorating situation in some criteria related to well-being, notably those related to social well-being. People stated, for example, that concerning joy, conviviality and mutual help the community is now worse off. The reasons stated for this decline were the decrease and the aging of the population but also the disappearance of some traditional practices related to agriculture. These traditional practices consisted in regular gatherings of people to work on the fields of each other and to accomplish some production activities, such as “fiadas” (spinning wool) and “desfolhadas” (stripping off corn leaves). During “fiadas” and “desfolhadas” people usually sang and danced together.

<Figure 3>

### ***Ecosystem services***

The natural resources that were most frequently mentioned in the semi-structured interviews as being affected by important changes were: cultivated fields, cows, goats, sheep and forest (Table 4). Objective data indicates there has been a general decrease for all these resources over the last three decades (Caldas, 1982; Medeiros, 1984; Ardal 2002). Perceptions of the trends by the locals agree with the objective data. We note that in relation to the forest and the cultivated fields, we only have objective data for the

period of 1970-1984, and we were not able to triangulate the tendency mentioned by the interviewees with more recent data.

Multiple causes were pointed for the tendencies shown in Table 4 during the semi-structured interviews and the trend lines exercise. Decreasing and aging of the population are the most referred. Furthermore, Sistelo people believe that reversing these population tendencies is not possible. “Sistelo is dead!” was the expression used to illustrate the deterministic character of these trends and the absence of a future.

<Table 4>

We performed a natural resources scoring and ranking exercise, applied to 9 persons, where importance of these different resources for the participants well-being was ranked (Table 5). Water springs, forest “baldio” and non-forest “baldio” were chosen as the most important resources to people’s well-being.

<Table 5>

Water springs were pointed as important because of their role in the irrigation of agricultural fields. In addition, the provision of drinkable water was also frequently mentioned as a service provided by water springs, both in the semi-structured interviews and in the discussion of the ranking exercise.

Air purification was the only regulation service provided by the forest referred as important to people’s well-being and one of the few regulation services referred through all this exercise. But two other persons also referred the importance of the forest in controlling carbon dioxide levels in the context of other tools.

Baldio is referred as a very important source of wood and pasture especially for people who don’t have their own properties. The statement “Baldio belongs to the poor!!” often used by the locals is a very clear example of the importance that this resource has to people of Sistelo.

Agricultural fields, although referred as important to some of the participants, were often devaluated during the discussions and on the semi-structured interviews. In fact, the possession of agricultural fields is by some people referred as a source of discomfort since they have to worry with their maintenance and cleaning.

Cattle is considered important as a source of income because of the subsidies. Beside the economical importance of this resource, people also referred an emotional attachment to cattle and to pastoral practices.

The landscape of “socialcos” was rarely referred as important to the people of Sistelo, despite its general appeal to outsiders. In fact, to the question “If it was possible to level the territory by making the “socialcos” disappear, would you agree?”, a significant number of the participants agreed with the leveling, because they associate the landscape of terraces to very hard and difficult work.

Concerning biodiversity, it is not spontaneously referred by people as being important for their well-being, although in the ranking exercise, one person had referred it as a priority in the maintenance of a healthy and clean environment.

## **DISCUSSION**

The local criteria for well-being identified in this study, although context dependent and with a unique combination, presents some commonalities, both in terms of criteria and constituents, to those identified in “Voices of the poor” a series that gathers the views of 60.000 poor men and women from 60 countries (Narayan et. al., 2000a and 2000b). In Portugal no comparable study is known.

The decreasing tendencies of natural resources presented by the interviewees in the semi-structured interviews and confirmed by the trend lines exercise are corroborated by the objective data, which indicates that local’s perceptions are reflecting the real processes.

The causes appointed by locals for the decreasing tendencies of the natural resources in Sistelo are also corroborated by the work of other authors (ARDAL, 2002; Caldas, 1982; Medeiros, 1984). It is apparent that the decreasing trends are the result of the synergetic effect between several causes, according to the data obtained in the framework of this project and other work of (ARDAL, 2002; Caldas, 1982; Medeiros, 1984). Decreasing and aging of population seems to be the main indirect drivers affecting Sistelo’s ecosystems and livelihoods. These drivers are in general affecting all Portuguese mountain areas (Ferreira et al., 1999).

Some measures were implemented by the government as an encouragement to agricultural practices and animal husbandry, such as the attribution of subsidies for raising cattle and to help in the maintenance of the fields (ARDAL, 2002) but still, although there was a recent increase in the number of bovines, these incentives do not seem to be enough to boost agricultural activities and keep people in these rural areas.

The fact is that mountainous areas in Portugal “have always been among the least developed areas of the country” (Ferreira et al., 1999). Limitations to improvements of the agricultural productivity due to the physical characteristics of those regions are negatively reinforced by socio-economic disadvantages, both in terms of access to key infrastructure and services, and in lack of alternatives to agriculture for making a living.

Nowadays, difficulties in the mechanization of agriculture in mountain areas seem to be one of the main constraints to the improvement of agricultural practices. In fact, few are the fields in Sistelo with enough area and reasonable accesses allowing the use of machines.

Besides the constraints to enhance agro-pastoralism practices, people stated lack of “incentive” to produce as one of the main limitations to revive agricultural practices. With the globalization of markets, people have access to products coming from other countries and other regions of Portugal, and the high production costs prevent local products from obtaining a competitive position in the market.

This also explains why most of young people that still live in Sistelo work in outside structures like factories or other companies from the nearest village. For them, agriculture is very hard work that doesn’t pay off.

The decreasing tendencies of cultivated fields, cows, goats, sheep and forest are accompanied by a generalized improvement in well-being as perceived by the community, representing a disconnection between human well-being and the local provisioning of ecosystem services. The causes for this are twofold. In one hand, human well-being does not depend only on ecosystem services but also of access to other kind of assets: human, physical, financial, social, “state provided” infrastructure, political and institutional. On the other hand, there is a spatial disconnect between where the ecosystem services are produced and where people benefit from these services. For instance, some of the services provided by Sistelo, such as the cultural landscape of

“socialcos” or the regulation of the water quality in the River Vez benefit people elsewhere.

Several local well-being criteria identified in this study do not depend directly on local ecosystem services: money income, access to goods and services, such as better roads, assets, in particular a house, age, leisure time, capacity to work, loneliness, retirement pensions and, finally, freedom of choice and action (to the present generation). On the contrary, freedom of dependence of local provisioning ecosystem services is considered a major improvement for the well-being of the community.

Some local well-being criteria are more directly related to local ecosystem services, such as fields for self-provisioning of food. The provisioning of fuelwood is also valued because for the great majority of households hearth is the only heating system. Nevertheless, these provisioning services have nowadays a diminishing importance because of other sources of income and better access to goods and services, which provides people with more substitution power.

This diminishing importance of these provisioning services could seem to contradict the results of the ranking presented in Table 4, considering the high frequency by which these provisioning services are referred as well as their role as potential sources of income. The contradiction is only apparent and can be a reflection of a very extractive perspective over local ecosystems. On the other hand, existing problems with the maintenance of some of the irrigation channels, and the internal conflicts between the population and the local authority that is exploring the forested “baldio” exclusively, where trees logging is forbidden to the local people, can also induce people to stress the services for which access is being threatened.

Health and a safe environment were also identified as local criteria for human well-being. Therefore regulating ecosystem services, although less mentioned, are recognized as having great value, at least in terms of water and air purification.

Locals also mentioned several cultural services, in particular recreational, sense of place, social, cultural heritage and aesthetic and these kind of services are considered quite important. Old people stated, for example, an emotional relation with agropastoralism practices. For them these practices have also recreational value. People also linked, at least partially, some criteria of social well-being to agricultural practices that have now disappeared, a cultural ecosystem service important to enhance social capital

and well-being. Furthermore the Vez river is as a very important symbol of cultural and local identity, and is referred in traditional songs and folks as a river of pure and clear water.

The landscape of “socialcos”, recognized by outside people as having unique cultural and aesthetical value is pointed by people of Sistelo as having many disadvantages. Considering that the maintenance of this particular kind of landscape is entirely dependent on human activity, and local people doesn’t have sufficient incentive to preserve it – a very hard work that doesn’t pay off, an important question arises: If we want to preserve the landscape, who pays to whom and how much will it cost to assure the preservation of the terraces? In a future study we will try to address these questions by assessing the economic value of this landscape and the responses needed for its preservation.

Biodiversity was not spontaneously referred by people as being important for their well-being, either in the semi-structured interviews either in the ranking exercise, but it was noted in informal talks that people have a good knowledge about local species. The existence of this knowledge is a relevant indicator of the importance of local biodiversity to people from Sistelo, and to understand the dimension of this importance this variable will be assessed by other methods in a future the study.

The issues here discussed open many questions. Considering that there is a disconnection between some local ecosystem services and local community well-being, two questions are crucial, not only to understand the complete links between human well-being and ecosystem services but also to better understand the processes and find the best solutions for action: (1) what are the consequences of decreasing of local ecosystem services on the well-being of people in other places and at other scales; (2) what are the consequences of this decreasing on the well-being of future generations. These questions will need to be answered.

#### **ACKNOWLEDGMENTS**

The authors are grateful to all the population in Sistelo and in particular to those participating in this research study.

## LITERATURE CITED

ARDAL, 2002: Núcleo Rural de Sistelo. Candidatura ao Programa Operacional Regional, Medida Agricultura e Desenvolvimento Rural. Acção 7 – Valorização do ambiente e património rural. Associação Regional de Desenvolvimento do Alto Lima, Arcos de Valdevez.

Caldas, E., 1994: Terras de Valdevez e montaria do Soajo – Memória monográfica do concelho de arcos de Valdevez. Verbo, Lisboa, 385 pp.

Caldas, J., 1982: Pequenas explorações agrícolas familiares no concelho de Arcos de Valdevez – Hipóteses para um estudo. Terras de Val de Vez, 2, Sep, Braga.

Chambers, R. 1992: Rural Appraisal: Rapid, Relaxed, and Participatory. Institute of Development Studies Discussion Paper 31, Institute of Development Studies, Brighton, 68 pp.

CONFAGRI, 2002: A Agricultura e a Conservação dos Recursos Naturais [online] Confederação Nacional de Cooperativas Agrícolas e do Crédito Agrícola de Portugal, CCRL. Cited 30 January 2003. Available at:

<http://www.confagri.pt/Ambiente/AreasTematicas/ConsNatureza/documentos/documento1.htm>

Daily, G. 1997. Nature's services: societal dependence on natural ecosystems. Island Press, Washington, D.C.

Ferreira, J., M. Roca et E. Ventura, 1999: Prospects for sustainable development in mountain areas in Portugal: conceptual and policy-related issues, in Progress in Research on Sustainable Rural System, I. Bowler, C. Bryant and A. Firmino (eds), International Geographical Commission on “Sustainability of Rural System”, Série Estudos, nº 2, C.E.G.P.R., Lisboa, 163-173.

Fleischer, A., 2000: Measuring the Recreational Value of Agricultural Landscape. European Review of Agricultural Economics, 27(3): 385-398.

Graça, L., 1996: Regadios Tradicionais nas Montanhas do Norte de Portugal (Serra da Peneda – Um caso exemplar). In El Agua A Debate Desde La Universidad; Hacia una nueva cultura del agua. Zaragoza: Institución Fernando el Católico (C. S. L. C.), 12 pp.

Instituto Nacional de Estatística, 2001: XIV Recenseamento Geral da População, Instituto Nacional de Estatística, Lisboa (some data referred under this reference is not published and was requested to INE).

MA 2003: Ecosystems and Human Well-Being. A framework for assessment. Island Press, Washington DC, 245 pp.

Medeiros, I., 1984: Estruturas Pastoris e Povoamento na Serra da Peneda. Centro de Estudos Geográficos, Lisboa, 92 pp.

Narayan, D. 1996: Toward Participatory Research. World Bank Technical Paper number 307, The World Bank, Washington D.C., 265 pp.

Narayan, D., R. Patel, K. Schafft, A. Rademacher et S. Koch-Shulte, 2000a: Voices of the Poor. Can Anyone Hear Us. Oxford University Press, New York, 343 pp.

Narayan, D., R. Chambers, M. Shah et P. Petesch, 2000b: Voices of the Poor. Crying Out for Change. Oxford University Press, New York, 314 pp.

Norton, A., 2001: A rough guide to PPAs. Participatory Poverty Assessment. An introduction to theory and practice. Overseas Development Institute, 85 pp.

PLA Notes CD-ROM 1988-2001. Participatory learning and action. Sustainable Agriculture and Rural Livelihoods Programme, International Institute for Environment and Development, London.

Pereira, H. M., T. Domingos, L. Vicente. Report on the User Needs and Response Options. Portuguese Sub-Global Assessment of the Millennium Ecosystem Assessment. Available at: <http://www.ecossistemas.org> .

Pretty, J., I. Guijt, J. Thompson, I. Scoones, 1995: A Trainer's Guide for Participatory Learning and Action. International Institute for Environment and Development, London, 267 pp.

Rey, J. , 2000: Território e Povoamento. In: Cadernos da Montanha: Peneda 1, L. Graça and H. dos Santos (eds.), DRAEDM, Lisboa, pp. 22-39.

Rietbergen-McCracken J. et D. Narayan, 1998: Participation and Social Assessment : Tools and Techniques. The International Bank for Reconstruction and Development / The World Bank, Washington, D.C., 347 pp.



Salzman, J., B. H. Thompson, and G. C. Daily. 2001. Protecting Ecosystem Services: Science, Economics, and Policy. *Stanford Environmental Law Journal* 20:309-332.

SEAGA, 2001: Field Level Handbook. Food and Agriculture Organization of the United Nations, Rome, 134 pp.

Sen, A., 1999: *Desenvolvimento como liberdade*, (L. Motta, trad.), Companhia das Letras: São Paulo, 409 pp.

## TABLES

Table 1. Comparison of some socio-demographic indicators of Sistelo with Portugal national average.

Indicator	Sistelo	Portugal
Population Density (persons/Km2)	13	112
Women (%)	62	52
Residents 65 years and above (%)	39	16
Illiteracy rate, 10 years old and above (%)	36	9

Table 2. Organization of the fieldwork.

	Tools and Methods	Applied to	Selected from
1st visit and 2nd visit	Meetings with local authority, local organizations and organizations operating in the area.	Key informants.	Sistelo and outside but with activities linked to Sistelo.
	Semi-structured interviewing.	Key informants; Individuals; Casual groups.	Sistelo's five small localities.
3rd Visit	Trend lines, Well-being ranking, Problem ranking.	Systematically selected groups: (1) Young people with mixed gender; (2) Middle-aged and older women; (3) Middle-aged and older men.	Igreja (the central locality of the community)
4th visit	Natural resources ranking.	Randomly encountered	Igreja (the central locality of the community)
	Well-being ranking, using card sorting Criteria for Well-being ranking	Key informants.	
All visits	Direct observation;	-	-
	Familiarization and participation in community or daily activities.		

Table 3. Human well-being criteria most referred by the participants.

<b>Material Well-Being</b>	<b>Bodily Well-Being</b>	<b>Social Well-being</b>	<b>Security</b>
Money income	Health	Loneliness	Security from retirement pensions
Access to goods and services	Age	Conviviality	Safe environment: air and water quality
Assets: house and fields	Leisure	Mutual Help	-
Food: quantity and quality	Capacity to work	Joy	-
<b>Freedom of Choice and Action</b>			

Table 4. Tendencies of natural resources based on the semi-structured interviews and on objective data, and main causes for those tendencies mentioned in the semi-structured interviews and trend lines exercises.

<b>Natural resources</b>	<b>Tendency perceived by locals</b>	<b>Tendency from objective indicators</b>	<b>Causes</b>
Cultivated fields	↓	↓	Decreasing and aging of the population High production costs Damaging of irrigation channels by the floods
Cows	↓	↓	Decreasing and aging of the population
Cows (from 1999 to 2002)		↑	Implementation of subsidies
Goats	↓	↓	State appropriation of the “Baldio” in the 40’s
Sheep	↓	↓	Decreasing and aging of the population Goats and sheep are more difficult to control than cows
Forest	↓	↓	Occurrence of fires Insufficient vigilance of forest areas

Table 5. Combined results of natural resources scoring and ranking

<b>Natural resources</b>	<b>Provided Services</b>
Water springs	Provisioning of water to irrigation Provisioning of potable water to the houses Valuation of the properties
Forest / Forested Baldio	Provisioning of wood and fuel Source of income to the parish Air purification (regulation service)
Non Forested Baldio	Provisioning of wood and pasture
Agricultural fields	Provisioning of food Source of income
Cattle	Source of income Helps the farmer to distract himself, source of pleasure and joy (cultural service)
River Vez	Provisioning of water to irrigation Aesthetical Value (cultural service) Cultural values part of local history and traditions (cultural service) Provisioning of fish Provisioning of healthy pure water
“Socalcos” Landscape	Aesthetical value (cultural service) Provisioning of pasture and corn to feed the animals Cultivation area
Biodiversity	Healthy environment (regulation service) Provisioning of herbs for tea and medicines Aesthetical value (cultural service) Provisioning of animals for the hunter

## **FIGURE LEGENDS**

Figure 1. Geographic situation of Sistelo.

Figure 2. Pictures of Sistelo: Socialcos, pastoralism, inverneiras and brandas

Figure 3. Expressions on well-being and poverty used by the locals.

Figure 1.

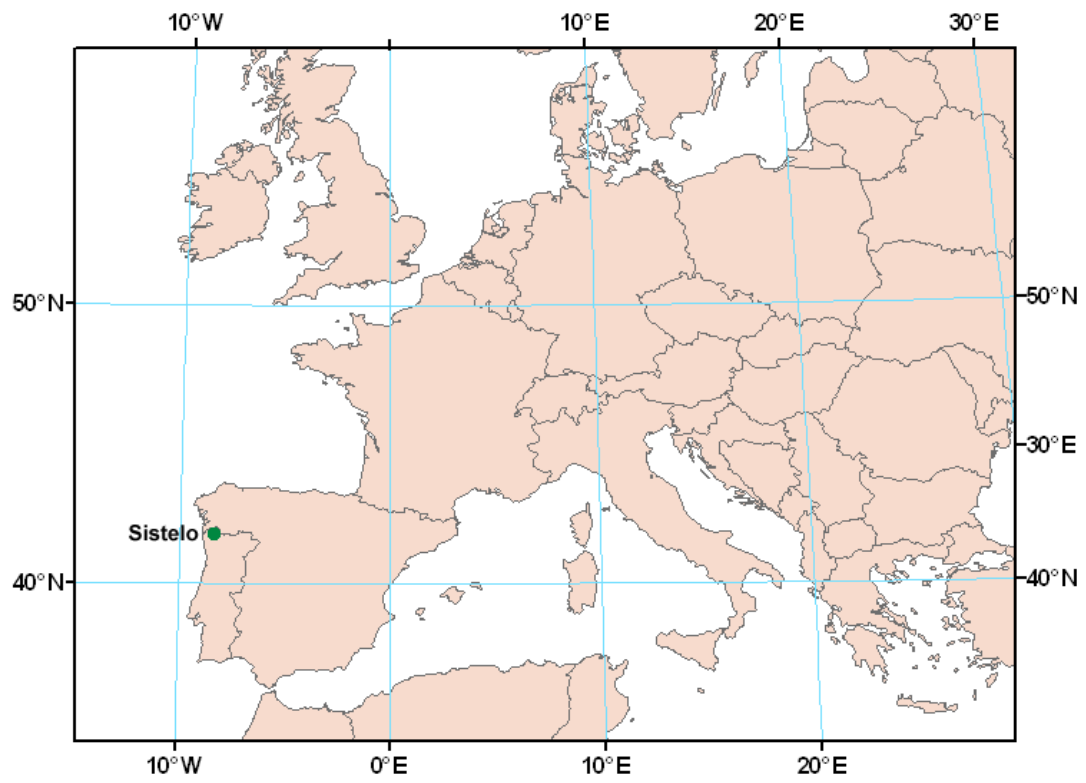




Figure 2.

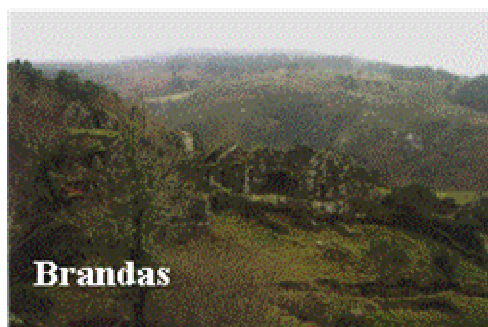


Figure 3.

