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SOCIAL ECOLOGY AND TRADITIONAL LANDSCAPE ENHANCEMENT

Some issues from a case study in the Gorizia Karst

Abstract
Governance approaches combined with sustainable planning and landscape management tools have progressively increased the link to the environment concept from an ecological-naturalistic point of view, leading to a wider vision of the future. This idea moves close to sustainable development principles in a potential integration scenario that considers economic growth, environmental safeguarding and sharing choices.
It becomes extremely important to act for landscape management and enhancement, especially in marginal areas, using social ecology practices able to recover the ecosystem services, such as biodiversity, supported by active population involvement.
The case study, located in the Isonzo Karst (Italy), analyzes the effects of "sustainable grazing" reintroduction on about 700 hectares of dry karstic grassland, as an example of social ecology practice. Territory and landscape planning and local heritage sustainable promotion paths come out in this study to be essential tools to achieve an integrated and long term sustainability dimension.

Keywords: social ecology, biodiversity, landscape enhancement, sustainable grazing, participatory planning

Introduction. A marginal and archetypal territory
This study was conducted in the westernmost part of the karst plateau called the Isonzo Karst (*Carso*), located between the Slovenian border and the cities of Gorizia and Monfalcone.
The area is a mosaic of diverse habitats, such as forest fragment, scrublands, hedges dry stone walls and dry rocky grassland (*landa* or *gmajna*). The typical *landa carsica* ecosystems are extraordinarily rich in species that for their beauty and diversity represent high value elements of the natural and cultural landscape [1], [2].
This karstic landscape presents itself as a sensitive area where, during the 20th century, deep wounds have been inflicted. The WWI devastation, the post-1945 border (well-known as "Iron Curtain"), the Cold War and the consequent wide military servitude activated on it, have significantly modified the landscape morph-functional profile. In addition, the population, about 20.000 inhabitants settled on approximately 800 kmq (Fig.1), has not significant changed significantly since the 1960s while the traditional local economy suffered in the same period as the population found employment in the industrial, port, and tertiary activities of Monfalcone, Gorizia and Trieste.
The consequence has been the lack of care for the land, evident today in the Karst landscape.The *landa carsica* grassland is included in the *Natura 2000* site "Carso Triestino e Goriziano" (SAC-IT3340006) with the code 62A0 (Eastern sub-Mediterranean dry grassland). Their protection implies the recognition of the centrality of man as a co-evolutionary factor determining their formation and conservation.
These features make this landscape an extraordinary area whose ecological values are at least equal to the historical-testimonial ones.
Most of the past enhancement efforts failed because they were not based on a clear identification of the relationship between different territory elements.
According to Poldini [2], the territorial structure compatible with the highest level of autochthonous biodiversity must be composed of about 40% of deciduous forests, 20% of shrubs and 20% of pastures and permanent meadows.

Fig. 1. The territory of the province of Gorizia and its municipalities. The Isonzo Karst extends between Savogna d'Isonzo, Sagrado, Fogliano Redipuglia, Ronchi del Legionari, Doberdò del Lago and in small part also affects the Municipality of Monfalcone.

The *landa carsica* is a secondary zoogenic prairie formed as a result of grazing sheep in ancient times and cows, more recently, on deforested areas. This deforestation became particularly evident about 4000 years ago, roughly in the Bronze Age and early Iron Age when the *Castellieri* (hill forts) civilization flourished. When in 1814 the territory came under the domain of Austria, the Karst appeared as a "desert of stones" and the Habsburg administration began an afforestation action that continued, to a lesser extent, with the return to Italy until the 1930s (Fig.2).
The vegetation species came mostly from eastern steppes whose origin can be ascribed to the pastoral practices associated with transhumance and periodic hay-making that are thousands of years old [3].
Since the Second World War, grazing and animal husbandry have undergone a major decline due to changes in socio-economic conditions, with negative consequences for land management [3].
As a result, secondary succession began its course leading to the progressive scrubbing-over of the karst dry grasslands (with dominance of Smoke-bush; *Cotinus coggygria*), re-establishing forest cover (Karst hophornbeam- downy oak wood) through a series of intermediate stages [4].
Today, after a decade of neglect of traditional agro-pastoral practices, there is a trend towards a return to farming in the Karst area.
The recovery of the *landa carsica*, as well as the supporting biodiversity, would also reduce the risk of severe fires that affect the Karst areas [5] (Fig. 3).

Sharing choices for sustainable planning
The reintroduction of grazing in the Isonzo Karst is quite rightfully not only a practice which can defend and increase biodiversity and the landscape, but which can also foster the social construction of the landscape by the settled community [6], and the case study deals with the issue of the need, especially in marginal socio-economic areas, for the creation, with the participation of the local communities, of choices relating to the future of the said communities.

Fig. 2. Karst reforestation in the 1930s [8].

Fig. 3. Comparison of grazed (left) and non-grazing (right) landa carsica (photo credits: A. Altobelli).

"Since time before history, which has tormented it mercilessly, the Karst has always been a very delicate ecosystem, straddling the continental and Mediterranean systems" [7, p. 86], in which all the geomorphological elements of Karst are present – not by chance was it first studied and defined as "classic Karst" – and, as a bio-geographical threshold, it is where moors, scrub, oak forests, Mediterranean vegetation, bushland, woods planted with black pine, but also agricultural land divided by dry stone walls, vineyards, vegetation in sink-holes, Karst lakes with reeds, willows and poplars, etc. all coexist [9]. This great variety, also thanks to the long and differentiated work that man has carried out since the Neolithic period, exists together with other historical and cultural values that mark the landscape, evidenced by the specific way in which the houses and villages are built and by small and large artefacts linked to a poor but industrious economy, and by the marks and scars left by the two world wars of the twentieth century. A rich heritage of history, of the environment and of traditions, which contrasts with the economic desertification and progressive abandonment linked to the marginalization of the Karst area and to the "condition of dependence on the activities offered by the metropolitan centres" [10, p. 110] which were the result, especially in the Gorizia Karst, of the fact that the local community became attracted, during the second half of the twentieth century, by the productive and tertiary centres of Monfalcone and Gorizia.

This was the situation. However, in the last two decades previously unknown bottom-up local development actions have been taken in this area, forms of upgrading not linked to strong actors (private subjects, entrepreneurs from other contexts, public administrations), but much more often to associations that have created a minute network between those who live, produce, go to school, etc. in the area, and "a pact with which a community undertakes to take care of its territory" started to develop [11, p. 14] (Fig. 4).

Of these actions, those aimed at the construction of eco-museums, i.e. action taken by groups of associated subjects dedicated to the conservation and enhancement of the territorial assets through the creation and management of "a project for local heritage, directed by/addressed to the local community, in pursuit of a sustainable development process" [12, p. 47], have special value. In particular, between 2009 and 2019, in the Isonzo area and especially in the Gorizia Karst area, GOtoECO was founded. It is an association for the enhancement of the territory, created thanks to the commitment of a group of students and young architects of Trieste University, who have developed both research activities and project workshops, as well as organised meetings with local subjects interested in the respectful development of the territory and in increasing the awareness of eco-museum issues on the part of the population, in order to propose the development of a "widespread eco-museum"[1]. This action has taken place over time both through community profiling methods – especially by carrying out various informal walks, promoting mapping activities and developing problem trees – and, subsequently, through the creation of certain "Action Planning Events", particularly dedicated to forms of design and to micro-planning workshops [13]. The first aim of these actions was the exchange of ideas between local subjects and the

Fig. 4. Survey on the Carso, with university students, inhabitants of the village of Doberdò and breeders (photo credits: A. Altobelli).

association, relative to the development and conservation of the specific features of the Karst, and in particular the conservation of traditional agricultural practices and the development of forms of local economy based on said practices and on integration with other practices, such as those of sustainable tourism.
The Outreach and Mapping activities carried out in the area immediately highlighted certain objectives:

- to recognize the territorial resources and to share their recognition as values for the development of the territory, and especially of the Isonzo Karst;
- to encourage the local community to actively participate in the various phases of the creation of the project and to propose eco-museum activities;
- to welcome and to promote local development projects, building a strong partnership network and proposing the widespread creation of the eco-museum as a "territorial antenna" and a reference point for larger networks, especially international networks.

The involvement and the jointly performed planning was always carried out with the support and direct involvement of the municipal administrations of the Isonzo Karst (in particular the Municipalities of Doberdò and Sagrado), and involved three steps: information, inclusion and collective work on the relevant issues that emerged in the first two phases. This last step, initially organized according to the GOPP (Goal Oriented Project Planning) technique and progressively followed by methods entailing continuously increasing interaction on the themes of the project[2], achieved, for the first time in this area, the genuine collective construction of a shared vision of the future.
The meetings held gave priority to the definition of a "problems tree" and an "objectives tree", which focused on three fundamental themes for the socio-economic recovery of the Karst: Attractiveness, Hospitality, and Accessibility. In identifying the problems, it is clear that the three themes are afflicted by shortcomings, especially of cohesion and programming: there is no shared vision of the quality and potential of the Karst, and there is no entrepreneurial mentality or support; and lastly the public administration has no general plan for accessibility, especially as regards integrated transport systems and "slow travel". These general problems are at the root of certain specific problems, illustrated as a problems tree, together with their immediate effects on the territory and on the community, and the corresponding objectives tree which indicates possible strategies and project actions, accompanied by the expected results (Tab. 1).

Tab. 1. Problems tree (left) and objectives tree for Isonzo Karst [11].

ATTRACTIVENESS	HOSPITALITY	ACCESSIBILITY
Basic problem: lack of a shared vision	**Basic problem: lack of an entrepreneurial mentality**	**Basic problem: there is no general plan for road/travel systems and for accessibility**
Problems	**Problems**	**Problems**
1. THE QUALITY OF THE TERRITORY DOES NOT EMERGE Effects: Little increase in work, the territory is isolated, there are no clear ideas	1. LACK OF ECONOMIC SUPPORT AND THERE IS NO GENERAL PROJECT Effects: A resigned attitude, a fear of being overwhelmed, lack of training, lack of good practices	1. FOR ACCESS, ONLY CARS ARE CONSIDERED Effects: Lack of public transport and of alternative means of transport, no confidence in innovative ideas
2. THE PEOPLE FEEL ABANDONED Effects: Actions entrusted to individuals, projects are few and fragmentary, energy is dispersed	2. INADEQUACY OF THE CURRENT OFFER Effects: Businesses leave the area, those that remain are open only part time	2. INSUFFICIENT SIGNS AND INDICATIONS Effects: Poor accessibility to attractive structures and centres, the value of the places is not recognized
3. LITTLE INTEREST IS SHOWN TOWARDS THIS AREA Effects: Large projects "unrelated" to the territory, a lack of resources, citizens are not involved	3. PRESENCE OF EMPTY BUILDINGS/EQUIPMENT Effects: The territory results as downgraded and there is little care for the territory, lack and repetitiveness of the contents	3. A LACK OF CLEAR-CUT RULES Effects: Little security, promiscuous actions
4. THE TOURIST SEASON IS SHORT Effects: Tourist activities are not supported, tourism does not produce general economic development, there is a tendency to avoid getting involved	4. LACK OF RESPONSIBILITY FOR SPACE MANAGEMENT	

ATTRACTIVENESS	HOSPITALITY	ACCESSIBILITY
Basic objective: to build a shared vision	**Basic objective: to educate towards, and to foster, an entrepreneurial mentality**	**Basic objective: to draw up a general plan for accessibility**
Single objectives	**Single objectives**	**Single objectives**
1. TO MAKE THE QUALITY OF THE TERRITORY EVIDENT Expected results: to increase the offer of work, to interrupt the condition of isolation, to share ideas for the future	1. TO GIVE ECONOMIC SUPPORT AND A CLEAR-CUT GENERAL PROJECT FRAMEWORK Expected results: investments in training, to accompany and support those who commit themselves, to find and spread good practices	1. TO MAKE THE TERRITORY ACCESSIBLE TO EVERYONE Expected results: an increase in local public transports, investments in alternative transport systems (soft mobility), investments in innovative ideas
2. TO DEVELOP A CLOSER AND PROFITABLE RELATIONSHIP WITH BODIES AND INSTITUTIONS Expected results: To accompany the initiatives of individuals and of private citizens in order to build a dense and coherent network, channelling energies towards recognizable priorities	2. TO ADJUST THE OFFER TO THE NEEDS OF THE MARKET Expected results: support for entrepreneurship, a tendency towards longer openings (seasonal, weekly)	2. TO INSTALL EFFECTIVE SIGNS AND INDICATIONS Expected results: to ensure accessibility to significant structures and places, promoting recognition of the value of the places
3. TO COMMUNICATE WITH THE EXTERNAL WORLD AND TO CREATE INTEREST IN THE AREA Expected results: to develop projects on different scales, well-rooted in the territory, to find adequate resources, and to involve the inhabitants of the Karst in the decisions	3. TO USE THE SPACES ADEQUATELY Expected results: greater care for the territory, increased variety of the elements of the offer	3. TO DEFINE CLEAR-CUT RULES Expected results: to guarantee safety for all road users, to define spaces and routes dedicated to different types of transport
4. TO DEVELOP LOCAL RESPONSIBILITY FOR SPACE MANAGEMENT Expected results: sustainable tourism activities, to encourage investments and involvement, to increase the economic development of the territory	4. TO IDENTIFY AND CLEARLY DISTRIBUTE MANAGEMENT RESPONSIBILITIES	

The hard involvement of stakeholders and the occasion of the landa carsica recovery project

Workshops and community planning activities put in place by the association, in collaboration with some Karst municipalities, Trieste University and numerous local entrepreneurs and cultural operators, therefore intended to respond to these requests in the following years (and possibly to include the answers already developed). So they become a real tool for the social construction of the landscape, recognized as a collective heritage [14] and as an aid to the development of actions, to safeguard this territory of environmental and socio-economic value, associated with the reintroduction of grazing, which remains the activity of greatest impact (Fig. 5).
Unfortunately, such supporting activities were not adequately developed by the actors who, in the following years, had to bear the responsibility mainly for producing virtuous actions for the enhancement of the Karst as a landscape characterized by nature, history and activities of the primary sector. On one hand, the Karst Local Action Group, a consortium of public and private entities, has provided numerous loans for the development of the area but without ever organizing a real programme for the construction of community objectives, relying above all on territorial marketing actions.
On the other hand, the *Ecomuseo Territori*[3] has not yet had the capacity to develop eco-museum issues, a profitable relationship between entities and institutions, effective and credible mapping, community awareness operations, or the activation of local responsibility for landscape management, which was already a goal from 2010[4].
In the last ten years, the most important projects, especially in terms of economic

Fig. 5. Program of work for the construction of the Parish Map of the Municipality of Sagrado, at the center of the Isonzo Karst (source: arch. I. Ciuffarin).

Fig. 6. Traces of the "cold war" in the grazed Karst landscape (photo credits: A. Altobelli).

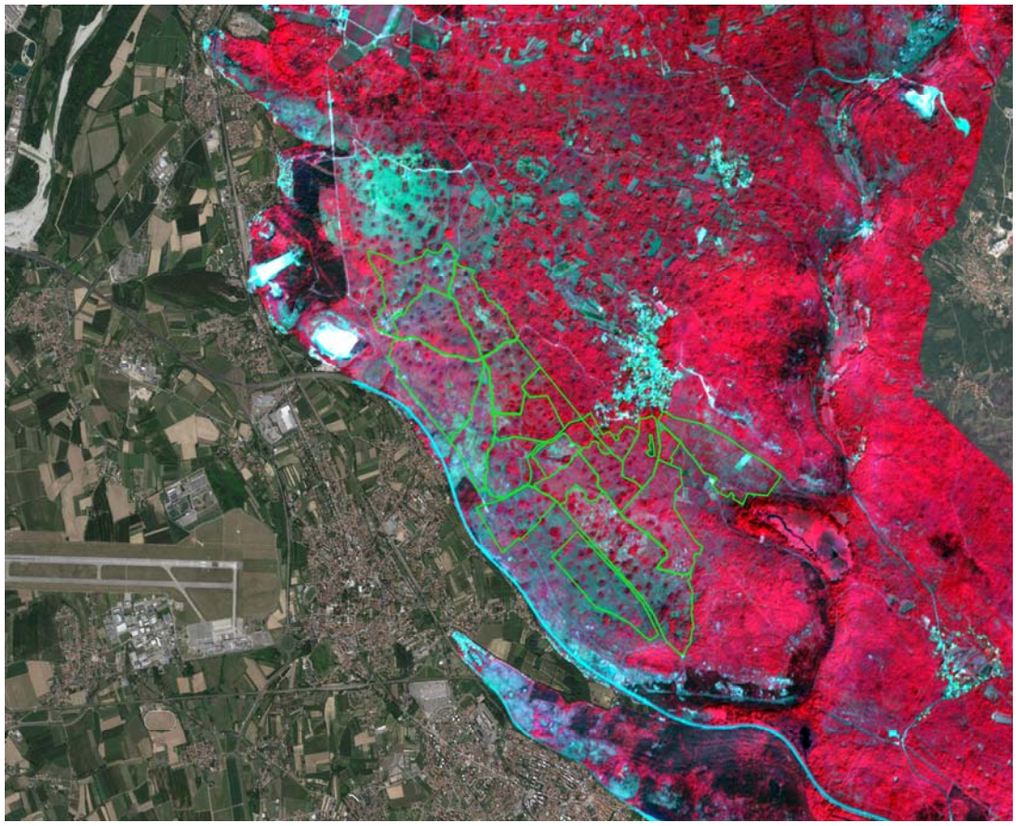

Fig. 7. False color infrared Sentinel-2 image (29 August 2018) of the Isonzo Karst with overlapping (green) grazed areas occupied. (https://scihub.copernicus.eu/).

investment, have in fact focused on the creation of facilities for the tourist use of the Karst. The new visitor centers of the Doberdò and Pietrarossa Lakes Nature Reserve, educational itineraries, the recovery of the Great War historical sites started with the *Carso 2014+* project, have led to a greater knowledge and awareness of the history and nature of the Karst, but have also had a minimal impact from the point of view of socio-economic, as well as environmental sustainability.

It therefore seems important today to return to constructing territorial and landscape governance actions to protect this common asset, which put the contextual knowledge of the communities in the foreground, and to provide adequate resources for these actions and tools for their integration with other policies which have an impact on the territory. Furthermore, it must not be forgotten that local communities have contributed to creating the landscape and can contribute to maintaining it on a daily basis, and that "the quality of the landscape and of the environment is not a luxury" but "an investment for our future and represents, as demonstrated by thirty centuries of Italian history, a crucial value which is not only cultural [and environmental], but civil and economic in nature" [15, p.307].

In this regard, in the next paragraph we describe the important experience of the reintroduction of grazing, which proves to be today the most effective social ecology action developed in the Isonzo Karst.

Controlled grazing for sustainable management of karst grassland

To maintain karst grassland and prevent it from bush encroachment, the grazing of livestock is of fundamental importance. Grazing livestock greatly affects the composition of pasture plant communities. With proper grazing management animals, because animals graze selectively, increase the floristic-vegetation diversity [1].

To take advantage of the regional law (L.R. 8/1977) a memorandum of understanding for the recovery of the *landa carsica* by grazing has been activated with local farmers. The law allows for firefighting purposes, for a maximum of 7 years, the temporary occupation of uncultivated land.

The occupation was carried out under the control of the Agriculture and Forests Inspectorate of Trieste and Gorizia and the scientific responsibility of the Life Science Department of the University of Trieste.

The project started in 2016 and currently about 700 hectares of bushland pasture are used for the grazing of 100 donkeys, 50 cows and 50 sheep (Fig. 6).

Pasture management practices require a good understanding of soil and vegetation properties, that can be evaluated by fieldwork and remote sensing techniques. In satellite remote sensing open-source alternatives are increasingly being preferred. To monitor the reintroduction of grazing, the *landa carsica* is continuously monitored through images from ESA's Sentinel-2 satellite (https://scihub.copernicus.eu/) (Fig. 7).

Through the elaboration of the satellite images, the degree of bushland encroachment in the pasture was calculated. Furthermore, the impact of grazing has been calculated by the use of spectral vegetation indices sensitive to the amount of green biomass presents.

Figure 8 shows the trend of the chlorophyll index [16] in pastures with cows and donkeys compared with an ungrazed control area.

The curves relating to the index are in tune with the characteristic production trend of Mediterranean pastures [17].

The lowest value of scrubbing-over of 25% and/or afforestation was considered to be the most economically advantageous for landa carsica restoration [18].

In addition, Zanatta [19] highlights that over 75% of the level of bushland encroachment loses the typical structure of turf grass with a strong loss of species diversity.

For a sustainable management of pasture, organic farming regulations were adopted. In addition, given the low pasture productivity and pastoral value, rotation of grazing was implemented with a low stocking rate of 0.5 LU (Livestock Units; ha-1) [17]. Which means that a cow must have at least two hectares of pasture available for the whole year.

In October 2018, to assess the problems related to the reintroduction of grazing on the Karst, an

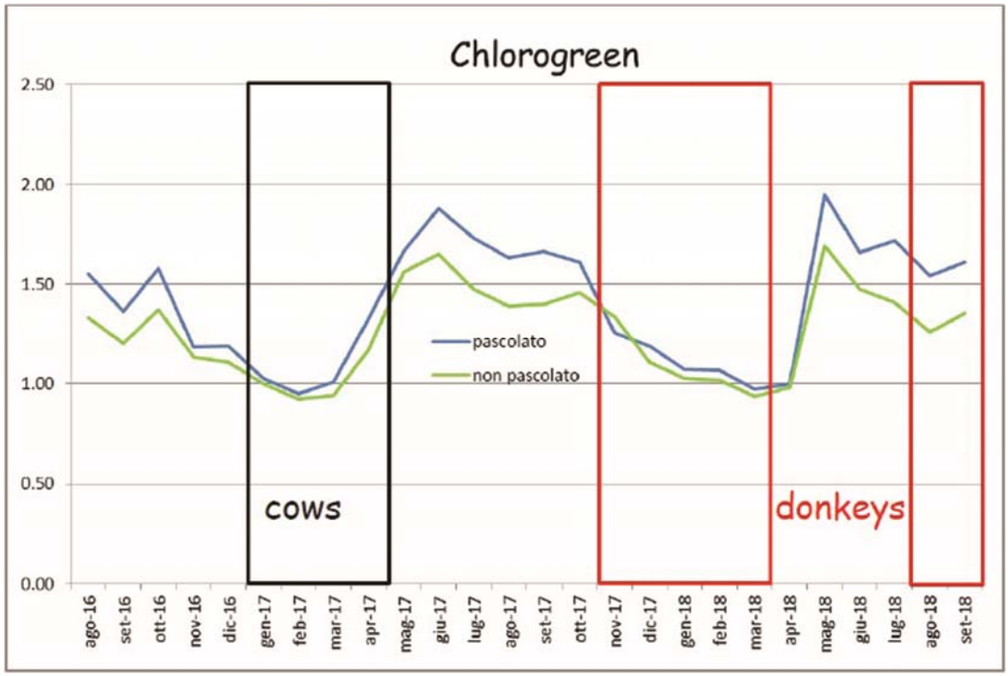

Fig. 8. Seasonal pattern of green biomass by satellite vegetation index images (from August 2016 to September 2018). In the black box the grazing period of cows while the red ones those with donkeys.

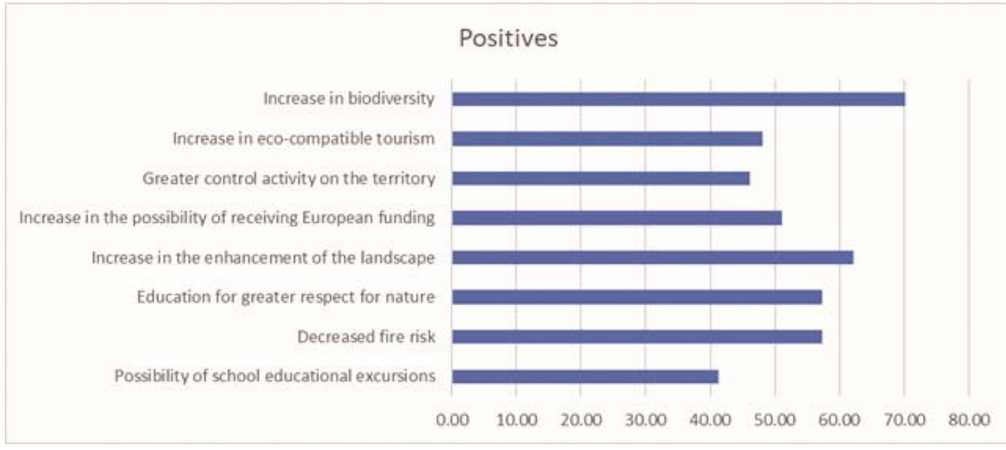

Fig. 9. Results (%) of the multiple choice questions about the advantages of reintroducing grazing.

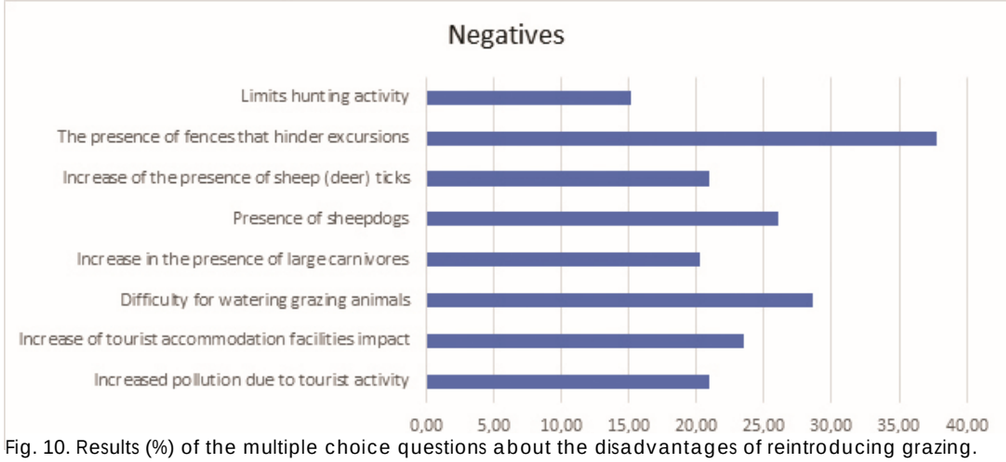

Fig. 10. Results (%) of the multiple choice questions about the disadvantages of reintroducing grazing.

online questionnaire was completed by people who frequent the area.
The path of territorial empowerment [20] began with a public conference (22 September 2018) inviting the stakeholders (environmental associations, animal welfare associations, breeders' associations, managers of hunting reserves, historical-cultural groups, Nordic walking and mountain biking associations, etc.). Subsequently, at the request of the participants, the questionnaire was made available online until the end of October 2018.
The questionnaire begins with a brief introduction which specifies the territory and the objectives of the project. The first two questions of the questionnaire are multiple choice questions about the advantages and disadvantages of reintroducing grazing. In the third question the participant must choose whether it is overall favourable or unfavourable for the reintroduction of grazing. The questioning ends with an open question in which the participant can add any personal comments.
In September 2018, a public questionnaire on the reintroduction of grazing on the Isonzo Karst was prepared to gather the different opinions of people. Out of 141 completed questionnaires, 85% of people responded favourably to the reintroduction of grazing.
Again, from the questionnaire the most positive aspect for reintroduction concerns the increase in biodiversity, while the most negative aspect is due to the presence of fences that hinder excursions. The results of the questionnaire are specifically shown in the Figures 9 and 10.
If, from a social, economic and environmental point of view, the objectives achieved by the project are clear, the recent modification of the regional law 8/1977 does not recognize grazing as a fire prevention measure. As a result, temporary occupation of land is no longer permitted. It will therefore be necessary to find a new agreement between the various stakeholders that will allow the continuation of this important project.

Conclusions

The reintroduction of the grazing of livestock in the Isonzo-Karst is important for three main reasons:

1) It reduces the risk of severe fires, in fact, no fire has occurred since 2016.
2) It promotes biodiversity in accordance with the objectives of the Natura 2000 Network.
3) It encourages local involvement in the development of the Karst landscape.

From an ecological point of view, because the Karst is a very delicate ecosystem, an organic farming model with an appropriate stocking rate of livestock must be maintained.
From a social point of view, to assess the problems related to the reintroduction of grazing, the online questionnaire (September-October 2018) confirmed the favourable approval of local stakeholders (85%).
The hope is that this project will increase the attractiveness of the area and the sustainable economic supply chain.
As the temporary occupation (regional law 8/1977) of the karstic land will end in August 2021, it will be necessary to find a new agreement that will guarantee the continuation of this important project.

ACKNOWLEDGEMENT

Dr. Caterina Degenhardt for the preparation of the questionnaire.
Dr. Erica Salis for data collection.
Environmentalist association E. Rosmann and the Municipality of Monfalcone for having made the Pietrarossa visitor center available.

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NOTES

1. The definition derives from a combination of the widespread museum model, especially in the form of an open-air museum featuring a system of theme-based itineraries, and the Ecomuseum model first developed in the 1970s in France by Georges Henry Riviére and Hugues de Varine.
2. Most of the activities took place in preparation of, or on the occasion of, the NaturalmenteGO events (held in various places in the Karst between 2010 and 2018) and of the landscape design workshops or competitions dedicated to photography and art linked to the same.
3. The eco-museum, which is located in Monfalcone, without a precise geographical-cultural characterization, was recognized in 2012 as a regional Eco-museum, to the detriment of the widespread eco-museum project, thanks to the long historical research and cultural promotion carried out on the lower plain of the Isonzo (and marginally on the Karst) by the Monfalconese Cultural Consortium, which constitutes its backbone.
4. The lack of an integrated vision and a common strategy for the defence of the Karst landscape appears evident from the websites of the two bodies mentioned: http://www.galcarso.eu/ e https://www.ecomuseoterritori.it/.