Public Perception on Measures Needed for the Ecological Restoration of Grecian Juniper Silvopastoral Woodlands

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Abstract.

The purpose of the study was to explore the views of social groups operating around the silvopastoral woodlands of the EU priority habitat type *9562 *Grecian Juniper Woods* and the formulation of measures that will contribute to the ecological restoration of the habitat type. The first phase (February 2014) was conducted with questionnaires addressed to social groups in the region. The Principal Component Analysis showed that the main factors forming the perception of social groups are (a) the advantages and benefits of the habitat type (15.79%), (b) threats (14.91%), (c) interdisciplinary complementarity of livestock management and Forestry (9.24%), (d) cost effectiveness (8.61%), (e) present condition (8.57%), and (f) direct degradation of wood-standing capital (7.48%). The second phase (June 2016) included a simulation exercise on the institutional environment of a LIFE+ project activities and held within a summer school. It was found similarity in the factors which determine the attitude of the two groups (society, institutional groups) with emphasis on the economic benefits and the interdisciplinary complementarity of livestock management and forestry.

Keywords: *Juniperus excelsa*, *Juniperus foetidissima*, restoration, conservation, role playing

1. Introduction

The success of ecological restoration depends to a large extent on the participation of societies in decision-making and the scientific community in the formulation of measures. For this reason, it is necessary to outline the public perception of issues of environmental importance, as societies living in areas with increased potential environmental vulnerability are more sensitive to decision-making (Johnson *et al.* 2005). Impacting this concept is particularly important for the Prespa basin communities, as ecological conditions maintain local unique ecosystems at European Union level. Among these, the priority habitat type *9562 Greek juniper woods, formed by silvopastoral woodlands, has been the subject of protection and ecological restoration of the project LIFE12 NAT Restoration and Conservation of the Priority Habitat Type *9562 (LIFE+ JunEx). The ecological characteristics of the habitat have been significantly altered, mainly due to the abandonment of traditional management (grazing, logging) and failure to take ecological restoration measures will lead to habitat loss (Vrahnakis *et al*. 2012). The purpose of the research was to investigate the public perception as expressed by social groups associated with the priority habitat type *9562 *Juniperetum excelsae*. This exploration provides important tools in the formulation of eco-recovery measures by the scientific community as they were modeled at a thematic summer school held in Prespa.

2. The Grecian Juniper silvopastoral woodlands and the LIFE+ JunEx project

The priority habitat type *9562 Grecian Juniper woods (*Juniperetum excelsae*) includes the rare juniper silvopastoral woodlands (dominated by the high standing *Juniperus excelsa*) and is located in the western part of the Prespa National Park (Vrahnakis *et al*. 2012). They cover an area of approximately 2200 Ha and are found at an altitude of 850-1250 m, in W, N and E exposures, at slopes of 5-500%. The Prespa juniper woodlands have been closely related to the social development of Prespa, as historically constituted or preserved the rural and professional life of the inhabitants (Catsadorakis 1999). Typical traditional use of high juniper woods was grazing. Nowadays, the decrease in the number of livestock, especially goats, is the main cause of the rapid expansion of broad-leaved woody species (Vrahnakis 2014). In addition, the cutting in the woods of broadleaved tress for firewood was very common and in this way the invasive broadleaved trees were actively controlled. The decline of grazing and fire-wooding for the Prespa juniper silvopastoral woods has as an additional effect the increase of biomass and, during prolonged dry periods, uncontrolled fires (Fotiadis *et al*. 2014). In order to prevent the risk of altering the structural and functional characteristics of the habitat type and ultimately limiting the extinction risk, ecological recovery measures are required. These measures are in progress, as the EU-funded (by 75%) project "LIFE12 NAT/GR/000539 Restoration and Conservation

of the Priority Habitat Type *9562" is being developed in the region since 2013. The main purpose of the LIFE+ JunEx project is the rehabilitation, restoration and promotion of the juniper silvopastoral woodlands through the resumption of the productive activity of livestock grazing as a measure of woodland management and protection. The concrete actions of the LIFE+ JunEx project are expected to have positive socio-economic consequences by educating inhabitants about the uniqueness of the priority habitat type, raising awareness for the restoration and conservation of the habitat and increasing the local income. An important action to raise awareness and disseminate the results of LIFE+ JunEx was the organization of two five-day summer schools. The courses were addressed to students / alumni with an academic background in forestry with a strong interest in the habitat type or in conservation practices applied in the management of habitat types of the Natura 2000 Network, as well as to scientists from the Prespa National Park Management Body and other research institutions.

3. Materials and methods

In order to investigate the views of the social groups and to formulate measures that would contribute to the objectives of the LIFE+ JunEx project, a two-phase social research was planned. The first phase took place in February 2014, and aimed at assessing the initial knowledge status and awareness on issues related to the reference habitat type. The research was based on a Survey of Socio-Economic Reference (Monitoring Protocol) with questionnaires addressed to the most important social groups in Prespa, which are related to the habitat type: 1) stock breeders, 2) forest workers, 3) and 4) owners of ecotourism units (restaurateurs, hoteliers), 5) students of high school and lyceum, 6) visitors, and 7) fishermen.The survey was conducted with structured questionnaires completed with personal interviews. The questionnaire included closed-ended questions. The methodology involved randomized stratified sampling. The basis of the stratification was social and demographic characteristics of the respondents who structure their social profile (6 questions), such as gender, age, educational level, career perspectives, capacity and duration of activity, and accordingly adjusted for groups of students and visitors. There was a series of questions of general interest about the potential of Prespa socio-economic development and mainly the perception of the respondents on the issues of low-intensity development (4 questions). A latest group of complex questions (7 questions) explored the specific interest of respondents for the woodlands of interest. These formed the main body of the survey as they were focused on the woodlands and the change in time responses (start/end of the LIFE+ JunEx project) compose social maturity indicators. For the sample size's calculation (ni) the optimal allocation method (Wright 2012) was applied. The following sample sizes were calculated: stock breeders n1 = 46, forest workers n2 = 26, owners of ecotourism unit n3 = 9, students n4 = 59, visitors n5 = 85, fishermen n6 = 16, restaurants n7 = 10. In all, the questions addressed to 251 subjects. Subjects' responses were coded on a five-step Likert scale (Vrahnakis 2015). In addition, multivariate statistical techniques, such as exploratory factor analysis (in major components) for specific questions, were applied to identify the main factors that affect the attitude of focus groups.The second phase took place during the summer school (27 June - 1 July 2016). After the completion of field visits to adjacent woodlands, where LIFE's concrete actions took part in the last three years, the 18 participants (9 students and 9 professionals) were divided into 4 groups of 4-5 people. The groups were divided in such a way that they included both professionals in the management of natural areas (foresters) as well as students of Forestry. The groups used the *role playing* technique, where researchers attribute roles (common institutional attributes) to the subjects and receive their responses on specific issues after a specific time (Lewis-Beck *et al.* 2004). The roles of the 4 groups/institutions were: Local Society, Non-Governmental Organization (NGO), Municipality / Managing Authority of Prespa National Park, Ministry/Directorate of Forestry of Florina. The four groups were asked to respond within one hour (a) the institutions' view of the concrete actions developed under the LIFE+ JunEx project, and (b) to identify further actions needed.An analysis of the common points of the two phases (social research, role playing) was followed and conclusions were drawn.

4. Results

4.1. Principal Components Analysis

Twenty seven (27) out of 251 subjects were subtracted as their responses were incomplete. Averages and standard deviations of the 19 initial variables as calculated for the 224 subjects are presented in Vrahnakis (2015).As shown by the values of the Pearson correlation coefficient and their significance (for significance level $\alpha = 0.05$), the determinant value (0.002), the Bartlett's sphericity test, and the KMO index value(0.766) all basic assumptions for applying PCA were fulfilled (for analysis see Vrahnakis 2015). For interpretation purposes, a simplified structure of factor loads' matrix was obtained by applied a varimax rotation to the original matrix of correlations. According to the eigenvalue criterion (>1), six (6) components were obtained to account for 64.60% of the overall variance in the model of social perception for juniper woods (Table 1). Factor loads distributed within six (6) major components are given in the rotated matrix of factors (Table 2). To facilitate the interpretation of the distribution and the general interpretation of the factors in the matrix, only those loads which have an absolute value of >0.400 are presented.Factor loads (Table 2) showed that the first factor (explaining 15.79% of the total variance, Table 1) brought together the advantages and benefits from the juniper silvopastoral woodlands. Among these, *livestock husbandry* had the highest contribution (0.762) in the determination of this factor. The second factor (14,906% of the total variance) reflected the threats to junipers, with *visitors* having the highest load (0.789). This factor was negatively correlated with the *public consultation* (-0.726), which highlighted its importance in addressing threats. The third factor (9.237% of the variance) was determined as interdisciplinary complementarity between *forestry* and *livestock husbandry*, the perception of which was uniform and independent (-0.649) of the professional background

(*focus group*) of the subjects. It seemed that the safeguarding of the floristic *diversity* (0.411) played a particular role in the formation of this perception. The fourth factor (8.614%) referred to as economic criteria, with tourism-related ones to attain high loads (0.672). The fifth factor (8.569%) was related to the knowledge of the current state of juniper woods as it was related to knowledge of the importance of *undergrazing* (0.650) and *invasion* of broadleaved species (0.790). Finally, the sixth factor (7.477%) was associated to the degradation of standing-wood capital due to *wildfire risk* (0.663) or *illegal woodcutting* (0.670). Indeed, this perception was not related to the *knowledge* or not of the word *juniper* (-0.436), and it seemed to represent a general perception of subjects.

4.2. Role playing

(a) Local society

The members of the local community group were particularly focused on the professional groups involved in primary production and related to the reference habitat type, such as forest workers, livestock breeders, and fishermen. Members emphasized the "economic impact on local income, in the present and in the future", on the "difficulties in the implementation of concrete actions" and on "the possibility of additional employment during the winter time, due to the relatively mild climate in the studied area". Concerning the livestock dimension interest was shown in "new land parcels for grazing", while concerns were raised about existing infrastructures, the need to transport animals from other areas of Prespa and the potential of the LIFE+ JunEx to "sustain a larger livestock capital in the area". The actions of planting seedlings, garbage collection of junipers and the need to inform residents about "the values of juniper" drew the attention of the group.

(b) Non-governmental organization (NGO)

The NGO group envisaged a General Project on the Restoration of Habitats Types. The preparation and submission of the proposal for this project included "the exploration and contact of a specific scientific agent for the support and writing of this proposal, communication with local land management bodies and public services in order to ensure the support, approval and visibility of the project to local media". The implementation of the project will follows, where "depending on the level of cooperation with the Forestry Directorate that will be achieved for each action, the implementation includes the conclusion of a program contract, the preparation of studies, the implementation (preferably by local bodies), the communication - visibility of project actions and feedback, control and correction phases". The actions foreseen by the restoration project were (1) Mechanical thinning of broadleaved woody species, (2) Re-introduction of sheep/goat grazing, (3) Planting of juniper seedlings, (4) Collection of garbage and other flammable material, (5) Promotion – Information campaigns for the values associated with juniper silvopastoral woodlands. Overall, the positive effects are reflected in "quality of life in direct job creation, local income enhancement, implementation of legislation and country's alignment to EU-generated legal demands, and improving the image of the region and the municipality of Prespa".

(c) Municipality / Managing Authority of Prespa National Park

The group was concerned of the benefits of LIFE+ JunEx brings for the local community.

Table 1. Extracted principal components based on the total variance explained, after varimax rotation (extraction method: PCA)

Component	***Extraction sums of squared loadings***			***Rotation sums of squared loadings***		
	total	***% of variance***	***cumulative %***	***total***	***% of variance***	***cumulative %***
1	5.056	26.611	26.611	3.000	15.791	15.791
2	1.991	10.480	37.091	2.832	14.906	30.697
3	1.549	8.150	45.241	1.755	9.237	39.934
4	1.367	7.193	52.433	1.637	8.614	48.548
5	1.302	6.852	59.285	1.628	8.569	57.117
6	1.009	5.309	64.595	1.421	7.477	64.595

Table 2. Factor loads distribution within 6 principal components (presented loads >±0,400, extraction method: PCA, rotated method: varimax with Kaiser normalization, number of iterations for convergence: 9)

	Component					
	1	2	3	4	5	6
Focus group			-.649			
Juniper word					.564	-.436
Income increase				.781		
Tourism increase				.672		
Diversity	.514		.411			
Recreation increase	.519					
Beauty increase	.680					
Husbandry increase	.762					
Hunting increase	.634					
Architecture	.676					
Wildfire risk						.663
Illegal woodcuting						.670
Overgrazing		.635				
Undergrazing					.650	
Visitors		.789				
Urban expansiom		.784				
Shrub invansion					.790	
Public consultation		-.726				
Forestry / livestock husbandry conflict			.856			

Together with the Managing Authority, they undertake supportive actions, such as information campaigns led by special scientists. In addition, they are aware of the importance of information dissemination to the students of the Universities and channelizes their information actions in this direction, while the two bodies (Managing Authority, Society for the Protection of Prespa) jointly include in the targeted information groups the social security bodies (policemen, frontier guards), as the two bodies do not hold repressive authorization from the State. Also emphasis placed on voluntarism and informational actions.

(d) Ministry / Directorate of Forestry of Florina

The ministry / forestry team in its report described the stages of approval and licensing of the actions included in the LIFE+ JunEx project. Any authorization requires scientific documentation, e.g. *"…after the scientific documentation has been preceded ...*" or "*…we are asking for an afforestation study*". This need is justified by the group as the area's protection status so far demanded the lack of active management. The group committed to transfer the firewood to the nearby communities; however again it is required scientific documentation of the amount of residue (branches, etc.) left to the ground. As final stage it is expected to incorporate planned actions into the management practice of the protected silvopastoral woodland. In this way, the coexistence of forestry and livestock husbandry for the benefit of the protected area is accepted at an institutional level.

5. Discussion

Multivariate analysis of principal components (PCA) showed that the main factors that form the perception of social groups for the habitat type can be grouped into the advantages and benefits they derive from, threats and degradation of the habitat type, and the interdisciplinary complementarity of livestock husbandry and forestry.The ecological advantages and benefits to local and wider society of preserving the priority habitat type have already been highlighted and their significance has been demonstrated. However, according to Wortley *et al.* (2013), the exclusive focus on ecological results, without considering socio-economic benefits, is considered insufficient to assess the success of the actions but also the restoration projects as a whole. As in the case of the reference habitat type, the need for ecological restoration can be reinforced by a number of factors, including the need to increase grazing land, firewood cutting, or other ecosystem services such as clean water, climate change mitigation, biodiversity conservation or soil degradation (Suding 2011).In relation to the advantages and benefits of the ecological reintroduction of the reference habitat type, the attitude of the local community is also affected by the emerging threats and degradation. This highlights the risks and threats that result from the degradation of the habitat type's structure due to the abandonment of the traditional silvopastoral practices of using its primary resources, such as grazing and firewood that control the biomass of the broadleaved woody species, both perceived by local society. This perception of the need to implement preventing measures for risks and threats is the basis for many eco-recovery projects and programs (Vareltzidou and Strixner 2009).The complementarity of forestry and livestock husbandry, i.e. by the wood production and grazing has been demonstrated in many parts of the Mediterranean region (Rigueiro-Rodríguez *et al.* 2009). This close relationship between the two occupational activities in Prespa, as described by combined and controlled grazing in forest systems, is a common activity practiced in almost all open harvesting forests in Greece, such as valonia oak silvopastoral woodlands (Vrahnakis *et al.* 2014).The institutional analysis that was attempted in the framework of the summer school, although it was simulated, revealed similar approaches. A central consideration is the economic relationship that arises for users of primary resources. This relationship is expected to further develop through temporal and spatial extensions to

make better use of the natural resources provided by the reference habitat type of Grecian juniper silvopastoral woodlands. This refers to the expansion of logging in the winter and the increase of existing grazing land. In any case, these extensions must be accompanied by infrastructure developments, e.g. watering tanks, shelters.

6. Conclusions

Considering that (a) the public opinion survey was carried out in the early stages of the project and that (b) the opinion of the experts, as recorded in the margins of a summer school, was investigated using a simulation technique, the following conclusions are made:• The main factors regulating the attitudes of social groups on habitat type are the advantages and benefits of social groups, threats and risks for habitat degradation and the complementarity of forestry and livestock husbandry professional activities. Particular emphasis is placed on the economic benefits of the local community.• The complementarity of forestry and livestock husbandry professional activities is desirable from the institutional environment, but scientific evidence of the required measures is a prerequisite.

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