SRE of Prespa NP –Assessment, protection and *in-situ/ex-situ* conservation, through involvement of young professionals

Manual on Monitoring and Assessment of Plant Species

This manual is prepared by ILIRIA in the frame of project "SRE of Prespa NP –Assessment, protection and in-situ/ex-situ conservation, through involvement of young professionals", supported by CEPF & PONT

Abbreviations

AOO	Area of occupancy
CBD	Convention for Biological Conservation
CEPF	Critical Ecosystem Partnership Fund
CR	Critically Endangered
CSO	Civil Society Organizations
EDM	Electronic Distance Measurer
EEC	European Econimic Community
EN	Endangered
EOO	Extent of occurrence
EU	European Union
GeoCAT	Geospatial Conservation Assessment Tool
GPS	Global Positioning System
IUCN	International Union for Conservation of Nature
LC	Least Concern
MoTE	Ministry of Tourism and Environment
MoETPI	Ministry of Environment
NAPA	National Agency of the Protected Areas
NE	Not Evaluated
NP	National Park
SpCI	Species of Community Interest
VU	Vulnerable

Contents

Introduction

The Manual of Assessment and Monitoring of Threatened Plant Species has been prepared in the frame of project: "SRE of Prespa NP –Assessment, protection and *in-situ/ex-situ* conservation, through involvement of young professionals" aiming to advance conservation, protection and assess the threatened or endemic, subendemik and KBA plant species of Albania in general and particularly the strictly endemic species of Prespa NP. The manual provided the methodological bases for plant species monitoring and their habitat types conservation in the Prespa ecosystem, as well as other values of the area through transboundary collaboration in both PAs, Galicica in North Macedonia and Prespa NP in Albania.

Further on the manual aims to help users build their capacity to assess biodiversity in general and plant species in particular, improve their information on biodiversity, and apply their assessments to better decision-making, incorporation into overall and specific conservation actions.

The main aspects of the monitoring/assessment process should be planned in the close collaboration between local and central stakeholders. At the current circumstances in the monitoring, assessment and conservation of restricted endemics of Prespa NP were intended to be involve the botanists with staffs of RAPA, volunteers of CSOs within/nearby Prespa NPs, and young professionals with biology education background.
The Manual will serve as a basic guideline, easily usable by the monitoring officers and staffs of PAs as weel as by voluntieers. The methodology of the species assesmnet, described in this manual were based on the IUCN species assessment guideline (Version 14, 2019)[1] and international best practices implemented so far by ILIRIA experts. It is also easily applicable in practice for a real assesment of indicatore plants or habitats in a certain PA or throughout the country.

1.1. Legal bases for the plant monitoring and assessment

The manual has been prepared in order to fulfill the institutional obligation of the NAPA, RAPA and responsible stakeholders in the local governance, based on the Law No. 9587, dt. 20.7.2006 *"***For protection of Biodiversity"** *(amended by law No. 37/2013, dt. 14.2.2013, and No. 68/2014, dt. 3.7.2014),* that recently is updated by low No. 41 dt. 23.4.2020. The new updation of the law (No. 41, dt. 23.4.2020) is partially aligined with Reguation No 511/2014 of April 16 (EU) of the European Parlament and of the European Council.

Furtherr more, the MoTE have been charged by the point 4 of article 102 of the Constitution of Albania and puarsuant to point 5 of article 22 of the Law No. 9587 date 20.7.2006, "For protection of Biodiversity" to aprove each 5-yeras "The Red list of Flora and wild Fauna of Albania" after the monitoring and assessment of threatened or endagered species.
This manual is in accordance with the Strategic Policy Document for Protection of Biodiversity[2] and Action Plans for species that are also the principal instruments for the monitoring of plant species and habitats in Albania. It is also relevant to the international protocols for plant monitoring[3] and species conservations and agreements.

[1]IUCN Standards and Petitions Committee. 2019. Guidelines for Using the IUCN Red List Categories and Criteria. Version 14. Prepared by the Standards and Petitions Committee. Downloadable from http://www.iucnredlist.org/documents/RedListGuidelines.pdf.
[2]MoE. (2015). Dokument i Politikave Strategjike per Mbrojtjen e Biodiversitetit. 168 pp.
[3]IUCN Standards and Petitions Committee. 2019. Guidelines for Using the IUCN Red List Categories and Criteria. Version 14. Prepared by the Standards and Petitions Committee. Downloadable from http://www.iucnredlist.org/documents/RedListGuidelines.pdf.

1.2. Plant diversity and why we should monitor and assess them?

As defined by the Convention on Biological Diversity (CBD), biological diversity is "the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part, diversity within species, between species, and of ecosystems" (Article 2)[4]. Assessing the status and trends of biodiversity is essential for sustainable development strategies at all levels, from village to nation to region. Biodiversity is crucial for the wellbeing of people and the Earth. Ecological communities maintain the ecological and evolutionary processes that sustain life. These are necessary to help maintain the planet's chemical balance, moderate climate, renew soil, and conserve species diversity[5].

According to a report delivered by the Royal Botanic Gardens, Kew, in the world there are about 391,000 plant species, currently known to science, from which ca. 369,000 species (or 94 percent) are flowering plants[6]. Herbaceous plants and Trees are essential for our life on earth. They are a key component of the cultural, economic and natural landscapes of the earth.

Kathy Willis, Director of Science at the Royal Botanic Gardens, Kew, makes this assessment of the role of plants in our live and our world: "…the importance of plants to all of our lives– from food, medicines, clothing, building materials and biofuels, to climate regulation" Despite of this reachnes, from the known 391,000 plant species, only about 31,000 of these species have at least one documented use. These include uses for food, medicine, recreation, genes, poisons, animal feed, and building material"[7].

Albania, as part of Europe geographically lies between two biogeographic regions, Mediterranean and Alpine and is distinguished for its rich flora and fauna. With ca. 3,660 plant species in a small area of 28,748 km^2, floristically Albania is ranked among the richest countries of the Europe. More than 400 plants of the Albanian flora are known also as medical or industrial plants species. Based on our data collected along 15 years and the literature sources, in Albania there are 73 endemic taxa that belong to 20 families and 40 genera. The data show also that the southern part of Albania is richest with 48 taxa, compared with 25 taxa found in the north and north-eastern part of the country. Generally, most of endemic taxa occur in the altitudes from 400 m up to 1500 m, on open grasslands in between shrubs and forests of the Sub-Mediterranean and Sub-Alpine regions and in the rocky slopes or canyions. The high diversity of ecosystems and habitats (marine and coastal ecosystems, wetlands, river deltas, sand dunes, lakes, rivers, Mediterranean shrubs, broadleaf, conifers and mixed forests, alpine and subalpine pastures and meadows, and high mountain ecosystems) make it possible to have a larger number of the plants than we known so far.

Notwithstanding the above, the state of plant diversity is not an open green light. Botanists, based on the current data and progressive astimation, say that 21 percent of all plant species — or one in every five-plant species — is likely threatened with extinction[8]. The biggest threats of World,

[4]https://www.cbd.int/
[5]IUCN, M & E, 2000. A Guide to the Assessment of Biological Diversity DRAFT Developed by The IUCN M & E Initiative and The IUCN Biodiversity Policy and International Agreements Unit
[6]https://news.mongabay.com/2016/05/many-plants-world-scientists-may-now-answer/
[7]Kathy Willis, BGK. https://news.mongabay.com/2016/05/many-plants-world-scientists-may-now-answer/
[8]https://news.mongabay.com/2016/05/many-plants-world-scientists-may-now-answer/

European and Albanian flora are large-scale destruction of habitat for agriculture and tourism development, logging, livestock farming as well as using pesticides and climate change.

According to the specialists of IUCN[9] about 57% of herbaceous plant species of Europe and 42% of European tree species have been redlisted as threatened (i.e. assessed as Critically Endangered, Endangered or Vulnerable) and therefore having a high risk of extinction.

Regarding to conservation status of Albanian plant species, from the total number of endemics, only 15 species are considered as threatened one, while six species are assessed as CR, two species as EN and four species as VU by the current Red list of Flora and Fauna of Albania[10].

Plant species can be regarded as the natural unit to form the basis for conservation policy and management, so they monitoring and determination of their protection status is important for the future of the ecosystem and our life. Notwithstanding the above, the state of plant diversity is not an open green light. Botanists, based on the current data and progressive astimation, say that 21 percent of all plant species — or one in every five-plant species — is likely threatened with extinction[11].

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1.3. Can we monitor and assess all the Plant species?

In a broad context we can not monitore all the plant species that occur in a certain country, ecosystem or habitat type, because the monitoring process and assessment is costly, needs time and participation availability of many specialsits and stakeholders.
Generaly, the monitoring and assessment process includes species or plant communities which serve as key indicatores for the health of habitats or ecosystems.

[9]Rivers *et al.* (2019) *European Red List of Trees*. Cambridge, UK and Brussels, Belgium: IUCN. viii + 60 pp.
[10]; [13]Urdhër Nr. 1280, datë 18.12.2013 "Për miratimin e Listës së kuqe të Florës dhe Faunës së egër të Shqipërisë", miratuar nga Ministri i Mjedit.
[11]https://news.mongabay.com/2016/05/many-plants-world-scientists-may-now-answer/
[12]Rivers *et al.* (2019) *European Red List of Trees*. Cambridge, UK and Brussels, Belgium: IUCN. viii + 60 pp.

So, the first target of monitoring is thretatened species, or so colled indicator species. This indicator species of the future of ecosystems that are subject of monitoring and assessment by the responsible institutions includes:

- *All the species of Annex II, Annex IV and Annex V of the Habitat Directive (Directive 92/43/EEC) are considered as species of Community Interest* and…
- *All plant species that are included on Appendix I of Bern Convention*
- *Globally threatened plant species, listed on IUCN Red list*
- *All threatened species of the National red Lists*
- *All the Albanian endemic and near endemic and KBA plant specie with restricted range of distribution that have not been assessed so far*.

In Albania, MoTE approves every five years "The National Red List of wild Flora and Fauna", but out of them, due to several reasons, some known endemics and subendemics with narrow areal of distribution remain unassessed. During last decade, in Albania were identified ca. 22 plant species of Community Interest, part of the Annexes II, IV and V of Directive 92/43/EEC and ca. 18 plant species that are listed and protected by BERNE Convention. 9 other plant species, assessed as threatened by IUCN are listed in the red list of Globaly threatened species. With great conservation intrest in Albania there are also the species, targeted as SpCI or Species of European Importance. Further more the new or the third "National Red List of wild Flora and Fauna" of Albania is under approval process and is expected to come out in the coming months.

On the other hand, the Republic of North Macedonia has drafted the new Management Plan for National Park Galichica[14] and has recently published the National Red List for Species Conservation[15], two important documents for conservation of restricted endemics in the entire natural ecosystem of Prespa.

In the frame of project: "SRE of Prespa NP –Assessment, protection and *in-situ/ex-situ* conservation, through involvement of young professionals" supported by CEPF and PONT, ILIRIA in collaboration with Research Centre for Environment and Materials in North Macedonia, expected to assess six transboundary restricted endemics, which share their growing habitats with Galichica NP and four other endemic species that occurs within the territory of Prespa NP in Albania.

2. What does plant monitoring means?

According to Elzinga et al. (2011)[16], the root of the word monitoring means "to warn," and an essential purpose of monitoring is to raise a warning flag that the current course of action is not working. The aim of monitoring is to identify and rise a problem and address a solution at the early stages of ist occurrence. This means taking measures that address this problem, for example extinguishing a fire in a grassland which endangers the extinction of an important population of a restricted endmic species, through a series of management activities.

[14]NP Galichica. (2020). Draft Strategic Environmental Assessment Report of the Management Plan for National Park Galichica for the period from 2021 – 2030. 100 pp.

[15]IUCN ECARO. (2018). National Red Lists for Species Conservation in Macedonia: setting the stage. IUCN Regional Office for Eastern Europe and Central Asia, Belgrade, Serbia. pi-viii + 1-53.

[16]Elzinga L. C, Salzer W. D, Willoughby W. J. Measuring & monitoring plant populations.

The monitoring were defined as as the collection and analysis of repeated observations or measurements to evaluate changes in condition and progress toward meeting a management objective. In case of plant monitoring this concept means data collecton and analyses of a plant population or an habitat types for assessment of the current status of monitored species and provides the evidence for management change or continuation[17].

Since the result of monitoring can be undertaken of effective measure for species conservation and protection, it can not be effective out of their habitat protection. So according to Elzinga et al. (2011), the monitoring include ***Resource monitoring*** that focuses on the plant resource itself and monitors some aspect of that resource such as average density, cover, or frequency population size, the overall increase or decrease in the population over time, causes of the risk factors and nature of threats when assessing the conservation status of a species and ***Habitat monitoring*** that describes how well an activity meets the objectives or management standards for the habitat. Measuring how well a grazing system meets those standards is an example of habitat monitoring.

Another example is to set a threshold level of the percentage of habitat that may be disturbed by a particular activity, such as collection of medicinal plants or expantion of invazive species.
Several indicator species with very narrow distribution range, often share their growing habitat between two ore more countries, so in this case the need for the design and set-up of a transboundary monitoring system as well as cooperation and joint management activities is neccesary[18].

In a broader sense, the monitoring of ecosystem health (biotic and abiotic) parameters strengthens information baseline for adaptive management and solve all the problems or improve the management at which it is targeted.

2.1. Key terms and concepts used in Plant Monitoring and Assessment

The plant monitoring manuals and the guidelanes of IUCN[19] use several terms and concepts like Observation, Observed, Survey, Research, Estimated, Projected, Inferred, Suspected, Taxon, Transect etc., that are with quite intrest to understand and apply the methodology of monitoring and assess the plant species in the field. They are defined as follows:

Area of occupancy: Area of occupancy (AOO) is a scaled metric that represents the area of suitable habitat currently occupied by the taxon.

Assessment of population condition: In this approach, the observer evaluates the condition of the population by noting occurrence and extent of utilization, disease, predation, and other factors.

[17]Ringold et al. 1996. Adaptive monitoring design for Ecosystem Management. Ecological application, 6(3): 745-747.

[18]Christian Perennou (2009): Development of a transboundary monitoring system for the Prespa Park area. Annexes, 190 p.

[19]IUCN Standards and Petitions Committee. (2019). Guidelines for Using the IUCN Red List Categories and Criteria. Version 14. Prepared by the Standards and Petitions Committee. Downloadable from http://www.iucnredlist.org/documents/RedListGuidelines.pdf.

Boundary mapping: Mapping the perimeter of a plant population monitors change in the area occupied by the population.

Braun-Blanquet survey Method: Represent a rapid, visual assessment technique developed by plant sociologist Braun-Blanquet that is used to assess density, abundance and frequency of plants and plant communities in the rawobservations of cover in each quadrat at a transect.

Census: A census of the population counts or measures every individual. The main advantage of this approach is that the measure is a count and not an estimate based on sampling. No statistics are required. The changes measured from year to year are real, and the only significance of concern is biological.

Conflict: The degree of management conflict between potential conservation actions and existing or alternative uses (usually commercial) may be an important consideration in prioritizing populations. The degree of conflict may also dictate the form of monitoring (high conflict situations may require quantitative monitoring or even research into cause and effect).

Continuing decline: A continuing decline is a recent, current or projected future decline (which may be smooth, irregular or sporadic) which is liable to continue unless remedial measures are taken. Fluctuations will not normally count as continuing declines, but an observed decline should not be considered as a fluctuation unless there is evidence for this.

Cover: The amount of ground covered by the vertical projection of plant matter can be visualized by considering a bird's-eye photograph of the vegetation. The percentage of the ground obscured by vegetation is canopy (or aerial) cover. Basal cover is the percentage of the ground covered by the base or trunk of the plant.

Density: Density is the number of individuals or stems (or another counting unit) per unit area. It can only be used when a consistent counting unit can be recognized.

Ecology: is the study of interactions between living biota and their environment. Ecology provides the essential basis for nature conservation. Maintaining a mosaic of habitats ensures the survival of a rich variety of species. For instance, heathland is a valued landscape that is fast disappearing throughout much of Western Europe, but studies have helped identify how to preserve its ecological characteristic.

Estimated: information that is based on calculations that may include statistical assumptions about sampling, or biological assumptions about the relationship between an observed variable (e.g., an index of abundance) and the variable of interest (e.g., number of mature individuals). For example, transect counts of singing males of a bird species may be used with assumptions about the overall proportions of mature males these represent and about sex ratios to estimate number of mature individuals. The assumptions used should be stated and justified in the documentation. Estimation may also involve interpolation in time to calculate the variable of interest for a particular time step (e.g., a 10-year reduction based on observations or estimations of population size 5 and 15 years ago). For examples, see discussion under criterion A.

Extent of occurrence: Extent of occurrence is defined as "the area contained within the shortest continuous imaginary boundary which can be drawn to encompass all the known, inferred or projected sites of present occurrence of a taxon, excluding cases of vagrancy.

Extent of threats: Threats can be evaluated in terms of scale and intensity. Scale describes the percentage of the populations affected and the distribution of threats across the landscape. Intensity describes the degree to which populations are affected by threats (e.g., extirpation of the population, mortality of a few individuals).

Extreme fluctuations: "Extreme fluctuations can be said to occur in a number of taxa where population size or distribution area varies widely, rapidly and frequently, typically with a variation greater than one order of magnitude (i.e., a tenfold increase or decrease)."

Frequency: If a population is visualized overlaid with a grid defining sampling units, the percentage of those units occupied by the species is the frequency. As quadrat size changes, frequency also changes; thus, frequency is a measure that is dependent on the size of the sampling unit.

Generation: Generation length is the average age of parents of the current cohort (i.e., newborn individuals in the population). Generation length therefore reflects the turnover rate of breeding individuals in a population. Generation length is greater than the age at first breeding and less than the age of the oldest breeding individual, except in taxa that breed only once.

GeoCAT: is a web tool that harnesses primary biological data for semi-automated IUCN Red List assessment and analysis. This web tool facilitate the determination of AOO and EOO of monitored species.

Habitat: is a place where an organism makes its home. A habitat meets all the environmental conditions an organism needs to survive. For a plant species, that means everything it needs to find and uptake the mineral nutrients, to live in communities with other biota, and successfully reproduce. The main components of a habitat are shelter, water, food, and space.

Habitat quality: Depending on the situation, higher priority for monitoring may be applied to populations found on degraded or disturbed habitat (because they are more at risk) or on stable or pristine habitat (because protection is a better conservation investment than restoration).

Immediacy of threats: The rate at which threats may occur and populations decline is another important consideration. Species or populations with ongoing or immediate threats would rank higher than those with potential threats.

Inferred: information that is in the same general type of units but not a direct measure of the variable of interest (refer to definition of 'Suspected' below for examples that are not measured in the same general type of units). Examples include population reduction (A2d) inferred from a change in catch statistics, continuing decline in number of mature individuals (C2) inferred from trade estimates, or continuing decline in area of occupancy (B1b(ii,iii), B2b(ii,iii)) inferred from rate of habitat loss. Inferred values rely on more assumptions than estimated values. For example, inferring reduction from catch statistics not only requires statistical assumptions (e.g., random sampling) and biological assumptions (about the relationship of the harvested section of the population to the total population), but also assumptions about trends in effort, efficiency, and spatial and temporal distribution of the harvest in relation to the population. Inference may also involve extrapolating an observed or estimated quantity from known subpopulations to calculate the same quantity for other subpopulations.

KBA (Key Biodiversity Area): Key Biodiversity Areas are nationally identified sites contributing significantly to the global persistence of all biodiversity in terrestrial, freshwater and marine ecosystems. Hence, KBAs are seen as an 'umbrella' designation, which includes globally important sites for different taxa and realms, such as Important Bird and Biodiversity Areas, Important Plant Areas, Prime Butterfly Areas, and others.

Known declines: Species with known declines based on monitoring or observation are more important for monitoring and management than species that are considered stable.

Location: The term 'location' defines a geographically or ecologically distinct area in which a single threatening event can rapidly affect all individuals of the taxon present. The size of the location depends on the area covered by the threatening event and may include part of one or many subpopulations. Where a taxon is affected by more than one threatening event, location should be defined by considering the most serious plausible threat.

Mature individuals: The number of mature individuals is the number of individuals known, estimated or inferred to be capable of reproduction.

Monitoring difficulty: Monitoring some types of plants, such as annuals and geophytes, can be nearly impossible due to temporal and spatial variability. Some species, such as those found on cliffs, are difficult to access. Monitoring species growing on fragile sites, such as erosive slopes or semi-aquatic habitats, may cause unacceptable investigator impacts.

Natura 2000: is a network of protected areas within the EU that offers habitats for rare and threatened species. EU funding has advanced the means for more accurate and cost-effective monitoring of the network's habitat sites spread across more than 50 million hectares.

Observation: is the active acquisition of information from a primary source. In living beings, **observation** employs the senses. In science, **observation** can also involve the perception and recording of data via the use of scientific instruments. The term may also refer to any data collected during the scientific activity.

Observed: information that is directly based on well-documented observations of all known individuals in the population (i.e., effectively a census of the known individuals).

A survey: is a research method used for collecting data from a predefined group of respondents to gain information and insights into various topics of interest. They can have multiple purposes, and researchers can conduct it in many ways depending on the methodology chosen and the study's goal.

Photopoints: Photopoints are pictures that are retaken from the same position of the same frame at each observation.

Photoplots: Photoplots straddle the division between qualitative and quantitative monitoring. These are usually close-up photographs of a bird's-eye view of a plot within the frame. Plot size varies with camera height and lens type, but commonly ranges from 50 cm x 30 cm to 1 m x 1 m. Photoplots can provide a qualitative record of a small portion of the population, or they can be used as a plot to measure cover and/or density.

Plant communities: is a association of plant species within a designated geographical units, which forms a relatively uniform patch, distinguishable from neighboring patches of different vegetation types. The components of each plant community are influenced by geomorphology of substrate, biogeographic region and climate and human disturbance.

Population and population size: In the Red List Criteria the term '**population**' is defined as the total number of individuals that includes all individuals (mature and other life stages) that are assigned to the taxon throughout ist distribution, whereas the '**population size**' is defined as the total number of mature individuals in all areas. Even if some of the taxon exists in subpopulations that might be seen as distinct populations in a general biological sense, for the purposes of the criteria, the total number of mature individuals in all areas (or all subpopulations) is used to measure the "population size" of the taxon.

Population location: Selecting populations on the fringe of the distribution of the species usually increases the range of genetic variability conserved. These populations may also occupy fringe habitats that are marginal and stressful, and may express response to range wide stresses, such as climate changes, before more central populations. population size is defined as the total number of mature individuals in all areas.

Population viability: A population with individuals distributed among all age classes is more demographically "healthy" than one with obviously skewed stage distributions (e.g., all old or dying individuals). Monitoring may be concentrated on those populations with the best potential for long-term survival or on those that are obviously in trouble.

Presence or absence: Noting whether the species of interest is still at the site may be an effective way to monitor a species with many roadside populations. Populations located along roads can be noted by a "windshield check" by other specialists in the course of their work.

Previous information/monitoring/research: Populations with previous monitoring or natural history studies may be a higher priority if data suggest a decline or problem, or a lower priority if data suggest the population is stable or increasing.

Projected: same as "estimated", but the variable of interest is extrapolated in time towards the future, or in space. Projected variables require a discussion of the method of extrapolation (e.g., justification of the statistical assumptions or the population model used) as well as the extrapolation of current or potential threats into the future, including their rates of change.

Rarity: Rarity relates to population size, number of populations, and distribution of populations across the landscape. In comparing species, perhaps the most useful aspect of rarity for monitoring is the number of populations. A species restricted to a single large population is at more risk than one with fewer total numbers distributed in several populations. Similarly, populations clustered in a small area may all be affected by the same threat, while populations that are widely distributed are less likely to be affected by a single impact.

Reduction: Reduction is a decline in the number of mature individuals of at least the amount (%) stated under the criterion over the time period (years) specified, although the decline need not be

continuing. A reduction should not be interpreted as part of a fluctuation unless there is good evidence for this. The downward phase of a fluctuation will not normally count as a reduction."

Research: is defined as the creation of new knowledge and/or the use of existing knowledge in a new and creative way so as to generate new concepts, methodologies and understandings. This could include synthesis and analysis of previous research to the extent that it leads to new and creative outcomes

Recovery potential: Some species will only recover with a large expenditure of resources, while others have high recovery potential. You may choose to focus on the species with the highest potential, especially if several species could be managed for recovery with the same resources required for one.

Sample: A sample measures only a portion of the plant population. No sample is an identical representation of the population as a whole. It is an estimate of that population; thus, some error is associated with the sample (the difference between the sample estimate and the real value of the population). Statistics is the tool used to assess that error (see Chapters 5, 6, 7, and 11). A sample of quantitative data should only be taken if the results are to be analyzed statistically, because the error associated with that sample can be quite large, and the monitoring useless for detecting change. Only through statistical analysis can the magnitude of sampling error be assessed.

Sampling: The act or process of selecting a part of something with the intent of showing the quality, style, or nature of the whole.

Sensitivity to threats: Species vary in their sensitivity to threats depending on their biology and ecology. Species with a long-lived seed bank are buffered from population declines because a single good germination year can function as a rescue. Species with populations that vary widely from year to year but lack a seed bank are more prone to local extinction. Species that are limited to midsuccessional stages are vulnerable to both disturbance and succession caused by lack of disturbance. Species dependent on other species for pollination or seed dissemination are more sensitive than those that are wind-pollinated and dispersed. Species that have exacting habitat requirements are more sensitive than those that are more cosmopolitan in habitat.

Severely fragmented: The 'severely fragmented' refers to the situation in which increased extinction risks to the taxon results from the fact that most of its individuals are found in small and relatively isolated subpopulations (in certain circumstances this may be inferred from habitat information). These small subpopulations may go extinct, with a reduced probability of recolonization.

Site condition assessment: Site condition assessments provide a repeated evaluation of the quality of the habitat. The monitoring is designed to detect obvious and dramatic changes that can be recorded photographically, with video, or in written descriptions aided by a standard form.

Special management area: Specially designated areas such as Research Natural Areas (RNAs) and purchased preserves represent a significant investment of resources. If rare plant populations are an important factor for establishment or purchase, maintaining the population is a management priority. Monitoring of these populations would be a higher priority than populations in non-designated areas. Conversely, it may be assumed that the protection afforded by designation reduces threats, as well as the need for monitoring.

Subpopulations: "Subpopulations are defined as geographically or otherwise distinct groups in the population between which there is little demographic or genetic exchange (typically one successful migrant individual or gamete per year or less)." The typicall subpopulations have little demographic or genetic exchange, this may or may not amount to their complete isolation in this regard.

Suspected: information that is based on variables in different types of units, for example, % population reduction based on decline in habitat quality (A2c) or on incidence of a disease (A2e), or on circumstantial evidence. For example, evidence of qualitative habitat loss can be used to ***infer*** that there is a qualitative (continuing) decline in area of occupancy, whereas evidence of the amount of habitat loss can be used to ***suspect*** a population reduction at a particular rate. In general, a suspected population reduction can be based on any factor related to population abundance or distribution, including the effects of (or dependence on) other taxa, so long as the relevance of these factors can be reasonably supported.

Taxon *and* ***Taxa:*** The terms '*taxon*' and 'taxa' in case of the assessment of a species status is used to represent species or lower taxonomic levels, including forms that are not yet fully described, and excluding humans.

Unique habitat: Populations located on unique habitat likely contain unique genetic combinations and are important for conserving the range of genetic diversity of the species.

Vigor: Measures include biomass production, the number of new shoots produced, the number of reproductive shoots produced, the number of seeds produced, plant height, plant volume, and many others.

2.2. Plans of Plant Monitoring

Before begining of activities the staff/institutions should have clear objectives and the targets of monitoring. The objectives of monitoring may include the observation of plant communities or floristic composition, cover vegetation, biomass production, the health of habitat types or ecosystem or the protection status of rare plant species, all aimed to increase, decrease or maintain the status of certain population of a species, habitat types or ecosystem.

Generaly, there is a tendency when managing rare species to intend to have an increase of population size. In some cases, the populations of certain species may already be at the maximum potential of the habitat where it is located and the habitat can hold. This means that it is not impacted or no any apparent threats is observed. For these, a more realistic objective would be to maintain current condition. For some other populations of species we can set a threshold that will need a management action if the population falls below the threshold.

Setting objectives for plant populations in areas that are not affected by humans or recreational use may require little interaction with interest groups or other intersted stakeholders. Large populations, or populations of species with collection interest by local communities such can be medical or industrial plants or other ecosystem products, may require extensive communication efforts before the start of monitoring. In this case the communication with interested bodies/communities is facilitated by a monitoring plan that explains the rationale for the monitoring project, documents objectives and the management response.

According to Elzinga et al. (2011)[20], the plans of plant monitoring serve five important functions (figure 1):

- A plan provides a full description of the ecological model, the objectives, and the proposed methodology.
- Draft monitoring plans provide a means to solicit input from many participants.
- A final monitoring plan consolidates all information into a single document that can beeasily accessed and referenced.
- A final monitoring plan documents the location and techniques of the monitoring in sufficient detail that a successor can continue the monitoring.
- A final monitoring plan documents the agency's commitment to implementing a monitoring project and the management that will occur based on monitoring results. A monitoring plan can also be signed by all participants to demonstrate their support for the project and acceptance of the proposed management changes that may result.

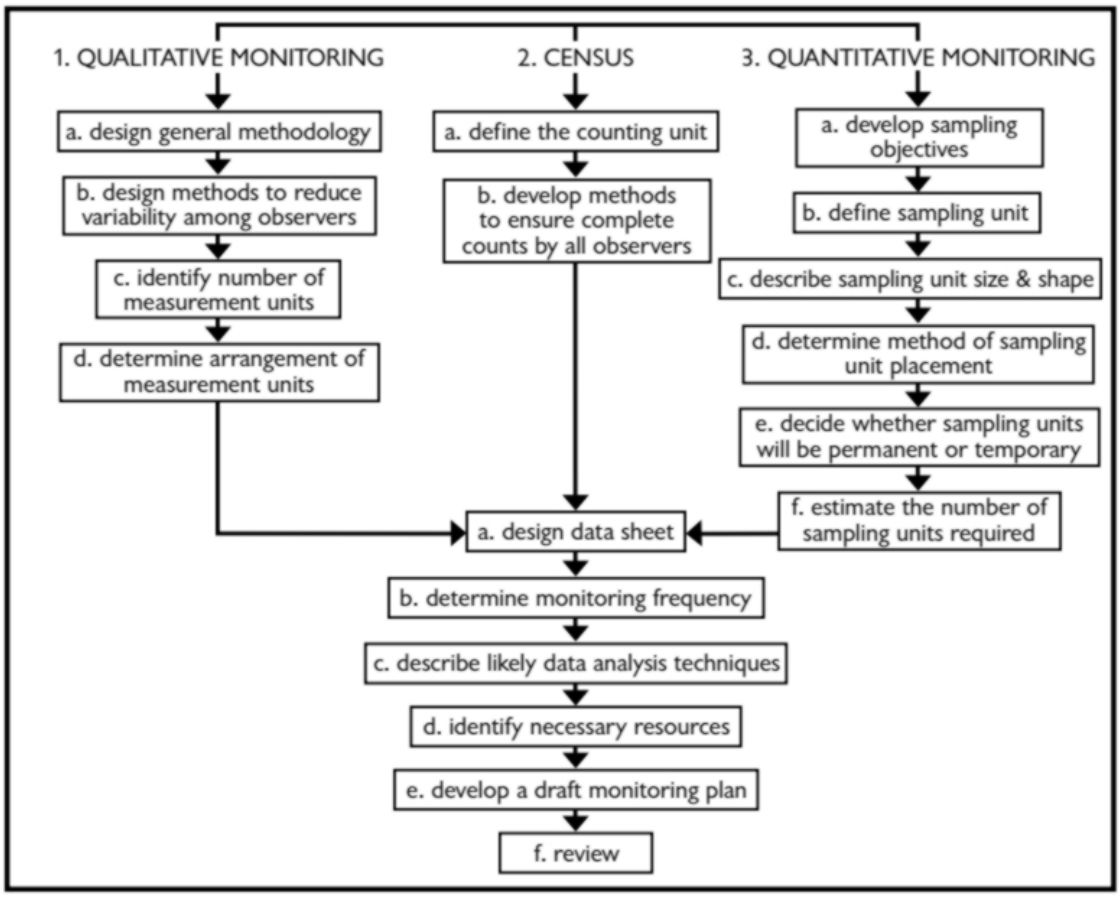

Figure 1. *Flow diagram of monitoring process illustrating the sub-steps of designing a monitoring methodology for plant monitoring* (by Elzinga *et al*., 2011)

The monitoring plan for the assessment of threatened species should also contain the priority species and their populations, and documents that are needed for the assessment process. This documentation will be useful for a continuous monitoring and managers and for the other responsible institutions, particularly the MoTE that is obligated institution to aprove the red list of

[20]Elzinga L.C, Salzer W.D, Willoughby W.J. (2011). Measuring & monitoring plant populations.

flora and fauna of Albania. For threatened endemic/subendemic species select priority populations and habitats that are planned to monitor and assess. These priority species require reassessment each three or five years due to changes in threats, management, conflicts, and the interest of international CSOs.

Plan of plant monitoring must be complete, providing all the information and actions as well as management objective, sampling objective, management response, location, and methodology (for more detale see figure 1 above).

2.3. Field equipments, used in the field or office for plant monitoring and assessment

The plant monitors and assessors before action in the field should have prepared all standard field equipment, neccesary for a seccesfull monitoring process.

The main equipments used in the field includes:

- ✓ Field notebooks and data sheets
- ✓ Recorded sheets, from privious monitorings in case of permanent plots
- ✓ Determination keys of Albanian flora books
- ✓ Hiking shoes
- ✓ Herbariums and plant presses
- ✓ Digital camera
- ✓ Tapes in a variety of lengths, increments, materials, and cases. At least one tape that is a minimum of 100m long is recommended
- ✓ Clipboards
- ✓ Clinometers. They measure slope, heights, and vertical angles
- ✓ Electronic Distance Measurer (EDM). An EDM is a survey tool that reads distance and direction between stations, and records the values electronically
- ✓ Electronic data recorders (tape recorders, portable computers and field data-loggers)
- ✓ GPS
- ✓ Satellite or aerial photographs of the sites
- ✓ Big nail, metal pens or metal detector
- ✓ Local topographic or Google earth maps
- ✓ Small shovel for digging plant material
- ✓ Pocket knife
- ✓ Paint and flagging
- ✓ Hand magnifier
- ✓ Plastic mounts
- ✓ Drone
- ✓ Other instruments that can serve for measurement of ecological parmeters
- ✓ Office equipments for data analyses like PC, Laptop, softwear for data proccesing ect.

3. Methodology of Plant Monitoring and Assessment

The plant monitoring, generaly is based on periodic observations and surveys of the plant communities and floristic composition using transects along species habitat. “Transect” means “cut across”. The transects are two types: Line transect which is a long piece (or linear plot) of ground with parameters 1 wide x 10 m long that is placed along transect regularly or randomly and a belt transect that is a series of quadrats (square plots) that are placed along transect regularly or randomly and the plant species in each quadrat or linear plot identified and their abundance recorded[21] (fig. 2. A and B).
The length of transect varies depending on the monitored objectives and the number of subpopulations or localities. A single small local population with few individuals (local scale), means a short transect within a given locality, whereas to many large populations with wide distribution range of a species, require landscape scale transects. Determination of the length of a transect is important becouse from the transect length depending the monitoring design, cost and the time of its realisation. Generaly, the landscape transects scale are guided by management considerations and priorities and limited by resources available for monitoring. This type of transects involve in the monitoring all known populations of the species, populations on national or transnational boundaries, populations within a vegetation type or in different habitat types as well as populations with a specific management treatment (e.g., grazed populations).

During practicall actions in the field a combination of permanent plots (quadrats) with line transect is rekommended, depend on the objectives of monitoring. Along the transect, monitoring staff records all the ecological data that they observe. The recorded data can be qualitative and quantitative. The quantity values or numerical values to be known during the monitoring includes the recording of presence/absence, number of individuals (abundance) or mature individuals, population size, coverage, volume and weight (dominance), collectivity (sociality) and distribution, incidence (frequency), degree of permanence (constancy), life forms and their representation in percentages, quantitative information about the severity, duration and scope of threats and their interaction with the life history traits that determine the species'
susceptibility to these threats etc. The qualitative data includes evaluation of stratification (floor formation)/substrate, dry matter, aspect, viability, qualitative information about the dispersal ability, habitat specificity, habitat loss and landscape patterns etc.

Some of these properties can be established during vegetation surveys on field research or in large scale by analysing of satellite images or orthophotos. Nevertheless, to produce a real image that will reflect the constancy of and connections among the species inside the monitoring plots or plant community, it will be necessary to make comparisons with other stands within the same community (figure 3), or with other related communities, where we use the so-called synthetic estimates. In this case, a combination between permanent plots and line transect methods for site monitoring, is necessary (figure 3).

[21]Reiss, M. & Chapman, J. (2000): Environmental Biology, Cambridge University Press. 100 p.

Line Transect method (see figure 3) can be used for recording of vegetation data in different parts of ecosystems. A quadrat (plot) is placed according to the same randomization procedure as for the areal features. The size and the number of linear plots along the line transect vary according to the habitat types, changes on vegetation or plant communities along it. In species-poor or uniform habitats a small number of plots will be sufficient. In case of multiple plots, they are placed in each linear transect according to the appropriate rules (Bunce *et al*., 2011)[22]. The size of linear plots in a line transect is 1 x 10 m as shown in figure 3, whereas the number of plots can be taken in each 50 or 100 m altitude, depending of the changes on vegetation and habitat types. However, quadrats or plots cannot overlap each-other in one transect. The random transects is repided for each subpopolation or in different habitat types and different areas.

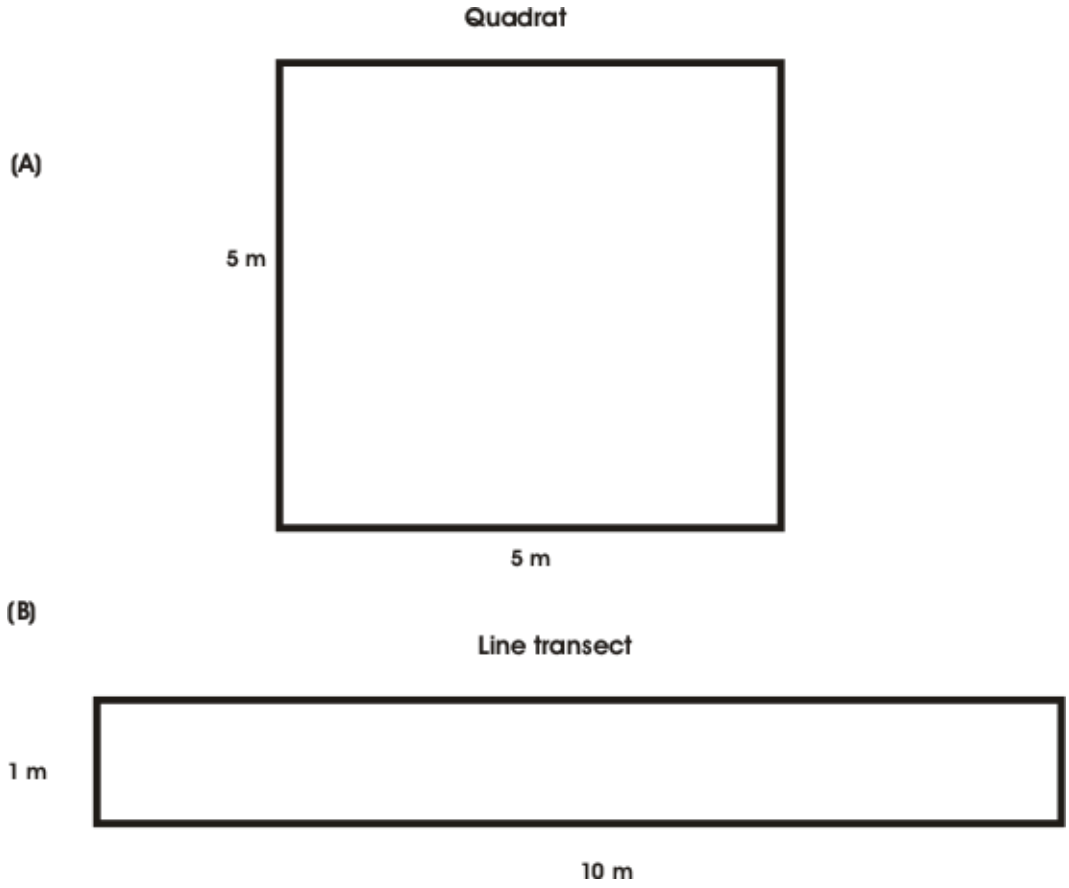

Figure 2. *Quadrat (A) and linear plot (B) that is placed along transect regularly or randomly for floristic and vegetation monitoring*

A permanent quadrat serves as a sampling unit with a known area dependent on the habitat type and the flora and vegetation that can be examined. For example, the sizes of vegetation quadrat for grasslands are quadrates with surface 5 m x 5 m (fig. 2-A and 4). Larger quadrats are needed for heathlands and woodlands, for example 10 x 10 m (figure 3) or more (20 m x 20 m/ 100 m x 100 m).

[22]Bunce R.G.H., Roche, P., Bogers, M.M.B., Walczak, M., de Blust, G., Geijzendorffer, I.R., van den Borre, J. (2010): Handbook for Surveillance and Monitoring of Habitats, Vegetation and Selected Species, 102 p.

The details for all recorded elements over time within habitat and the plot are presented in the template and the sheets (Tabels 4 & 5). The sheets contain also other details, for example, the litter and species composition.

Field action: The main instrument that is used in the transect is GPS. During walking in line transect, can be switched on in order to record a track along the line transect and the central coordinates for which linear plots or permanent ones. Transect can be chosen in order to cover all altitudinal levels of the forest or grasslands and reach all parts of the selected site (see fig. 3). In order to describe the vegetation cover and species composition in the selected sites for a long time, the centre of permanent plots can marked with a fixed iron nail. The observations of plant communities can be estimated with the method of Braun-Blanquet[23] using the simplified scale (see tables 1-3). Along the tracks, the observations on the phenology and growth height of the selected species at the point of time can recorded too.

The monitoring includes floristic composition, record of threatened species and determination and description of Habitat Types, its present states and trends, invasive species, natyralneess of ecosystem ect. One important key of element of the monitoring is the potential for the detection and evaluation of flows within and between habitats and plots.

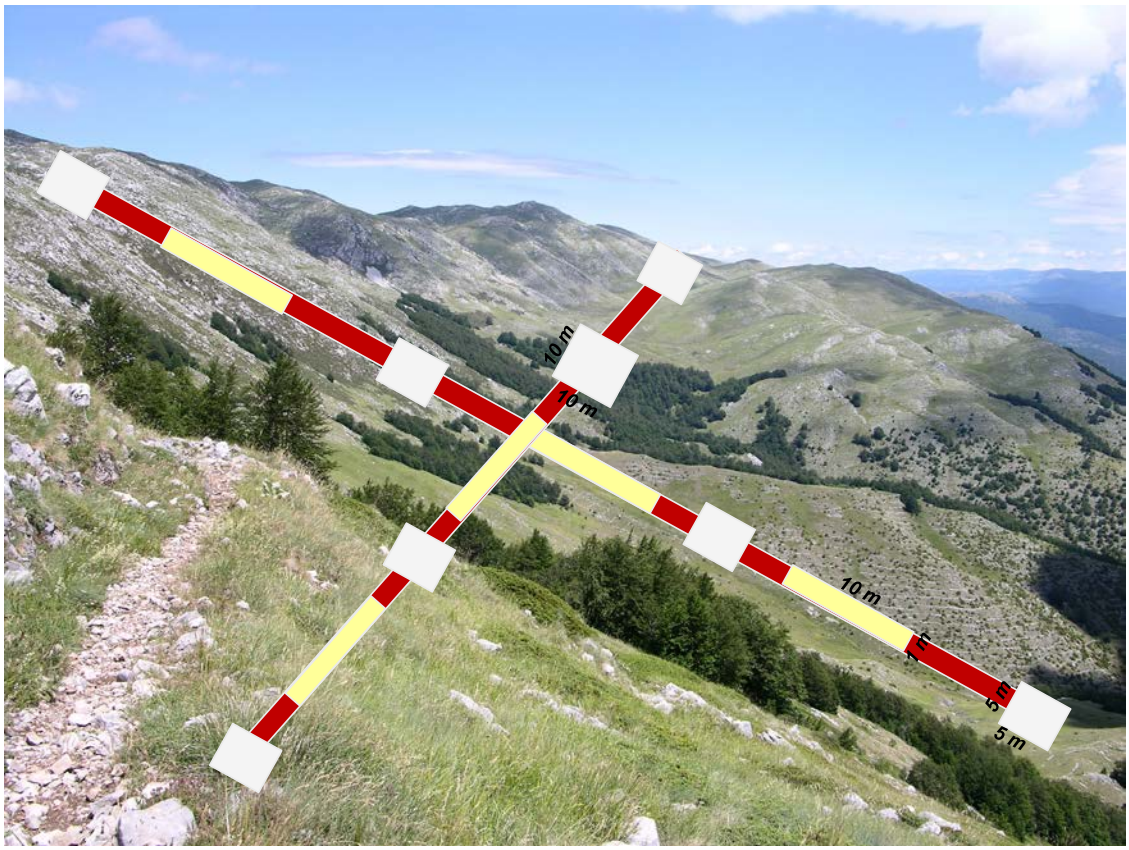

Figure 3. *The monitoring of floristic and vegetation composition using large scale transect in subalpine and alpine pastures*

[23]Braun Blanquet J. (1964). *Grundzüge der Vegetationkunde*. Springer, Wien.

3.1. Monitoring protocol for plant diversity

During monitoring survey, a long transect, the selected area and plots should be as homogenous as possible and the most relevant data should be entered – survey number, date, site, elevation, exposure, inclination, growth and coverage, plant cover height, stratification, geological affiliation and petrographic composition, soil depth, size of area explored, approximate size of total stand, etc. Also, there should be an indication of human and animal impact on the plant cover (e.g. whether the cutting woods, burned, or, in case of grasslands, whether or not there has been grazing, mowing, etc.). In the following we will explain the most important properties and how they can be estimated in a line transect or quadrats.

Localization of the permanent plots or quadrats allowed us to measure the abundance of plant species. The simplest measure for this purpose is species frequency. The species frequency equals the percentage of plots in which one species were recorded. If a species, for example *Allium albanicum*, is recorded in two plots from ten plots of the all transect, his frequency is 20 %. Other quantitative data, neccesary for species assessment that contributes in the evaluation of the dynamics of species population is the **density of individuals or the mature individuals**. The species density is the average number of individuals of this species per unit area. For example, if the number of Cvijici's Saffron (*Crocus cvijicii*) in ten plots of transect is 270, his density is given by:

270 : (10 plots x 5 m x 5 m) = 1. 08 m (1)

…or one species per square metre.
The number of individuals (in case of routinely monitoring of biodiversity) can be recorded by using the Braun-Blanquet scale, which has 5 values, represented in Arabic numerals 1-5 (tab. 1):

Table 1. *Estimation of **number of individuals** using of Braun-Blanquet scale*

Value	Species occurrence
1	the species is very rare
2	the species is rare
3	the species is not frequent
4	the species is frequent
5	massive occurrence of the species

The measuring of species density and abundance of the herbaceous plants is often difficult to estimate because one species can be in different vegetation or flowering phase in the time of recording. In this case better is to determine the **percentage cover**, which means the percentage of each plot covered by each species.

The coverage of a species can be best calculated by means of a vertical projection of the plants over ground parts, upon the ground area. The more appropriate manner for assessing the **percentage cover** of vegetation is the Braun-Blanquet scale (table 2), which determine coverage as follows: 1 the species covers 1-5%; 2 the species covers 6-25%; 3 the species covers 26-50%; 4 the species covers 51-75 %; 5 the species covers 76-100%.
The coverage of species in some plant communities undergoes significant changes in the course of a year, depending from the litter and precipitation or the temperature variations.

Dominance – these differ among individual species. One species of a plant community may be represented in a great number of units, which may be densely distributed, but still they may not cover a large area (e.g. species of the genus *Centaurea*, *Solenanthus*, *Oxytropis*). A *combined estimate of the number of individuals and their coverage* is used for vegetation research. The establishment of the value of the number of units in a quadrat, their density and coverage, for each particular taxon, is an arduous, long-lasting methodological procedure, which is why Braun-Blanquet introduces the so-called combined estimate (see table 1-3).

Table 2. *Estimation of **percentage covers** by using of Braun-Blanquet scale*

Cover (%)	Braun-Blanquet scale
< 1	+
1-5	1
6-25	2
26-50	3
51-75	4
76-100	5

The other important ecological measurements that can be recorded in the field is **presence and permanence (constancy)** – that allows us to assessing for establishing the presence of each individual species within the community.

Furthermore, the plots should be pure, i.e. no alien elements should be present. Braun-Blanquet gives the following table regarding the degree of presence:

Table 3. *Estimation of **degree of presence** in quadrat*

Degree of presence	Percentage of species occurrence in areas surveyed
I	0-20%
II	20-40%
III	40-60%
IV	60-80%
V	80-100%

To establish the degree of presence, conducting 10 surveys of well-developed plots will be sufficient, but certainly, the higher number of surveys gives better results.

Collectivity (sociality) – the term collectivity is used for the phenomenon among plants to occur either as solitary units, or form groups (clusters, tussocks), pads, or form large groups.
Many plants will retain their original appearance in all circumstances, whereas a considerable number, depending on the living conditions, change significantly their mode of growing. Therefore, it is important to determine the collectivity (sociality) of each individual species. Thus, for example, the high-mountain thicket *Bruckenthalia spiculifolia* develops in small pads, but it will frequently form large groups which, in the course of the blooming phase, even define the physiognomy of vast areas. The same goes for the whortleberry *Vaccinium myrtilus*, which exhibits significant variability in terms of its level of sociality.

In relation to vegetation analysis, along with coverage, Braun- Blanquet also gives ***sociality values***, as follows: 1 is an indication of a plant occurring as solitary individual units, 2 stands for plants growing in small tussocks, 3 for plants in small pads, 4 small groups, and 5 represents plants in large groups. With regard to this type of research, next to the figure indicating numbers and coverage, as part of the combined estimate, another figure is entered to indicate collectivity, and the two figures are separated by a dot. Thence, if the table contains 1.1, it means that the plant occurs abundantly in the stand, but as solitary individual units. If 3.2 are entered, it will mean that the plant's coverage is 25-50% and that it grows in small tussocks. In case we have 5.5, the plant covers more than 75% and grows in large groups.

The using and application of the ecological measurements as **collectivity**, **dominance** or combined estimate in the field is a difficult process and it can be done only by phytosociologists.

Recording sheets or Vegetation tables – A prerequisite tool for recording plant species or plant communities are the recording sheets and vegetation tables. The recording sheet and vegetation table is as important to characterize all contents of the quadrate or permanent plot as far as an association as the diagnostic description is to an individual plant species.

A table elaborated in detail constitutes a baseline, and it is only then that one can draw correct conclusions about the composition of the plots or plant communities, their systematic affiliation, systematic relationship, as well as their importance in the plant cover of an area. The community should be presented in such a way that it can be recognized easily, since it will not only be used for theoretical considerations, but it also has its own a practical value.
In order to create a table, it is necessary to study quite a number of stands. The table 4 shows the most important general data for every vegetation survey, collected in the course of the survey, such as the date, site, ecological properties of the habitation, the size of the area surveyed, elevation, etc.

The sheet or vegetation table contains also the inventory of species, with values of the numbers, coverage and collectivity (sociality) for every individual species, arranged according to some principle. In the template 4, are given the most properties that are recorded in a quadrat for the monitored site of Dry Mountain.

3.2. Monitoring protocol for threatened and strictly endemic species

The monitoring protocol of threatened and strictly endemic species depends on the population size and the sampling units that can be individual plants or they may be quadrats (plots), points, or transects. The *sample* is simply part of the population, a subset of the total possible number of sampling units (see figure 2). The protocol should be adapted based on the target/threshold objectives and change from sample-based monitoring to monitoring based on a qualitative technique or a complete census. Threatened species and strictly endemic species with more than 3-subpopulation and wide distribution range can envolve using data that are recorded from **landscape scale transects** (described in 3.1, figure 3) or **local scale transect** by sampling of random selection process in combination with data gathered with complete census of threatened species that have less than 3-subpopulations (figure 4) with narrow distribution range.

The census (or the direct counting of population size with a limited number of mature individuals) or local scale monitoring, means selection one or few subpopulations in few localities, not randomly from the all known subpopulations of a species. or all subpopullations of a species that

occurs only in one or two subpopullations with narrow range of distribution. This type of monitoring can be applyed when the monitoring resources are limited and when the population or populations of species have a very narrow distribution range.

Table 4. *Recording sheets used in monitored quadrats*

Area No	Area type	Area Code:	Area Name	State Code	State_ type	Component
			Mali i Thatë	**Al**	Biodiv ersity	
GPS N	E	Altitude m	Size of plot	Geographical Name		
40 54.746	20 51.489	1750 m	5 x 5 m	East of borderpoint No 10		
Observ er	XXXXXXX		Date	8.7.2011		
Trees: 0 %; Scrubs 5 %; Semi scrubs 0 %; Grass 35 %; Stone 60 %; Litter 10 %						
Ownership: NP; Limestone substrate						
Habitat Code: 6210 Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) (* important orchid sites).						

Nr.	Species	Co ver	Phenophase	High cm	Remarks
1	*Morina persica*	2	Flowering	10-50	The plots were taken in a semy-flat limestone pasture. In the plot there are 5-mature individuals of *Oxytropis dinarica* (Murb.) Wettst. subsp. *weberi* Chrtek & Chrtková and one mature individual of *Chamaecytisus pseudojankae* Pifkó et Barina. The plot is heavy grazed and eroded
2	*Sesleria caerulans*	3	Before flowering	40	
3	*Thymus cherlerioides*	2	Flowering	5	
4	*Scabiosa ochroleuca*	+	Before flowering	30-60	
5	*Helianthemum canum*	1	Fruiting	10	
6	*Leontodon hispidus*	+	Fruiting	20	
7	*Oxytropis dinarica* (Murb.) Wettst. subsp. *weberi* Chrtek & Chrtková	1	Fruiting	10	
8	*Chamaecytisus pseudojankae* Pifkó et Barina	+	Fruiting	20	
9	*Carduus acanthoides L.*	r	Fruiting	10	
10	*Vincetoxicum hirundinaria*	r	Flowering	10	
11	*Thymus* sp.	+	End of flowering	10	
12	*Festuca hercegovinica*	+	Flowering	20	
13	*Trinia glauca*	+	Fruiting	20	
14	*Anthyllis vulneraria*	+	Flowering	20	
15	*Juniperus communis*	r	Fruiting	40	
16	*Scorzonera hispanica L*	+	End of flowering	40	

17	*Avenula praeusta*	1	Fruiting	60	
18	*Achillea* sp.	+	New sprout	40	

The selection of subpopulations ore population, over others should be done based on some criteria such as previous information, ease of access, degree of threat or lack of it, low noumber of mature individiuals, and inclusion in a special management area such are data gathered without using some type of random sampling procedure. According to Elzinga et al. (2011)[24], the fact that statistics cannot be applied to nonrandom sampling procedures makes proper analysis and interpretation of the data virtually impossible; this should reinforce the need to use a random sampling procedure in designing and implementing monitoring.

The census or direct counting of mature individuals should be estimante in each monitoring period, and when the changes are observed; the only interpretation required is determining whether the change observed is biologically significant.

In Albania there are several endemics that have subpopulations with less than 500 mature individuals per subpopulations. In this case, the census is recomended, by free walking and counting all individuals of the species in the field, using also photos, orthophotos or drone images (figura 5).

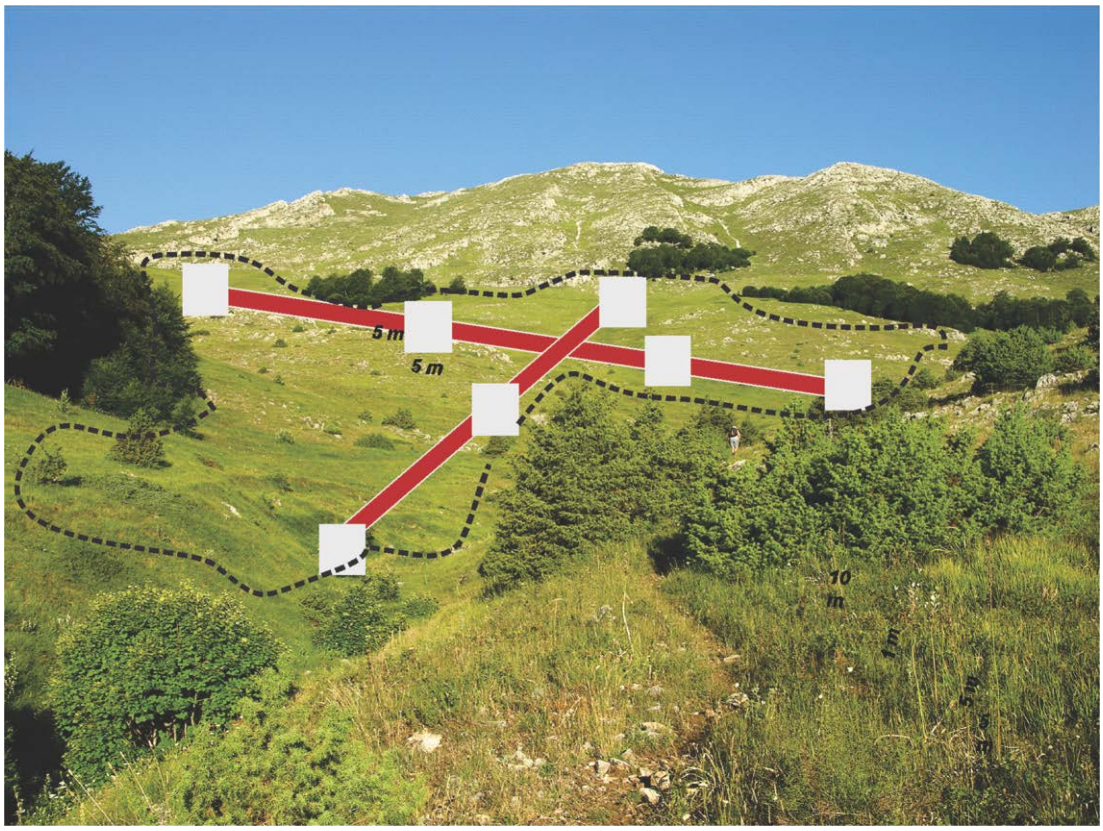

Figure 4. *The monitoring of single population using local scale transect method in alpine grasslands*

[24]Elzinga L. C, Salzer W. D, Willoughby W. J. Measuring & monitoring plant populations.

The best indicator species of the health of Habitat types or ecosystems than can be monitored through landscape scale transects (described in 3.1, figure 3) are all species of Annex II, IV and V, protected from Habitat Directive[25]. Since we have not a clear panorama about the indicator plant species, endemics and threatened plant species with narrow distribution range will serve as indicators, because they play an important role in the health and future of the ecosystems.
The possible potential indicator species which must be the target of monitoring through local scale transect or census include the strictly endemics, threatened and endangered species of Globally, Mediterranean concern, or of threatened species that have less than 3-subpopulations or all the species with few than 3-subpopulations, included in the section 1.3. The collection of existing data for the knower sites can provide enough information for the preliminary identification and field observation, too. A good source for the identification of the threatened and endangered species in the monitoring sites is also the National Red List of Flora and Fauna, published each 5-years from the MoTE.

Figure 5. *The monitoring of population of Centaurea soskae, mature individuals (dashed line) and non-mature individuals (undashed line), using Drone images in a rocky slope face*

The monitoring target as indicator species are also all the endemic species of the country, which are not assessed for the lists mentioned above.

During monitoring of threatened or strictly endemic species in the field or before that, in addition to the data described in Table 4, the monitoring staff record or collect also data about the target species and its habitat as they are summarised in the Table 5.

[25]Directive 92/43/EEC (1992): Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora. European Treaty Series, Nr. 104: pp. 14-80.

The documentation of individual indicator species includes quantitative data on population size, area of occupancy, extent of occurrence or number of locations, etc., all of which are used to determine the threatened status of indicator or monitored species.

3.3. Monitoring of plant diversity in ecosystems and habitats

All ecological measurements should be performed across an accurately defined area, which can be with a surface 10 m x 10 m or rare larger (20 m x 20 m) in case of forests with big and higher trees. The quadrats in transect should be taken into the centre of the line of transect in order to provide the uniformity of sites and avoid edge effects or paths as much as possible.

Table 5. Recording sheets used in monitorin of Plant Species

a). Species Biology
- life history (annual, perennial)
- reproductive ecology
- non-reproductive adults
- pollinators
- flowering period
- annual variability in flowering
- seed maturation period
- seed viability
- seedling ecology if is possible
- germination requirements
b). Population
- population size (range, average)
- annual variation
- number and distribution of populations
c). Associeted species cover
Estimation of **percentage covers** of associated species follow the Braun-Blanquet scale (1-5 scale). The associated species list includes all species recognizable during survey period with cover of over 10% and any weedy species.
d). Habitat
- gemorphology of substrate
- soil
- annual precipitations (if is knower)
- annual temperatures and summer temperatures
- snow cover
- elevation
- aspect (exsposition)
- slope
- moisture
- biotic features
- community
- potential importance of competition
- animal use
- insects
- natural disturbance
- fire
- slope movement
- small scale (e.g., animal diggings)
e). Threats
- natural
- herbivory
- disease
- predators
- succession
- weed invasion
- anthropogenic impact
- on-site (grazing, logging, etc.)
- off-site (changes in hydrology, pollinators)
f). Trend (of speciespopulation and habitat)
g). Causes of Trend (of species population and habitat types)
h). Management Options

The monitoring of large forest or grasslands, often require application of a large-scale monitoring, using Drone or Satellite images, the methodology include a preparatory work which begin with

randomly selection of small quadrats with surface 10 m x 10 m within large quadrates (1 km x 1 km), taken from air. Several small quadrats within the big ones (1 km x 1 km), based on the randomize selection, are checked in the field in order to estimate their accuracy compared with areal photographs or satellite images (Fig. 6). The position of the vegetation quadrats should be located by GPS and marked on the map. The depth of colors in areal photographs or satellite images can be justified with layers of different herbaceous, scrubby or woody plants present in a quadrat.

The best protocol in large-scale monitoring is the EBONE (Bunce *et al*., 2010)[26] protocol. This protocol requires identification of species in the forest quadrats, after recording of the herbaceous species, the woody species can be recorded by layers, beginning with dwarf-shrubs up to forest trees (Table 6). After recording of each present species, the coverage should be estimated for each of recorded species, using 5 % cover categories. Total cover may be 100 % if several layers are present for example *Pinus nigra* 100% over *Erica herbacea* 30 %. Species with less than 5 % cover (for example *Galanthus nivalis* 2 %) are given a nominal cover of 1 %. Bare ground includes also leaf litter and the rocky or gravelly cover must be recorded too.

Furthermore, the quantitative and qualitative estimation of forested habitats, meadows, and pastures, needs to combined with Braun-Blanquet estimations of the numbers, coverage and sociality which are explained above (see Tables 1,2,3).

Table 6. *The recording of layers in the selected sites for monitoring in the forest*

Name of the layer	Number of the layer	Height values
Tree layer 1	1	above 15 m
Tree layer 2	2	5-15 m
Shrub layer 1	3	2-5 m
Shrub layer 2	4	0.6-2 m
Dwarf shrub layer 1	5	0.3-0.6 m
Dwarf shrub layer 2	6	up to 0.3 m

Identification of habitat typess in the forests requires also the information about the indicator woody or herbaceous species and **documenting** the coverage of each one and collectivity, which are developed in the previous section (see sections 3.1 & 3.2). Reference to the phenological condition, new springs or the dead woods, invasive species, the litter or the ecological condition for the monitored site can be recorded during the surveys too. Photographs of indicator species and the quadrates during the survey can be recorded for illustrations and office analyses by using the specific software to evaluate both the vegetation cover and its floristic composition.

However, it is not sufficient just to identify the species and lower taxa constituting such a plant community, but it is also required for their numerical values to be known – **their numbers**, **dominance**, **collectivity** (sociality), **degree of permanence** (constancy), **stratification**, **life forms** and their **representation in percentages**, etc. Most of these properties can be established during field research of the stands of a particular plant community, while conducting vegetation surveys,

[26]Bunce R.G.H., Roche, P., Bogers, M.M.B., Walczak, M., de Blust, G., Geijzendorffer, I.R., van den Borre, J. (2010): Handbook for Surveillance and Monitoring of Habitats, Vegetation and Selected Species, 102 p.

where they represent the *analytical estimates*. Nevertheless, to produce an actual image that will reflect the constancy of and connections among the species inside a particular plant community, it will be necessary to make comparisons with other stands within the same community, or with other related communities, where we use the so-called *synthetic estimates*.

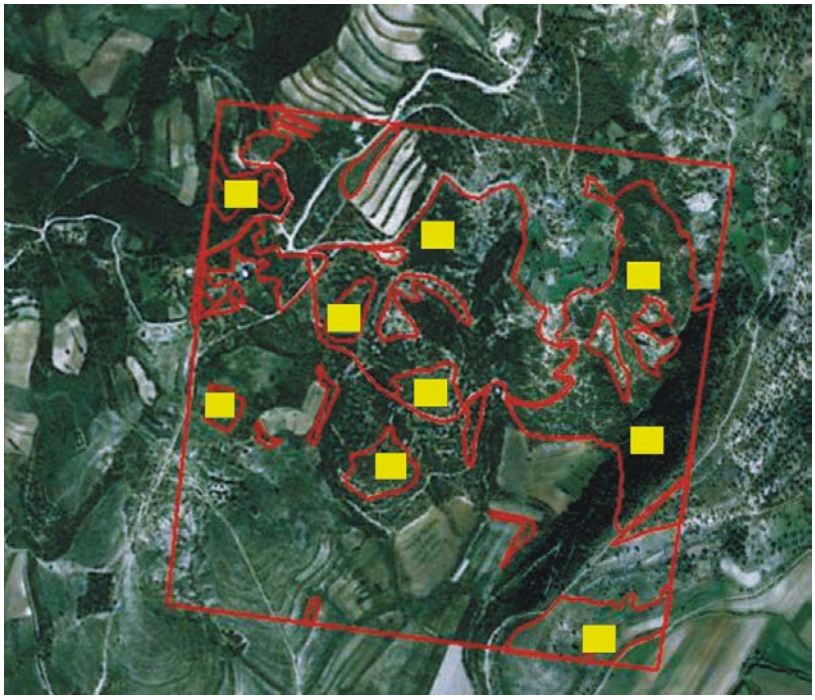

Figure 6. *Scheme of largescale monitoring, using quadrat (1 km x 1 km) taken from areal photographs or satellite images, and small quadrats with surface 10 m x 10 m (yellow) that are selected randomly within the large quadrat* (by Bunce et al., 2010)

Identification of dominant plants, plant communities and the substrate geomorphology during field observations is the baseline for determination of **Habitat types** in the ecosystem and species territory. The list of Habiat types is given by Habitat directive (Council Directive 92/43/EEC of 21 May, 1992 on the conservation of natural habitats and of wild fauna and flora and Resolution No. 4) and in the Interpretation Manual of European Union Habitats (2013)[27]. The monitoring includes determination and description of **Habitat Type**, its present states and trends. One of the key elements of this approach is the potential for the detection and evaluation of flows within and between habitats.

The recording and monitoring of single species of meadows and alpine pastures follows the same methodology used for the threatened species (see sec. 3.2). Species which are target for the monitoring in meadows and alpine pastures are species of the Habitat Directive (Council Directive 92/43/EEC of 21 May 1992)[28] or Bern Convention (1979)[29].

[27] https://ec.europa.eu/environment/nature/legislation/habitatsdirective/docs/Int_Manual_EU28.pdf

[28] https://ec.europa.eu/environment/nature/legislation/habitatsdirective/index_en.htm

[29] https://www.coe.int/en/web/bern-convention

Vegetation surveys over such areas should be large enough to encompass all the species of the quadrats along transects (see figure 3). All the indicator species found outside the surveyed quadrats must be entered in separate recording sheet. The recording in the meadows and pastures must assess and the degree of invaded quadrats from invasive species, if they are present.

The Monitoring of the biodiversity of higher plants should be done **each 3 years or 5 years**, dependent on the scale of threats that poses habitats and plant species in the selected sites.

4. Assessment of conservation status for a taxon

The methodology for assessment of conservation status of threatened and strictly endemic species was based in the "Guidelines for Using the IUCN Red List Categories and Criteria"[30] of IUCN.

Apart the group-species of the section 1.3, the target species of monitoring can be also all species that are included in the threatened categories (CR, EN and VU) (figure 7) at
national or global level, after an assessment process according to the Guidelines for Using the IUCN Red List Categories and Criteria. Threatened species can be selected from the current Red lists of Flora and Fauna of Albania[31] or threatened species of IUCN[32] and the "National Red Lists for Species Conservation in Macedonia"[33], in case of monitoring and assessment of transbaoundary species. Despite of that, the target of monitoring and assessment of conservation status can be and the species of categories NT or reassessment of the species that are evaluated as DD, depends from their extinction risk and budget.

The guideline for assessment of conservation status, explanations the quantitative and quantitative properties used to assess the species based on the criteria of IUCN (2019)[34]. The IUCN guidelines explains how the criteria should be applied to determine whether a taxon belongs in a category of threat, and gives examples from different taxonomic groups to illustrate the application of the criteria. The section 2.1 of this manual, also provide detailed explanations of the definitions of the many terms used in the criteria.

The assessment of conservation status for a taxon can applied at national or regional levels and it must be recognized that a global category may not be the same as a national or regional category for a particular taxon. For example, taxa assessed as LC (Least Concern) globally might be CR (Critically Endangered) within a geographical area or a country where numbers are very small or

[30]IUCN Standards and Petitions Committee. (2019). Guidelines for Using the IUCN Red List Categories and Criteria. Version 14. Prepared by the Standards and Petitions Committee. Downloadable from http://www.iucnredlist.org/documents/RedListGuidelines.pdf.

[31]Urdhër Nr. 1280, datë 18.12.2013 "Për miratimin e Listës së kuqe të Florës dhe Faunës së egër të Shqipërisë", miratuar nga Ministri i Mjedisit.

[32]www.iucnredlist.org

[33]IUCN ECARO (2018). National Red Lists for Species Conservation in Macedonia: setting the stage. IUCN Regional Office for Eastern Europe and Central Asia, Belgrade, Serbia. pi-viii + 1-53

[34]IUCN Standards and Petitions Committee. (2019). Guidelines for Using the IUCN Red List Categories and Criteria. Version 14. Prepared by the Standards and Petitions Committee.

declining, perhaps only because they are at the margins of their global range. On the other hand, taxa assessed as VU (Vulnerable) on the basis of their global declines in numbers or range might, within a geographical area or a country where their populations are stable, not even nearly meet the criteria for VU, i.e. be LC. Although this appears illogical, it is a result of the structure of the criteria. However, when an endemic or strictly endemic species of a country or a geographic region is classified as CR, it may retain this assessment globally when it is assessedaccording to the IUCN guidelines.

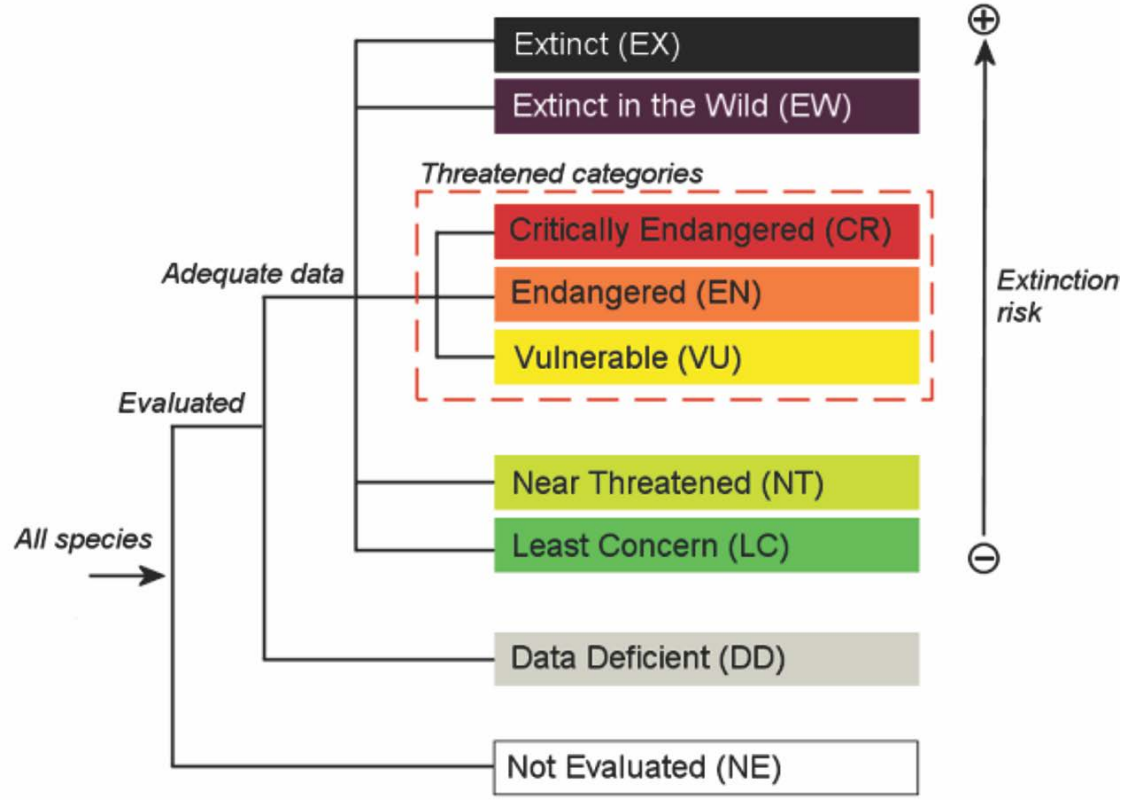

Figure 7. *Structure of the IUCN Red List Categorie* (by the IUCN Red List, 2019)

4.1. Categories and Criteria used in the Assessment of Conservation status

The final conservation status of a taxon can fulfill the classification within nine categories (figure 9). Two higher categories, ***Extinct*** and ***Extinct in the Wild,*** are reflections of non observations of a taxa in their habitat of occurrence during last efforts/monitorings. Extinct means that there is no reasonable doubt that the last individual are disappiered. Extinct in the Wild means that the taxon is extinct in its natural habitat, but it occur in the botanical gardens. The most important in conservation point of view are three categories, ***Critically Endangered, Endangered*** and ***Vulnerable***. The taxon that is assessed under this categories on the basis of quantitative criteria show the different threats that a taxon undergoes by directing it towards extinction or improvement of its current threatened status towords Near Threatened.

The category **Near Threatened** is applied to taxa that do not qualify as threatened now, and to taxa that do not currently meet the criteria for a threatened category. The category **Least Concern** is applied to taxa that do not qualify as threatened or Near Threatened. The "least concern" means that these taxa are of lesser concern than species in other higher categories.

The quantitative parameters of species conservation status are reflected in **five criteria** that are used to determine if a taxon is threatened or not, and if it is threatened, what is the category of threat it belongs in (Critically Endangered, Endangered or Vulnerable) (figure 8)[35].

The **five criteria** that indicate the present size of popolations, distribution, trends and their threats ect. used in determination of conservation status of a taxon are:

A. Population size reduction (past, present and/or projected)
B. Geographic range size, and fragmentation, few locations, decline orfluctuations
C. Small and declining population size and fragmentation, fluctuations, or few subpopulations
D. Very small population or very restricted distribution
E. Quantitative analysis of extinction risk (e.g., Population Viability Analysis)

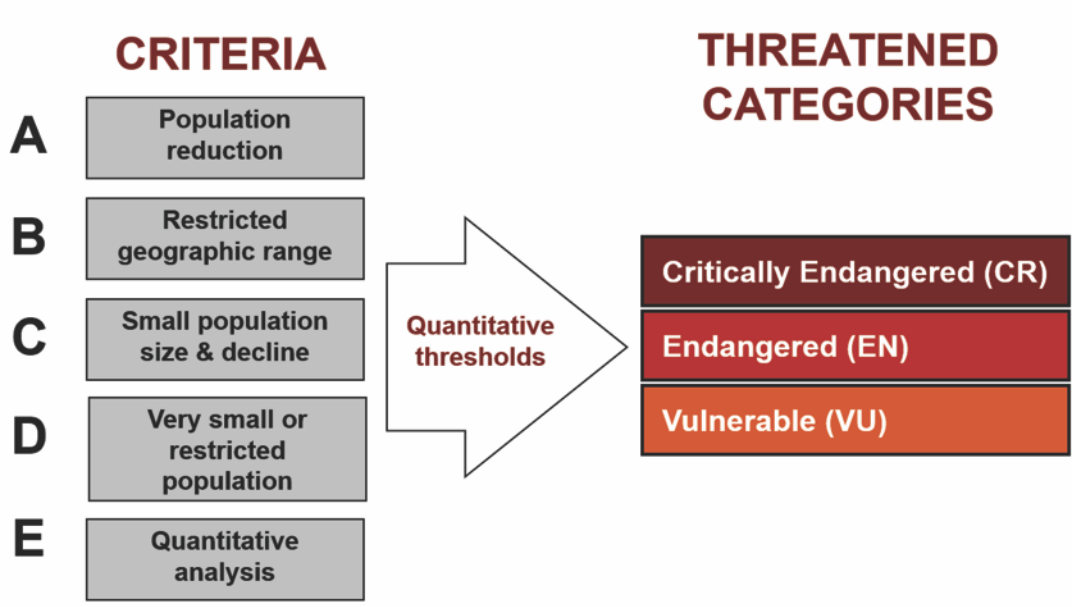

Figure 8. *Structure of Criteria and quantitative thresholds* (by the IUCN Red List, 2019)

The criteria **A, B** and **C** use also subcriteria to justify more specifically the listing of a taxon under a particular category. For example, a taxon listed as "Vulnerable C2a(ii)" has been placed in the Vulnerable category because ist population is fewer than 10,000 mature individuals (criterion C) and the population is undergoing a continuing decline and all its mature individuals are in one subpopulation (subcriterion a(ii) of criterion C2) (see figure 17).

In section 2.1 of this manual are explaned the meaning of most qualitative and quantitative terms and concepts used in monitoring and assessment process, whereas in the section 3.1, 3.2 & 3.3, there is methodology of plant monitoring, which help in determination of the indicators used in **Criteria** and **Subcriteria** for the evaluation of the species conservation status.

[35]IUCN Standards and Petitions Committee. (2019). Guidelines for Using the IUCN Red List Categories and Criteria. Version 14. Prepared by the Standards and Petitions Committee.

4.2. Evaluation of Spatial metrics, used in Criteria and subcriteria

Despit of above, in the previous sections, the determination methodology of some indicators of Criteria and subcriteria, or so colled **Spatial metrics**, such as Locality and number of locations, Area of occupancy (AOO) and Extent of occurrence (EOO) have not described. They measure different aspects of risk-spreading or insurance against spatially explicit threats. Therefore, all three measures should be estimated and assessed against the criteria where available data permit. Below were explened the meaning of this metrics in case of species conservation assessment and how we can get the best results from office processing of collected data during field observations.

Location: The term 'location' defines a geographically or ecologically distinct area in which a single threatening event can rapidly affect all individuals of the taxon present. The size of the location depends on the area covered by the threatening event and may include part of one or many subpopulations (figure 9). Where a taxon is affected by more than one threatening event, location should be defined by considering the most serious plausible threat (IUCN, 2019)[36].

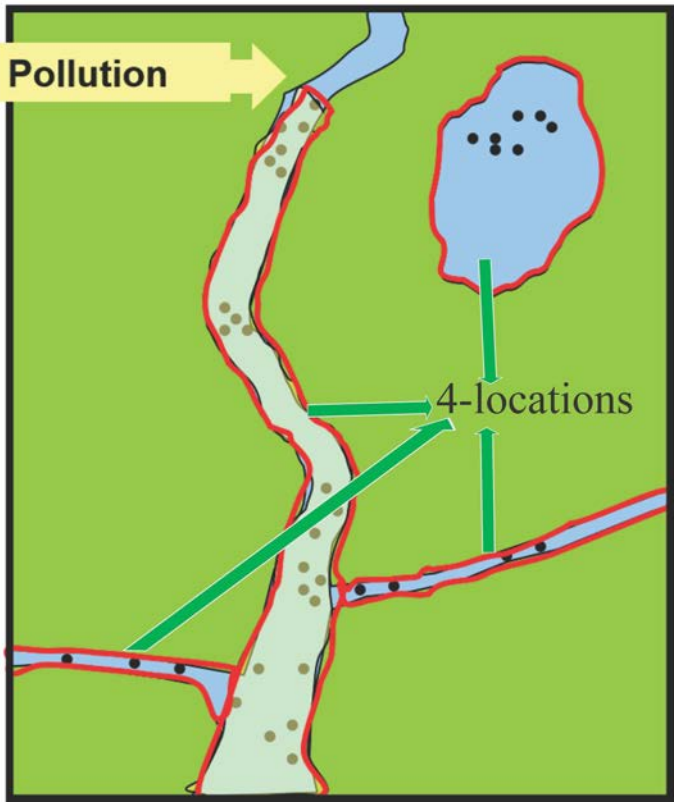

Figure 9. *Calculation of Number of Locations in polluted water ecosystem* (by IUCN, 2012)

[36]IUCN Standards and Petitions Committee. (2019). Guidelines for Using the IUCN Red List Categories and Criteria. Version 14. Prepared by the Standards and Petitions Committee.

In this way, the term **Location** and **number of locations** should not be confused with the geographical name **Locality** (e.g. where the most serious plausible threat is habitat loss that occurs gradually and cumulatively via many small-scale events, such as clearance of small areas for small-holder grazing or building, a location can be defined by the area over which the population will be eliminated or severely reduced within a single generation or three years, whichever is longer). If two or more subpopulations occur within an area that may be threatened by one such event, they must be counted as a single location (see fig. 9). Conversely, if a single subpopulation covers an area larger than may be affected by any single event, it must be counted as more than one location.

Extent of occurrence (EOO) and **Area of occupancy (AOO)** are also two most important metrics used in the Criteria A, B and D, sometimes with many difficulties to evaluate, particularly in large scale monitoring for assessment of species with wide distribution range and with many populations and subpopullations. The KEW staffs have prepared the web tool GeoCAT (Geospatial Conservation Assessment Tool) to facilitate the evaluation of data for semi-automated IUCN Red List assessment and analysis. Kew is a world-leading institution for plant species conservation assessments. GeoCAT has been developed to fill this gap and specifically provides a tool to harness primary biodiversity data for application of the IUCN Red List system for conservation assessments. This tool is freely available through the internet; conservationists will have ease of access to a quick, quantifiable and repeatable species conservation assessment tool without the overheads of a full GIS with its associated learning curve and costs.

AOO can be measured with the surface of quadrats with a surface 2 km x 2 km = 4 km^2 in which the species is present (see Figure 10b). The total surface of the quadrats in wich the species occurs makes the AOO for a given species. The EOO (Extent of occurrence) can often be measured by a minimum convex polygon (the smallest polygon in which no internal angle exceeds 180 degrees and which contains all the sites of occurrence)" (IUCN, 2019).

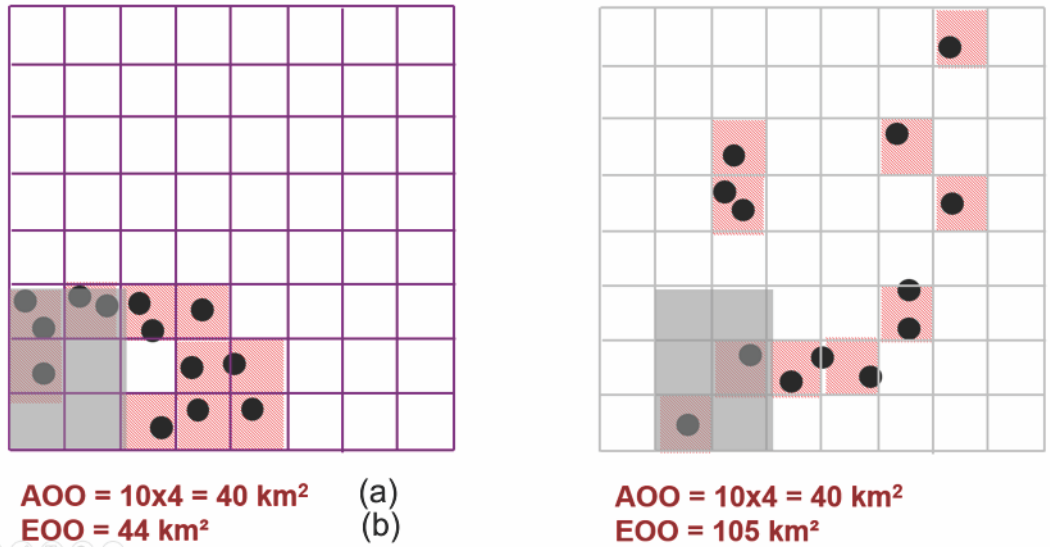

Figure 10. *The comparison of taxa with same AOO (a) but different EOO) (b), where a single threating event (gray area) is morer likely to impact the taxon withsmaller EOO* (by IUCN, 2012)

The GeoCAT (Geospatial Conservation Assessment Tool) can be accessed eaisely by the link: http://geocat.kew.org/. After opening the link, on the home page clik on the window "Start a new project" (see figure 11).

In the screen another “window” will appear that informe “Start your assessment by…”. This action should be performed if you have reserved data (AOO) from previous monitoring and to it should be added the current collected data (figure 12).

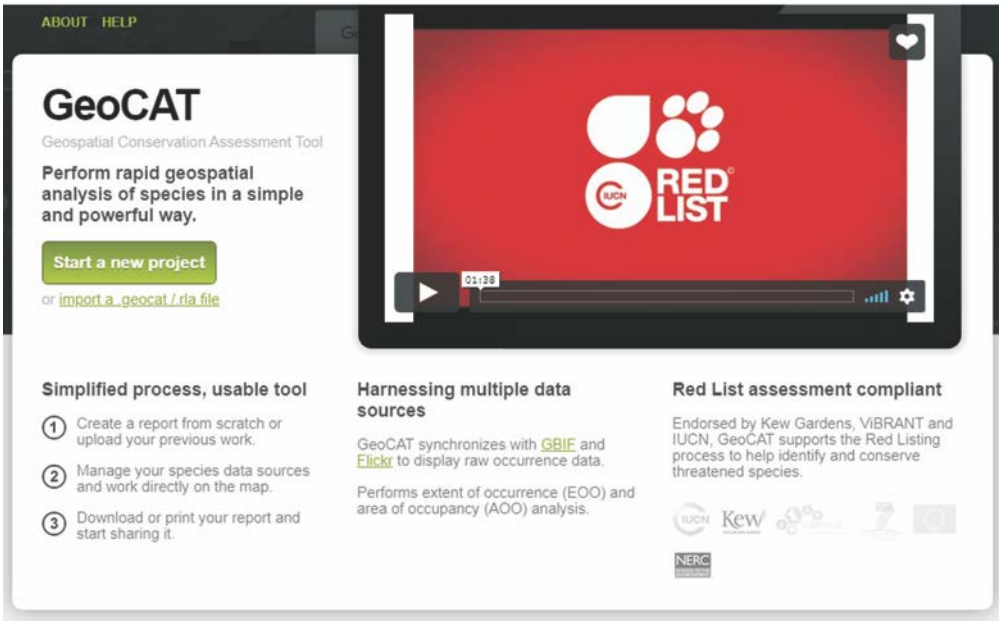

Figure 11. *The Home page of GeoCAT*

In case you are going to add the data, which was received for the first time (or currently), then the windows “Start your assessment by…” should closes. The world map in the current vew will appear (figure 13).

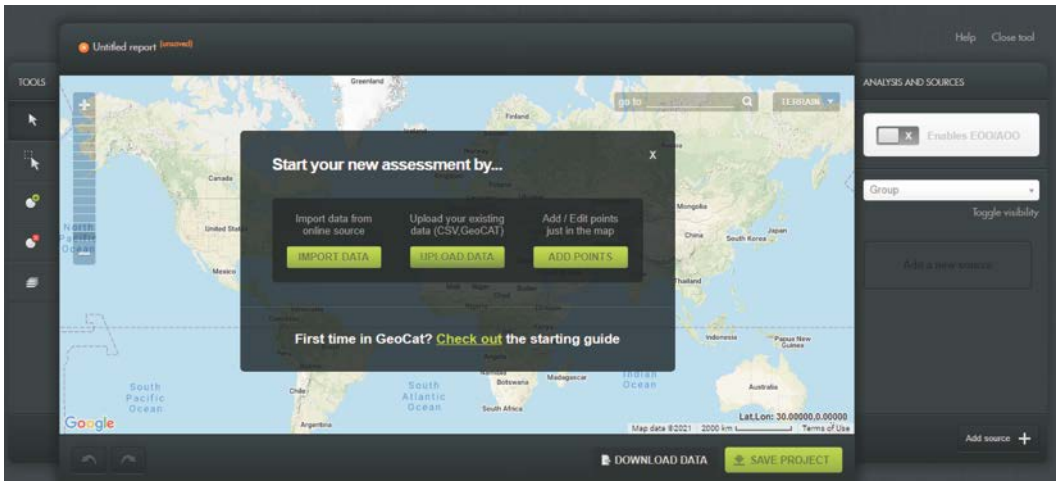

Figure 12. *The starting of the project on the base of privious data*

Through zooming process, we can go to the country or geographical area where the subpopulations and populations of the species have been observed. In our sample, the area Oher-Prespa crosborder area is zoomed in, where the coordinates of the species *Centaurea soskae* were observed in 4-localities (blue dots in the figure 14).

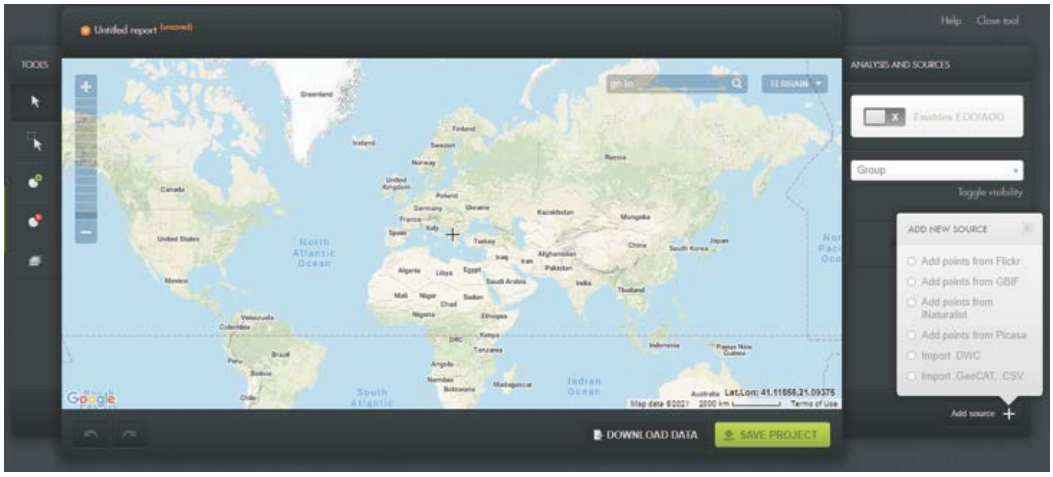

Figure 13. *The starting of the project on the base of data collected for the first time.*

Three subpopullations of the species occur in Albanian side of the area of the population distribution range and one of them were located in the North Macedonian side of Ohrid Lake.

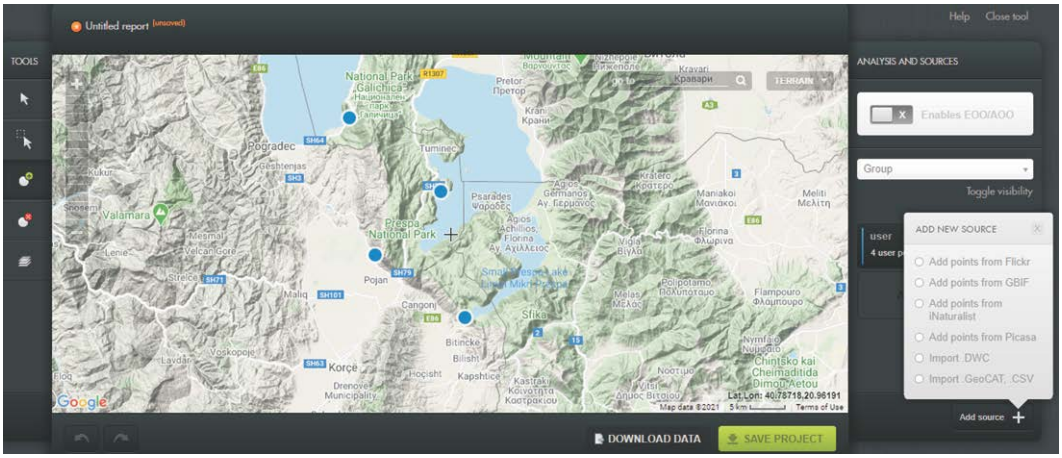

Figure 14. *The starting of the project on the base of data collected for the first time.*

Making this data valid by activititng the window “Enable AOO/EOO” the program automatically calculates the values of AOO (48 km^2) and EOO (218.867 km^2) for this specie (figure 15).

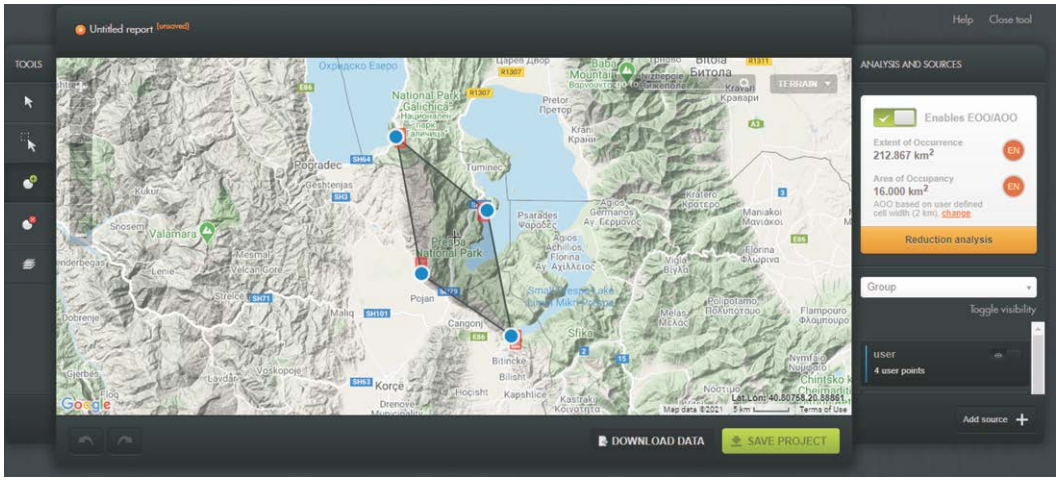

Figure 15. *The starting of the project on the base of data collected for the first time.*

The GeoCAT assessment tool for determination of AOO and EOO, should be used by filed monitoring officers because they are best knower of the geographical position of subpopulations in a zoomed map. Consequently the obtained result is more accuarate.

The data of AOO/EOO, obtained from the current monitoring can be **Download** as **CSV, KML** or **CIS** format, shown in the figure 16. The recomended format of storing is KML for using also in the next monitoring by **Import data, Upload data** or **Add points** (see figure 12) only the new data of the future monitorings.

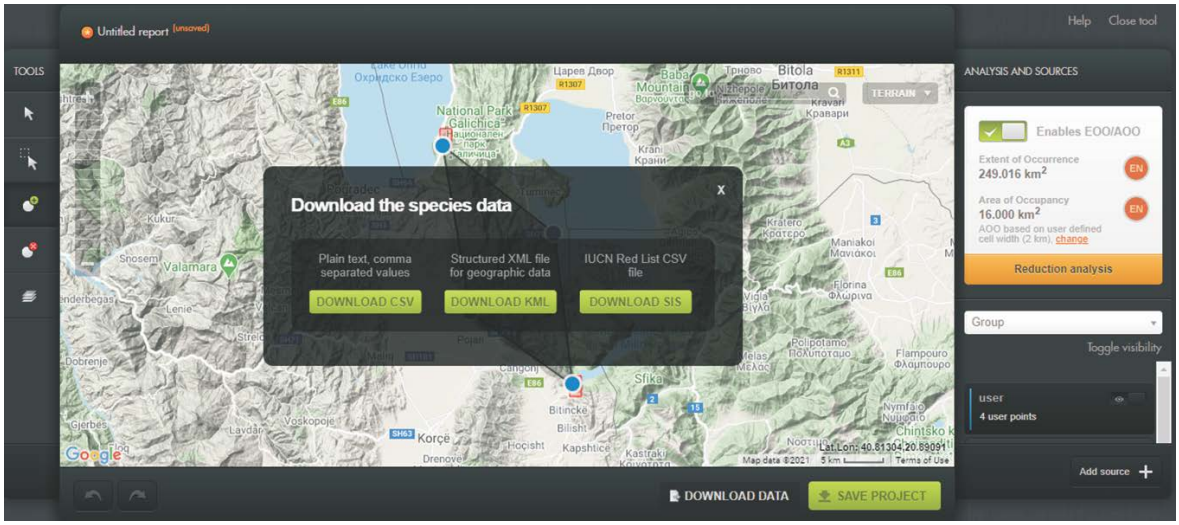

Figure 16. *The storage formats of data which are collected for the first time.*

4.3. Data analyses and assessment of conservation status, examples

All the data recorded during field monitoring in the section 3.1, (1), tabeles 1, 2 and 3 (page 17), are subject of data and statistical analyse for evaluation of Population/subpopulations, Population size, Mature individuals and Current Population Trend, used in five: Critera A, B, C, D and E and their subcriteria. The **average age of parents in the population** can be calculated based on the equation:

$$G = \sum x l_x m_x \Big/ \sum l_x m_x \quad (2)$$

where the summations are from age (x) 0 to the last age of reproduction; mx is (proportional to) the fecundity at age x; and lx is survivorship up to age x (i.e., $lx = S0 \cdot S1 \cdots Sx\text{-}1$ where S is annual survival rate, and $l0 = 1$ by definition). This formula is implemented in an associated spreadsheet file. To use this formula, follow the instructions in the Guidelines for Using the IUCN Red List Categories and Criteria[37]., (see also figure 17).

[37]IUCN Standards and Petitions Committee. (2019). Guidelines for Using the IUCN Red List Categories and Criteria. Version 14. Prepared by the Standards and Petitions Committee

A. Population size reduction. Population reduction (measured over the longer of 10 years or 3 generations) based on any of A1 to A4

	Critically Endangered	Endangered	Vulnerable
A1	≥ 90%	≥ 70%	≥ 50%
A2, A3 & A4	≥ 80%	≥ 50%	≥ 30%

A1 Population reduction observed, estimated, inferred, or suspected in the past where the causes of the reduction are clearly reversible AND understood AND have ceased.

A2 Population reduction observed, estimated, inferred, or suspected in the past where the causes of reduction may not have ceased OR may not be understood OR may not be reversible.

A3 Population reduction projected, inferred or suspected to be met in the future (up to a maximum of 100 years) *[(a) cannot be used for A3]*.

A4 An observed, estimated, inferred, projected or suspected population reduction where the time period must include both the past and the future (up to a max. of 100 years in future), and where the causes of reduction may not have ceased OR may not be understood OR may not be reversible.

based on any of the following:

(a) direct observation *[except A3]*

(b) an index of abundance appropriate to the taxon

(c) a decline in area of occupancy (AOO), extent of occurrence (EOO) and/or habitat quality

(d) actual or potential levels of exploitation

(e) effects of introduced taxa, hybridization, pathogens, pollutants, competitors or parasites.

B. Geographic range in the form of either B1 (extent of occurrence) AND/OR B2 (area of occupancy)

	Critically Endangered	Endangered	Vulnerable
B1. Extent of occurrence (EOO)	< 100 km²	< 5,000 km²	< 20,000 km²
B2. Area of occupancy (AOO)	< 10 km²	< 500 km²	< 2,000 km²
AND at least 2 of the following 3 conditions:			
(a) Severely fragmented **OR** Number of locations	= 1	≤ 5	≤ 10
(b) Continuing decline observed, estimated, inferred or projected in any of: **(i)** extent of occurrence; **(ii)** area of occupancy; **(iii)** area, extent and/or quality of habitat; **(iv)** number of locations or subpopulations; **(v)** number of mature individuals			
(c) Extreme fluctuations in any of: **(i)** extent of occurrence; **(ii)** area of occupancy; **(iii)** number of locations or subpopulations; **(iv)** number of mature individuals			

C. Small population size and decline

	Critically Endangered	Endangered	Vulnerable
Number of mature individuals	< 250	< 2,500	< 10,000
AND at least one of C1 or C2			
C1. An observed, estimated or projected continuing decline of at least (up to a max. of 100 years in future):	25% in 3 years or 1 generation (whichever is longer)	20% in 5 years or 2 generations (whichever is longer)	10% in 10 years or 3 generations (whichever is longer)
C2. An observed, estimated, projected or inferred continuing decline AND at least 1 of the following 3 conditions:			
(a) (i) Number of mature individuals in each subpopulation	≤ 50	≤ 250	≤ 1,000
(ii) % of mature individuals in one subpopulation =	90–100%	95–100%	100%
(b) Extreme fluctuations in the number of mature individuals			

D. Very small or restricted population

	Critically Endangered	Endangered	Vulnerable
D. Number of mature individuals	< 50	< 250	**D1.** < 1,000
D2. *Only applies to the VU category* Restricted area of occupancy or number of locations with a plausible future threat that could drive the taxon to CR or EX in a very short time.	-	-	**D2.** typically: AOO < 20 km² or number of locations ≤ 5

E. Quantitative Analysis

	Critically Endangered	Endangered	Vulnerable
Indicating the probability of extinction in the wild to be:	≥ 50% in 10 years or 3 generations, whichever is longer (100 years max.)	≥ 20% in 20 years or 5 generations, whichever is longer (100 years max.)	≥ 10% in 100 years

Figure 17. *Summary of the five criteria (A-E) used to evaluate if a taxon belongs in a threatened category (Critically Endangered, Endangered or Vulnerable)* (by the IUCN Red List, 2019)

One of the most important calculation used in Criteria A, is **Population size reduction** during more than 10-years or **3-generations**. The formula (2), given above is implemented also in the workbook (spreadsheet) file Generation_Length_Workbook.xls, which is available at https://www.iucnredlist.org/resources/generation-length-calculator. This workbook is also useful for exploring the effects of various assumptions on the **calculated generation length** (criteria A, C1 and E). Other calculations about **Reduction** (criterion A) are implemented in the workbook file CriterionA_Workbook.xls, available at: https://www.iucnredlist.org/resources/criterion-a. As shown above, if no more than 10-years or 3-generations data are avaliable, then no any species can be evaluated for Critera A.

The evaluation of other qualitative indicators such as **number of localities**, **AOO** and **EOO** have been described in the section 4.2. This indicators or spatial metrics are important for evaluation of Criteria B and D. If AOO can be calculated directly at the reference scale of 4 km^2 (2 × 2 km) cells (in case of species with one locality), then using of section 4.2 is not necessary. The assessment of current conservation status of a taxa needs using some Quantitative analysis (criterion A and E).

In the "Guidelines for Using the IUCN Red List Categories and Criteria" (IUCN, 2019), a quantitative analysis is defined as: "any form of analysis which estimates the extinction probability of a taxon based on known **life history**, **habitat requirements**, **threats** and **any specified management options**. **Population viability analysis** (PVA) is one such technique.

In the sections 3.1, 3.2 & 3.3 of this manual, particularly through the Tables 4 and 5, giveare shown the protocols for calculation of all available data that fulfill the requrements of a quantitative analysis. By the avaliable data, recorded during monitoring or collected from literature, the quantitative analyses gave an aasumption on the species Biology, Habitat and Ecology, Use and Trade, Threats, Conservation Actions ect. Generaly, quantitative analyses are used for assessing taxa under criterion E. It is important to note that the risk-based thresholds of criterion E, should not be used to infer an extinction risk for a taxon assessed as VU, EN and CR under any of the criteria A to D.

According to the instructions of the Guidelines for Using the IUCN Red List Categories and Criteria[38], in case of the assessment of the **Taxa known only** from its **type locality** and there is no information on its current status or possible threats, the taxon **should be listed as DD**. If there are no plausible threats, and the area is relatively well known, **Least Concern is appropriate**, unless criteria A, B or C is met. If people have searched for the taxon, both at the type locality and at a reasonable number of other potential localities, and no more than 50 mature individuals are estimated, then the taxon would be listed as Critically Endangered D. If any significant or plausible threats can be identified, then a full assessment will be necessary to determine the most appropriate classification (e.g., Critically Endangered under criteria B or C, or Vulnerable under criterion D2). If, despite searches, the taxon has not been recorded since the collection of the type specimen, and there are threats in the area, a listing of Critically Endangered (Possibly Extinct) or Extinct may be appropriate. Modelling of environmental fluctuations, estimation of the variances of model parameters should include only temporal variation; variation due to demographic stochasticity, measurement error, spatial variation, etc. should be subtracted. For example, if survival rates are

[38]IUCN Standards and Petitions Committee. (2019). Guidelines for Using the IUCN Red List Categories and Criteria. Version 14. Prepared by the Standards and Petitions Committee.

based on census data, binomial variance representing demographic stochasticity can be subtracted from total observed variance, (Akçakaya, 2002)[39].

The final protocol of a Red List assessment include listing all the major threats in the required documentation, as described in IUCN (2019), using a standard classification scheme available at www.iucnredlist.org/technical-documents/classification-schemes.

As working methodology, the evaluation of the conservation status of a taxon, using the figure 17, (*Summary of the five criteria (A-E) used to evaluate if a taxon belongs in a threatened category (Critically Endangered, Endangered or Vulnerable)*, starts form the bottom of the table going up. Specifically, it starts from Criterion E (Quantitative analyses), going up to D, C, B and A and than going from lower Category on the right to the higher one on the left (e.g from VU to Endangered and than Criticall Endangered categories).
In case when for a taxon there have been no privious evaluations or if for a taxon there is no data for its 3- generation length (or more than 10-year), than this species can not be evaluated for Criterion A.

In addition, when we evaluate the species conservation, taking into account quantitative indicators (Criteria A to D), other qualitative ones are just as important for the evaluation of current status of a species (e.g. life history, habitat requirements, threats and any specified management options).

In the frame of project: "SRE of Prespa NP, –Assessment, protection and *in-situ/ex-situ* conservation, through involvement of young professionals", 10-plant species will be observed and monitored in the Prespa and Galichica National Parks for evaluation of their current protection status. Four of them (*Allium albanicum, Centaurea shumkana, Chamaecytisus pseudojankae* and *Oxytropis dinarica* subsp. w*eberi)* are restricted only in the Albanian side of Prespa ecosystem, and six others are transboundary species (*Centaurea galicicae, Dianthus galicicae, Edraianthus horvatii, Festuca galicicae, Laserpitium ochridanum* and *Sempervivum galicicum,* or *Centaurea soskae),* that shared their habitat of occurrence in between two countries, North Albania and Macedonia

The "pasport" documentation of an assessed taxon include the following steps:

Taxon Name:
Common Name(s):
Taxonomic Source(s):
Assessment Information:
Justification:
Global and European regional assessment:
Geographic Range:
Population:
Habitat and Ecology:

[39]Akçakaya, H.R. (2002). Estimating the variance of survival rates and fecundities. *Animal Conservation* 5: 333–336.

Use and Trade:
Threats:
Conservation Actions.
For more see also the examles below.

In the following, there are given 3-different examples of three assessed species by IUCN, assessed as threatened (VU, EN and CR). One species is endemic of Albania (*Tulipa albanica*); one other (*Festuca galicica)*, is stenoendemic of Dry Mt & Galichica (Albania and North Macedonia) or a transboundary species and third one (*Solenanthus albanicus)*, is a species with unknown current population size, assessed as Endangered and native to Greece (according to the assessor, see: http://dx.doi.org/10.2305/IUCN.UK.2011-1.RLTS.T161867A5506759.en). In fact, it is also a transboundary species, distributed in north Pindos between Albania and Greece.

Example 1.
Tulipa albanica, Albanian Tulip

Taxon Name: *Tulipa albanica* Kit Tan & Shuka

Common Name(s): English: Albanian Tulip

Taxonomic Source(s): WCSP. 2017. World Checklist of Selected Plant Families. Available at: http://apps.kew.org/wcsp/.

Assessment Information

Red List Category & Criteria:	**Critically Endangered B1b(iii)c(i,ii,iii)+2b(iii)c(i,ii,iii)** ver 3.1
Year Published:	2018
Date Assessed:	May 20, 2013

Justification: *Tulipa albanica* is endemic to northeastern Albania where it was known only from its type locality. There are two subpopulations, separated by the reservoir of a downstream dam. The extent of occurrence and area of occupancy of the species are very small, at 8 km². The current observation of population size, reports to be c.260 mature individuals. The quality and extent of its habitat is declining as a result of small-scale mining and grazing, as well as succession. The species is assessed as Endangered (B1b(iii)c(i,ii,iii)+2b(iii)c(i,ii,iii)).

Geographic Range

Range Description:
The Albanian Tulip (*T. albanica*) is endemic to Albania. The species is only recently described and is known so far to grow only at its type locality near Surroi, a village in northeastern Albania, along both sides of the Black Drin River. It has been found at altitudes between 500 and 700 m asl (Shuka *et al*. 2010). The extent of occurrence and area of occupancy for the species are 8 km2. There are two subpopulations, divided by the reservoir of a dam.

Country Occurrence:
Native: Albania

Population
During an observation in May 2008, when the species was not yet described, c.280 mature individuals were observed and most of them were found in an area of 4 km², whereas in the other half of the area of occupancy, which is separated from the first one by the Black Drin River, less than one fourth of the individuals were found. The monitoring of mature individuals in May 2010 showed a decline of the population with 200 mature individuals, but the observation in May 2013, shows an increase with 260 mature individuals in total. The generation length for the species is three years. It is likely that the population declined after construction of a dam downstream, but there is no information on this. However, a decline in population on the serpentine is suspected to have occurred since mining was observed in 2013.

Current Population Trend: Decreasing

Habitat and Ecology (see Appendix for additional information)
This species occurs in steep gravelly serpentine or limestone substrates, located on both sides of the Black Drini River, at altitudes between 500 m and 700 m, mostly in clearings among *Quercus* spp, *Forsythia europaea* or *Juniperus oxycedrus* woods dominated by *Polygalo-Forsythietum europaeae* and associations of the alliance *Querco-Carpinion orientalis*. On its habitat *T. albanica* is accompanied by other interesting species like *Aristolochia merxmuelleri, Halacsya sendtneri, Paramoltkia doerfleri, Polygala doerfleri, Sanguisorba albanica, Veronica andrasovszkyi, Aster albanicus* subsp. *albanicus* and tertiary relict species of *Euphorbia glabriflora, Genista hassertiana* and *Dioscorea balcanica*. The quality of the habitat is declining with loss of nutrients due to the low vegetation cover and the substrate composition. The species is found in two forms, one completely yellow, the other with red petal tips.

Systems: Terrestrial

Use and Trade: Collection of small quantities for horticultural purposes has been observed recently.

Threats (see Appendix for additional information)
The major threat to the species is the natural succession of vegetation, covering the clearings among the woody scrub. We suspect that the species is very adaptable to shady conditions. Excessive grazing by sheep and cattle, which was observed during the spring and summer. In 2013, mining for chromium on the serpentine rocks was observed which impacts the habitat of the subpopulation on the serpentine substrate.

Conservation Actions (see Appendix for additional information)
The area where the species occurs and the species itself are not protected by the Albanian law. There is a clear need for monitoring and protecting the species. Protection of the site where the species occurs is needed also because the locality is an important area for several Albanian endemics, relict species and species endemic to the Balkans. The creation of small clearings between the scrubs can help increase the population size. The species was assessed as Critically Endangered for Albania (MEA 2013).

Credits
Assessor(s): Shuka, L.
Reviewer(s): Caković, D., Boršić, I, Matevski, V. & Allen, D.J.

Appendix

Habitats

(http://www.iucnredlist.org/technical-documents/classification-schemes)

Habitat	Season	Suitability	Major Importance?
1. Forest -> 1.4. Forest - Temperate	Resident	Suitable	Yes

Threats

(http://www.iucnredlist.org/technical-documents/classification-schemes)

Threat	Timing	Scope	Severity	Impact Score
2. Agriculture & aquaculture -> 2.3. Livestock farming & ranching -> 2.3.2. Small-holder grazing, ranching or farming	Ongoing	Unknown	Unknown	Unknown
	Stresses:	1. Ecosystem stresses -> 1.2. Ecosystem degradation 2. Species Stresses -> 2.1. Species mortality		
3. Energy production & mining -> 3.2. Mining & quarrying	Ongoing	Minority (50%)	Unknown	Unknown
	Stresses:	1. Ecosystem stresses -> 1.2. Ecosystem degradation 2. Species Stresses -> 2.1. Species mortality		
7. Natural system modifications -> 7.2. Dams & water management/use -> 7.2.11. Dams (size unknown)	Past, unlikely to return	Majority (50-90%)	Rapid declines	Past impact
	Stresses:	1. Ecosystem stresses -> 1.1. Ecosystem conversion 2. Species Stresses -> 2.1. Species mortality		
7. Natural system modifications -> 7.3. Other ecosystem modifications	Ongoing	Unknown	Unknown	Unknown
	Stresses:	1. Ecosystem stresses -> 1.2. Ecosystem degradation		

Conservation Actions in Place

(http://www.iucnredlist.org/technical-documents/classification-schemes)

Conservation Actions in Place
In-Place Research, Monitoring and Planning
Action Recovery plan: No
In-Place Land/Water Protection and Management
Conservation sites identified: No
Occur in at least one PA: No
Area based regional management plan: No
In-Place Species Management

Festuca galicicae

Assessment by: Shuka, L. & Matevski, V.

Taxon Name: *Festuca galicicae* Horvat ex Markgr.-Dann.

Taxonomic Source(s): WCSP. 2018. World Checklist of Selected Plant Families. Available at: http://apps.kew.org/wcsp/.

Assessment Information

Red List Category & Criteria:	**Vulnerable B1ab(ii,iii)+2ab(ii,iii)** ver 3.1
Year Published:	2018
Date Assessed:	May 31, 2013

Justification:
Festuca galicicae is a local endemic of Dry and Galicica mountains in Albania and FYR Macedonia, with an area of occupancy of 40 km^2 and an extent of occurrence of 212 km^2. The population size is estimated to be at least 27,000 mature individuals. It is threatened by overgrazing and fire in the Albanian part, and by succession and the lack of grazing on the FYR Macedonian side. There is a continuing decline in the quality of habitat and the area of occupancy and the species is listed as Vulnerable (VU B1ab(ii,iii)+2ab(ii,iii)).

Geographic Range

Range Description:
This species is restricted to the southwestern part of FYR Macedonia and the southeastern part of Albania (Tutin *et al*. 1980, V. Matevski pers. comm. 2012). It is a high-mountain species found in Dry (Pllaja e Pusit, Sheshi i Rinisë and Buza e Korites and in the southern part of Dry mountain; Albania) and Galicica (Kazan, Kosta Bachilo, Tomoros, Suvo Pole, Magaro and Petrinsko Polje; FYR Macedonia) mountain, located on the border between the two countries. Its extent of occurrence is estimated to be around 212 km^2 and the area of occupancy 40 km^2.

Country Occurrence:

Native: Albania; Republic of North Macedonia

Population
The population of *F. galicicae* in Albania is large, with more than 7,000 individuals, assessed in 2011. The population size in the Macedonian parts of the mountain is unknown, but it is larger than the Albanian population, with at least 20,000 mature individuals. Whilst the population of *F. galicicae* is not severely fragmented within its distribution range, it is certainly closely related to the ecological conditions.

Current Population Trend: Unknown

Habitat and Ecology (see Appendix for additional information)
The species is found in alpine pastures and meadows of the *Stipo-Festucetum* plant community, in Dry and Galicica Mts., between 1,800 and 2,200 m, on calcareous substrate. It occurs in the Habitat Directive listed in habitat code: 6170 "Alpine and subalpine calcareous grasslands". The distribution of the species on the mountain is correlated with the calcareous substrate. **Systems:** Terrestrial

Use and Trade: The plant is eaten by animals in mixed pasturage.

Threats (see Appendix for additional information)
In the Albanian part, a primary threat to this plant is overgrazing, whereas in the Macedonian distribution, in a protected area where grazing was effectively prevented in the past, succession is a problem. In Albania, fires reduce the vegetation cover which causes soil erosion and leads to population decline.

Conservation Actions (see Appendix for additional information)
The species has not been assessed in either country. One-third of localities in Albania and all localities in FYR Macedonia are within a protected area, the Prespa International Park, so it is well conserved. However, in FYR Macedonia the species is in the list of protected wild species in the Republic of Macedonia (Official Gazette 139/7 October 2011).

Credits

Assessor(s): Shuka, L. & Matevski, V.

Reviewer(s): Boršić, I, Allen, D.J. & Caković, D.

Bibliography

IUCN. 2018. The IUCN Red List of Threatened Species. Version 2018-1. Available at: www.iucnredlist.org. (Accessed: 28 June 2018).
Tutin, T.G., Chater, A.O., Heywood, V.H., Richardson, I.B.K., Burges, N.A., Valentine, D.H., Walters, S.M. and Webb, D.A. 1980. *Flora Europaea. Volume 5, Alismataceae to Orchidaceae (monocotyledones)*. Cambridge University Press, Cambridge.

Appendix

Habitats

(http://www.iucnredlist.org/technical-documents/classification-schemes)

Habitat	Season	Suitability	Major Importance?
4. Grassland -> 4.4. Grassland - Temperate	-	Suitable	Yes

Threats

(http://www.iucnredlist.org/technical-documents/classification-schemes)

Threat	Timing	Scope	Severity	Impact Score
2. Agriculture & aquaculture -> 2.3. Livestock farming & ranching -> 2.3.2. Small-holder grazing, ranching or farming	Past, unlikely to return	Unknown	Unknown	Past impact
	Stresses:	1. Ecosystem stresses -> 1.2. Ecosystem degradation		
7. Natural system modifications -> 7.1. Fire & fire suppression -> 7.1.1. Increase in fire frequency/intensity	Ongoing	Minority (50%)	Unknown	Unknown
	Stresses:	1. Ecosystem stresses -> 1.2. Ecosystem degradation		

Conservation Actions in Place

(http://www.iucnredlist.org/technical-documents/classification-schemes)

Conservation Actions in Place
In-Place Land/Water Protection and Management
Conservation sites identified: Yes, over part of range
Occur in at least one PA: Yes
Percentage of population protected by PAs (0-100): 61-70

Conservation Actions Needed

(http://www.iucnredlist.org/technical-documents/classification-schemes)

Conservation Actions Needed
1. Land/water protection -> 1.1. Site/area protection

Research Needed

(http://www.iucnredlist.org/technical-documents/classification-schemes)

http://dx.doi.org/10.2305/IUCN.UK.2018-1.RLTS.T131652S4A18609722.en

Solenanthus albanicus

Assessment by: Delipetrou, P.

Taxon Name: *Solenanthus albanicus* (Degen & Bald.) Degen & Bald.

Synonym(s): *Cynoglossum albanicum*

Assessment Information

Red List Category & Criteria:	**Endangered B1ab(v)+2ab(v)** ver 3.1
Year Published:	2013
Date Assessed:	April 5, 2011

Justification: Although there is no data on population size and trends and there is little information on threats, *Solenanthus albanicus* has a very restricted distribution and apparently it has been seen only four times ever. Any adverse effect such as grazing can threaten its survival. It is therefore classified as Endangered but the plant also qualifies for Vulnerable based on criterion D2.

Geographic Range

Range Description: *Solenanthus albanicus* is present in the north of Greece, where it is found in the North Pindos range: Gramos Mt (Souflikas peak, near Kotyli); Douskon Mt (southwest side, this location may be at either side of the Greek-Albanian border) and the South Pindos range: Athamanika Ori Mts (Kakarditsa Mt above Athamania village in Aspropotamos at 2,050–2,250 m asl). It has an extent of occurrence of c. 3,200 km² and an area of occupancy of 16 km², based on a 2x2 km grid.

Country Occurrence:

Native: Greece

Population
The records of *Solenanthus albanicus* in Greece are few. It was first collected on Douskon Mt in 1896 (*locus classicus*). Zaganiaris (1940) collected the plant on Gramos Mt, and later Sfikas (1995) discovered two locations on the same mountain. Aldén (1976) collected the plant on Kakarditsa Mt in 1973 and described it as *Solenanthus pindicus*. Obviously, *Solenanthus albanicus* is a very rare plant in Greece, but there is no data on the current population size. It is found at four locations.
Current Population Trend: Unknown

Habitat and Ecology (see Appendix for additional information)
This species inhabits dry mountain rocks. It flowers in July, but this may be incomplete. The exact altitude range is not known, but it is possibly 800–2,250 m asl.

Systems: Terrestrial

Threats (see Appendix for additional information)
Sfikas (1995) reports that grazing causes population decline of *Solenanthus albanicus* because the plant is a favourite forage for cattle and sheep. Grazing is an intense activity in the distribution area of the plant.

Conservation Actions (see Appendix for additional information)
Solenanthus albanicus is listed on Annex II of the Habitats Directive and under Appendix I of the Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention). The species is protected in Greece by Presidential Decree 67/81 and part or the whole of the population is included in the Natura 2000 sites GR1320002, GR2110002 and GR2130003. Information on the current population size and trend should be collected.

Credits
Assessor(s): Delipetrou, P.

Reviewer(s): Bilz, M. & Bazos, I.

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Appendix

Habitats

(http://www.iucnredlist.org/technical-documents/classification-schemes)

Habitat	Season	Suitability	Major Importance?
0. Root -> 6. Rocky areas (eg. inland cliffs, mountain peaks)	-	Suitable	-

Threats

(http://www.iucnredlist.org/technical-documents/classification-schemes)

Threat	Timing	Scope	Severity	Impact Score
2. Agriculture & aquaculture -> 2.3. Livestock farming & ranching -> 2.3.4. Scale Unknown/Unrecorded	Ongoing	-	-	-
	Stresses:	1. Ecosystem stresses -> 1.2. Ecosystem degradation 2. Species Stresses -> 2.1. Species mortality 2. Species Stresses -> 2.2. Species disturbance		

Conservation Actions in Place

(http://www.iucnredlist.org/technical-documents/classification-schemes)

Conservation Actions in Place
In-Place Land/Water Protection and Management
Occur in at least one PA: Yes
In-Place Education
Included in international legislation: Yes

Research Needed

(http://www.iucnredlist.org/technical-documents/classification-schemes)

Research Needed
1. Research -> 1.2. Population size, distribution & trends

Additional Data Fields

Distribution
Estimated area of occupancy (AOO) (km²): 16
Estimated extent of occurrence (EOO) (km²): 3200
Number of Locations: 4