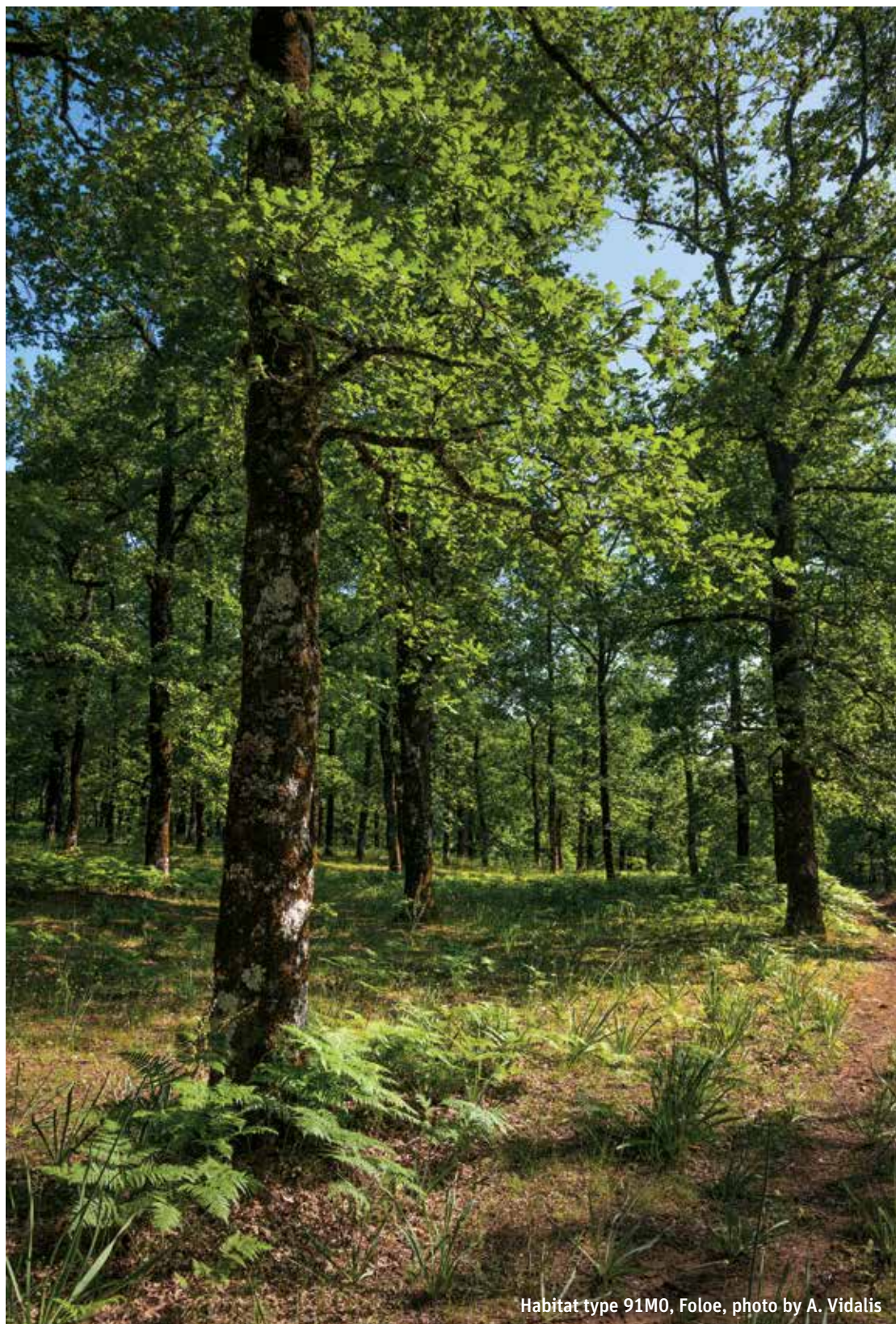


**METHODOLOGY
FOR MONITORING AND
CONSERVATION STATUS
ASSESSMENT
OF THE HABITAT TYPES
IN GREECE**



Habitat type 91M0, Foloe, photo by A. Vidalis

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P. Dimopoulos, I. Tsiripidis, F. Xystrakis, A. Kallimanis, M. Panitsa

**NATIONAL CENTER OF ENVIRONMENT
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and Biodiversity

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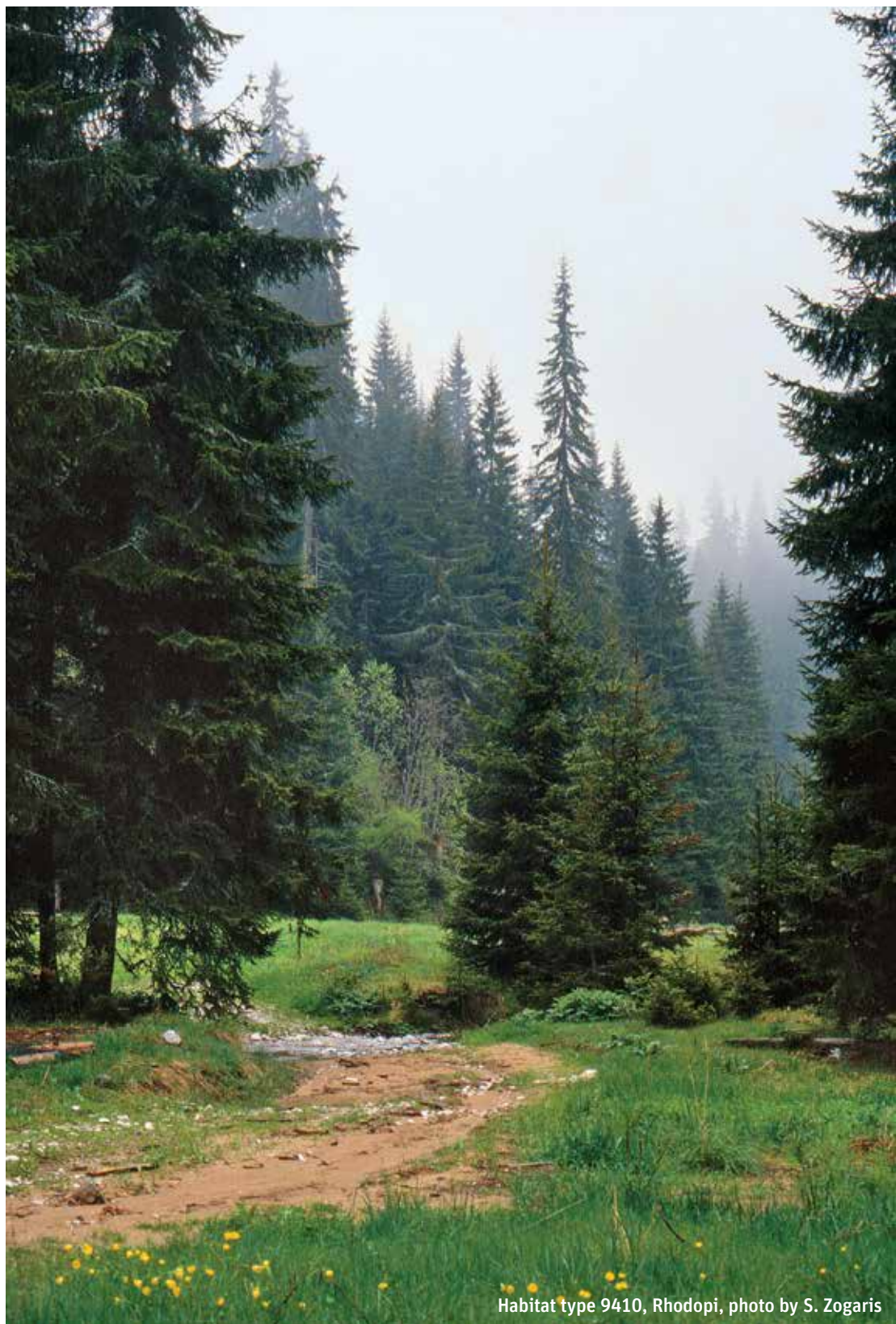
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Habitat type 9410, Rhodopi, photo by S. Zogaris

Preface

Surveillance and monitoring of the conservation status of habitat types and species is a very important tool for making legislative and policy decisions with the aim to accomplish sustainable development planning.

In this context, the European Union, by means of both the Nature Directives and the Biodiversity Strategy, sets the basis for the adoption and implementation of conservation measures, taking into account the economic, social and cultural values and peculiarities of each Member State. The information gathered is necessary so as to identify potential problems, focus on conservation actions, and measure the success of conservation efforts.

Through surveillance and monitoring, scientists record the conservation status, the future trends and the pressures acting on a habitat type, in order that the effectiveness of management measures and land-use regulations could be assessed.

*This handbook describes the methodological framework developed and implemented for the first time in Greece (period 2013-2015), in the frame of the project **“Surveillance and assessment of the conservation status of habitat types of community interest in Greece”**. The framework was founded on an integrated and standardized bottom-up approach to monitoring and assessing the conservation status of habitat types that yielded baseline reference data with more than 10.000 standardized conservation status assessment protocols, collected by scientists and specialized researchers from the Universities of Greece, after extensive field work. This project was invited and supervised by the Ministry of Environment and Energy and was funded by the Operational Program “Environment & Sustainable Development” 2007-2013.*

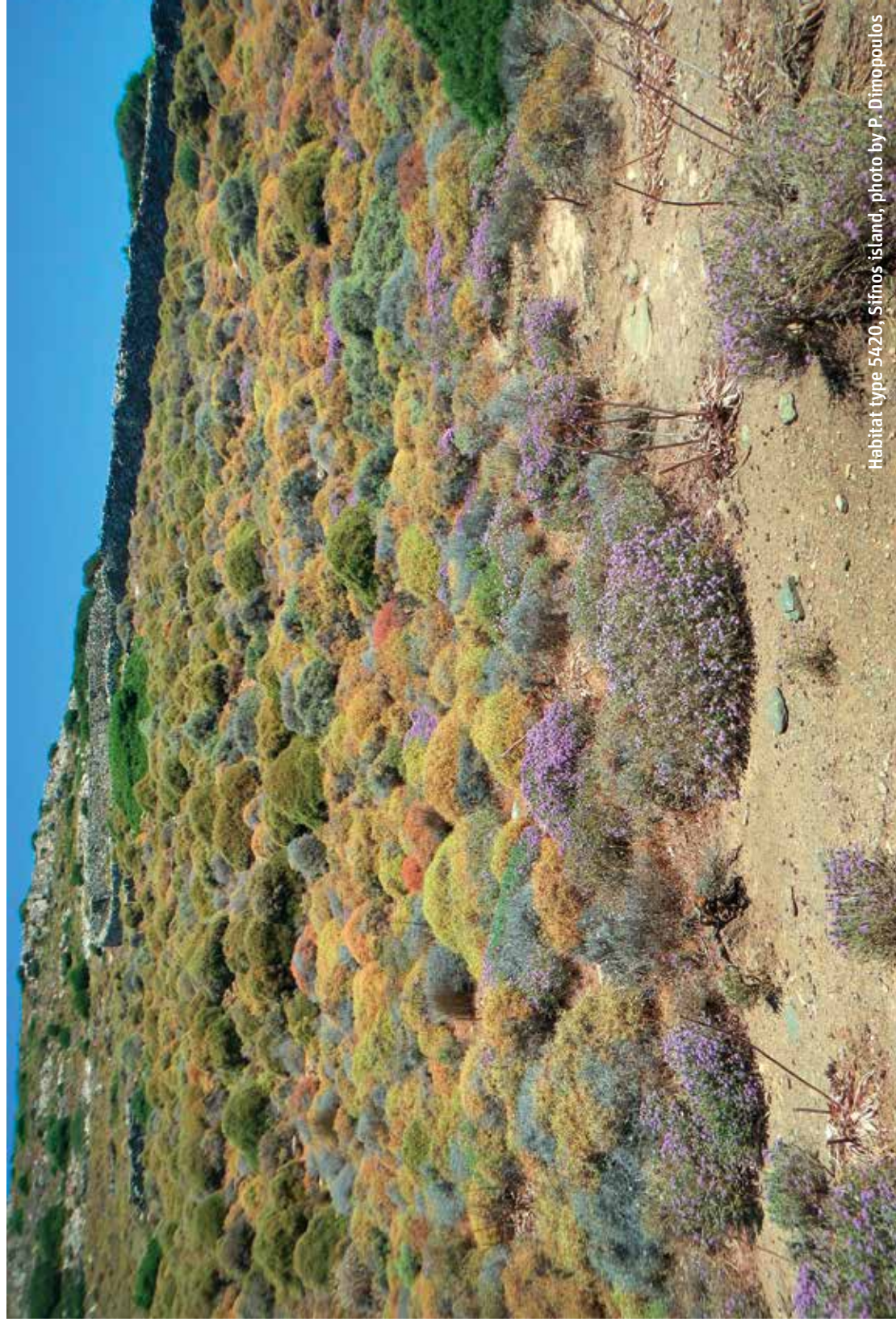
The volume of data currently available is the scientific basis for adequately managing the natural habitat types, their species, as well as the entire Natura 2000 protected areas, in order to conserve the biodiversity of Greece, which is our National Natural Capital.

This Methodological Guide on Habitats’ Surveillance and Monitoring together with the recently published Technical Guide on Mapping and Assessment of Ecosystems and their Services act synergistically as preparatory actions for the implementation of the Integrated Project LIFE - IP 4 NATURA, which, in combination with other initiatives, such as the new Law 4519/2018 for the Managing Authorities, clearly outline our political will to systematically address nature conservation and its emergence as an important factor towards the sustainable development.

We thank the National Center of Environment and Sustainable Development, which in cooperation with the Directorate of Biodiversity and Natural Environment Management of the Ministry of Environment and Energy highlights this effort by taking the initiative to publish the methodology applied during the habitat types’ monitoring project; a project that has encoded a very large volume of scientifically sound work completed by dozens of Greek scientists.

Socrates Famellos

The Alternate Minister of Environment and Energy



Habitat type 5420, Sifnos island, photo by P. Dimopoulos

1. Introduction

The project «Surveillance and Assessment of the conservation status of habitat types of community interest in Greece» was funded by the Operational Program «Environment & Sustainable Development» 2007-2013, which was co-financed by the European Commission Cohesion Fund and the European Regional Development Fund and the Greek Program of Public Investments (national resources). This project was invited by the Ministry of Environment, Energy and Climate Change (YPEKA) and was supervised by the Ministry's Directorate of Biodiversity, Soil and Waste Management / Department of Biodiversity and Protected Areas (former Department of Natural Environment Management).

In the framework of this project, the surveillance and assessment of the conservation status of habitat types in Greece was planned and carried out with extensive field campaigns to collect data. The aim of this project was to assess the conservation status of the habitat types for the period 2007-2012 in accordance with the provisions of article 11 of the Habitat's Directive (92/43/EEC). The results of this project comprised the basis for the preparation of the third national report for the implementation of Directive 92/43/EEC.

Surveillance, Monitoring and Conservation Status Assessment

Surveillance refers to the systematic measurement of variables and processes over time in order to create a time series of data.

Monitoring refers to the systematic data collection and to the measurement / assessment of variables and processes in a standardized method at regular intervals and in time sequence. It assumes that data collection is performed for a specific purpose.

The repeated surveillance (i.e. the recording of data for a species, a habitat type, or an ecosystem) over time is the foundation of **monitoring**.

Through surveillance and monitoring, scientists record the conservation status, the trends of a habitat type and the pressures acting on it. The information collected is necessary to identify possible problems, to focus on conservation actions, and to assess the outcome of conservation efforts. In Conservation Biology, monitoring is arguably the main scientific tool for observing / comprehending land-use impacts and changes, but also for assessing the effectiveness of management measures.

The primary axes of habitat types monitoring are:

- the **obligatory six-year National Report** according to the implementation of Article 17 of Directive 92/42/EEC regarding the conservation status of the habitat types of community interest in every Member State (MS) of EU.
- the **scale of observation**, which is an important parameter for the content of monitoring.
- the **criteria for the assessment** of the conservation status, and how these criteria relate to the scale of observation
- the **analysis and monitoring of qualitative criteria** (i.e. criteria / parameters that constitute the conservation status of a habitat type) for which assessment is performed throughout a habitat's distribution range **at various scales** from locally, to EEA reference grid, to nationally.
- the **analysis and monitoring of quantitative criteria** (e.g. range and area of a habitat type of community interest) for which assessment is performed at the national scale.

The program for the surveillance / monitoring and conservation status assessment of the habitat types started early at 2014. As a first step, the project's scientific team took into account the above-mentioned axes and the key elements that should guide the preparation of the 3rd Greek Report (2007-2012) in implementation of Article 17 of Directive 92/43/EEC. These consultations highlighted the following needs:

- to establish a national framework for Monitoring and Conservation Status Assessment,
- to re-evaluate the conservation status of habitat types (in comparison to the previous article 17 reporting period 2000-2006) on the basis of the nationally established monitoring framework,
- to evaluate the effectiveness of the conservation policies and management actions that have been implemented in the sites of the Natura 2000 network in Greece,
- to collect field data (article 11 of Directive 92/43/EEC),
- the surveillance / monitoring and conservation status assessment framework to cover all habitat types included in the Annex I of the Habitats Directive,
- to monitor the habitat type's condition not only inside the sites of the Natura 2000 network but throughout the territory of Greece, so as to assess the current conservation status of the habitats at the national scale.

Guiding principles of the methodology used for the monitoring and conservation status assessment of the habitat types in Greece

This manual describes the methodological framework that was implemented in Greece for the first time during the 2013-2015 period (and aimed to assess the conservation degree/status of habitats for the reference period 2007-2012) with an integrated and standardized bottom-up approach to survey and assess the conservation status of habitat types based on field sampling.

This approach was developed and applied for the first time in Greece. This approach is grounded on a large-scale field campaign to collect the data needed for the habitat type's assessment. Sampling takes place within each Natura 2000 site (including Sites of Community Importance (SCI) and Special Areas of Conservation (SAC)), but also in areas not belonging in the Natura 2000 network, where the habitat type occurs. Sampling is standardized on the basis of each field researcher using the standard conservation status assessment protocols prepared for each habitat type. The necessary next step is the upscaling of the field data collected locally (at the scale) to the national scale

for the assessment of the parameters of conservation status.

In this book, the reader could find the methodology developed for the assessment the conservation degree (local scale) or conservation status (national scale) of the parameters needed according to the Directive 92/43/EEC, for the habitat types in Greece and for different reference scales:

- a) at the scale of the **sample plot** (using the standardized sampling protocols) assess the conservation degree of structures and functions, including typical species, and their future prospects,
- b) at the scale of **each cell of the EEA reference grid** assess the conservation degree of structures and functions, including typical species, and their future prospects,
- c) at the scale of **the Sites of Community Importance or Special Areas of Conservation** assess the conservation degree of structures and functions, the conservation degree of area, and their future prospects,
- d) at the **national scale**, for the overall conservation status assess all parameters (range, area, structures and functions and future prospects).

Qualitative and quantitative characteristics of the output of this approach

The methodological approach applied in the conservation status assessment, yielded baseline reference data from **9,867 sampling localities** (i.e. 9,867 standardized protocols filled in) for habitat type conservation status assessment. These include 8520 sampling locations inside sites of the Natura 2000 network, and 1347 sampling locations outside the Natura 2000 network. Further field work was undertaken to sites of the Natura 2000 network, which are under the responsibility of Management Bodies, and so the total number of sampling localities examined is expected to exceed 11,000.

This volume of data is now the scientific baseline reference for the efficient management of the natural habitat types, the species inhabiting them, as well as the entire Natura 2000 sites in which they occur.

From the 2nd Reference Report (2000-2006) to the 3rd Reference Report (2007-2012)

Since the Compilation of the 2nd National Report of Reference on the Implementation of the Habitats Directive (for the period 2000-2006) in the preparation, completion and submission of the 3rd Report (2007-2012) there has been a substantial and important change. The second report was a single document for each habitat type prepared at national level based on best expert judgment. In the third report, the assessment was based on a large number of standardized conservation status assessment protocols being filled in thousands of sampling localities - in sites inside and outside the Natura 2000 network - where each habitat type occurs.

In order to standardize the relevant information collected and to minimize the subjective input from the scientists involved in the assessment, the first step was to design standardized sampling protocols for each habitat type. Then, all researchers involved in the field campaigns were appropriately trained through an in-house training process for field investigators. The training was carried out by specialized scientists with proven track record, knowledge and experience in nature conservation research.

From the Conservation Status Assessment to the Future Surveillance and Monitoring

Monitoring of habitat type's conservation status follows the principles of vegetation and plant communities monitoring. This can only be done through repeated surveillance of sampling localities creating a time-series of the characteristics of vegetation (such as species composition, typical species abundance and trends), as well as of the quantitative or qualitative data for the biotic and/or abiotic factors that indicate the conditions of the habitat type.

There are **two alternatives on how to analyze the time series data** from habitat type monitoring:

I) The first alternative is to compare data sets corresponding to different time periods through numerical analyses. This approach is used by neces-

sity when we do not know the precise geographic location of the sampling locations examined in the past. Through this approach we can compare characteristics between data sets and search for some specific trends in them. For example, we can find the disappearance of a subtype of a habitat type or the increase of the contribution of annual species in the species composition of a habitat. By identifying such trends, we may draw indirect conclusions about changes that happened and perhaps the causes behind them.

II) The second alternative is to compare the data collected from the same sampling locations, but at different time periods. This approach relies on the establishment of permanent sampling plots through the repeated sampling of the same locations at different time periods. This alternative has the advantage of detecting more directly the changes that have occurred in the vegetation, i.e. offering greater strength allows the detection of even finer changes compared to the first alternative.

Therefore, **the proposal for the future monitoring program is to sample vegetation and assess conservation status at the same sampling locations** that sampling took place during the surveillance / monitoring of habitat types project in 2013-2015.

The number of sampling locations may remain constant (same as the number of locations sampled in 2013-2015) or change (increase or decrease). The number of sampling locations examined for each habitat type in this project is adequate to produce reliable results for a time series analysis. However, a greater number of sampling locations would benefit the accuracy of the results. On the other hand, the number of sampling locations, in practice, is usually determined by the available resources (financial, time and personnel).

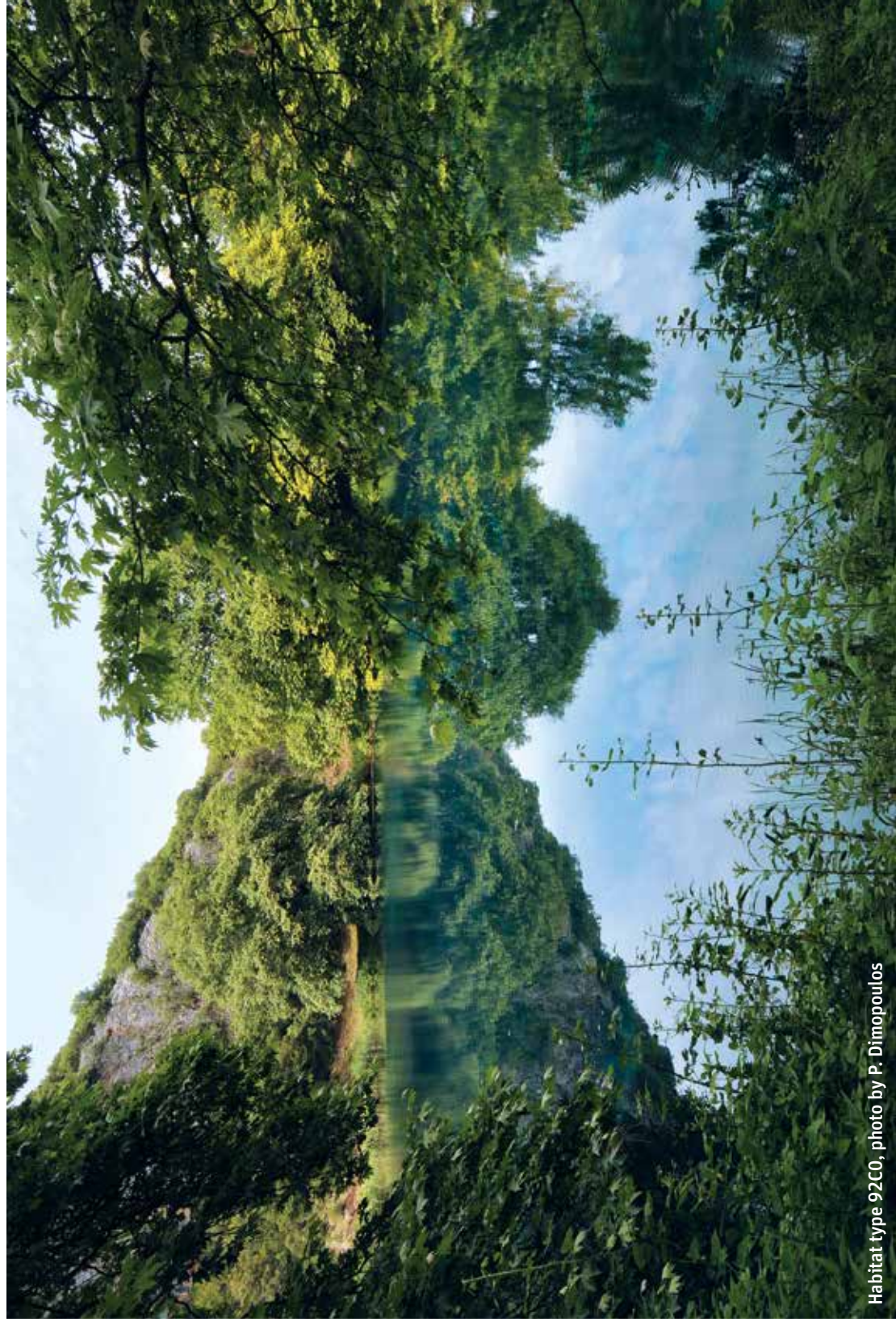
The data collected in each sampling location should be the same or more than those collected in the project of surveillance / monitoring of habitat types in the period 2013-2015. In particular, it is proposed to collect the following data in each sampling location:

1. The composition of typical plant species present in each sampling location
2. The abundance of typical plant species to be assessed on the Braun-Blanquet scale, but also on the AFOR scale
3. The presence or absence of the specific structures and functions listed for each habitat type in the standardized conservation assessment protocols produced in the current project
4. The pressures and threats on the habitat types, based on the European Union list, which was used in the surveillance / monitoring of habitat types 2013-2015
5. Abiotic data collected in the project of surveillance / monitoring of habitat types 2013-2015
6. The structure characteristics of the vegetation (e.g. the vegetation layers)

It is proposed that future surveillance / monitoring projects should collect the above list of data on each sampling location. However, future sampling requirements may include additional data depending on the habitat type and the specific objective of the monitoring program. For example, in the case of monitoring aimed to evaluate the effectiveness of a management practice or policy, it may be necessary to measure additional biotic or abiotic factors; while for the purposes of the conservation status assessment (in accordance with the Directive 92/43 /EEC), the above data is sufficient for a reliable assessment of the habitat types conservation status.

The monitoring, assessment and compilation of the National Report on the conservation status of each species and habitat type of community interest every six years is a legal obligation for all European Union Member States, according to the European nature conservation policy (as stated in the Directive 92/43/EEC). Also these actions contribute towards the success of international treaties that Greece and EU have ratified, such as the Convention on Biological Diversity.

However, these activities should not be regarded only as legal obligations, since **they are the basic instrument for assessing biodiversity trends, but also for the development and implementation of effective policies** aimed at preserving the biodiversity of Greece, which is our National Natural Capital.



Habitat type 92C0, photo by P. Dimopoulos

2. Conceptual and Methodological Framework of Conservation Status Assessment According to Directive 92/43/EEC

2.1 Assessment parameters - definitions and concepts

Conservation status assessment of habitat types is based on the synthesis of the assessment of four parameters: range, area, specific functions and structures and future prospects (Evans and Arvela, 2011).

2.1.1 Range

The range of a habitat type is defined as the outer boundaries of the wider geographic area in which the habitat type is encountered. It can be considered as an envelope within which, in certain places the habitat type is found (Evans and Arvela, 2011). Range is not identical with the precise localities that a habitat type actually occurs, as the pattern of the actual occurrence of a habitat type may be patchy and discontinuous within its natural range.

If the reason for the discontinuous occurrence of a habitat type is natural, then the range of the habitat type should not be considered as the widest continuous range including all intermediate areas (e.g. the range of an alpine habitat type should not include the areas of low altitude between the mountain ranges). Also, range is dynamic, not static (i.e. it may increase or decrease). If a habitat type spreads naturally (on its own) to new locations, these new locations should be considered as part of the range of the habitat type. Similarly, if habitat restoration, or creation of new sites or management practices (agricultural and forestry) contribute to the expansion of a habitat type, then its range should be re-estimated accordingly (Evans and Arvela, 2011).

2.1.2 Area

Area is defined as the total area occupied by a habitat type in all the locations it appears throughout its range.

2.1.3 Structures and functions (including typical species)

This parameter consists of two distinct sub-parameters that are presented separately: **typical species** and **specific structures and functions** for each habitat type.

Typical species

The term typical species is often cited in the Habitats Directive (92/43/EEC) but there is no precise definition of what constitutes typical species. Typical species should act as indicators of the conservation degree/status of habitat types and their structures and functions. According to Evans and Arvela (2011) typical species:

- should reflect the habitats favorable conservation degree / status and their structure and functions
- should be found only in the specific habitat type and be present over a large part of its range.
- should be sensitive to changes in the conditions of the habitat (i.e. act as “early warning indicator species”)
- should ideally remain stable over the middle-to long-term, so as to allow for comparisons between assessments when selected for the purpose of assessing conservation status
- may be drawn from any species group (e.g. vascular plants, lichens, mosses, fungi and animal groups, including birds, mammals and invertebrates).

The assessment of the conservation status of the typical species is not necessarily based on monitoring their population, but may be performed in a more general way, based on expert judgment or red data lists or other available records (Evans and Arvela, 2011).

On the basis of the observations and examples provided by Evans and Arvela (2011), typical species per habitat type should be specified for every Member State and they may even differentiate within the territory of each State. To this end, it is necessary to identify and describe the subtypes of each habitat type. These subtypes should reflect the different plant communities that make up the habitat type, as well as their ecological and/or phyto-geographical differentiation. Most habitat types of Annex I of the Directive 92/43 /EEC correspond to types of vegetation that occur over a relatively wide range of ecological conditions and/or geographical areas. For this reason, each Member State should distinguish subtypes of habitat types that are relatively homogeneous in their ecology and species composition. These subtypes will be the basic ecological “entities” for which the conservation status will be assessed. The main reason for detecting and describing habitat differentiation is the identification of the typical species for each habitat type and subtype. Habitat types structures and functions are more general features of the habitat and may be similar in different subtypes of a habitat type.

Structures and functions

Structures are considered to be the physical components of a habitat type that are mainly formed by species growing in the habitat type (Evans and Arvela 2011). For example, trees & shrubs in woodland define vertical and horizontal structures in a forest. More specifically the number of layers in the vegetation (canopy, understory), the height and complexity of these layers are habitat structural elements. A forest with two tree layers, one upper and dominant and a second lower and suppressed is very different from a forest of similar species composition which has just one tree layer. A vegetation stand where five layers could be discerned (bryophytes, low herbs, tall herbs, shrubs and trees) is structurally different from a vegetation stand with similar species composition but with different number or identity of component layers (e.g. herbs, low shrubs, tall shrubs and trees). Habitat structures need not reflect only living elements of the ecosystem, such elements may also include dead organic matter or abiotic features (Evans and Arvela 2011). For example, structures may include the cover and thickness of litter, the

rocky outcrops in the soil (e.g. for forest habitat types), or the slope or aspect of cliffs (e.g. for rock and scree habitat types).

Functions are the ecological processes occurring at a number of temporal and spatial scales and may vary greatly between habitat types (Evans and Arvela 2011). For example functions may include processes like forest regeneration or nutrient cycling. Evans and Arvela (2011) underscore the possibility that habitat functions may also be linked to ecosystem services.

And while typical species were defined for specific habitat types (and even for part of the region of the specific habitat type), structures and functions may be more general characteristics and apply to more than one habitat types, or even to an entire category of habitat types. More specifically the same structures and functions (or slightly modified) may be used to assess the conservation status of a habitat type throughout its range inside a MS. Habitat types in Annex I of the Habitats Directive (92/43/EEC) as described in the Interpretation Manual (European Commission 2013), reflect ecosystems or vegetation units with similar structures and functions.

2.1.4 Future prospects

Future prospects refer to the three parameters used for conservation status assessment of habitat types, i.e. (1) range, (2) area and (3) structures and functions (including typical species). According to article 1e of the Directive 92/43/EEC, the definition of the Favorable Conservation Status for habitat types must take into account the likely future prospects of the habitat type, i.e. the future prospects of the three parameters should be favorable (Evans and Arvela 2011). Future prospects should be evaluated by considering two factors: (a) future trends and (b) likely future status, always taking into consideration the current conditions and conservation degree/status.

2.1.5 Overall assessment of conservation status (national level, biogeographic region)

The concept of habitat type conservation status assessment is based on the assessment of the status of the individual parameters first. The parameters are:

- **range**,
- **area**,
- **structures and functions** (including typical species),
- **future prospects** of each parameter,
- **overall future prospects** of the habitat type.

From the combination of the assessment of each parameter the overall conservation status of the habitat type for the biogeographic region within a MS is assessed.

Evans and Arvela (2011) provide guidelines for the assessment of each individual parameter (range, area, structures and functions, and future prospects). However, these guidelines are flexible and each MS may develop and apply its own methodology adopted on the specific conditions of each State.

The assessment of the parameters range and area is performed in comparison to threshold values (named Favourable Reference Values) which need to be set for each habitat type in each region.

Favourable Reference Values (FRV) are key concepts in the evaluation of Conservation Status. The **Favourable Reference Range** (i.e. the FRV for the parameter range) is defined according to the Directive 92/43/EEC, as the “*range within which all significant ecological variations of the habitat type is included for a given biogeographical region and which is sufficiently large to allow the long term survival of the habitat; favourable reference value must be at least the range (in size and configuration) when the Directive came into force ; if the range was insufficient to support a favourable status the reference for favourable range should take account of that and should be larger (in such a case information on historic distribution may be found useful when defining the favourable reference range); ‘best expert*

judgement’ may be used to define it in absence of other data”

Similarly, the Favourable Reference Area (i.e. the FRV for the parameter area) is defined according to the Directive 92/43/EEC, as the “*the total surface area in a given biogeographical region considered as the minimum area necessary to ensure the long-term viability of the habitat type; this should include necessary areas for restoration or development for those habitat types for which the present coverage is not sufficient to ensure long-term viability; favourable reference value must be at least the surface area when the Directive came into force; information on historic distribution may be found useful when defining the favourable reference area; ‘best expert judgement’ may be used to define it in absence of other data”*.

For the purposes of the Conservation Status Assessment, FRVs are considered set and are used to assess the current and future values of the parameters area and range. If the parameter value for range (or area) is equal to or greater than the Favourable Reference Range (or the Favourable Reference Area respectively), then the parameter Range (or Area) is considered as Favourable. If the parameter value is less than the Favourable Reference Value, then that parameter is considered Unfavourable Inadequate. And if the parameter value is much less than the Favourable Reference Value then that parameter is considered Unfavourable Bad.

The assessment of the current status of the parameters is based on the data collected during the reference period. But the assessment of the future prospects needs to rely on the analysis and estimate of the current conditions in combination with the future trend that each parameter displays (Figure 2.1). So, in order to derive the predicted future status, we need to project the future trends on the observed current status. The combination of the current status and future trend and status are used to assess the future prospects of each assessment parameter (Figure 2.1).

The evaluation of the future trends of the assessment parameters for a habitat type is based on the analysis of the effects that the observed pressures

and estimated threats may cause to these parameters. This evaluation should take into account:

- a) the number and importance of the pressures and threats recorded in each habitat type,
- b) the presence or absence of mitigating management actions that may moderate the impact of these pressures and threats.

The assessments rely on the overall effect that pressures and threats may have on the conservation status of the evaluation parameters. If there are threats of high or medium importance, then the future trend of the assessment parameters will very likely be decreasing (unless there are management actions to mitigate their impact). If there are only threats of low importance or no threats at all, then the future trend may be considered stable or increasing. Pressures and threats are recorded using the list compiled by the European Commission and is publicly available in the website for the reports according to the Article 17 of Directive 92/43/EEC¹. Furthermore, for the parameters range and area the assessment requires estimating the observed trends for increase, decrease and stability of these parameters. The future trend of range (or area) is assessed as positive if the range (or area) is expected to expand or remain stable over the next 12 years. Correspondingly, the trend is negative if the range (or area) is expected to decrease and is strongly negative if the range (or area) is expected to decrease drastically. A decrease is considered drastic if the range (or area) is expected to decline at an average annual rate (over the next 12 years) of 1% or more of the range (or area) of the habitat type.

Based on the current status of the parameters range, area and structures and functions, and with the assessment of future trends and future status for these parameters it is possible to estimate the future prospects of the parameters, according to the evaluation matrix in Table 2.1.

For the **overall assessment of the future prospects** of a habitat type, the future prospects of the three parameters (range, area and structures and functions) are taken into account. The integration of the future prospects of the three param-

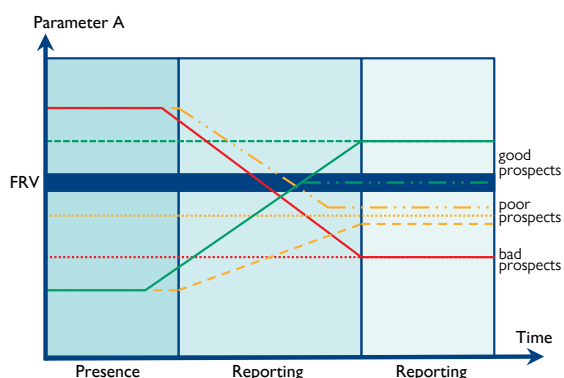


Figure 2.1 Framework for the assessment of the future prospects of a parameter based on its current value in combination with future trend so as to derive predicted future status. Adapted from Evans and Arvela (2011).

ters could be assessed using the evaluation matrix in Table 2.2.

Finally, the overall assessment of the habitat types conservation status on the biogeographical level is based on the combination of the assessment of each parameter estimate according to the rules outlined in Table 2.1.

The conceptual framework for conservation status assessment of habitat types is generic. It offers guidelines and it is flexible. However, it does not offer a specific methodology on how to estimate the parameters or how to set the reference values required to complete the assessment.

The assessment of the parameter **Structures and functions** (including typical species) needs to be estimated for the current conditions, but also to be incorporated on the estimation of future trends and future status. Simultaneously, this parameter needs to be fine-tuned, so as to reflect the variation existing along the geographic range of the habitat type. Therefore, the parameter structures and functions **is more effectively and reliably estimated at the local scale** (Søgaard *et al.*, 2007), **in contrast to the other two parameters (range and area) that are more efficiently estimated at the regional (national) scale**. Therefore, the applied methodological approach needs to be adjusted to these

1 (https://bd.eionet.europa.eu/activities/Reporting/Article_17/reference_portal, accessed November 2017)

Table 2.1 Evaluation matrix for future prospects for habitat types using the parameters: range, area, and structures and functions. The evaluation is based on current status, future trend and predicted future status for each parameter separately. Notes: **1.** Depending on the expected future status in two reporting cycles (12 years): if it is expected to be less than the FRV then it is poor, if it is expected to be much less than the FRV, then it is bad. **2.** Depending on the expected future status in two reporting cycles (12 years): if it is expected to be equal to or greater than the FRV then it is good, if it is expected to be less than the FRV then it is poor, if it is expected to be much less than the FRV, then it is bad. **3.** Depending on the expected future status in two reporting cycles (12 years): if it is expected to be equal to or greater than the FRV then it is good, if it is expected to be less than the FRV then it is poor, if it is expected to be much less than the FRV, then it is bad.

Current status	Future trend	Future status	Future prospects		
Equal to or greater than FRV	+ (increase)	> Greater than FRV	Good		
Equal to or greater than FRV	= (stable)	=/> (Equal to or greater than FRV)	Good		
Equal to FRV	- (decrease)	</<< (Less than FRV)	Poor ¹	Bad ¹	
Greater than FRV	- (decrease)	>/=</<< (greater than, equal to, less than FRV)	Good ²	Poor ²	Bad ²
Less than FRV	+ (increase)	>/=< (greater than, equal to, less than FRV)	Good ³	Poor ³	Bad ³
Less than FRV	= (stable)	< (Less than FRV)	Poor ¹		Bad ¹
Less than FRV	- (decrease)	</<< (Less than FRV)	Poor ¹		Bad ¹
Unkown	+ (increase)/ - (decrease)/ = (stable)/ X (unknown)	X (unknown)	Unknown		

Table 2.2 Evaluation matrix for the overall assessment of future prospects for habitat types, through the combination of the future prospects of the three parameters: range, area and structures and functions. Adapted from Evans and (2011).

	Favourable	Unfavourable-Inadequate	Unfavourable-Bad	Unknown
Future prospects	All parameters have good prospects OR one parameter with unknown prospects, and the other two with good prospects	All other combinations	One or more parameters have bad prospects	Two or more parameters have unknown prospects, and no parameter with bad prospects

Table 2.3 Evaluation matrix for the overall assessment of conservation status for habitat types, through the combination of the assessments of the four parameters: range, area, structures and functions, and future prospects. FRV stands for Favourable Reference Value; MS stands for Member State. Adapted from Evans and Arvela (2011).

Parameter	Conservation status			
	Favourable (FV)	Unfavourable - Inadequate (U1)	Unfavourable - Bad (U2)	Unknown (insufficient information to assess)
Range	Stable (balance between losses and gains) or Increasing AND Not less than FRV	All other combinations	Large reduction (more than 1% reduction per year for the duration specified by the MS) OR Current value less than 90% of the FRV	Lacking information or with insufficient or unreliable information
Area	Stable (balance between losses and gains) or Increasing AND Not less than FRV AND No significant changes in the spatial pattern of occupancy within the range (if there are available information)	All other combinations	Large reduction (more than 1% reduction per year (the percentage may differ among MS if there is justification) OR Large losses in the spatial pattern of occupancy within the range OR Current value less than 90% of the FRV	Lacking information or with insufficient or unreliable information
Structures and Functions (including typical species)	Structures and functions (including typical species) in good condition without significant changes or pressures	All other combinations	More than 25% of the habitats area in bad condition regarding structures and functions (including typical species)	Lacking information or with insufficient or unreliable information
Future prospects (range, area and specific structures and functions)	Future prospects in excellent / good condition without significant impacts from pressures and threats. Long term survival ensured	All other combinations	Future prospects are bad. Significant impact from threats are expected. Long-term viability of the habitat types is not assured	Lacking information or with insufficient or unreliable information
Overall conservation status	All parameters in good condition OR one parameter in unknown condition, and the other three in good condition	One or more parameters in Unfavourable - Inadequate (U1) condition with no parameters in Unfavourable - Bad (U2) condition.	One or more parameters in Unfavourable - Bad (U2) condition.	Two or more parameters in Unknown conditions with no parameters in Unfavourable (either U1 or U2) condition.

conditions and to be specified in such a way that the data collected will inform the assessment of all the parameters reliably and accurately.

2.2 Habitat type reference grid

Beyond the guidelines on the conservation status assessment methodology, Evans and Arvela (2011) also specify the basic spatial unit for the preparation of the distribution and range maps of each habitat type to be submitted as part of the article 17 report. For this purpose, they propose the use of the EEA reference grid at the 10 x 10 km² resolution.

This common European reference grid should replace the national reference grids used in the previous report for the conservation status of habitat types in implementation of the article 17 of the Directive 92/43/EEC for the period 2000-2006. The use of a common reference grid would standardize the presentation of the information, especially for habitat types that are distributed across national borders.

EEA produced such reference grids for all EU Member States. These reference grids consist of 10 x 10 km ETRS 89 grid cells in the ETRS LAEA 52 10 projection. These grids are in accordance with the provisions of the INSPIRE Directive.

2.2.1 Selection of the EEA grid cell size

The Greek territory includes 2056 cells of the EEA reference grid at 10 km (Figure 2.2). The sites of the Natura 2000 network in Greece (i.e. areas with designations Sites of Community Importance (SCIs) / Special Areas of Conservation (SACs), as well as Special Protection Areas (SPAs)) are distributed in 1090 cells.

Although the common European grid has been specified for the submission of maps for the habitat types conservation status assessment at the 10 km resolution, that does not prohibit MS from submitting additional maps, with more detailed distribution data (i.e. at higher resolution), in cases of increased conservation interest or for habitat types of exceptional ecological value. At the European Environment Agency (EEA) website, there are available for download shapefiles with the grid cells to be used by each MS at the resolution of 10 x 10 km², but also for the finer resolution 1 x 1 km², as well as for the coarser resolution 100 x 100 km². Instructions for preparing grids at other scales are also provided. For more information: (<http://www.eea.europa.eu/data-and-maps/data/eea-reference-grids-2#tab-additional-information>).

The following chapters present the adjustments and specifications of the methodological approach for the conservation status assessment of habitat types, as implemented in Greece during the reference period 2007-2012 (carried out the period 2013-2015).

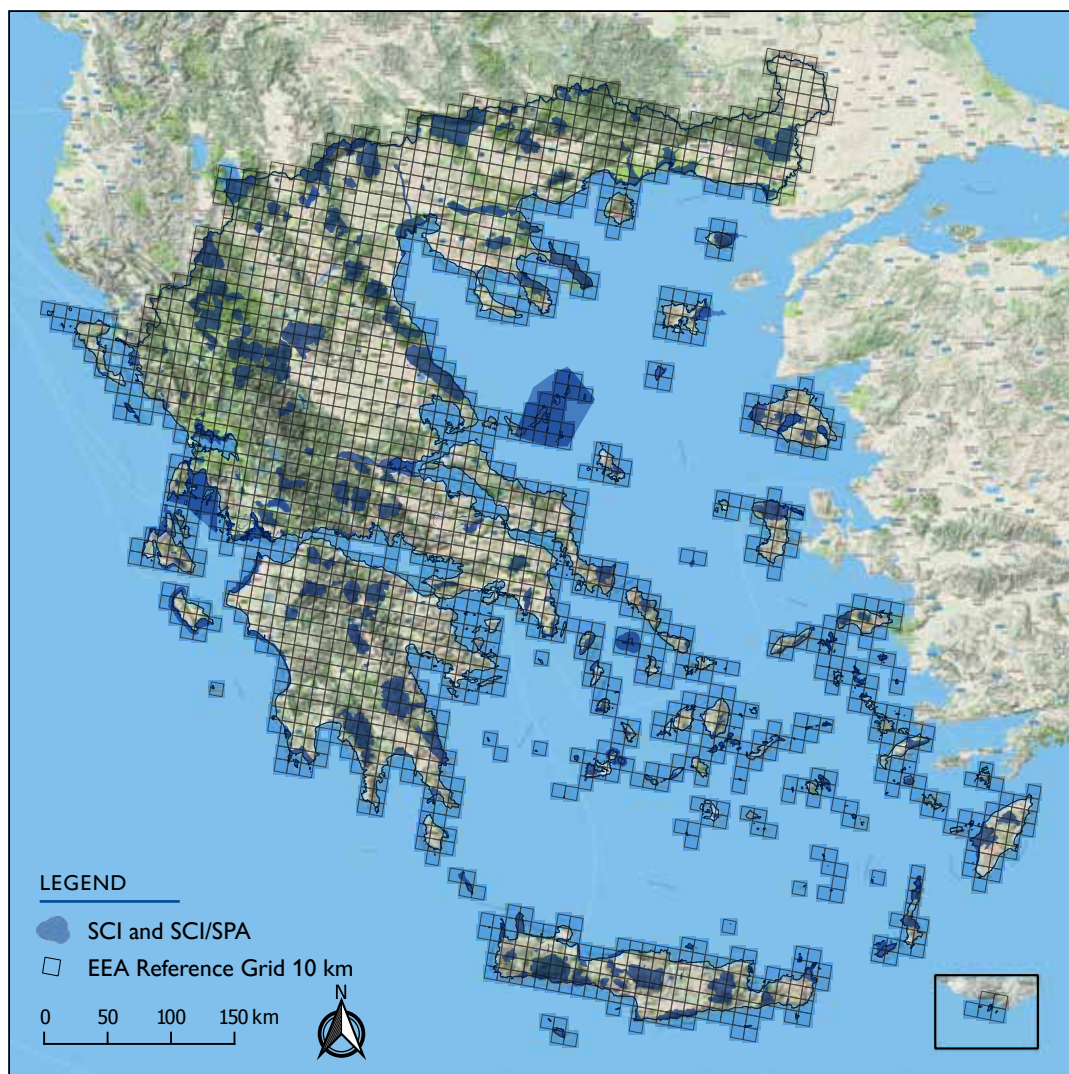


Figure 2.2 Sites of the Natura 2000 network in Greece and the EEA reference grid at 10 x 10 km² resolution.

3. Habitat Types Recorded in Greece

3.1 Methodological approach for the finalization of the list of habitat types to be monitored and assessed

The definitive list of habitat types recorded in Greece was based on the Deliverable A1: Final catalogue of habitat types (Δημόπουλος *et al.*, 2014), which was developed in the framework of the project “Surveillance and assessment of the conservation status of habitat types of community interest in Greece”. This project was invited by the Ministry of Environment, Energy and Climate Change (YPEKA) and was supervised by the Ministry’s Directorate of Biodiversity, Soil and Waste Management / Department of Biodiversity and Protected Areas (former Department of Natural Environment Management). The project was funded by the Operational Program “Environment & Sustainable Development” 2007-2013, which was co-financed by the European Commission Cohesion Fund and the European Regional Development Fund and the Greek Program of Public Investments (national resources).

For the compilation of the definitive list of habitat types recorded in Greece the following sources of information was used:

- the results of the project “Identification and description of the habitat types in areas of conservation interest” 1999-2000 (hereafter referred to as IDHTACI project) funded by the then Ministry of Environment, Planning and Public Works (which is currently the Ministry of Environment and Energy),
- the results of the monitoring project that were included in the 2nd Greek National Report for the implementation of Directive 92/43/EEC
- the updated database for the Natura 2000 network (which is available at <http://www.ypeka.gr/Default.aspx?tabid=432>,
- literature sources, mainly from peer reviewed publications, but also from other publications like theses, technical reports, etc.

3.2 List of habitat types

During the IDHTACI project, there was a list of habitat types recorded in Greece, which included also certain habitat types of Greek interest in addition to the habitat types of the Annex I of the Directive 92/43/EEC. These habitat types of Greek interest were assigned the codes 6270, 6280, 6450, 91K0, 91L0 according to Greek Technical Mapping Guide (Dafis *et al.*, 2001). However, based on the most recent version of the Interpretation Manual of the European Union Habitats (European Commission 2013), these four digit codes (6270, 6280, 6450, 91K0, 91L0) now are used for habitat types of Annex I of the Directive 92/43/EEC that do not occur in the Greek territory.

Based on the data from the IDHTACI project and the most recent (2013) version of the Interpretation Manual (European Commission 2013), Table 3.1 includes a list of habitat types recorded in Greece. The list contains the currently valid Annex I habitat type codes (with changes where necessary). Also, there are comments about the assignment of specific habitat types of Greek interest to habitat types of the Annex I, and information on the codes that changed.

Table 3.1 Update of the list of codes of the habitat types recorded in Greece. Comments are included on the correspondence of habitat types of Greek interest to the habitat types of Annex I of the Directive 92/43 / EEC.

Code and name of the habitat types of Annex I (Directive 92/43 /EEC)	New code and name of habitat type	Comment
COASTAL AND HALOPHYTIC HABITATS		
1210 Annual vegetation of drift lines		No change
1240 Vegetated sea cliffs of the Mediterranean coasts with endemic <i>Limonium</i> spp.		No change
1310 <i>Salicornia</i> and other annuals colonizing mud and sand		No change
1410 Mediterranean salt meadows (<i>Juncetalia maritimi</i>)		No change
1420 Mediterranean and thermo-Atlantic halophilous scrubs (<i>Sarcocornietea fruticosi</i>)		No change
1430 Halo-nitrophilous scrubs (<i>Pegano-Salsoletea</i>)		No change
1510* Mediterranean salt steppes (<i>Limonietalia</i>)		No change
COASTAL SAND DUNES AND INLAND DUNES		
2110 Embryonic shifting dunes		No change
2120 Shifting dunes along the shoreline with <i>Ammophila arenaria</i> (white dunes)		No change
2190 Humid dune slacks		No change
2220 Dunes with <i>Euphorbia terracina</i>		No change
2230 <i>Malcolmietalia</i> dune grasslands		No change
2250* Coastal dunes with <i>Juniperus</i> spp.		No change
2260 <i>Cisto-Lavanduletalia</i> dune sclerophyllous scrubs		No change
2270* Wooded dunes with <i>Pinus pinea</i> and/or <i>Pinus pinaster</i>		No change
FRESHWATER HABITATS		
3130 Oligotrophic to mesotrophic standing waters with vegetation of the <i>Littorelletea uniflorae</i> and/or <i>Isoeto-Nanojuncetea</i>		No change
3140 Hard oligo-mesotrophic waters with benthic vegetation of <i>Chara</i> spp.		No change
3150 Natural eutrophic lakes with <i>Magnopotamion</i> or <i>Hydrocharition</i> - type vegetation		No change
3170* Mediterranean temporary ponds		No change
3240 Alpine rivers and their ligneous vegetation with <i>Salix elaeagnos</i>		No change

Code and name of the habitat types of Annex I (Directive 92/43 /EEC)	New code and name of habitat type	Comment
3250 Constantly flowing Mediterranean rivers with <i>Glaucium flavum</i>		No change
3260 Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation		No change
3280 Constantly flowing Mediterranean rivers with Paspalo-Agrostidion species and hanging curtains of <i>Salix</i> and <i>Populus alba</i>		No change
3290 Intermittently flowing Mediterranean rivers of the Paspalo-Agrostidion		No change
TEMPERATE HEATH AND SCRUB		
4060 Alpine and Boreal heaths		No change
4090 Endemic oro-Mediterranean heaths with gorse		No change
SCLEROPHYLLOUS SCRUB		
5110 Stable xerothermophilous formations with <i>Buxus sempervirens</i> on rock slopes (Berberidion p.p.)		No change
5210 Arborescent matorrals with <i>Juniperus</i> spp.		No change
5230* Arborescent matorrals with <i>Laurus nobilis</i>		No change
5310 <i>Laurus nobilis</i> thickets		No change
5330 Thermo-Mediterranean and pre-desert scrub		No change
5420 <i>Sarcopoterium spinosum</i> phrygas		No change
5430 Endemic phrygas of the Euphorbio-Verbascon		No change
NATURAL AND SEMI-NATURAL GRASSLAND FORMATIONS		
6110* Rupicolous calcareous or basophilic grasslands of the Alysso-Sedion albi		No change
6170 Alpine and subalpine calcareous grasslands		No change
6220* Pseudo-steppe with grasses and annuals of the Thero-Brachypodietea		No change
6230* Species-rich <i>Nardus</i> grasslands, on siliceous substrates in mountain areas (and submountain areas, in Continental Europe)		No change
6260* Pannonic sand steppes	New habitat type code for Greece	New record for Greece (Fotiadis et al., 2014)
62A0 Eastern sub-mediterranean dry grasslands (<i>Scorzoneralia villosae</i>)	New habitat type code in the Directive 92/43/EEC	The old records of the habitat type 6210 have been assigned to the new habitat type 62A0 (classification revision)

Code and name of the habitat types of Annex I (Directive 92/43 /EEC)	New code and name of habitat type	Comment
62D0 Oro-Moesian acidophilous grasslands	New habitat type code in the Directive 92/43/EEC	Habitat code was added after Bulgaria and Romania joined EU
6420 Mediterranean tall humid herb grasslands of the Molinio - Holoschoenion		No change
6430 Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels		No change
6510 Lowland hay meadows (<i>Alopecurus pratensis</i> , <i>Sanguisorba officinalis</i>)		No change
RAISED BOGS AND MIRES AND FENS		
7140 Transition mires and quaking bogs		Change of code from 7130 to 7140 in Greece
7210* Calcareous fens with <i>Cladium mariscus</i> and species of the Caricion davallianae		No change
7220 Petrifying springs with tufa formation (Cratoneurion)		No change
7230 Alkaline fens		No change
ROCKY HABITATS AND CAVES		
8140 Eastern Mediterranean screes		No change
8210 Calcareous rocky slopes with chasmophytic vegetation		No change
8220 Siliceous rocky slopes with chasmophytic vegetation		No change
8310 Caves not open to the public		No change
8320 Fields of lava and natural excavations		No change
FORESTS		
9110 Luzulo-Fagetum beech forests		No change
9130 Asperulo-Fagetum beech forests		No change
9140 Medio-European subalpine beech woods with <i>Acer</i> and <i>Rumex arifolius</i>		No change
9150 Medio-European limestone beech forests of the Cephalanthero-Fagion		No change
9180* Tilio-Acerion forests of slopes, screes and ravines		No change
91BA Moesian silver fir forests	New habitat type code in the Directive 92/43/EEC	Habitat code was added after Bulgaria and Romania joined EU
91CA Rhodopide and Balkan Range Scots pine forests	New habitat type code in the Directive 92/43/EEC	Habitat code was added after Bulgaria and Romania joined EU
91E0* Alluvial forests with <i>Alnus glutinosa</i> and <i>Fraxinus excelsior</i> (Alno-Padion, Alnionincanae, Salicion albae)		No change

Code and name of the habitat types of Annex I (Directive 92/43 /EEC)	New code and name of habitat type	Comment
91F0 Riparian mixed forests of <i>Quercus robur</i> , <i>Ulmus laevis</i> , <i>Ulmus minor</i> , <i>Fraxinus excelsior</i> or <i>Fraxinus angustifolia</i> along the great rivers (<i>Ulmion minoris</i>)		No change
91MO Pannonian-Balkan turkey oak-sessile oak forests	New habitat type code in the Directive 92/43/EEC	The old records of the habitat type of Greek interest 924A have been assigned to the new habitat type 91MO (classification revision)
9250 <i>Quercus trojana</i> woods		No change
9260 <i>Castanea sativa</i> woods		No change
9270 Hellenic beech forests with <i>Abies borisii-regis</i>		No change
9280 <i>Quercus frainetto</i> woods		No change
9290 <i>Cupressus</i> forests (Acero-Cupression)		No change
92A0 <i>Salix alba</i> and <i>Populus alba</i> galleries		No change
92C0 <i>Platanus orientalis</i> and <i>Liquidambar orientalis</i> woods (<i>Platanion orientalis</i>)		No change
92D0 Southern riparian galleries and thickets(<i>Nerio</i> - <i>Tamaricetea</i> and <i>Securinegion tinctoriae</i>)		No change
9310 Aegean <i>Quercus brachyphylla</i> forests		No change
9320 <i>Olea</i> and <i>Ceratonia</i> forests		No change
9340 <i>Quercus ilex</i> and <i>Quercus rotundifolia</i> forests		No change
9350 <i>Quercus macrolepis</i> forests		No change
9370* Palm groves of <i>Phoenix</i>		No change
9380 Forests of <i>Ilex aquifolium</i>		No change
9410 Acidophilous <i>Picea</i> forests of the montane to alpine levels (<i>Vaccinio-Piceetea</i>)		No change
9530* (Sub-)Mediterranean pine forests with endemic blackpines		No change
9540 Mediterranean pine forests with endemic Mesogean pines		The old records of the habitat type 9540 in the case of high-altitude Oro-Mediterranean pine forests (<i>Pinus heldreichii</i> or <i>Pinus peuce</i>) have been assigned to the new habitat type 95A0 (classification revision)
9560* Endemic forests with <i>Juniperus</i> spp.		No change
9580 Mediterranean <i>Taxus baccata</i> woods		No change
95A0 High oro-Mediterranean pine forests	New habitat type code in the Directive 92/43/EEC	In the IDHTACI project (1999-2001) this habitat was part of the habitat type 9540

Code and name of the habitat types of Annex I (Directive 92/43 /EEC)	New code and name of habitat type	Comment
HABITAT TYPES OF GREEK INTEREST		
1260 Sublittoral zone of the islets of the Aegean(halophytic meadows, phryganic-halophytic communities, chasmophytic-halophytic comm.)		The old records of the habitat type 1260 have been assigned to the Annex I habitat types 1240 or 1430 depending on the typical species and the ecological conditions (classification revision)
1270 Coastal Saginetea communities on stable substratum		The old records of the habitat type 1270 have been assigned to the Annex I habitat type 1310 (classification revision)
1440 Salt pans		No change
32B0 Euro-Siberian annual communities of muddy riverbanks	3280: Mediterranean rivers with Paspalo-Agrostidion	
5150 Pteridium aquilinum stands		No change
5160 South east sub Mediterranean scrub (Prunion fruticosae)		No change
5340 Eastern Mediterranean Garrigues		No change
5350 Pseudomaquis		No change
5360 Formations with <i>Spartium junceum</i>		No change
6270 Cretan steppes		The old records of the habitat type of Greek interest 6270 have been assigned to the Annex I habitat type 6220 (classification revision)
6280 Oro-Mediterranean grasslands (Ononido-Rosmarinetea)		Habitat type of Greek interest. Not assessed.
6290 Mediterranean subnitrophilous grasslands		Habitat type of Greek interest. Not assessed.
6450 Hellenic Supra-Mediterranean wet grasslands		Habitat type of Greek interest. Not assessed.
651A Mesic pastures		Habitat type of Greek interest. Not assessed.
72A0 Reed thickets		No change
72B0 Rush communities		No change
8260 Adiantetalia: Acrocladio-Adiantetum		The habitat type was retained. Its conservation status was not assessed.
GR 91K0 Greek forests of <i>Betula pendula</i>		The habitat type was retained with a different code (GR 91K0)
GR 91L0 Supra-Mediterranean stands of <i>Populus tremula</i>		The habitat type was retained with a different code (GR 91L0)
925A <i>Ostrya</i> , <i>Carpinus</i> and mixed thermophilous forests		Habitat type of Greek interest. Not assessed.
925B <i>Celtis australis</i> forests		Habitat type of Greek interest. Not assessed.

Code and name of the habitat types of Annex I (Directive 92/43 /EEC)	New code and name of habitat type	Comment
92E0 Balkan scrub of red <i>Salix</i>		The old records of the habitat type of Greek interest 92E0 have been assigned to the Annex I habitat type 3240 (classification revision)
934A Greek <i>Quercus coccifera</i> woods		No change
934B Sclerophyllous scrub with <i>Crataegus monogyna</i>		The old records of the habitat type of Greek interest 934B have been assigned to the Annex I habitat type 934A (classification revision)
9440 Greek forests of <i>Pinus sylvestris</i>		The old records of the habitat type of Greek interest 9440 have been assigned to the Annex I habitat type 91CA (classification revision)
951A Greek forests of silver fir		The old records of the habitat type of Greek interest 951A have been assigned to the Annex I habitat type 91BA (classification revision)
951B <i>Abies cephalonica</i> forests		No change

3.3 Comments on the habitat types of Greek interest or to the new additions to Annex I of the Directive 92/43/EEC

3.3.1 Changes in Annex I habitat types

From the habitat code **6210**: Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*) to the habitat code **62A0**: Eastern sub-mediterranean dry grasslands (*Scorzonera villosae*)

From the plant sociological perspective, it is highly unlikely that the habitat type 6210 occurs in Greece. After field investigations for the possible presence of habitat type 6210 in Greece, it was concluded that the habitat type is 62A0 and not 6210. The two habitat types have similar physiognomy but the species composition of 62A0 has more Mediterranean species (Calaciura and Spinelli 2008). Therefore, all references to the habitat code 6210 have been replaced with habitat code 62A0.

7130 – [Blanket bogs (* if active bog)]

Based on the interpretation manual, the definition of habitat type 7130 is:

“Extensive bog communities or landscapes on flat or sloping ground with poor surface drainage, in oceanic climates with heavy rainfall, characteristic of western and northern Britain and Ireland. In spite of some lateral water flow, blanket bogs are mostly ombrotrophic. They often cover extensive areas with local topographic features supporting distinct communities [*Erico-Sphagnetalia magellanici*: *Pleurozium purpureum* -*Ericetum tetralicis*, *Vaccinio-Ericetum tetralicis* p.; *Scheuchzerietalia palustris* p., *Utricularietalia intermedio minoris* p., *Caricetalia fuscae* p.]. *Sphagnum* play an important role in all of them but the cyperaceous component is greater than in raised bogs.”

In Greece, this habitat type has not been reported in the literature and is not expected to occur due to the climatic conditions. Most Greek bogs are minerotrophic, not ombrotrophic. The climatic conditions, even in the mountains, do not correspond to those of the Atlantic type climate necessary for the formation of blanket bogs. The plant communities and plant species reported in the habitat type's definition do not occur in Greece, or do not occur in the same locality to form blanket bogs.

Therefore, all records for the habitat type 7130 should be replaced with habitat type 7140 “Transition mires and quaking bogs”.

9170 – *Galio-Carpinetum* oak-hornbeam forests

Based on the definition of habitat type 7130 according to the interpretation manual, the presence of habitat type 9170 in Greece is unlikely. Also, the inspection of the relevés showed that this is typically woods with *Carpinus orientalis* with occasional records of *Carpinus betulus*. Therefore, the records of habitat type 9170 (which is a habitat type of Annex I of the Habitats Directive) should be classified as the Greek interest habitat type 925A (*Ostrya*, *Carpinus* and mixed thermophilous forests).

91AA – *Eastern white oak woods

This is a new habitat type that was added to the Annex I of the Habitats Directive after Bulgaria and Romania joined the EU. This habitat type includes azonal white-oak dominated woods with a sub-mediterranean flora, occupying thermic oases within the sub-continental *Quercion frainetto* and *Carpinion illyricum* zones. The presence of this habitat type in Greece was considered likely, and field work was undertaken to look for it. But the definition of the habitat type according to the interpretation manual (European Commission, 2013) is not detailed enough to allow its distinction from other similar habitat types, we consider

that the definition needs more amendment, in order to certify its presence in Greece.

91BA – Moesian silver fir forests

In the IDHTACI project (1999-2001), the Greek white fir forests were classified in the Greek interest habitat type 951A. Since then, and according to the more recent edition of the interpretation manual (European Commission, 2013), the habitat type 91BA has been added to the Annex I habitat types. This habitat type includes the Balkan forests of *Abies alba*. Therefore, the records of the Greek interest 951A habitat type should be included in the 91BA habitat type. Thus, in the list of the habitat types of Greece, the habitat type 951A has been replaced by the type 91BA.

91CA - Rhodopide and Balkan Range Scots pine forests

In the IDHTACI project (1999-2001), the *Pinus sylvestris* forests of Greece were classified in the Greek interest habitat type 9440 (Δημόπουλος κ.ά. 2014). So there are several records (both in the habitat maps and in the phytosociological database) of the Greek interest habitat type 9440. But this habitat type code is not accepted in the updated classification of habitat types, and the new habitat type 91CA was added to the Annex I list of habitat types. Therefore, and after inspecting the relevés records for the 9440 habitat type, it was concluded that the old references to 9440 actually represent the new habitat type 91CA and thus old records were changed. So in Greece now the habitat type 91CA (Rhodopide and Balkan Range Scots pine forests) is recorded and monitored.

91M0 - Pannonian-Balkan turkey oak- sessile oak forests

Habitat type 91M0 includes forests with sub-continental thermo-xerophilous *Quercus cerris*, *Q. pet-*

raea or *Q. frainetto* and related deciduous oaks. Its range includes continental northeast Greece, and it is distributed generally between 250 and 600 (800) m above sea level (European Commission, 2013). This type of forest is often related to agro-forestry management systems (Bergmeier *et al.* 2010). This habitat type physiognomy resembles that of habitat types 924A and 9280, and the distinction among them is not always easy. Furthermore, based on its floristic composition, habitat type 91M0 is similar to *Ostrya*, *Carpinus* and mixed thermophilous forests (which during the IDHTACI project have been classified in the Greek interest habitat type 925A). Therefore, to investigate the presence and distribution of habitat type 91M0 in Greece we examined the phytosociological database for all relevés that included the species *Quercus cerris*, *Q. petraea*, *Q. petraea* ssp. *medwediewii*, *Q. robur*, *Q. robur* ssp. *pedunculiflora* in their canopy with a coverage at least 2 of the Braun-Blanquet scale. There were 577 relevés with these species in the canopy. Out of these, 533 relevés had exact geographic coordinates. Among these relevés, 257 were in the altitudinal range (200-800 m) that is part of the definition according to the Interpretation Manual. Several of these relevés belong to habitat type 9340 (*Quercus ilex* and *Quercus rotundifolia* forests) which also has these oak species present in its canopy. The relevés belonging to 9340 has been removed from further consideration. Also relevés from Sterea Ellada, Thessaly and the Peloponnisos have been removed from consideration since it is unlikely that the habitat type will appear there. Finally there were 173 relevés left that fulfill all the criteria (Figure 3.1).

For each of these relevés the species composition was compared to the species named in the definition of habitat type 91M0 in the Interpretation Manual (European Commission 2013). The relevés that had six or more typical species present were considered highly likely to belong to habitat type 91M0. The geographical locations of these set of relevés and the sites of the Natura 2000 network where these relevés are located are presented in Figure 3.2.

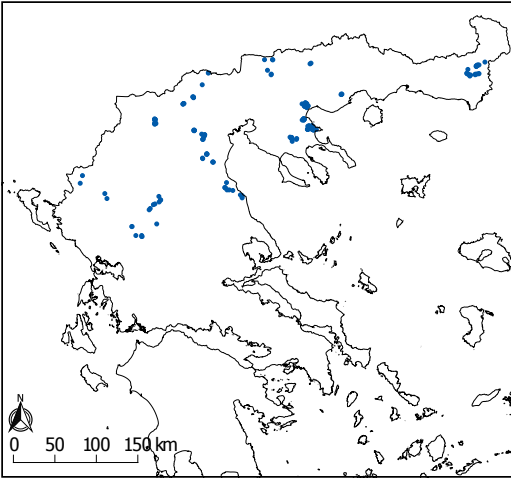


Figure 3.1 Geographic locations of the relevés sampled during the IDHTACI project (1999-2001), with dominant oak species in the canopy that is likely to belong to habitat type 91M0.

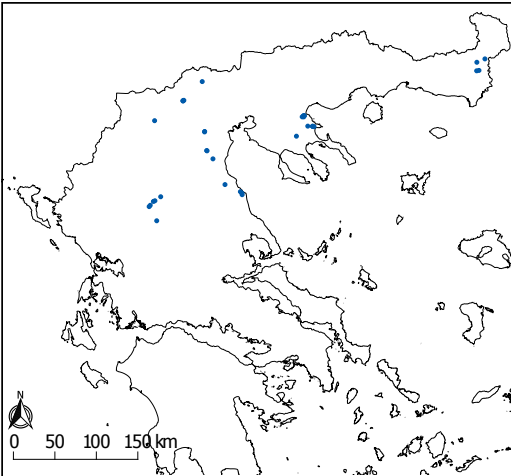


Figure 3.2 Geographic locations of the relevés with 6 or more typical species of the habitat type 91M0.

3.3.2 Changes in Greek interest habitat types

1260 – Sublittoral zone of the islets of the Aegean (halophytic meadows, phryganic-halophytic communities, chasmophytic-halophytic comm.)

According to Dafis *et al.* (2001), this habitat type of Greek interest includes mixed communities of halophytic species and species of phrygana and scrub or chasmophytic species. Also, habitat type 1260 includes the halophytic meadows growing in the coastal zone that receives the effect of the spraying of the sea, but it is not submerged (or rarely submerged) by the wave. It is a heterogeneous habitat type with more than one vegetation types included. On the basis of Bergmeier and Dimopoulos (2003), the vegetation of these areas belong to the classes Pegano-Salsotea and Crithmo-Staticetea, which were previously associated with habitat type 1260, should be more properly assigned to the following habitat types of the Annex I of the Directive 92/43/EEC: 1430 (Mediterranean and thermo-Atlantic halophilous scrubs *Sarcocornietea fruticosi*) and 1240 (Vegetated sea cliffs of the Mediterranean coasts with endemic *Limonium* spp.).

Based on the above, the records of the habitat type of Greek interest 1260 were assigned to the mentioned Annex I habitat types based on their geographical distribution and plant community composition, as follows:

- To habitat type 1430 the relevés from the floristic region of Crete and Karpathos (GR4320003, GR4320006, GR4320008, GR4340013), and
- To habitat type 1240 the relevés from other Natura 2000 sites in Crete and in the Aegean islands.

6270 – Cretan steppes

According to Dafis *et al.* (2001), the habitat type of Greek interest 6270 includes Cretan steppes that are rare and isolated formations with *Lygeum spartum* on the southern coast of Crete. However, in the more recent edition of the Interpre-

tation Manual (European Commission, 2013) the habitat type code 6270 has been assigned to a habitat type (Fennoscandian lowland species-rich dry to mesic grasslands), which is included in Annex I of the Directive 92/43/EEC. Therefore, and in order to avoid confusion, the habitat type of Greek interest 6270 has been classified as habitat type 6220 (Pseudo-steppe with grasses and annuals of the Thero-Brachypodietea), which is also included in Annex I of the Directive 92/43/EEC. This action was deemed necessary, since, according to its definition, habitat type 6220 includes not only Class Thero-Brachypodietea, but also Classes Poete abulbosae and Lygeo-Stipeteta.

6280 – Oro-Mediterranean grasslands (Ononido-Rosmarinetea)

The habitat type of Greek interest 6280 has been recorded in few localities in four Special Areas for Conservation in Greece (GR1260007, GR1330001, GR1330002, GR1340001). According to the available information on its floristic composition, it cannot be classified as any other of the defined habitat types of the Annex I of the Directive 92/43/EEC. However, in the more recent edition of the Interpretation Manual (European Commission, 2013) the code 6280 has been assigned to the habitat type “Nordic alvar and precambrian calcareous flatrocks”. Therefore, it would create confusion to retain the 6280 code as is. Thus, to avoid confusion, the habitat type of Greek interest is not retained in the updated list of habitat types of Greece and has not been assessed.

6290 – Mediterranean subnitrophilous grasslands

The habitat type of Greek interest 6290 has been recorded in few localities in seven Special Areas for Conservation in Greece. It represents a heterogeneous habitat type with floristic composition that could be associated with the phytosociological classes Festuco-Brometea, Thero-Brachypodietea and Stellarietea mediae. According to the

available information on its floristic composition, it cannot be classified as any other of the defined habitat types in the more recent edition of the Interpretation Manual (European Commission, 2013). Therefore this habitat type is not retained in the updated list of habitat types of Greece and has not been assessed.

6450 – Hellenic Supra-Mediterranean wet grasslands

The habitat type of Greek interest 6450 includes mesic grasslands that could be associated from a phytosociological point of view with the class Molinio-Arrhenatheretea, the order Trifolio-Hordeetalia and the alliance Trifolion resupinati. According to recent studies in Greece and other neighboring Mediterranean countries (Biondi *et al.* 2012, Dimopoulos *et al.* 2012, Genovesi *et al.* 2014), and the definition of grassland habitat types in the more recent edition of the Interpretation Manual (European Commission, 2013), the habitat type of Greek interest 6450 does not correspond to any existing habitat type of the Annex I of the Directive 92/43/EEC. Therefore, habitat type 6450 is not retained in the updated list of habitat types of Greece and has not been assessed.

651A – Mesic pastures

According to Dafis *et al.* (2001), the habitat type of Greek interest 651A, includes grazed mesic pastures, fertilized in properly drained soils. According to the available information, it does not correspond to any existing habitat type of the Annex I of the Directive 92/43/EEC. Therefore, this habitat type is not retained in the updated list of habitat types of Greece and has not been assessed.

8260 – Adiantetalia: Acrocladio-Adiantetum

The habitat type of Greek interest 8260 has been recorded in 22 sampling localities in two Special

Areas for Conservation in Greece. It is a habitat type with chasmophytic vegetation that includes *Adiantum capillus-veneris* and mosses and occurs on wet rocks (continuously receiving water) along small rivers, in ravines or in caves close to permanent water bodies (Dafis *et al.* 2001). It is an azonal vegetation type which is widespread in the Mediterranean region. This habitat type is closely related to habitat types 8110, 8220, and 8230. The main difference is that habitat type 8260 occurs in slate, while habitat types 8110, 8220 and 8230 occur in siliceous rocky formations and two of them (8110 and 8230) have not been recorded in Greece. In conclusion, this habitat type does not correspond to any of the Annex I habitat types, and therefore it was retained in the list of habitat types in Greece, but it was not assessed.

91K0 – Greek forests of *Betula pendula*

The Greek forests of *Betula pendula* are usually precursors of oak or spruce forests (Δημόπουλος *et al.* 2013). The stands of this type of forest occurs in several sites of the Natura 2000 network in Greece, most of which are under the authority of Management Agencies. According to the more recent edition of the Interpretation Manual (European Commission, 2013), there is no habitat type defined that corresponds floristically or ecologically to the Greek forests of *Betula pendula*. Therefore, it is considered necessary to retain this habitat type, but the habitat type code needs to be changed, since there is currently an Annex I habitat type assigned to code 91K0 (Illyrian *Fagus sylvatica* forests, Aremonio-Fagion). For the purposes of this assessment, and to avoid confusion, the Greek interest habitat type is proposed to be coded GR91K0.

3.4 Literature review and database

3.4.1 Introduction

The literature on the vegetation of Greece, although quite extensive, refers generally to Greece or the information provided is descriptive. The collection of literature data aimed to explore the vegetation **throughout Greece** in order to reach conclusions about both the current actual distribution of habitat types, as well as their potential distribution. All categories of vegetation were investigated, even those corresponding to habitat types that were not included in the monitoring project and whose conservation status was not assessed. After the data was extracted from the scientific publications, the vegetation units were matched to the habitat types. Many of the habitat types for which literature data was available were proposed for monitoring in the monitoring project. Through this process, all available data have been investigated and assessed about the presence or absence of some habitat types that were not in the original list of habitat types in Greece. All the data collected were used in later stages of the monitoring and conservation status assessment project.

The available publications include data on all semi-natural and natural habitat types (except for the human dominated land cover classes 1020 and 1021). This published record information was combined with the data from habitat mapping (i.e. data from the IDHTACI project 1999-2001). From this review we present information on:

- first, the habitat types of Annex I of the Habitats Directive (92/43/EEC), as defined in the most recent edition of the Interpretation Manual of European Union Habitats (European Commission, 2013),
- second, habitat types of Greek interest (not included in Annex I), some of which are included in the monitoring project.

For the purposes of the monitoring and conservation status assessment of the habitat types, **381 publications were collected**, of which 197 are in Greek and 184 are in other languages (mainly in English). These publications provide information for locations throughout Greece (regardless

of whether the geographic location is inside or outside sites of the Natura 2000 network). The information provided can be used in various ways, such as for the establishment of sampling locations outside Natura 2000 sites.

The majority of the 381 publications were published in the 2001-2010 period (Figure 3.3), a time period when most of the field sampling for vegetation research took place (Figure 3.4). The oldest publication analyzed is that of Παπαϊωάννου (1948), while 2005 is the year when the largest number of scientific studies was published (45 in total).

Most publications (288) are based on vegetation sampling according to the Braun-Blanquet phytosociological method. However, other publications provide vegetation data either descriptively or by other methods. This literature review identified 20,961 relevés, many of which were included in more than one publications.

Regarding the geographical distribution of this sampling effort, most publications refer to Northern Greece (the North East-NE and North Central-NC floristic regions of Greece sensu Strid) (Figure 3.5). The next most studied regions were the remaining continental floristic regions of Greece (Sterea Ellas-StE, North Pindos-NPi and Peloponnisos-Pe), as well as the Kriti and Karpachos (KK) region. On the other end the Ionian Islands-Iol, and the Islands of North Aegean (NAe) and East Aegean (EAe) are the less well studied regions in Greece. The patterns for sampling effort as derived from the number of published relevés are similar (Figure 3.6).

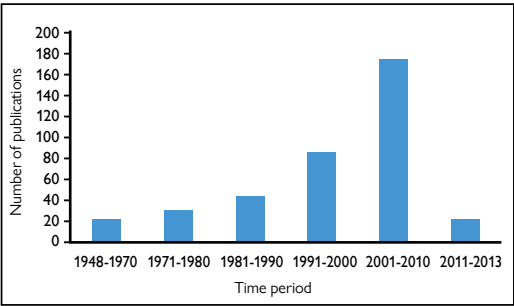


Figure 3.3 Number of publications per time period regarding vegetation and habitat types in Greece.

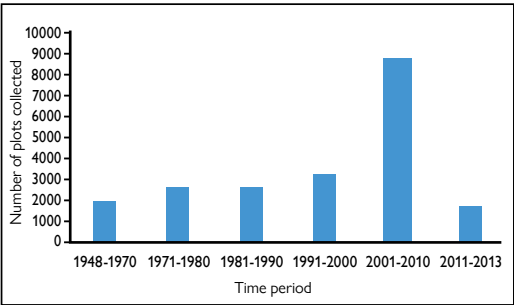


Figure 3.4 Number of new additional vegetation sampling data published per time period in Greece.

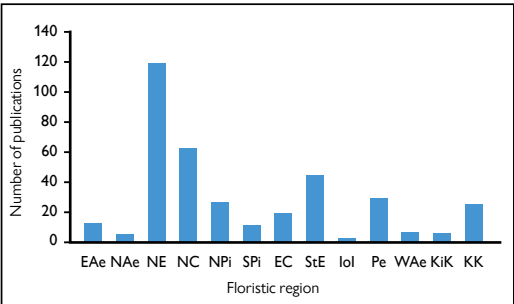


Figure 3.5 Number of publications regarding vegetation and habitat types per floristic region in Greece.

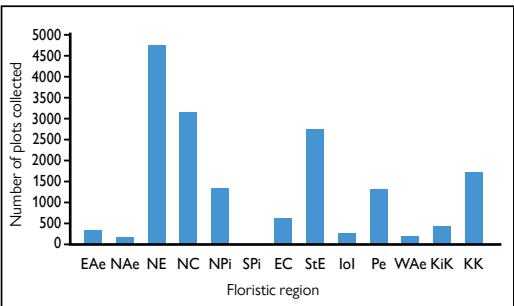


Figure 3.6 Number of plots collected regarding vegetation and habitat types per floristic region in Greece.

3.4.2 Database

The aim of the database created was to use all information on habitat types as thoroughly as possible. The literature sources used are reliable scientific sound publications (e.g. peer reviewed publications in international scientific journals, conference proceedings, scientific books, MSc dissertations, and doctoral theses). Also, the database included grey literature sources, such as research reports, environmental studies, technical reports of scientific projects, studies and publications that have not been peer reviewed, or unpublished data contained in experts' private records. For this second group of publications the scientific reliability has not been rigorously tested, and thus their use always was done with caution. The above data were input in a database, which also included:

a) the citation information of the publication (e.g. author names and affiliations, date, publication source)

b) detailed description of the habitat type relevant information in the publication, such as habitat type examined, date of data collection, geographic location, name of researcher(s), sampling method, ecological information (e.g. altitude), etc.

c) geographic information that allows the projection of the data to a geographic information system (GIS), in accordance with the provisions of the INSPIRE directive 2007/2/EC (e.g. geographic coordinates, toponym, study region).

All this information was recorded in three Excel worksheets (Sheet 1: publication records, Sheet 2: habitat types, Sheet 3: field names and interpretation).

Sheet 1: publication records

This worksheet contains all the literature sources located that may be used to assess the conservation status of habitat types in Greece. Altogether 381 publications are included. The worksheet contained 26 fields to record information:

- **"Reference_ID"**: a unique code identifier for each publication
- **"Authors"**: the author or authors of each publication
- **"D_Year_pub"**: year of publication
- **"Title"**: title of publication
- **"Publ"**: publication source. i.e. Journal title, Publisher of book etc.
- **"Source_type"**: classification of each publication according to its type. This field has the options: (a) "paper" for peer-reviewed scientific journals, (b) "conference" for conference presentations in proceedings, (c) "PhD Thesis" for doctoral theses, (d) "Master Thesis" for MSc dissertations, (e) "other" for other types of publications like technical reports, or project deliverables, (f) "unpubl." unpublished data contained in experts private records, and (g) "diploma" for undergraduate student dissertations.
- **"Ref_Title"**: the full title of the publication
- **"pdf_file"**: the availability of the publication as a pdf file in the internet. If available the URL address of the publication is in this field.
- **"eval"**: the reliability of the publication. The evaluation of the reliability was in three classes: very good, good, moderate
- **"method"**: sampling method used for data collection, e.g. Braun-Blanquet, descriptive, etc.
- **"eval_meth"**: the reliability of the data contained according to how detailed they are. The evaluation of the reliability was in three classes: very good, good, moderate
- **"Nr_relevés"**: number of relevés included in the publication
- **"Nr_rel_synoptic_tab"**: number of relevés included in the synoptic tables
- **"Nr_rel_lit"**: number of relevés included in the publication but were reported in other older publications
- **"Nr_rel_orig"**: number of relevés published for the first time ever in this publication
- **"D_Year"**: year (or range of years) of data collection
- **"Researc"**: the name of the researcher(s) that collected the data for this publication
- **"Floristic_region"**: floristic region where sampling took place
- **"Distribution"**: Toponym or name of location where sampling took place

- **“Latitude”**: the latitude coordinate of the sample plots. In cases where the latitude is not reported, or is reported with accuracy of up to 2 digits, this is a general geographic description (not possible to pinpoint the relevé location)
- **“Longitude”**: the longitude coordinate of the sample plots. In cases where the latitude is not reported, or is reported with accuracy of up to 2 digits, this is a general geographic description (not possible to pinpoint the relevé location)
- **“Altitude”**: Altitude (or range of altitudes) of relevés as meters above sea level
- **“TKS”**: name or code of Sites of Community Interest where the sampling took place (if sampling took place inside a site of the Natura 2000 network)
- **“Grid”**: range of EEA grid cells examined
- **“Syntaxa”**: the vegetation unit identified in the publication
- **“HabType_ID”**: the habitat type code(s) examined.

Sheet 2: habitat types

The aim of the literature review was to collect information on habitat types. This worksheet includes the most critical information of the database, i.e. the information regarding the habitat types extracted from the publications collected. There are 1670 records for habitat types and locations. The worksheet contained 13 fields to record information:

- **“HabType_ID”**: the habitat type recorded
- **“Syntaxa”**: the vegetation unit identified in the publication and is relevant to the habitat type examined
- **“Reference_ID”**: a unique code identifier for each publication (link to worksheet 1)
- **“D_Year_pub”**: year of publication
- **“D_Year”**: year (or range of years) of data collection for the habitat type
- **“Researc”**: the name of the researcher(s) that collected the data for the habitat type
- **“Floristic_region”**: floristic region where the habitat type was recorded
- **“Distribution”**: Toponym or name of location where the habitat type was recorded
- **“Latitude”**: the latitude coordinate of the sample plots. In cases where the latitude is not re-

ported, or is reported with accuracy of up to 2 digits, this is a general geographic description (not possible to pinpoint the relevé location)

- **“Longitude”**: the longitude coordinate of the sample plots. In cases where the latitude is not reported, or is reported with accuracy of up to 2 digits, this is a general geographic description (not possible to pinpoint the relevé location)
- **“Altitude”**: Altitude (or range of altitudes) of the habitat type as meters above sea level
- **“TKS”**: name or code of Sites of Community Interest where the habitat type was recorded (if it was recorded inside a site of the Natura 2000 network)
- **“Grid”**: range of EEA grid cells where the habitat type was recorded

Sheet 3: field names and interpretation

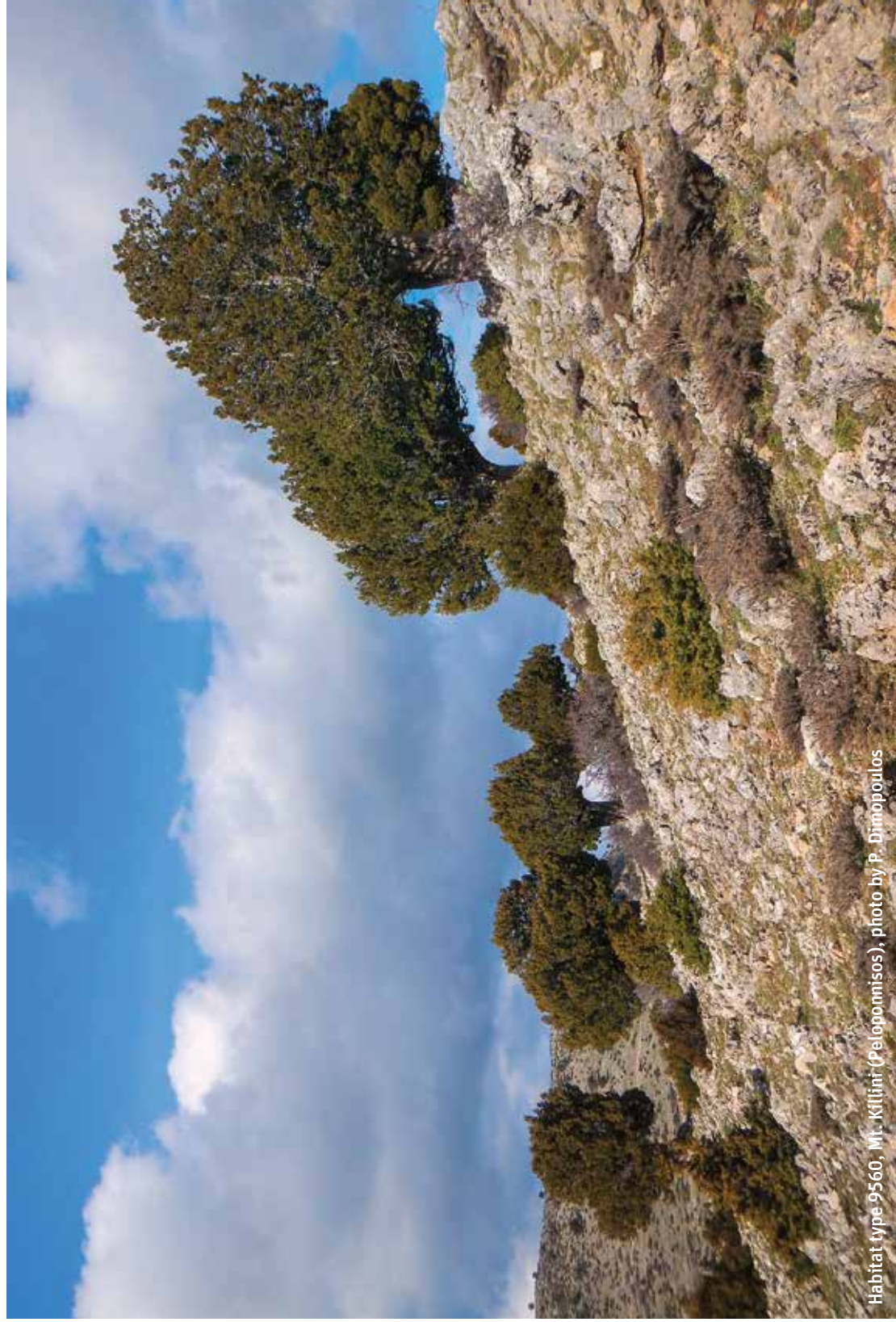
For the database to be reusable there is a need for documentation of its content. In the third worksheet, there are all necessary explanations for the contents of the fields of the other two worksheets (Sheet 1: publication records and Sheet 2: habitat types).

3.4.3 Issues that arose and ways to resolve them

Processing the database led to certain issues, like nomenclature or questionable observations. It was necessary to make changes (for example updating of nomenclature and even corrections) both on the habitat maps data and on the relevé data. As discussed in detail in the preceding section, the habitat maps produced in 1999-2001 during the IDHTACI project used habitat type codes that now need revision and update (e.g. the codes assigned to some habitat types now refer to different habitat categories, and new habitat types added to Annex I of the Directive 92/43/EEC correspond closely to habitat types of Greek interest); in that sense, all such records were revised and updated. At the relevé dataset arose some issues also. Some relevés were assigned to habitat types that needed revision for the reasons stated in the previous section, or some other fields of the relevé needed corrections. During the IDHTACI project a total of 15991 relevés were sampled. Changes were made to the habitat type codes of different relevés as summarized in Table 3.2.

Table 3.2 Summary presentation of the changes needed so that the habitat type codes used during the IDHTACI project (1999-2001) would correspond to the habitat type codes currently in use (and in accordance with the most recent edition (2013) of the Interpretation Manual of European Union Habitats).

Habitat type code in the IDHTACI project (1999-2001)	Currently valid habitat type code
1260	1240
1260	1430
1270	1310
2195	2190
2210	2110
3120	3130
3132	3130
5130	5210
5211	5210
5212	5210
5213	5210
5320	5420
5331	5330
6173	6170
6210	62A0
6211	62A0
6270	6220
6432	6430
7130	7140
8216	8210
8217	8210
8218	8210
8219	8210
8230	8220
9120	9130
9170	925A
9440	91CA
9536	9530
9540*	95A0
9563	9560
32B0	3280
821A	8210
924A	91M0
92EO	3240
934B	934A
951A	91BA



Habitat type 9560, Mt. Kilini (Peloponnisos), photo by P. Dimopoulos



Habitat type 9370, Preveli (Kriti), photo by P. Dimopoulos

4. Adaptation of the Methodology for the Evaluation of the Parameters of Habitat Type Conservation Status Assessment in Greece

Habitat type's conservation status assessment is based on the evaluation of the parameters: range, area, and structures and functions (including typical species) (Evans and Arvela, 2011), as was described in Chapter 2. This chapter focuses on the detailed description of the methodology applied in Greece for the assessment of the conservation status of the habitat types for the compilation of the most recent national report on the implementation of the Habitats Directive 92/43/EEC in accordance to article 17 (i.e. the report for the period 2007-2013). More specifically, this chapter describes:

- i. the methodology applied for the estimation of the range and area of occupancy of each habitat type in Greece and how the Favourable Reference Values (FRVs) for these parameters were set.
- ii. how the sub-types of each habitat type were distinguished to reflect the ecological and / or biogeographical variation of the habitat types in Greece.
- iii. the methods used to identify the typical species of each habitat type and sub-type and also how the list of specific structures and functions for each habitat type was compiled.
- iv. how the future prospects of each parameter (range, area, and structures and functions) separately was assessed and how the overall assessment for each habitat type was performed.
- v. the field campaigns undertaken to collect the necessary information using the sampling protocols designed for this task
- vi. the methodology for assessing the conservation degree and the conservation status from the evaluation of the parameters (range, area, and structures and functions) which were estimated at different spatial scales: structures and functions were assessed at the local scale (Natura 2000 site estimate) while range and area were estimated at the national scale.

4.1 Range

Range refers to the outer geographic boundaries of the wider area in which the habitat type is encountered in the Greek territory. The observed values are compared to the Favourable Reference Values to assess the status of this parameter (see section 2.1.5). FRVs were provided for each habitat type in Greece at the previous national article 17 report (for the period 2001-2006) without detailed description of the methods employed to estimate them. Evans and Arvela (2011) recommend to use the same values for the most recent report also, but in the case of Greece the FRVs changed and were estimated *de novo*. The reasons why this was necessary are:

- i) the methods employed to estimate both range and area of each habitat type changed considerably, and
- ii) the territory examined changed. The previous national article 17 report examined only the area covered by the sites of the Natura 2000 network; while the more recent report examined the entire Greek national territory.

Thus, for the assessment of the conservation status of the parameters range and area, the value of the parameters was estimated *de novo* using the methodology described below, and then a group of experts assessed whether this value meets the criteria to be considered as FRV. Only then, the conservation status of the parameters were assessed.

The estimation of the range of habitat types in Greece was made separately for zonal and azonal habitat types.

4.1.1 Zonal habitat types

Zonal habitat types are characterized and distinguished by their typical plant species. The distribution of these typical species is directly associ-

ated with a number of key ecological parameters (mainly climate and soil). Therefore, it is possible to apply mathematical models of prediction of the species range for each of the typical species of the habitat type, in order to infer the wider distribution of the habitat type.

Habitat suitability models are often used to associate the locations in which a focal species is recorded with the environmental variables of these locations to locate the geographical range with the suitable environmental conditions for the survival and reproduction of that focal species (Hijmans and Graham, 2006). The application of these models requires (i) a number of known locations of the focal plant species presences and (ii) data on the appropriate ecological factors (e.g. climate), typically in the form of rasters, with the ultimate aim to estimate the likelihood of occurrence of the focal species in each area (e.g. raster cell). The results of the algorithms are usually rasters with values between 0 and 1, indicating the probability of occurrence of the focal species in each raster cell analyzed.

To build these habitat suitability models for predicting the plant species ranges, known locations of plant species presences were required to train the model. For this purpose, we used the phytosociological database Hellenic Natura 2000 Vegetation Database (Dimopoulos *et al.*, 2012). This database contains information collected from approximately 16,000 relevés, where the species composition of each relevé is recorded. Most of these relevés (14,438 relevés) were collected during 1999 and 2000 as part of the IDHTACI project. Complementary, a number of additional relevés collected during the period 1952–2000 were digitized, as part of the database Hellenic beech forests database (Tsiripidis *et al.*, 2012), and were also included in our analysis.

The second requirement of these models is data on the appropriate ecological factors. For this purpose we used an array of available datasets, and more specifically:

- The vegetation map of the Special Forestry Secretariat of the Hellenic Ministry of Environ-

ment, Energy and Climate Change at a scale of 1 : 50 000

- The Corine Land Cover Land Use data for the year 2000 at a scale of 1 : 100 000.
- The soil maps (Náκος 1991) at a scale of 1 : 50 000, from which we extracted data on type and depth of soil. Simultaneously we used data from the Greek geological map (also at a scale of 1:50000) (<http://amagis1.e-per.gr/PublicGRApp/?sid=hr5j6vc3upnbdp376eevaui9g4>).
- The bioclimatic variables of the Worldclim dataset (Hijmans *et al.* 2005) (www.worldclim.org). The bioclimatic variables are known to display strong collinearity, and thus to avoid variance inflation issues in our models, we calculated the Pearson Correlation Coefficient for each pair of bioclimatic variables using ENMTools ver. 4.4.1 (Warren *et al.*, 2010), and selected to preserve in our models only those variables that displayed Pearson coefficient less than 0.75. More specifically we used: Mean Diurnal Range (BIO2), Isothermality (BIO3), Mean Temperature of Coldest Quarter (BIO11), and Precipitation of Wettest Quarter (BIO16).
- Elevation data for our study area were extracted from ASTER Global Digital Elevation Model (ASTER GDEM), at a spatial resolution of 30x30m. From the digital elevation model we calculated slope and aspect using the Surface Aspect tool of ArcGIS ver. 10.1 (ESRI, 2011).

Species distribution models were constructed using the maximum entropy method (Maxent) for modeling species geographic distributions with presence-only data (Phillips *et al.*, 2006). Maxent is a general-purpose machine learning method, which is often used for species distribution modeling, since it calculates the probability of occurrence of a species under a set of constraints (like missing information regarding the species distribution). For the application of the method, we used the software Maxent ver. 3.3.3k (Phillips *et al.*, 2006). Presence data were randomly split into two subsets: one for model training (including 80% of the data) and one for testing (with the remaining 20%). For each species the algorithm ran once.

Altogether, we predicted the distribution for more than 700 plant species. Out of these predictions, 353 species distributions were eventually used to

predict the distributions of the habitat types. For the prediction of the presence of a habitat type in a cell, at least two of its typical species should have a high probability of presence in the given cell. The greater the number of typical species of the habitat type predicted to be present in a cell, the greater the probability of occurrence of the habitat type in the cell. Furthermore, the predictions of distribution of each habitat type were evaluated by expert judgment to avoid any unrealistic predictions.

The model predictions on the probability of the species occurrence and consequently the estimation of the distribution of the habitat type contains inaccuracies. The sources for these inaccuracies are the use of information at different spatial scales, but also the availability and accuracy of the species presence data. The presence of the species was recorded accurately, but these records represent a small fraction of each species distribution within Greece. Also, the species range predictions based mainly on bioclimatic parameters often fail to take into account other factors that may affect the spatial pattern of vegetation (Chiarucci *et al.*, 2010), like existing land use / land cover.

For each habitat type, the **potential area** occupied was estimated by subtracting from the prediction of the potential range all areas characterized by variables that we know to restrict the distribution of the typical species of the habitat type. Such constraints may be based on ecophysiological limitations (e.g. minimum temperature air) or on the basis of existing land use / cover. The data used for this purpose included:

■ **Land cover/ land use data:**

- Habitat type maps from the IDHTACI project
- Corine Land Cover Land Use data for the year 2000 (Bossard *et al.*, 2000)
- Forest vegetation maps
- Potential natural vegetation maps (Bohn *et al.*, 2000; Bohn *et al.*, 2004)
- Forest formations map (Μαυρομάτης 1980).

From these sources, the combination of datasets that are more appropriate for each habitat type was used.

■ **Geological - Soil data:** Most of the soil data were extracted from the soil maps (Νάκος 1991), which were provided by the Forestry Directorate of the Hellenic Ministry of Environment, Energy and Climate Change. Complementary, the geological map of Greece was used.

■ **Elevation data:** The data were extracted from ASTER Global Digital Elevation Model.

An example of the application of this method to predict the distribution of habitat type 5110 (Stable xerothermophilous formations with *Buxus sempervirens* on rock slopes (Berberidion p.p.) is presented in Figure 4.1.

The procedure applied in all zonal habitat types is similar to the one described for 5110, modifying the typical species of each habitat type accordingly and applying rules suitable for each habitat type (based on expert judgment).

4.1.2 Azonal habitat types

The distribution of azonal habitat types is determined by the specific local conditions of the substrate or hydrogeology, which define the composition, structure and dynamics of vegetation, overcoming the effect of macroclimate (Mucina *et al.*, 2006).

For the estimation of the distribution of habitat types which are associated with azonal vegetation formations, available data on the local ecological conditions were used. The aim was to identify the most determining ecological factors that drive the spatial pattern of the distribution of these habitat types. Such information was derived from the technical instructions of the IDHTACI project (Dafis *et al.* 2001), the most recent edition of the Interpretation Manual of European Union Habitats (European Commission, 2013), and / or other sources with more detailed information for specific habitat types. The maps on land cover, soil, geology and other environment factors used are the same as described in the previous section on zonal habitat types. Additional data for the azonal habitat types come from:

- **Hydrographic network:** The distribution of several habitat types depends on the hydrographic network. The data of Greece's hydrographic network as a vector data file was obtained from the website <http://geodata.gov.gr>. Where appropriate, for the estimation of the distribution of certain habitat types, either the 20 m catchment area around the water bodies was calculated on either side of the hydrographic network (e.g. for the habitat types of riparian forests), or the hydrographic network was used as it is (e.g. for the freshwater habitat types).
- **Coastline:** For the coastal habitat types, the coastline and the 50 m buffer zone was used. The data were obtained from the website <http://geodata.gov.gr>.

The exact methodology used for estimating the range of zonal and azonal habitat types is described in detail by Τσιριπίδης *et al.* (2014). There the authors provide more detailed information on the typical species used for the modeling of zonal habitat types, the way environmental variables were treated for the final check of the distribution of habitat types as well as on the way environmental data were used to assess potential distribution of habitat types associated with azonal vegetation.

After the final audit, the predicted range of each habitat type was projected on the 10 km EEA grid. For each cell of this grid, cell-based data were retrieved with the use of the rangetool software (Mac Shary, 2012) for the production of the range map of each habitat type in accordance with EU standards. These are the range maps presented in the national report for the period 2007-2013 according to article 17.

4.2 Area

The evaluation parameter Area refers to the total area occupied by each habitat type. The assessment of this parameter is done by comparing the current value to a Favourable Reference Value, as was the case with the parameter Range.

For the purposes of the habitat types' conservation status assessment for the latest national report, the area occupied by each habitat through-

out the Greek territory was estimated de novo according to the methodology described in this chapter. At a first step, the existing land cover / land use maps were overlapped with the potential habitat range estimated (see above). Then, all land cover classes that do not correspond to the structure / physiognomy of the focal habitat type were removed from the potential range estimates. Due to the fact that there is no updated land cover / land use map in Greece, information from various sources have been used, such as:

- **Corine Land Cover Land Use data for the year 2000.** These data were acquired from the European Environment Agency (<http://www.eea.europa.eu/data-and-maps/data/clc-2006-vector-data-version-2#tab-gis-data>). In these data, the thematic classification of the land cover is hierarchical with 44 classes at the finest thematic resolution. This classification scheme includes both natural and human dominated land cover classes. The scale of the data is 1: 100 000, with minimum mapping area 25 ha and minimum line segment 100 m (EEA, 2007). Although the resolution may not be too detailed for local applications, the Corine data is the most updated land cover data set covering the entire Greek territory.
- **Forest Vegetation Maps:** The local Forestry Departments throughout Greece identify and map the forest stands in their area of responsibility, as part of the forest management. This is important information for the distribution of the main types of forest vegetation. Typically, the data contains information on dominant forest species accompanied by information on the harvest or standing volume, which can be used to distinguish between habitat types with the same forest species in different growth form (shrub-forest). The mapping scale is comparable with the scale of habitat type's maps, but often the information has not been updated for the last decades. Another limitation is that these maps offer no useful information on non-forest habitat types.

Furthermore, the IDHTACI project (1999-2001) carried out the mapping of the natural habitat types inside the Greek Natura2000 protected areas. Therefore, the areas for which maps of hab-

it types were available were excluded from the overall range prediction and the actual data were used instead of the model predictions. In these areas, the mapping of habitat types was based on remote sensing interpretation and field data and was not based on prediction of models. Similarly, where there were recent maps of habitat types or specific knowledge of the location and extent of habitat types in specific areas, these sources were used (e.g. Κατσάδωράκης & Παραγκιμιάν 2007).

At the final step, the area of occupancy of each habitat type was projected on the 10 km EEA grid.

In Figure 4.2 an example of this approach for the estimation of the area of habitat type 9110 (Luzulo-Fagetum beech forests) is presented.

4.3 Defining the Favourable Reference Values

The article 17 national report requires **the determination of the National Favourable Reference Values (FRVs) for the parameters range and area of each habitat type**. FRVs represent the threshold which should be compared with the existing and future estimated values of the range and area parameters, so as to assess the current and future conservation status of these parameters (see section 2.1.5). Favourable reference values are assessed at Member State or biogeographical level within countries with more than one biogeographical region in their territory. In Greece, the whole territory belongs to the Mediterranean biogeographical region and therefore there is a requirement only for national level FRVs.

As mentioned in the previous section, the range and area of each habitat type were estimated for the entire Greek territory. In the previous reporting period, the national report examined only the habitat types present inside areas of the Natura 2000 network, thus the range and area parameters were assessed only for the extent of the areas of the network Natura 2000. So for the latest report, it was necessary to re-define FRVs at the national level.

For the estimation of FRVs there are general guidelines but no precise methodology. So in

the absence of specific data on the exact range and exact area of habitat types, the use of **operators** has been preferred for the FRVs of the above-mentioned parameters. The operators should be expressed in relation to the estimated values.

To this end, after the value of the range and area parameters for each habitat type was estimated, a panel of experts assessed whether the present value is satisfactory and fulfills the criteria for the long-term viability of the habitat type. For this estimation, the experts considered:

- i. the available knowledge on the historical distribution of each habitat type,
- ii. the potential distribution of each habitat type (e.g. through the potential natural vegetation approach), and
- iii. the expert knowledge on the requirements of each habitat type for its long term viability.

The outcome of this evaluation was to distinguish four conditions for the FRVs:

- **if the existing value of the parameter is considered sufficient, then the FRV is designated with the operator $\approx$** (approximately equal to the existing value) or **$>$** (higher than the existing value) or **$>>$** (much higher than the existing value)
- **if the existing value of the parameter is considered marginally insufficient, then the FRV is designated with the operator $<$** (lower than the existing value)
- **if the existing value of the parameter is considered insufficient, then the FRV is designated with the operator $<<$** (much lower than the existing value)
- **if it is unknown whether the current value is sufficient or not, then the operator used is $\mathbf{X}$** (unknown).

Once the FRVs have been defined, the comparison between the estimated values of the range and area parameters with the corresponding FRVs for each habitat type can be used to assess the current conservation status of these parameters, as described in section 2.2.5.

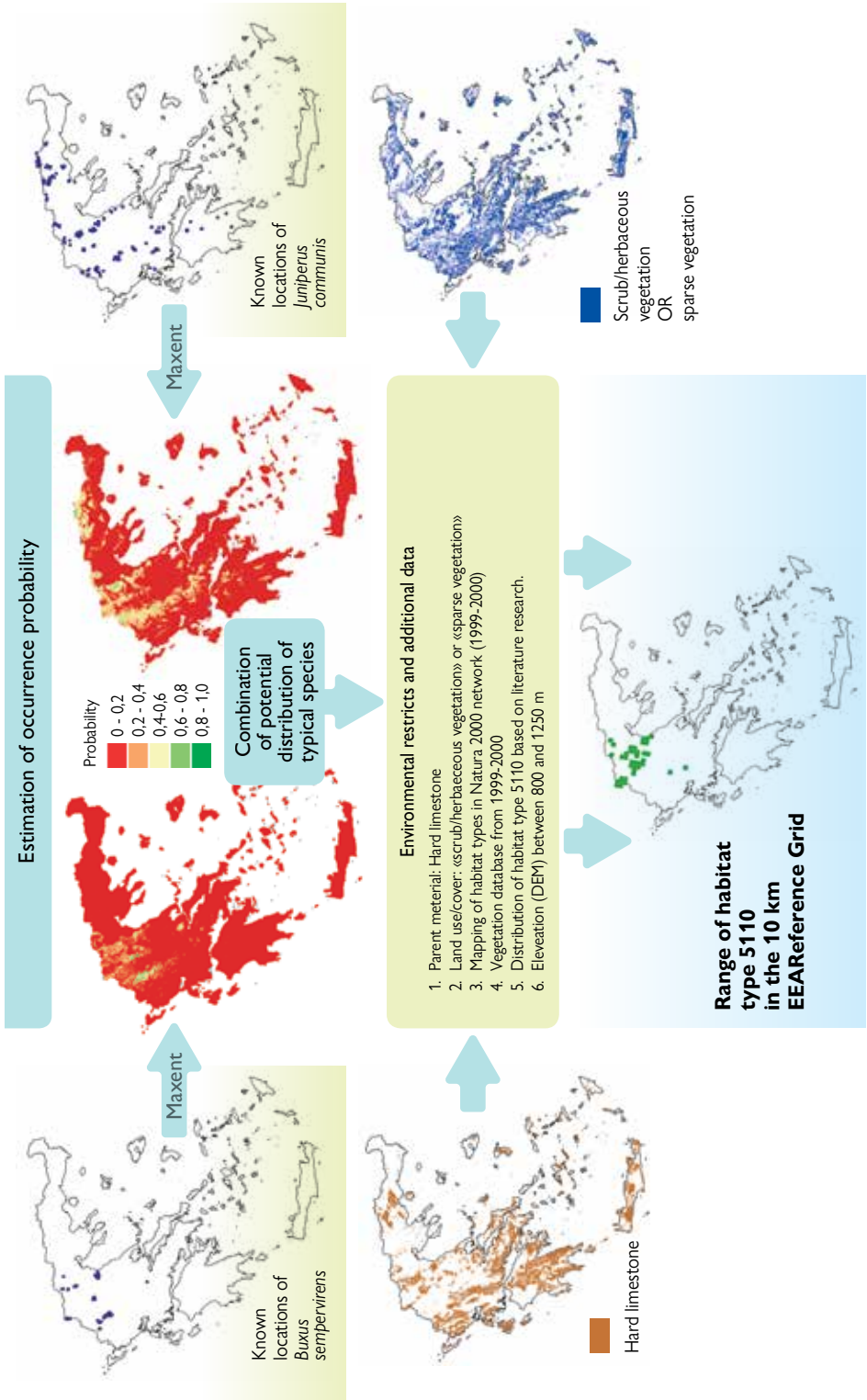


Figure 4.1 Procedure for predicting the range of habitat type 5110. From the known locations of the typical species of the habitat type (left-hand image, the locations of the species *Buxus sempervirens* are displayed), with the application of the Maxent algorithm, potential distribution maps of typical species were created. The maps predict habitat type presence as a probability of occurrence (in the range 0-1) as shown in the middle panel (again the example is *Buxus sempervirens*). Finally, with the application of a series of criteria, the final distribution map of the habitat type 5110 was developed.

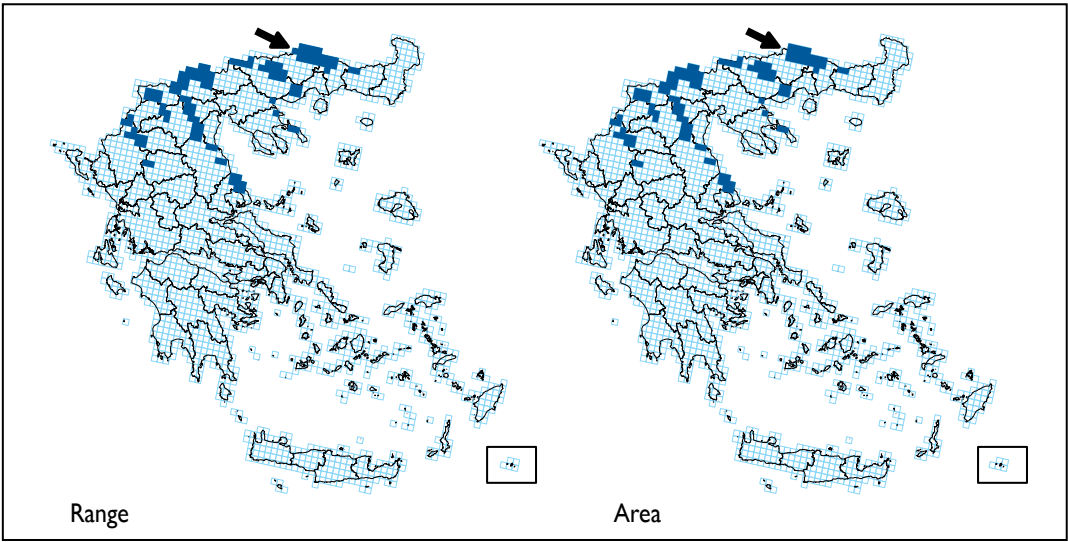


Figure 4.2 In the left panel the range of the habitat type 9110 (Luzulo-Fagetum beech forests) is presented (as projected on the 10 km EEA grid). In the right panel the area of the habitat type is shown in the same grid format. The arrow points to a cell where the habitat type could potentially be present, but there is no record of its presence (thus it is not considered occupied).

According to the experts' opinion, the range of all habitat types in Greece is large enough and sufficient for their long-term viability except for three cases (habitat types 62D0, 7220, 91AA) for which it is not possible to estimate the FRVs and are designated X (unknown), (Table 4.1). In accordance with the parameter range, the opinion of the experts regarding the parameter area is that the area occupied by most habitat types in Greece is large enough and sufficient for their long-term conservation in Greece. Therefore for most habitat types the status of the area parameter is considered to be favorable (Table 4.1). However, there are some exceptions concerning wetland and sand dunes habitat types, in which present area of occupancy is lower than the corresponding FRV. Also there are three cases (habitat types 62D0, 7220, 91AA) where the available information was deemed insufficient to reach a conclusion and they are designated X (unknown).

Table 4.1 Range and area as well as the corresponding FRVs for each habitat type in Greece (Mediterranean biogeographical region).

Habitat type code	Range		Area	
	Current value (km ²)	FRV operator	Current value (km ²)	FRV operator
1210	9,10	=	9,10	=
1240	305,75	=	305,75	=
1310	1748,0	=	69,36	>
1410	1991,0	=	155,64	>
1420	1800,0	=	236,56	>
1430	8,0	=	0,12	=
1510	503,0	=	6,02	>
2110	105,71	=	32,85	>
2120	105,71	=	33,12	>
2190	105,71	=	3,24	>
2220	105,71	=	9,63	=
2230	105,71	=	0,11	>
2250	105,71	=	20,0	>
2260	105,71	=	3,19	>
2270	11,27	=	8,66	=
3130	1616,0	=	14,58	>
3140	1880,0	=	0,13	>
3150	3529,0	=	33,47	=

Habitat type code	Range		Area	
	Current value (km ²)	FRV operator	Current value (km ²)	FRV operator
3170	335,0	=	1,93	=
3240	442,0	=	0,51	=
3250	6,0	=	0,09	=
3260	0,23	=	0,23	=
3280	66,51	=	45,71	=
3290	66,51	=	25,46	=
4060	689,0	=	164,87	=
4090	4882,0	=	1809,12	=
5110	300,0	=	14,13	=
5210	2772,0	=	487,17	=
5230	712,0	=	155,88	=
5310	712,0	=	156,43	=
5330	3206,0	=	301,04	=
5420	30126,0	=	7645,77	=
5430	913,0	=	264,27	=
6110	743,0	=	191,12	=
6170	2922,0	=	556,62	=
6220	3963,0	=	1039,62	=
6230	1257,0	=	150,16	=
62A0	3431,0	=	504,90	=
62D0	36,0	X	4,18	X
6420	1270,0	=	68,15	=
6430	1594,0	=	8,32	=
6510	713,0	=	10,38	=
7140	0,80	=	0,80	=
7210	574,0	=	0,07	=
7220	X	X	X	X
7230	203,0	=	1,52	=
8140	126,13	=	126,13	=
8210	204,80	=	204,80	=
8220	43,43	=	43,43	=
8320	3,54	=	3,54	=
9110	1971,0	=	1342,30	=
9130	2744,0	=	767,65	=
9140	976,0	=	179,91	=
9150	990,0	=	296,36	=
9180	569,0	=	115,61	=
91BA	35,0	=	1,16	=
91CA	722,0	=	182,76	=
91E0	694,0	=	84,89	=
91F0	567,0	=	96,42	=
91M0	30330,0	=	10772,99	=

Habitat type code	Range		Area	
	Current value (km ²)	FRV operator	Current value (km ²)	FRV operator
9250	901,0	=	189,56	=
9260	2229,0	=	484,17	=
9270	2245,0	=	525,57	=
9280	3225,0	=	996,0	=
9290	993,0	=	433,99	=
92A0	2679,0	=	267,28	=
92C0	5540,0	=	551,08	=
92D0	2255,0	=	137,59	=
9310	504,0	=	1,98	=
9320	15789,0	=	605,23	=
9340	12211,0	=	1837,03	=
9350	2251,0	=	296,30	=
9370	36,0	=	1,28	>
9410	184,0	=	80,21	=
9530	6545,0	=	2582,57	=
9540	16462,0	=	6882,16	=
9560	279,0	=	66,56	=
95A0	579,0	=	286,43	=

4.4 Typical species

The methodology employed for the determination of the typical species for each habitat type and sub-type is a two stage process (Tsiripidis *et al.* 2018). At the first stage, the habitat types and subtypes are defined, and in the second stage, the selection of the typical species for each habitat type takes place.

4.4.1 Determination of the sub-types of each habitat type

As a first step, the determination of the sub-types of each habitat type that has been recorded in Greece or that has been described in the literature took place. For this purpose, the phyto-sociological database Hellenic Natura 2000 Vegetation Database (Dimopoulos *et al.*, 2012) was used. This database contains information collected from approximately 16,000 relevés, where the species composition of each relevé is recorded. Most of these relevés (14,438 relevés) were collected during 1999 and 2000 as part of the project "Identification and description of the habitat types in areas of conservation interest" (referred

to as "IDHTACI"). This database is stored in the Turboveg software (Hennekens and Schaminee, 2001). For data handling and extraction we used the software JUICE ver. 7 (Tichý, 2002). With these data, the following procedures were performed:

1. For any plant taxa that the database included information at both species and subspecies level, records were merged to the species level for consistency and so that the taxonomic resolution would not affect the statistical analysis. In total, the database included records for 4352 taxa.

2. In the same relevé, some taxa appeared both at the canopy and in the understory. This detailed description of the vegetation structure in such a large dataset increases the noise and does not offer additional information for the distinction of vegetation units. Additionally, in other relevés the information was not recorded in such detail. Therefore, we merge species records per relevé, so that a species appears once in each relevé that it was observed.

3. Despite the high number of taxa recorded, many of them are rare. Species that were recorded in less than four relevés (out of the 16000) were removed to decrease the noise in the data. McCune and Grace (2002) advise to remove taxa that appear in less than 5% of the total sampling plots to reduce noise. In our case, the species removed had less than 0.07% frequency of appearance, thus they are not expected to influence the identification of habitat types and sub-types. After this step, in the dataset the number of taxa remaining was 3320.

4. Relevés were grouped according to a fine scale habitat classification scheme (employing 6 digit codes for habitat type identification) and the scientific team that recognized it. In the terrestrial ecosystems during the IDHTACI project, four teams of experts worked independently (on different regions of the country). There is still not an overall classification of all vegetation types in Greece (and more specifically, for all Natura 2000 protected areas of Greece). The classification of the database led to the determination of distinct syntaxonomic units at the association and commu-

nity level. Plant associations and plant communities are the basic building block of the hierarchical vegetation classification scheme (Braun-Blanquet, 1964; Kent and Coker, 1992; Dierschke, 1994). The use of the fine thematic resolution with classification of the relevés according to 6-digit habitat type codes aimed to make the best possible use of the available knowledge of that time and the field work carried out during the IDHTACI project. Also, it is an appropriate way to address the large heterogeneity of the data. This heterogeneity is related to the diversity of vegetation types (plant communities and plant associations) of each habitat type but also the different sampling intensity among the different types of vegetation examined. That classification produced 1280 vegetation groups, each of which corresponded to a different 6-digit habitat type code.

5. The dataset was classified by means of cluster analysis using the Ward's linkage method (Ward 1963) and the Lennon *et al.* (2001) index as distance measure. The Lennon index was introduced in order to measure species turnover among plots along a species richness gradient and then was used as a measure of beta diversity (Koleff *et al.* 2003). As a dissimilarity index, Lennon's index is symmetric and independent from the differences in species richness between the compared objects. In our case, the use of this index was preferred after comparing the classification results obtained with other distance measures (e.g. Bray-Curtis, Euclidean). The better performance may be attributed to the fact that our database includes plots of different sampling effort for the same habitat type.

6. The classification results distinguished 277 vegetation groups. In the results only vegetation groups represented by more than 6 relevés nationally were retained. Most of the habitat types were represented by more than one clusters, and few of them were represented by more than 10 clusters. Thus, the results captured the ecological and geographical variability within a habitat type, through the distinction of different subtypes within it.

7. For the beech forest habitat types (i.e. habitat types 9110, 9130, 9140, 9150, 9270 and 9280)

the distinction of the sub-types followed the publications of Bergmeier and Dimopoulos (2001), Tsiripidis *et al.* (2007a) and Tsiripidis *et al.* (2007b). The plant communities and associations described in these publications were associated, according to their composition, ecology and geography, with habitat types (see Table 4.2) and were added to the table of the habitat types and subtypes replacing the respective groups that were produced by the classification of the previous steps. The reason for this exception of beech forests was the fact that the database used by Bergmeier & Dimopoulos (2001) and Tsiripidis *et al.* (2007a, b) was more comprehensive (geographically and ecologically) than the database compiled during the IDHTACI project.

8. Finally, after removing from the list the habitat types of only national interest (which are not to be included in the national article 17 report), there were 229 sub-types covering 85 habitat types. The number of subtypes per habitat type is shown in Table 4.3.

Table 4.2 Correspondence between the Greek beech forest plant communities and associations to habitat types and subtypes.

A)	9110 - Luzulo-Fagetum beech forests of northeast Greece [<i>Calamagrostis arundinacea</i> - <i>Fagus sylvatica</i> comm. (Tsiripidis <i>et al.</i> 2007a, b)]
B)	9110 - Luzulo - Fagetum beech forests of central Greece [Orthilio secundae - Fagetum sylvaticae (Bergmeier & Dimopoulos 2001, Tsiripidis <i>et al.</i> 2007b)]
C)	9130 - Asperulo-Fagetum beech forests [Soldanello rhodopaeae - Fagetum sylvaticae, <i>Pulmonaria rubra</i> - <i>Fagus sylvatica</i> comm. and <i>Lamiastro montani</i> - Fagetum sylvaticae (Bergmeier & Dimopoulos 2001, Tsiripidis <i>et al.</i> 2007b)]
D)	9150 - Medio-European limestone beech forests of the Cephalanthero - Fagion of northeast Greece [<i>Brachypodium pinnatum</i> - <i>Fagus sylvatica</i> comm. (Tsiripidis <i>et al.</i> 2007a, b)]
E)	9150 - Medio-European limestone beech forests of the Cephalanthero-Fagion of central Greece [<i>Cardamine graeca</i> - <i>Fagus sylvatica</i> comm. (Bergmeier & Dimopoulos 2001, Tsiripidis <i>et al.</i> 2007b)]
F)	9280 - <i>Quercus frainetto</i> woods of northeast Greece [<i>Hieracium olympicum</i> - <i>Fagus sylvatica</i> comm., <i>Luzula forsteri</i> - <i>Fagus sylvatica</i> comm., <i>Melittis melissophyllum</i> subsp. <i>albida</i> - <i>Fagus sylvatica</i> comm. and <i>Quercus frainetto</i> - <i>Fagus sylvatica</i> comm. (Tsiripidis <i>et al.</i> 2007a, b)]
G)	9280 - <i>Quercus frainetto</i> woods of central Greece [<i>Lathyro alpestris</i> - Fagetum sylvaticae (Bergmeier & Dimopoulos 2001, Tsiripidis <i>et al.</i> 2007b)]
H)	9270 - Hellenic beech forests with <i>Abies borisii-regis</i> [<i>Geranium versicolor</i> - <i>Urtica dioica</i> - <i>Fagus sylvatica</i> comm. and <i>Geranio striati</i> - Fagetum (Bergmeier & Dimopoulos 2001)]

Table 4.3 Number of sub-types for each habitat type.

Habitat type code	Number of sub-types
1210	2
1240	5
1310	4
1410	2
1420	2
1430	1
1510	1
2110	3
2120	3
2190	1
2220	2
2230	2
2250	1
2260	2
2270	1
3130	2
3140	1
3150	1
3170	3
3240	2
3250	1
3260	2
3280	1
3290	2
4060	3
4090	5
5110	1
5210	4
5230	1
5310	1
5330	5
5420	6
5430	3
6110	2
6170	3
6220	5
6230	2
62A0	3
62D0	1
6420	1
6430	1
6510	1
7140	1

Habitat type code	Number of sub-types
7210	1
7220	2
7230	2
72A0	4
72B0	2
8140	5
8210	5
8220	2
8260	1
8320	1
9110	2
9130	1
9140	1
9150	2
9180	2
91BA	1
91CA	2
91F0	1
91M0	11
91E0	3
9250	1
9260	5
9270	1
9280	2
9290	3
92A0	4
92C0	5
92D0	3
9310	2
9320	8
9340	7
9350	2
9370	1
9380	1
934A	3
9410	1
9530	7
9540	12
9560	4
9580	1
951B	6
95A0	3
Total:	229

4.4.2 Determination of typical species

After the classification of the different habitat types and sub-types, the differential taxa of each cluster were determined by using the algorithm of Tsiripidis *et al.* (2009), which is based on species fidelity indices. The diagnostic species of the vegetation units (syntaxa) included in each habitat type or sub-type are considered as the typical species. For the final selection of the typical species, experts in each vegetation type reviewed this list in order to exclude taxa which exhibit preferential occurrence in certain habitat types, but they cannot be used as indicators of favourable conservation status. An example of such a species is *Amorpha fruticosa*, which although occurring only in riparian habitat types, it is an alien species indicating often intense disturbances in these ecosystems. The steps in the process are as follows:

1. For the 229 habitat types and subtypes defined in Greece, the differential taxa of each habitat type and sub-type were determined using the algorithm of Tsiripidis *et al.* (2009).
2. For the species found as differential by the above algorithm we calculated the phi coefficient (Chytrý *et al.*, 2002) by using the percentage frequency of taxa in the distinguished habitat types and subtypes. The phi coefficient was calculated for the habitat types and subtypes differentiated positively against the remaining ones that were differentiated negatively or not differentiated. As the calculation of the phi coefficient results in one value for all the habitat types and subtypes differentiated positively, we standardize this value by multiplying it by the ratio of the frequency of each taxon in each cluster to its maximum frequency in the table of clusters.

$$\varphi' = \varphi \times \frac{Ci}{Cmax}$$

where:

φ' = the standardized value of the phi coefficient based on the relative frequency in the different habitat types

φ = the phi coefficient calculated for the habitat types and subtypes differentiated positively

against the remaining ones that were differentiated negatively or not differentiated

Ci = the relative frequency of the species in the habitat types and subtypes differentiated positively

$Cmax$ = the maximum relative frequency for the species among the habitat types and subtypes differentiated positively

3. Finally, we also calculated the phi coefficient by the way proposed by Chytrý *et al.* (2002), using the percentage frequencies of taxa in the clusters. The latter compares the frequency of each taxon in each habitat type and subtype with the corresponding frequency in all the other habitats. This gives more weight to the so-called 'absolute differential species', i.e. the ones occurring almost exclusively in one or at most in very few clusters. This was done in order to take into account both types of differential species: those differentiating a large number of clusters and those differentiating one or few clusters. This phi coefficient is symbolized as φ'' .
4. After calculating both version of the phi coefficient, and in order to take into account both types of differential species, we calculated an average value of phi coefficient calculated by the former two methods for all the taxa found as differential by the algorithm of Tsiripidis *et al.* (2009), which is symbolized as φ_{final} . The advantage of this approach is that it combines different properties of the species as differential. The Tsiripidis *et al.* (2009) approach performs multiple comparisons between all the possible combinations of clusters in a dataset, and in this way it determines the diagnostic species of syntaxa of different hierarchical levels. This phi coefficient allows the determination of those species that differentiate a large number of habitat types and subtypes from the remaining habitats. While the Chytrý *et al.* (2002) approach identifies the species that differentiate only one or at most few habitat types from the remaining.
5. Then all typical species of each habitat type and subtype were ranked according to φ_{final} . The greater the value of φ_{final} , the greater the fidel-

ity of the species to the specific habitat type or subtype, and thus the greater the usefulness of the species as typical species. On this list, all species with ϕ greater than 0.25 were added. These later species appear almost exclusively in a specific vegetation unit.

6. By the methodological approach described above, a list of typical species was created for each habitat type and subtype. Experts in each vegetation type reviewed this list to produce the final list. Expert judgement was needed so as:

- To determine the cut-off value of ϕ_{final} in each habitat type, which will determine which species are deemed as differential (and thus as typical species for the purposes of the habitat type conservation status assessment),
- To correct for the use of species that were misidentified or that may have been erroneously recorded in the database.
- To remove species which are associated with only one habitat type, but are indicators of habitat degradation rather than favourable conservation status (e.g. alien invasive species).

In Table 4.4 the lists of the typical species for the two identified subtypes of the habitat type 9110 (Luzulo-Fagetum beech forests) are presented.

Table 4.4 List of the typical species for the two subtypes of the habitat type 9110 (Luzulo-Fagetum beech forests).

Luzulo-Fagetum beech forests of northeast Greece	Luzulo-Fagetum beech forests of central Greece (possibly including the Pindus mountain range)
<i>Aremonia agrimonoides</i>	<i>Abies borisii-regis</i>
<i>Calamagrostis arundinacea</i>	<i>Anemone nemorosa</i>
<i>Cardamine bulbifera</i>	<i>Aremonia agrimonoides</i>
<i>Carex digitata</i>	<i>Athyrium filix-femina</i>
<i>Corallorhiza trifida</i>	<i>Calamintha grandiflora</i>
<i>Deschampsia flexuosa</i>	<i>Cardamine bulbifera</i>
<i>Digitalis viridiflora</i>	<i>Cardamine impatiens</i>
<i>Dryopteris filix-mas</i>	<i>Corallorhiza trifida</i>
<i>Epipactis helleborine</i>	<i>Deschampsia flexuosa</i>
<i>Euphorbia amygdaloides</i>	<i>Dryopteris filix-mas</i>
<i>Fagus sylvatica</i>	<i>Epipactis helleborine</i>
<i>Fragaria vesca</i>	<i>Fagus sylvatica</i>
<i>Hieracium murorum</i>	<i>Festuca drymeja</i>
<i>Hieracium olympicum</i>	<i>Galium rotundifolium</i>
<i>Hieracium racemosum</i>	<i>Hieracium murorum</i>
<i>Hypericum cerastoides</i>	<i>Lamium galeobdolon</i> s.l.
<i>Luzula luzulina</i>	<i>Lathyrus alpestris</i>
<i>Luzula luzuloides</i>	<i>Luzula luzuloides</i>
<i>Neottia nidus-avis</i>	<i>Luzula sylvatica</i>
<i>Picea abies</i>	<i>Neottia nidus-avis</i>
<i>Pinus sylvestris</i>	<i>Orthilia secunda</i>
<i>Poa nemoralis</i>	<i>Poa nemoralis</i>
<i>Prenanthes purpurea</i>	<i>Polystichum setiferum</i>
<i>Pyrola minor</i>	<i>Prenanthes purpurea</i>
<i>Rosa pendulina</i>	<i>Sanicula europaea</i>
<i>Rubus hirtus</i>	<i>Silene multicaulis</i>
<i>Sorbus aucuparia</i>	<i>Vaccinium myrtillus</i>
<i>Symphytum tuberosum</i>	<i>Veronica chamaedrys</i>
<i>Vaccinium myrtillus</i>	<i>Viola reichenbachiana/riviniana</i>
<i>Vaccinium vitis-idaea</i>	
<i>Veronica chamaedrys</i>	
<i>Veronica officinalis</i>	
<i>Viola reichenbachiana/riviniana</i>	

4.5 Determination of specific structures and functions

Besides typical species, the conservation status assessment relies on the parameter “Structures and Functions” of each habitat type. Unlike typical species, structures and functions have a more ‘global’ character in the sense that the same list of structures and functions can be applied for a habitat type throughout its distribution within the country. Furthermore, some structures and functions can be shared among different habitat types of the same category (e.g. forests). The specific structures and functions were selected based on the ecological features of each habitat type in a way that:

- i. their presence is an indicator of favourable conservation status for the specific habitat type, or their absence is an indicator of unfavourable conservation status,
- ii. covers all the significant ecological features, structures and functions of habitat types so that recording their presence or absence can inform the conservation status assessment, and
- iii. their observation in the field is straightforward and relatively easy. For example, decomposition is a function difficult and time consuming to quantify, but the abundance of saproxylic beetles may serve as an easy to observe indicator.

For the selection of the specific structures and functions the literature was consulted (e.g. Hill *et al.* 2005; Søgaard *et al.* 2007, Joint Nature Conservation Committee, 2013; Davis *et al.* 2014). These structures and functions may include natural features (like diversity of dominant species age classes, or rich understory plant diversity) or lack of indications of anthropogenic degradation (like logging, or planted species).

In Table 4.5 a list of possible structures and functions for different categories of habitat types are presented. The categories of the habitat types follow the hierarchical classification of habitat types described in the Interpretation Manual (European Commission 2013).

Table 4.5 Examples of specific structures and functions for different categories of habitat types according to the Interpretation Manual (European Commission 2013). The first column indicates if it is a structure (**S**) or a function (**F**). In some cases the distinction is not clear since some structure may act as surrogate for functions, or vice versa.

S or F	Category of habitat types
Coastal And Halophytic Habitats	
S	Specific patterns of vegetation mosaic / vegetation zonation
S	Specific soil morphology (e.g. flat sand or high dunes)
S	Proportion of vegetation cover
S	Presence of specific vegetation features
S	Condition of substrate (e.g. gravel and boulders)
F	Clear pattern of succession
F	Presence of specific functional traits or biotic forms
F	High organic content in the substrate
Coastal Sand Dunes and Inland Dunes	
S	Dominance of specific life forms (e.g. annual plants, shrubs)
S	Dominance of specific species (e.g. <i>Centaurea spinosa</i> in habitat type 2260)
S	Presence of specific types of dunes (e.g. embryonic dunes)
S	Multi layered vegetation structure
S	Height of vegetation
S	Height of dunes
F	Resistance to inundation
F	Substrate properties (e.g. composition, nutrients)
F	Coverage of ammophilous species above a threshold value
F	Plant communities dominated by a specific species in a layer (e.g. <i>Pinus pinea</i> dominant in the shrub layer)
F	Specific spatial patterns of succession
F	Hydrological conditions
F	Presence of plant species stabilizing sand dunes

Freshwater Habitats	
S	Width and zonation of riparian vegetation
F	Absence of human modifications of the hydrological characteristics (e.g. dams)
F	Absence of alien and/or invasive species
F	Absence of specific biotic form (e.g. tall halophytes)
F	Fluctuation of water level
F	Coverage of charophytes
F	Dominance of plant species with specific traits (e.g. annual nitrophilous plants)
F	Composition of the substrate
F	Presence of riparian forests in the wider area
F	Presence of species of birds or fish
F	Water trophic conditions
F	Hydrological conditions
F	Water color
Temperate Heath and Scrub	
S	Presence of cryptogam layer
S	Proportion cover of shrubs
F	Absence of evidence of primary or secondary succession
F	Absence or low cover of synanthropic/nitrophilous species
F	Absence of indications of significant erosion
F	Abundance of perennial grasses
F	Presence/practice of grazing
F	Rich in plant species community
Sclerophyllous Scrub	
S	Soil morphology
S	Multilayered vegetation structure
S	Height of shrubs
F	Regeneration of dominant shrub species (presence of seedlings)
F	Absence of evidence of primary or secondary succession
F	Absence of indications of significant erosion
F	Abundance of perennial grasses
F	Presence of species with specific life forms
F	Presence of species with specific biotic forms
F	Presence/practice of grazing
F	Dominance of Mediterranean species

F	Upper storey dominated by species with specific traits (e.g. broadleaved evergreen shrubs)
F	Rich in plant species community
F	Rich in woody plant species community
Natural And Semi-Natural Grassland Formations	
S	Abundance of tall grasses
S	Cover of shrubs/trees
S	Community dominated by annual plants
S	Stabilized shores
F	Absence of cattle grazing
F	Absence of evidence of primary or secondary succession
F	Absence or low cover of synanthropic/nitrophilous species (species of Artemisietea / Stellarietea)
F	Absence of indications of significant erosion
F	Abundance of therophytes and grasses
F	Abundance of specific plant life-forms
F	Presence/practice of normal (regular) grazing
F	Non disturbed hydrological cycle
F	Rich in bird species community
F	Rich in plant species community
Raised Bogs And Mires and Fens	
S	Stand structure (e.g. dominance of one species)
S	Dominance of mosses characteristic of tufa formation with heterogenous composition by mosses (hepatic, leafy, etc.)
S	Vegetation cover
S	Coverage of specific species (e.g. Phragmites australis)
S	Occurrence of moss (Sphagnum) layer
S	Occurrence of specific moss species
S	Calcareous fen exhibits diverse age and height structure across the site
S	Vegetation height up to 100 cm
F	Absence of grazing
F	Absence of evidence of primary or secondary succession
F	Soil with no significant anthropogenic disturbances

F	Constant water supply or high levels of humidity
F	Stable, high water table
F	Presence of specific animal species
F	Presence of bird and insect species communities
F	Dominance of specific species (e.g. low sedges species of Cyperaceae family)
F	Absence of garbage
F	Absence of high levels of eutrophication
F	Non disturbed hydrological cycle
F	Surrounding habitat types in good/favourable status
Rocky Habitats and Caves	
S	Vegetation cover
S	Shrub cover
S	Presence of fine-grained soil
S	Substrate with no significant disturbances of natural dynamics
S	Presence of cryptogam layer
F	Typical species reproducing (e.g. flowering and producing)
F	Absence or low cover (<2%) of ruderals
F	No signs of regressive or progressive succession
F	Low cover of grassland species and species of xeric vegetation
F	Absence of planted species
F	Absence of nitrophilous species
F	Species richness relatively high
F	Grazing intensity of domestic or wild animals low
Forests	
S	Absence or low cover (<3%) of ruderals or light loving species
S	Herb layer coverage
S	Absence of planted species
S	Occurrence of at least two tree layers
S	Number of tree layers
S	Diversity of age classes of dominant species
S	Litter coverage above a threshold
S	Stand stratified (tree, shrub, herb layers present)

S	Coverage of typical dominant species
S	Soil horizon depth
S	Tree canopy not fragmented
S	No signs of regressive or progressive succession
S	Existence and coverage of cryptogam layer
F	Adequate regeneration of dominant species
S	Species richness relatively high
F	No signs of erosion
F	Absence of species indicating desertification
F	Absence of signs of significant disturbance (e.g. from logging, grazing)
F	No signs of regressive or progressive succession
F	Population dynamics attributes of dominant and typical tree species
F	Absence of coppiced stems
F	Dominance of specific species typical of the plant alliance or community
F	Occurrence of old trees above a certain coverage
F	Hydrological conditions
F	Light loving and grassland species with coverage below a threshold

4.6 Field work for data collection based on assessment protocols

4.6.1 Standardized sampling protocols

Conservation status assessment relied on data collected through fieldwork throughout the Greek territory. For the assessment of some parameters, such as range and area, bibliographic data are very useful, but the assessment of the parameters “Structure and function” and “Future prospects” could only be assessed using field data at the local scale. For this purpose special conservation status assessment protocols were prepared, so as to standardize the type and amount of data collected and to minimize the error probability due to the subjectivity of the field researcher (Hill *et al.*, 2005; Archaux, 2009). Lists of typical species and indicators of structures and functions, alongside pressures and threats should all be recorded at the local scale thus, were included in the field-sheets. In more detail, the field sheets, one for every habitat (sub)type included:

- A. header data, including relevé number and general ecological and structural features (total cover of each vegetation layer, elevation, exposition, inclination) and the date and position of sampling locality (e.g. geographical coordinates, name of locality)
- B. information on the vegetation coverage,
- C. the associated to the habitat type list of specific structures and functions,
- D. the assessment for the future trend of the conservation degree
- E. the assessment for the future status of the conservation degree
- F. the restoration possibility
- G. the possible positive impacts on the conservation degree (e.g. from management practices and policies)

H. general remarks (e.g. occurrence of invasive species, disturbances, adjacent vegetation types)

I. the associated to the habitat (sub)type list of typical species,

J. observed pressures and threats alongside their intensity.

Finally, each sampling locality was accompanied by a photograph depicting an overview of the sampling locality and detail from the sampling locality. An example of such field-sheet for the habitat type 9110 (Luzulo-Fagetum beech forests) sub-type of northeast Greece is presented in Figure 4.3. For each habitat type and subtype specific field sampling protocols were prepared. The section on typical species was unique for each such protocol. Specific structures and functions were also specified for each habitat type; but, some structures and functions appeared in more than one habitat types. In the following section, we present in more detail the information collected in each part of the protocol.

A. Header data, including general ecological features

Most of the fields in this section of the assessment protocol are common to all habitat types. Differences among habitat types refer to some ecological parameters that are relevant only to specific habitat types (e.g. the width of riparian vegetation for habitat types such as 92C0 or 91E0 or the depth of water for freshwater habitat types such as 3150). Header data fields are the following:

1. Evaluator: The name(s) of the researcher(s) that carried out the field work.
2. Natura 2000 sitecode: This field is completed only when field work takes place within the boundaries of a protected area of the Natura 2000 network.
3. Plot Code: refers to the plot sample id code. The first six digits of the code refer to the sampling data (in the Day /Month /Year format) and the last digit(s) refer to the ascending number for

the plot that the researcher(s) recorded at that date.

4. Date of assessment: The date sampling took place.

5. Coordinates: The coordinates of each plot are recorded for two points in each plot the center of the plot and the bottom right corner with the use of satellite GPS device. The recording of two points decreases the error in pinpointing the exact location of the plot, so that researchers could locate it again in the future.

6. Locality: Descriptive geographic identification of the sampling location (e.g. with the use of toponyms)

7. Plot size – Area assessed: Sample plot size refers to the surface area where the presence of typical species was recorded. Area assessed refers to the wider area where the field researcher recorded information like pressures and threats. For each habitat type category there were guidelines on the size of the plot to be examined as well as on how large an area to be assessed (see Appendix 1). These guidelines took into account the ecological features of each habitat type and the published record on the size of plots typically examined (among others Dierschke 1994; Chytrý and Otýpková 2003).

8. Photograph codes (Pictscentre, panor): The codes to identify the digital photograph of the plot center as well as a panoramic picture of the study site. For each picture the coordinates and the aspect should be recorded.

9. Topographical information: For each sampling location, recorded topographical information include Exposition, Altitude, Inclination, Relief, Geological substrate, and Soil type. This information could either be measured or estimated in the field.

10. Adjacent vegetation or habitat types: For any location where this is possible the type of vegetation or the habitat type of the adjacent area was recorded.

11. Substrate with significant disturbances: In this field the field researcher recorded if there was any evidence for substrate disturbance, like erosion, trampling etc.

12. Invasive/Ruderal species (incl. abundance): In this field the field researcher recorded the presence (and when possible assessed the abundance) of invasive or ruderal species within the area assessed.

13. Other: An open field where field researchers were encouraged to record anything that was included in the other fields and the researchers deemed important.

C. Vegetation coverage

Basic information on the appearance of the habitat type in the sampling plot is reported in this field. These features refer to the coverage of the soil by boulders, stones, gravel, fine-grained soil, litter and moss. In addition, the percent coverage and the average height of the three main vegetation layers (trees, shrubs and herbaceous) were recorded.

C. Specific structures and functions

A detailed checklist of the specific structures and functions of each habitat type and subtype was included in this field. The method used for the compilation of this list was described in detail in section 4.5. These structures and functions serve as indicators of favourable conservation conditions. The researcher in the field had to record the presence or absence of any structure or function in the area assessed.

D. Future trend

The future trend of the conservation status is assessed based on the pressures and threats occurring. The requirement for the field researcher to assess the future trend of the conservation status aims to focus the researchers on identifying the processes operating that may affect the condition of the habitat in the foreseeable future in every location sampled. Furthermore, the future trend estimate in the field is necessary so as to assess

9110" Luzulo-Fagetum beech forests" - NE

[illegible]

Pressures (P) and Threats (T) for the habitat type

[illegible]

the future status (next field) throughout the habitats area.

E. Future status

It is an assessment on the future conservation status of the parameters structure and function including the typical species of each habitat type in each location. The foreseeable future that the field researcher is trying to assess is the next twelve years.

F. Restoration possibility

Restoration possibility is the field that assesses the potential restoration of structures and functions (including the typical species) of the habitat type, if management actions are taken. This information is relevant, if the structures and functions are not in favourable conditions. This information is required in the completion of the Standard Data Forms for the Natura 2000 sites (see chapter 4.8).

G. Positive impacts

Here, the researchers record any management actions or conservation policies that are undertaken and could contribute in the improvement of the conservation status of the habitat types' structures and functions (and its typical species), or could mitigate the negative impacts of the pressures and threats occurring.

H. Notes

Field researchers are encouraged to record anything of importance that was not included in the other fields, or any other comments regarding the information provided in the rest of the protocol.

I. Typical species

For each habitat type and subtype the list of typical species is provided. In Table 4.4 the list of typical species for habitat type 9110 (Luzulo-Fagetum beech forests) subtype of northeast Greece is presented. The researcher in the field should establish a sampling plot and record which typical species are present in that plot. For each typical species present, the researcher should also re-

cord its coverage within the plot (Cover plot), its abundance in the wider area (Cover area), and its vitality (Vitality).

The coverage inside the sampling plot should be recorded using the Braun Blanquet scale (r, +, 1, 2m, 2a, 2b, 3, 4, 5) (Barkman *et al.*, 1964; Westhoff and Van Der Maarel, 1978). In the wider area assessed the abundance of the species should be recorded using the AFOR scale (Abundant, Frequent, Occasional, and Rare). Finally, for each species there should be a record of how vital it appeared, using three categories: (1) feeble plants with low and or no vegetative propagation or tree and shrub species occurring only as juveniles, (2) plants with vegetative propagation, but not completing their life cycle or tree species that cannot outreach the shrub layer, and (3) healthy well developed plants completing their life cycle. For more details see Table 4.6.

J. Pressures and threats

In each sampling location, and based on the wider assessment area, the pressures and threats to the habitat type structures and functions and its typical species were recorded. Pressures are the human activities or natural processes that are still ongoing and have an impact now or had an impact on the recent past (within the six-year reference period according to Article 17 of Directive 92/43/EEC); while threats are the human activities or natural processes that are considered likely to impact the habitat type in the future (Evans and Arvela, 2011). Also, a factor can be considered as both a pressure and a threat if it is already occurring and is expected to continue to occur in the foreseeable future as well. The sampling protocol records the code and/or the name of the pressure / threat, the type of effect (whether pressure, threat or both at the same time) and the importance of the impact.

The pressures and threats have been classified by the European Environment Agency that offers a comprehensive list to be used throughout the EU. The codes and categories of pressures / threats of this list constitute the European Commission's standard list (available at the web portal for reporting under Article 17 of Directive 92/43/EEC

(https://bd.eionet.europa.eu/activities/Reporting/Article_17/reference_portal, accessed February 2017). This list of pressures and threats is hierarchical with up to three levels. The first level is the coarsest thematic resolution. The researchers should record pressures and threats at least at the second level. In case of no pressures and threats occurring in an area, the code X should be recorded. Finally, if the pressure or threat occurring is not known, the code U (for unknown) should be recorded. The impact of the pressures and threats were recorded as High, Moderate or Low following the proposal of Evans and Arvela (2011).

4.6.2 Sampling locations for field campaign

The final step, before the field campaign for data collection, was the process of selecting the sampling locations for the collection of information included in the standardized conservation assessment protocols. The selection of these localities was based on two criteria:

1. To revisit the sampling locations whose vegetation structure and species composition were examined during the IDHTACI project (1999-2001), and
2. The need to assess the conservation status of habitat types in sites where the number of existing sampling locations was deemed insufficient, and in areas that were not sampled in the past.

Sampling locations of the IDHTACI project

Permanent sampling plots are advocated since they facilitate the comparison of present and past conditions, thus allowing the extraction of conclusions and improving the accuracy of monitoring ecosystem changes, despite the disadvantages they may have (Hill *et al.*, 2005). They are useful for the study of secondary succession (Xystrakis *et al.*, 2011), but also in the monitoring and assessment of the conservation status of ecosystems (Hill *et al.*, 2005). Thus, the existence of sampling plots with known coordinates from the IDHTACI project (Figure 4.4) offers the opportunity to plan a field campaign to resample the same locations. The data collected from revisiting the same sampling locations allows the comparison with the data collected during the period 1999-2000, i.e. after approximately 15 years. This comparison may lead to conclusions about the changes in the ecological conditions of the habitat types throughout Greece.

Thus, the design of the field campaign gave priority to revisiting the same sampling locations as in the IDHTACI project. But, when analyzing the IDHTACI project data, some errors were identified. These errors mainly concerned the geographical coordinates of the habitat types and of the corresponding sampling locations. The sam-

pling design took this into consideration and allowed for certain flexibility to resolve the issues that arose from these errors, these issues and solutions are discussed below.

i. Sampling locations with identical geographic coordinates

Some of the sampling locations of the IDHTACI project recorded the same geographical coordinates, and may either: (a) refer to the same habitat type (case A), or b) refer to different habitat types (case B).

Case A (same geographic coordinates - same habitat type): If the sampling locations were in very close proximity (especially in the case of a habitat type with limited area in a given site), one sampling location was selected in the existing coordinates and at the same time, another sampling location was added to a new location in a different part of the habitat types distribution (if available) so as to collect data from the same number of locations as in 1999-2000.

Case B (same geographic coordinates - different habitat types): This could occur under two different scenarios:

If the landscape heterogeneity was great and the conditions on site is a mosaic of habitat types, then during the IDHTACI project field researchers may have collected data from different habitat types in close proximity. In that scenario, in the new field campaign one sampling location was taken in these coordinates for the dominant (more common) habitat type in the area today, and a second sampling location for the other habitat type was selected in a different area. In case of no clear dominance of one habitat type, two new locations were selected one for each habitat type. The exact geographic coordinates of the new locations were recorded.

The second scenario is that there was an error in the coordinates. In that case, one sample for the habitat type in the area was taken in the old location, and a different sampling location for the second habitat type was identified and recorded in an adjacent area.

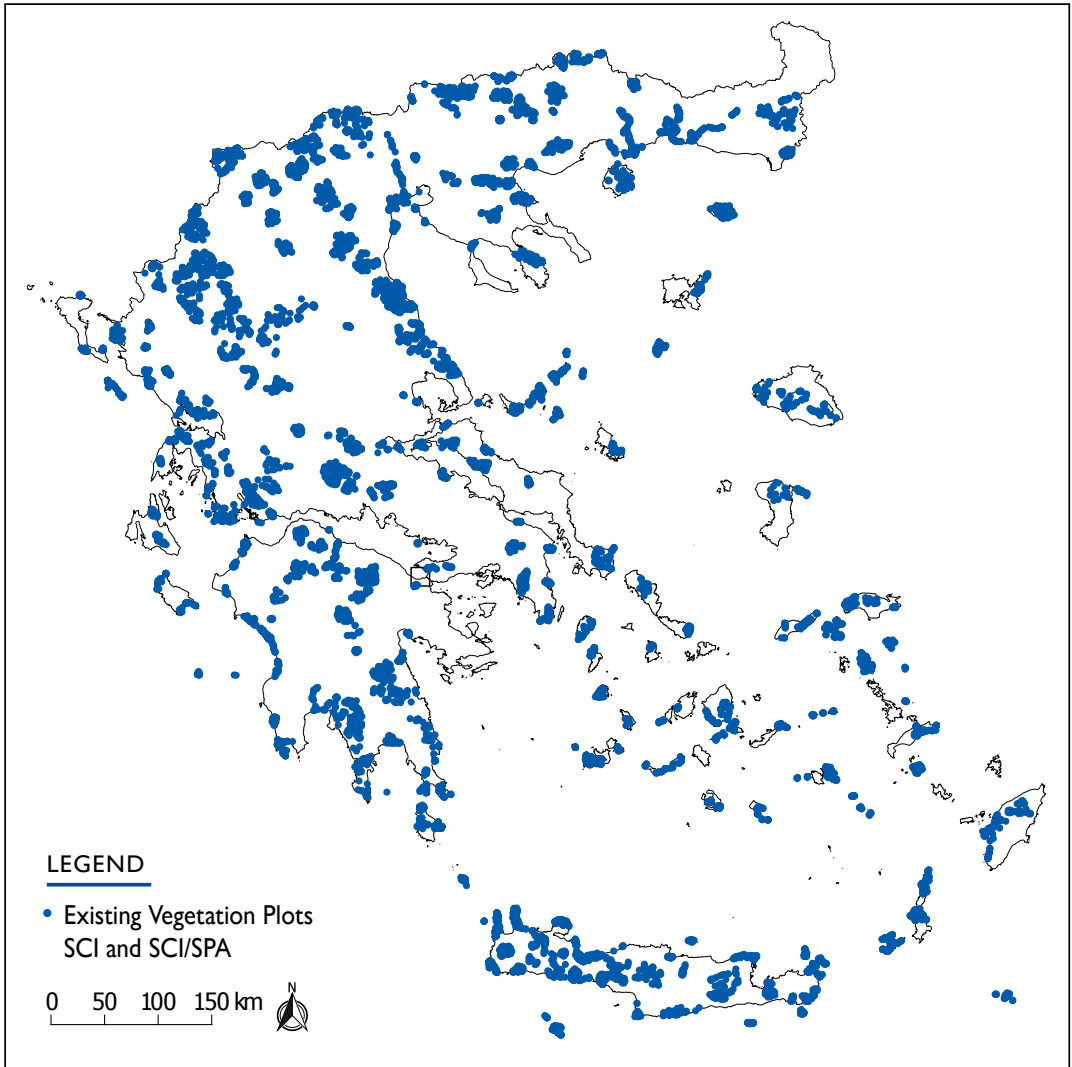


Figure 4.4 The sampling locations whose vegetation structure and species composition were examined during the “Identification and description of the habitat types in areas of conservation interest” IDHTACI project (1999-2001). The sampling locations are inside sites of the Natura 2000 network.

ii. Sampling locations in adjacent areas

There are habitat types characterized by great plasticity in their spatial patterns (e.g. sand dunes), so it is not unlikely that the exact location of such habitat types might have shifted during the intervening 15 years. In such cases, the new sampling location was in the area where the habitat type occurs today and as close as possible to the old location.

In other ecosystem types (e.g. forests), the close proximity of sampling locations may introduce bias and under-representation of the ecological conditions heterogeneity within the habitat. Therefore, such sampling does not allow proper assessment of the conservation status. In these cases, when sampling locations belonging to the same habitat type were found at locations less than 100 m apart (Figure 4.5), they were grouped together and considered as a single sampling location, i.e. field evaluators completed only one eval-

uation protocol in this location. At the same time, additional sampling locations for the same habitat type in the same Natura 2000 site were selected.

iii. Disagreement between the habitat type of the sample and the conditions on the ground

In the cases where the habitat type code on the sampling location of the IDHTACI project does not match the corresponding habitat type code in the field today, the following procedure was followed:

- i. If the habitat type (recorded in the IDHTACI project) occurs in the wider area, a sampling location for the original habitat type was selected in the neighboring area where it occurs.
- ii. If the habitat type (recorded in the IDHTACI project) does not occur in the wider area of the sampling location, but it is known to exist in other areas of the same Natura 2000 site (either from field visits or from the literature), a sampling location for this habitat type was selected in the area where it occurs within the same Natura 2000 site.
- iii. If based on the literature, but the field work and the judgment of the evaluator was proved that the identification / description of the habitat type to which the IDHTACI sampling location is classified is incorrect, then the field evaluator carried out sampling at the location referenced by the geographical coordinates but for the currently existing habitat type.
- iv. If the conditions changed since 2000, due to either human disturbance (e.g. land use change) or natural causes (e.g. wildfire), the following cases were distinguished:
 1. if in the coordinates of the IDHTACI sample occurs a natural habitat type then sampling takes place at the location but for the currently existing habitat type,
 2. if the disturbance is permanent or recent (for example quarry Figure 4.5) and thus there was no natural habitat type in the area, then sampling took place in the area (with zero typical species and structures and functions) to report the bad conditions for the habitat type in this location. Furthermore, if the habitat type is still present in neighboring areas

an additional sampling location was selected there.

New sampling locations

For a number of habitat types and in specific sites of the Natura 2000 network where the habitat type occurs but during the IDHTACI project no samples were taken, new sampling locations were selected to examine the conditions of the habitat types. The locations were selected to be representative of the conditions of the habitat types in the specific site.

The exact number of sampling locations selected was specified during the field work and it was not less than five per habitat type per site of the Natura 2000 network. Exceptions were made for rare habitat types that occur in restricted area in each site. Also the sampling locations tried to take into consideration the EEA 10 km reference grid, with at least one location in each grid cell that the habitat type occurs, if possible. Furthermore, the ecological differentiation of the site (e.g. alti-

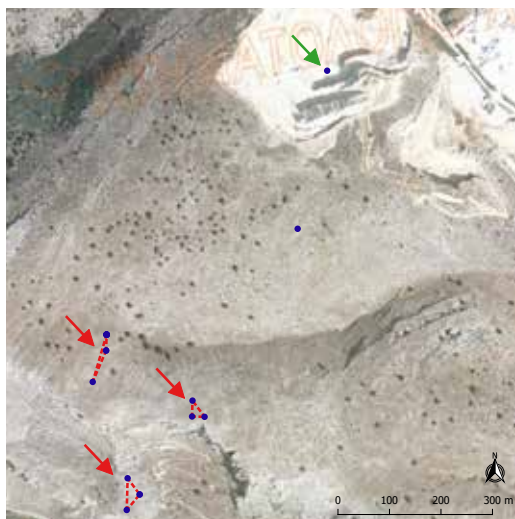


Figure 4.5 Issues arising when identifying sampling locations in the field from the sampling locations of the IDHTACI project (1999-2001). The red arrows identify sampling locations that belong to the same habitat type but are too close together to give a representative sample of the study area. The green arrow refers to a location where the land cover has changed due to human intervention (in this example a quarry).

tudinal gradient, different slopes and exposures, geological substrates) was also taken into account so that the new sampling locations would reflect the ecological differentiation of the habitat types in each Natura 2000 site.

Although the assessment of the conservation degree in each cell of the EEA 10 km reference grid was not a legal requirement, it was judged that the implementation of a “bottom-up” methodological approach using intermediate spatial scales to synthesize the results of the assessment, provide added information and insights and thus improves the assessment as described by Tsiripidis *et al.* (2018).

Criteria for selecting cell size of EEA reference grid

Although the 10 km EEA reference grid is an adequate scale for most habitat types, it is considered to be inadequate for rare and ecologically valuable habitat types for which Greece as a Member State has a major responsibility for their long term conservation. These habitat types were evaluated in a more fine scaled reference grid, so that the mapping of the conservation status as well as of the pressures and threats to the habitat type can be examined to more detailed spatial accuracy. The parameters that have played a key role in selecting the grid cell size are the national distribution pattern, the ecological value of each habitat type, and the degree of responsibility at national level for each habitat type (Dimopoulos *et al.*, 2006).

Based on the available IDHTACI habitat maps for each habitat type the following were calculated:

- i. **the area that the habitat type occupies in Greece** was estimated as the area it occupies inside the sites of the Natura 2000 network, and not as its potential area of occupancy throughout the Greek territory
- ii. **the number of cells of the 10 km EEA reference grid** that the habitat type occupies at national level. As before this estimation is based on the habitat types distribution inside the sites of the Natura 2000 network, and not the total distribution throughout Greece.
- iii. **the spatial pattern of the habitat types distribution within the sites of the Natura 2000 network**
- iv. **Greece’s degree of responsibility for the long term conservation of the habitat type**, and
- v. **the habitat type’s conservation value at the national level**, based on: a) its significance as a habitat for rare / endangered species, b) its rarity its endemism, c) its relative abundance in Greece compared to Europe, d) its function as a stepping stone for the coherence of the Natura 2000 network.

The characterization of each type of habitat in relation to its spatial pattern in the sites of the Natura 2000 network, Greece’s degree of responsibility and the conservation value of each habitat type are based on the work of Dimopoulos *et al.* (2005, 2006) and on the work of Panitsa *et al.* (2011) and Boteva *et al.* (2004).

The abundance/rarity of each habitat type in the sites of the Natura 2000 network in Greece was rated according to the following scale:

- 1-9 sites: rare,
- 10-19 sites: infrequent,
- 20-39 sites: scattered,
- 40-69 sites: widespread,
- >70 sites: common / abundant.

The responsibility of Greece for the long term conservation of the habitat types is assessed using the following criteria (Dimopoulos *et al.* 2006):

- T:** Important habitat type for endemic species.
- R:** Rare habitat type.
- E:** Endemic habitat type.
- L:** The spatial pattern is defined by extensive stands of a widespread habitat type.
- C:** The habitat type distribution in Greece is the centre of its overall range.
- D:** The habitat type distribution in Greece is on the edge of its overall range.

S: The habitat type in Greece could serve as stepping stone, in the sense of the Natura 2000 network coherence.

A prerequisite for assessing a habitat type on a more fine scaled reference grid is that its representativity and conservation status (as reported in the 2nd national report on the implementation of directive 92/43 /EEC), to be excellent (A) or good (B) in most of the sites it is present. Degraded habitat types that have lost their representativity or are characterized by degraded structures and functions could be assessed at a more fine scaled reference grid only on a case-by-case basis, because of time and cost constraints.

Based on the above criteria, all habitat types are assessed in the **10 km EEA** reference grid (as proposed by Evans and Arvela 2011). Exceptions were habitat types 2230, 2270, 3130, 3260, 5310, 6110, 7210, 8320, 9180, 91F0, 9310, 9370 and 9380 which are proposed to be assessed in the **5 km EEA** reference grid and habitat types 1430, 3140, 3250, 7140, 7220 which are proposed to be assessed in the **1 km EEA** reference grid. For more information on the methodology and the calculation of the criteria that led to the final selection of the cell size of the EEA reference grid, please see Ξυστράκης *et al.* (2014).

4.7 Assessment of conservation status / degree

After collecting the data homogeneously, using the standardized field sheets described in the previous section, the next step includes the application of methods for the objective assessment of each parameter. Locally, the conservation degree of structures and functions (including typical species) is assessed. By integrating and upscaling the local information to the national scale, the conservation status of the parameter structures and functions (including typical species) is assessed. At the national scale the conservation status of the parameters range and area is assessed. The following section describes the methodology employed for upscaling local estimates to the national level and integrating the different strands of information collected (Figure 4.6).

4.7.1 Conservation degree (local scale)

At local level (sampling locality), the conservation degree of structures and functions (including typical species) and the future trend of structures and functions are assessed. By combining these two parameters at the local level, the future conservation degree of structures and functions for that locality is assessed.

From the combination of the variables : (i) existing conservation degree of structures and functions (including typical species), (ii) future trend and (iii) future status of structures and functions, the future prospects of structures and functions at the local sampling area level are assessed following the rules in Table 2.2. The methodology applied in Greece is described in detail in Tsiripidis *et al.* (2018). In the following section, the main steps of the method are described.

Conservation degree of typical species at the sampling locality

For the assessment of the conservation degree of the typical species in each sampling locality, the fidelity value of each taxon was multiplied with coefficients related to its abundance and vitality. Thus, field evaluators were advised to record i) the abundance of the typical species found in

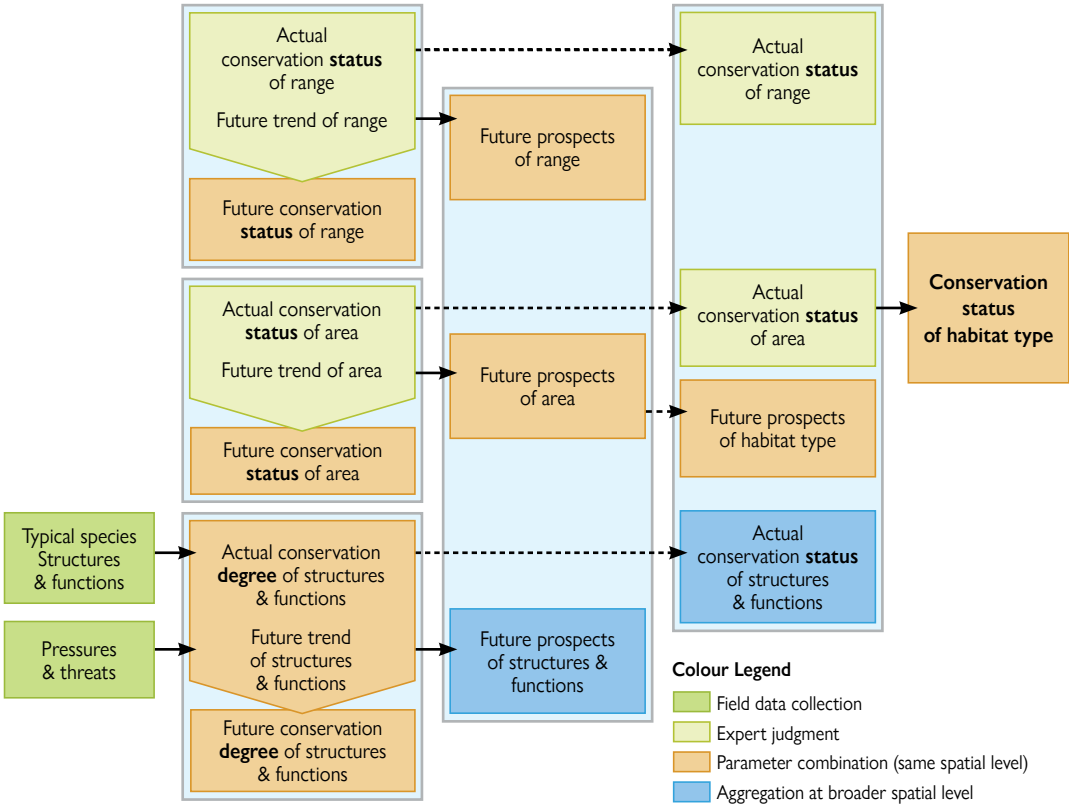


Figure 4.6 Methodological approach for assessing the habitat type conservation status at national level.

each sampling locality using the AFOR scale (A = Abundant, F = Frequent, O = Occasional, R = Rare) and ii) their vitality (Braun-Blanquet 1964; Dierschke 1994) using three categories (1: feeble plants, 2: plants with vegetative propagation and 3: well developed plants completing their life cycle). For more details see (Table 4.6).

The conservation degree assessment for the typical species at the sampling locality scale is done along the following steps (Figure 4.6):

- Assignment of sample plots to habitat types and subtypes, based on a floristic similarity measure
- Estimation of an index representing the conservation degree of typical species
- Assessment of the conservation degree of typical species, on the basis of the distribution of the values of the above-mentioned index.

Assignment of sample plots to habitat types and subtypes

The assessment of the conservation degree of typical species is based on the comparison of the species recorded at each sampling locality and the typical species list of a certain habitat subtype. Therefore, the first step is to check if all the sample plots were classified in the correct subtype (this was necessary especially for the cases that the field researchers used the general list of typical species for a habitat). For this check, we summed the fidelity values of the common species between each sample plot and the typical species of the habitat subtype that the plot was assigned to. The fidelity value of a given species differs among habitat subtypes. This sum for each habitat subtype was divided by the sum of fidelity values of all typical species of the subtype. Each plot was eventually assigned to that subtype for

Abundance of the typical species	
Abundance class	Abundance of the typical species
A: Abundant	Species with high abundance present in many locations in the area assessed.
F: Frequent	Species present in many locations in the area assessed, but with medium abundance in these locations OR Species present in a small proportion of the area assessed but with many individuals covering a considerable proportion of the area (e.g. between 12% and 25% of the total area assessed)
O: Occasional	Species present in many locations in the area assessed, but with medium abundance in these locations OR Species present in a small proportion of the area assessed but being common in it (e.g. less than 12% of the total area assessed)
R: Rare	Species with one or only few individuals in the area assessed. These individuals may be clumped or dispersed in the area examined.
Vitality of the typical species	
Vitality class	Description
1 - feeble plants	Plants that do not complete their life cycle in the study locality, plants with low and or no vegetative propagation, or tree and shrub species occurring only as juveniles
2 - weak plants	Plants with few flowers and seeds, plants with vegetative propagation, but not completing their life cycle or tree species that cannot outreach the shrub layer
3 - well developed	Well developed plants completing their life cycle

Table 4.6 The scale for recording typical species abundance and vitality in the field.

which it presented the maximum standardized sum. In this way, the number of common species between the plot and each subtype was taken into account, after being weighted by the fidelity values of the species for each habitat subtype. The use of fidelity as weight in the sums, aimed to take into account the ecological and geographical affinity of species with the habitat subtypes. The standardization of species fidelity values sums (by dividing with the sum of the fidelity values of all typical species of a subtype) was applied to make the sums of species fidelity values independent from the number of typical species of the habitat subtypes.

Estimation of index of conservation degree of typical species (ICDTS)

After assignment of each plot to the appropriate habitat subtype, the fidelity value of each taxon

was multiplied with coefficients related to its abundance and vitality.

The abundance coefficient was calculated by comparing the abundance of each taxon occurring in each sampling locality with its average abundance in the subtype, as it was calculated on the basis of the plots of the database classified in the subtype. The average abundance of each taxon in the subtype was transformed in the scale AFOR and the values 4, 3, 2 and 1 were given for the four grades (A, F, O and R) of the scale. If the abundance of the taxon in the sampling locality differed for more than one grade from that in the subtype, the coefficient was equal to the ratio of the abundance in the plot and to that in the subtype. For example, if the abundance of the taxon in the plot was 2 and its average abundance in the sub-type was 4, then the coefficient was equal to 2/4. If there was no difference in the abundance

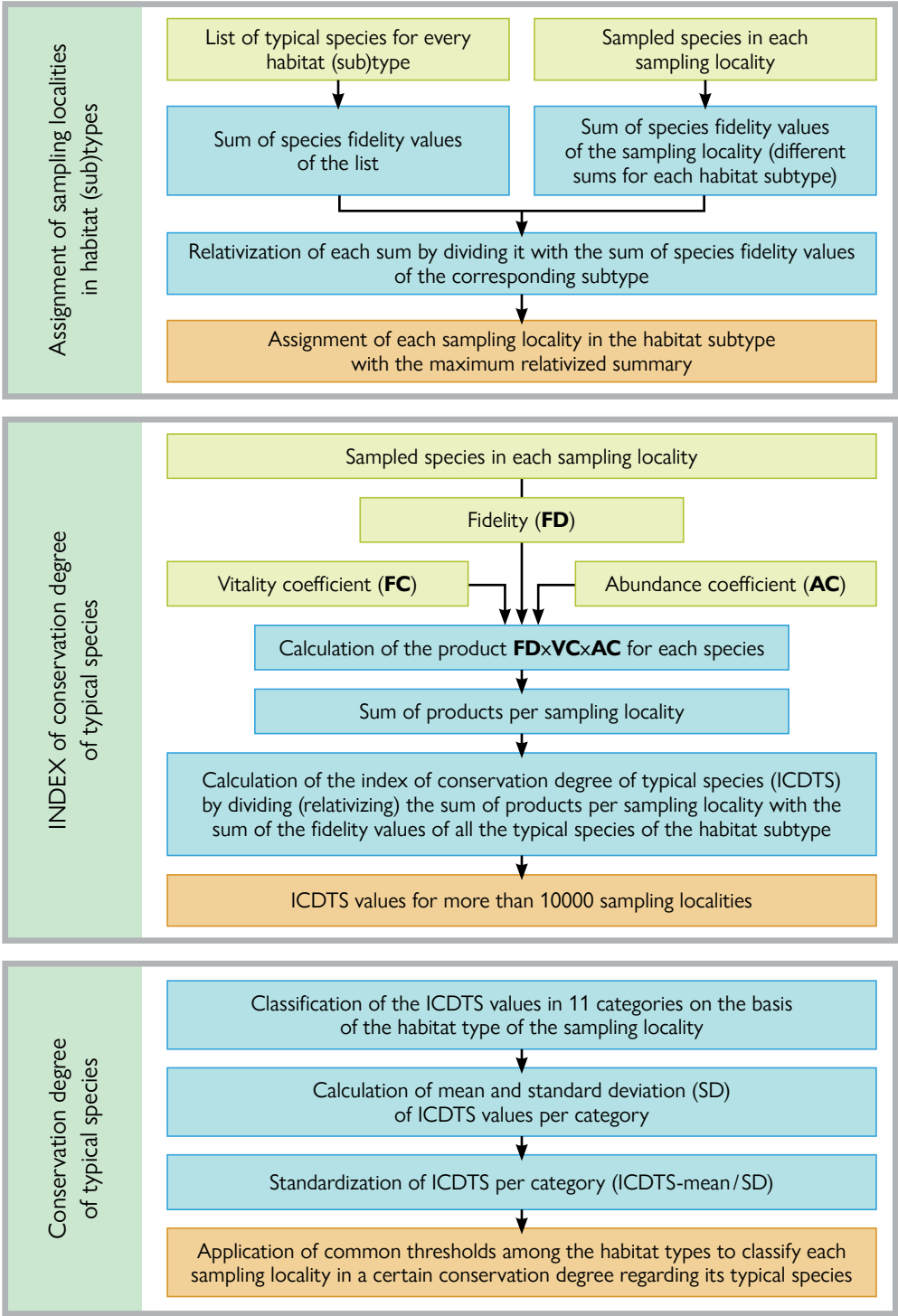


Figure 4.7 The scale for recording typical species abundance and vitality in the field. Modified from Tsiripidis *et al.* (2018)

or it was up to one grade of the AFOR scale, the coefficient was set to 1.

The vitality coefficient was set equal to 1, 0.66 and 0.33 for the vitality categories 3, 2 and 1, respectively.

For each plot we summed the products of the species fidelity values with the abundance and vitality coefficients and the sum was standardized by dividing it with the sum of fidelity values of all the species of the habitat subtype to which the plot was classified. This value was considered to represent the conservation degree of the typical species in each plot and it is named hereafter as the **index of conservation degree of typical species (ICDTS)**.

Assessment of the conservation degree of typical species

Habitat types were then divided in eleven categories (Table 4.7) based on their physiognomy and ecology; these categories correspond to a great extent to their categories distinguished in the Interpretation Manual for the Habitat Types. Within each of these eleven categories, the average and standard deviation of the ICDTS were calculated.

For each plot the difference of its ICDTS index value from the average one of the category of the habitat type it belongs, was calculated. This difference was then divided by the standard deviation (SD) of the ICDTS index of the habitat type category. In this way, we calculated how many SDs each plot's ICDTS differs from the average of the category of the habitat type it belongs. These values are comparable between the plots regardless the habitat type they belong. The distinction of different categories of habitat types and the calculation of averages and SDs per category was applied because the range of ICDTS index values differs according to the habitat ecology and the number of typical species. Ideally, the average and SD of ICDTS values should be calculated for each habitat type, but in our data set there were some habitat types with a relatively low number of plots.

Finally, after testing with different threshold values, the values presented in Table 4.8 were se-

lected to distinguish between the three classes of conservation degree (FV, U1 and U2) related to the typical species. The specific thresholds were chosen intuitively, after inspecting the percentage of plots which were classified in the three classes of conservation degree, as well as comparing the classification in conservation degrees that the thresholds produce, with the empirical estimations of the conservation degree of plots during the field sampling.

Assessment of the conservation degree for structures and functions

The next step was to assess the conservation degree for specific structures and functions at the sample locality level. This was done on the basis of the proportion of indicators that were marked to be present in each sampling locality from the total number of indicators for each habitat type. The following thresholds (Table 4.9) were selected to be applied for the assessment of the specific structures and functions.

Integrated assessment of conservation degree of structures and functions (including typical species) at the local level

The conservation degree of structures and functions (including typical species) was assessed after combining the assessment of its two sub-criteria: structures and functions and typical species. More specifically, the rules used for this synthesis to assess the overall conservation degree are shown in Table 4.10.

Future trend of conservation degree

The future trend of conservation degree of structures and functions was estimated by using the number and the importance of the pressures and threats recorded in each sampling locality. The trend is considered as **favourable (FV)**, when only up to one pressure/threat of medium or light importance (i.e. with no pressure/threat of high importance) is recorded. Alternatively if two or more pressures/threats are recorded or high importance pressures/threats are recorded, the degree may be favourable only if these impacts are counterbalanced by applied management meas-

Table 4.7 Habitat types grouped in habitat categories on the basis of their physiognomy and ecology. For each category the average and standard deviation of ICDTS from the relevés in our database is reported (adapted from Tsiripidis *et al.* 2018).

Habitat category	Average ICDTS	Standard deviation of ICDTS	Habitat type codes in each category
1	0.291	0.143	1210, 1240, 1310, 2110, 2120, 2190
2	0.275	0.138	1410, 1420, 1430, 1510, 2220, 2230, 2250, 2260
3	0.232	0.205	3130, 3140, 3150, 3170, 3240, 3260, 3280, 3290
4	0.204	0.112	4060, 4090
5	0.295	0.144	5110, 5210, 5330, 5420, 5430
6	0.207	0.151	6170, 6220, 6230, 62A0, 62D0, 6420, 6430, 6510
7	0.263	0.136	7140, 7210, 7230
8	0.211	0.182	8140, 8210, 8220, 8320
9	0.325	0.131	91E0, 91F0, 92A0, 92C0, 92D0
10	0.374	0.164	9110, 9130, 9140, 9150, 9180, 91CA, 91M0, 9250, 9260, 9270, 9280, 9410, 9530, 9560, 95A0
11	0.536	0.238	2270, 9290, 9310, 9320, 9340, 9350, 9540

Table 4.8 Key to assess conservation degree of typical species at the sample plot level (adapted from Tsiripidis *et al.* 2018).

Conservation degree	Value of ICDTS
Favourable (FV)	Plot's ICDTS > average-1 × SD
Inadequate (U1)	average-1×SD ≥ Plot's ICDTS > average-1.5 × SD
Bad (U2)	Plot's ICDTS ≤ average-1.5 × SD

Table 4.9 Key to assess conservation degree of structures and functions at the sample plot (evaluation protocol) level (adapted from Tsiripidis *et al.* 2018).

Conservation degree	Proportion of indicators marked as present
Favourable (FV)	≥ 50%
Inadequate (U1)	< 50% but ≥ 25%
Bad (U2)	< 25%

Table 4.10 Key to assess conservation degree of structures and functions (including typical species) at the sample plot (evaluation protocol) level(adapted from Tsiripidis *et al.* 2018).

Conservation degree	Combinations of conservation degree of sub-criteria
Favourable (FV)	Typical species and structures and functions FV
Inadequate (U1)	Typical species and/or structures and functions U1, but none U2
Bad (U2)	Typical species and/or structures and functions U2
Unknown	Typical species and/or structures and functions Unknown, but none U2

ures. If there is more than one and up to three pressures/threats of medium importance, none of high importance and no management measures counterbalancing the effect the pressures/threats, then the trend is considered as **unfavourable - inadequate (U1)**. If there are more than three pressures/threats of medium importance or at least one pressure/threat of high importance the trend is assessed as **unfavourable - bad (U2)**.

Future prospects of structures and functions

The future prospects of the conservation degree of structures and functions are then estimated on the basis of the current degree and the future trend for every sampling locality, following the suggestions described in Table 4.11 and the guidelines by Evans and Arvela (2011). The future prospects of the conservation degree of structures and functions were classified as FV, U1, U2 and X.

4.7.2 Upscaling from the conservation degree to the conservation status assessment

The assessment of the conservation degree at the sampling locality level should be upscaled to the national level using the methodology described below in order to derive the national level conservation status required for the Article 17 report.

At the spatial scale of sampling locality, we have estimated: i) the conservation degree of structures and functions (including typical species) and ii) the local prospects of the conservation degree of structures and functions. To assess the conservation status of each habitat type at the national level, two procedures are required: i) the upscaling of the local estimates at the national level and ii) the combination of this parameter with the parameters related with the area of occupancy and the range of the habitat type that have been assessed at the national scale.

The use of standardized sampling protocols allows for the evaluation of the conservation degree at a specific locality and, in turn, one or more sampling localities are included in a single unit of broader geographical scale (i.e. E.E.A. grid cell, Natura 2000 site, floristic region, MS). The transition among spatial scales from the local (sampling protocol)

Table 4.11 Evaluation matrix for the combination of current conservation degree of structures and functions and the future trend and future status of it so as to assess the local prospects of the structures and functions.

Current conservation degree	Future trend	Future status	Local prospects of conservation degree
FV	FV	FV	Good-G
FV	U1	FV	Good-G
FV	U1	U1	Poor-P
FV	U2	U1	Bad-B
FV	U2	U2	Bad-B
U1	FV	FV	Good-G
U1	FV	U1	Poor-P
U1	U1	U1	Poor-P
U1	U2	U2	Bad-B
U2	FV	FV	Good-G
U2	U1	U2	Bad-B

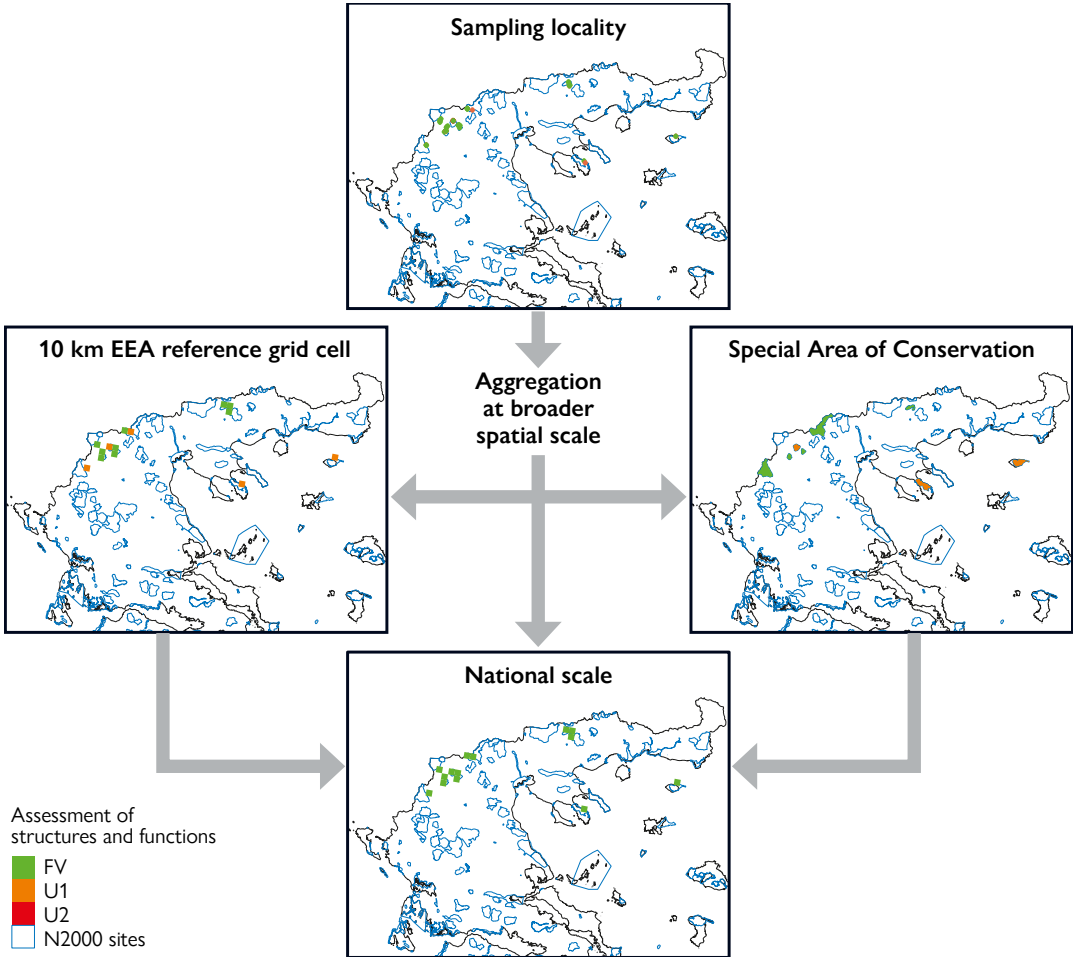


Figure 4.8 The upscaling approach employed in the Greek habitat conservation assessment methodology takes into consideration the assessment of parameters evaluated at different spatial scales, using objective algorithms (adapted from Tsiripidis *et al.* 2018).

to the national (in Greece, the national level coincides with the biogeographical region scale) could include one or more intermediate steps, ensuring for a considerable flexibility to evaluators. For the purposes of the Greek national level assessment, the local assessments were pooled at intermediate steps (more specifically for each E.E.A. 10x10 km grid cell) and then further aggregated these outputs at a broader national scale (Figure 4.8).

In Greece, the assessment of the conservation status was evaluated using the intermediate step of assessing the conservation degree for struc-

tures and functions and future prospects of each habitat type at the E.E.A. 10x10 km² grid cell. That is the reason why the instructions to field evaluators included a note to sample at least one locality, if possible, in every E.E.A. 10 km grid cell that a habitat type was known to occur.

To estimate the actual conservation degree of each habitat type at each E.E.A. 10 km grid cell, the 75-25 rule was applied (Table 4.12).

Next step includes the upscaling of outputs from the E.E.A. cell to the national level. This upscaling

Table 4.12 Rules for assigning conservation degree to each E.E.A. grid cell based on the conservation degree for the sampling localities examined (adapted from Tsiripidis *et al.* 2018).

Conservation degree at EEA 10x10 km ² grid cell	Rule
Favourable (FV)	≥ 75% of sampling localities included in the E.E.A. grid cell evaluated as FV in conservation degree of structures and functions
Inadequate (U1)	Any other combination
Bad (U2)	> 25% of sampling localities included in the E.E.A. grid cell evaluated as U2 in conservation degree of structures and functions
Unknown	> 25% of sampling localities included in the E.E.A. grid cell with unknown conservation degree of structures and functions but less than 25% of protocols evaluated as U2 in conservation degree of structures and functions

Table 4.13 Rules for assigning conservation status at the national level based on the conservation degree of the E.E.A. grid cells (adapted from Tsiripidis *et al.* 2018).

Conservation status of structures and functions at national level	Rule
Favourable (FV)	> 50 % of E.E.A. cells evaluated as FV in conservation degree of structures and functions
Inadequate (U1)	> 50 % of E.E.A. cells evaluated as U1 in conservation degree of structures and functions
Bad (U2)	> 50 % of E.E.A. cells evaluated as U2 in conservation degree of structures and functions
Unknown	> 50% of E.E.A. cells evaluated as Unknown in conservation degree of structures and functions

followed the “majority” rule¹, as presented in Table 4.13.

In the case of tie (lack of majority) the worst conservation degree was applied.

The final rules for the upscaling of the assessment outputs at broader scales were based on expert’s opinion. Consecutive assessments of the conservation status using different combinations of rule-sets for the intermediate steps were performed and the outputs were judged by a series of experts in order to select the combination of methods that best reflects the condition of habitat types in Greece. It was concluded that a strict “75-25” rule for the upscaling at the E.E.A. grid

cell, followed by the “majority” rule was the best combination for the final assessment of the conservation status at the national scale.

The same procedure was applied for the estimation of the prospects of structures and functions.

¹ If there is an estimate of the area occupied by each habitat type in each cell of the EEA reference grid, for the national level estimation a percentage weighting can be applied to the area of each habitat type in the cell; this was done in Greece for the cases where cartographic data was available..

4.7.3 Conservation status (national level)

The habitat type conservation status assessment is based on the combination of the assessment of the status of the individual parameters (Evans and Arvela 2011, but also section 2.2.5). The parameters are:

- i. range
- ii. area
- iii. structures and functions (including typical species)
- iv. future prospects of each parameter
- v. overall future prospects of the habitat type

The last parameter is a combination of the prospects of the other three parameters (Figure 4.6).

Current status for structures and functions

The current status and the future prospects for parameter structures and functions (including typical species) are firstly assessed at the local level through field work and with the use of the standardized sampling protocol and then the results are aggregated and upscaled following the methodology described in the previous section.

Current status for range and area

The current status for the parameters range and area is the result of comparing the current values of these parameters with the Favourable Reference Value (FRV) for each parameter (Table 4.1). If the current value is equal to or greater than the FRV, i.e. when the value of the assessment parameter is sufficient for the long term viability of the habitat type, then the status of the parameter is considered **Favourable (FV)**. If the parameter value is marginally less than the FRV then that parameter is considered **Unfavourable Inadequate (U1)**. And if the parameter value is considerably lower than the FRV then that parameter is considered **Unfavourable Bad (U2)**.

According to the method applied, and in congruence with expert judgment, the range parameter has values that are sufficient for the long-term conservation of almost all habitat types in Greece. Therefore, for most habitat types the

status of the range parameter is considered to be **Favourable - FV** (Table 4.1). Also, in three cases, the available information was deemed insufficient to reach a conclusion.

On the other hand, the picture differs for the area parameter. For most habitat types, the area parameter has values that are sufficient for the long-term conservation of almost all habitat types in Greece and therefore it is considered to be **Favourable - FV** (Table 4.1). However, there are cases that the area parameter is considered Unfavourable, since the value of the area parameter is less than the FRV. These cases concern mainly coastal and dune habitat types where there is a strong pressure from human activities (and especially activities related to tourism). Among the forest habitat types, only one (9370 Palm groves of Phoenix) had very limited area occupied (less than 1.3 km²) and thus was considered **Unfavourable-Inadequate**. Also, for three habitat types, the available information was deemed insufficient to reach a conclusion.

Future trend of the range and area parameters

The assessment of the future trend and the future status of the range and area parameters was based on the number and importance of the recorded pressures and threats and on the observed - if there were data available - trends of increasing or decreasing the value of the parameters area and range of each habitat type (for more details consult section 2.2.5). The assessment was based on expert judgment and bibliographical analysis. For habitat types whose range or area is expected to decrease significantly in the next reporting periods, and experts estimate that the future status of the range or area parameters will fall by at least one class from the current conservation status class, the future trend is assessed as **Unfavourable-Bad (U2)**. For the habitat types whose range or area is expected to decline without deteriorating the future range or area conservation status in next reporting periods, the future trend is assessed as **Unfavourable-Inadequate (U1)**. Finally, for habitat types whose range or area is not expected to decrease or is expected to increase in the foreseeable future (i.e. the next two

reporting periods), the future trend is assessed as **Favourable (FV)**.

Future status of the range and area parameters

The assessment of the future status of the range and area parameters was based on expert judgment, taking into account the recorded pressures and threats, and attempted to assess the value of the range and area parameters of each habitat type in the foreseeable future in comparison to their corresponding FRVs (Table 4.1), an approach similar to the one applied for the assessment of the current conservation status. Thus, if the range and area parameters are expected to be above the FRVs, they are rated as **Favourable (FV)**. If the future value of the range and area parameters is expected to be close to the FRV, but marginally lower, then the future status was evaluated as **Unfavourable - Inadequate (U1)**. Lastly, if the future value of the range and area parameters are estimated to be well below FRV then their future status is evaluated as **Unsatisfactory - Bad (U2)**.

Prospects of the range and area parameters

The prospects of the range and area parameters are estimated as a combination of assessments of the existing status, future trend and future status parameters, according to the methodology proposed by Evans and Arvela (2011) (Figure 2.1 and Table 2.1).

Future prospects of the habitat type

The assessment of the future prospects of the habitat type was performed by combining the assessment of the prospects of the three other parameters: i) range, ii) area and iii) structures and functions (including typical species). The integration of the three separate prospects followed the rules described in Table 2.2.

Overall conservation status assessment

The final assessment of the conservation status of each habitat type at the national level is achieved by combining the assessment of the individual parameters in the way shown in Table 2.3.

4.8 Estimation of the parameters for updating the Standard Data Forms for the sites of the Natura 2000 network

According to the Directive 92/43/EEC, every Member State is obliged to update the descriptive database of the protected areas belonging to the Natura 2000 network. These areas include Sites of Community Importance (SCIs), Special Areas of Conservation (SACs), as well as Special Protection Areas (SPAs) established under the Birds Directive. The database aims to: a) provide all necessary information to strengthen the networks coherence and to evaluate its effectiveness, b) assist in the decision making process regarding conservation policies and management practices, and c) serve as a platform to disseminate environmental information on biodiversity conservation.

The data collected for the monitoring of habitat types offers a considerable amount of information that can help to update the Natura 2000 database. This database includes fields like representativity, conservation status and the global assessment of the value of the site for conservation of the natural habitat type concerned. These fields are related to the assessment of the habitat type's conservation status carried out in accordance with Article 17 of the Directive 92/43/EEC. According to the Official Journal of the European Union (2011/484 /EU), the difference between the conservation status of the Standard Data Form (SDF) and the conservation status according to Article 17 is that **the SDF conservation status refers to the spatial level of the site of the Natura 2000 network, while the Article 17 conservation status refers to the biogeographical region within a Member State**. However, in Greece, the applied bottom-up approach for assessing the conservation status of structures and functions allows for the assessment of conservation degree at different spatial levels (from the sampling plot level to the national level). Thus, the conservation degree assessment (a step of the Article 17 conservation status assessment) could inform the SDF database. Nevertheless, the conceptual content of the conservation status used in the

SDF differs in part from the conservation status according to Article 17 of the Habitats Directive. Also, although the representativity of a habitat type or the value of a site for the conservation of a habitat type are not quantified for the purposes of monitoring according to Article 17, the data collected may contribute towards updating the information on the representativeness and value of the site. The following three sections present the methodology used to update three fields of the Natura 2000 Database, namely: (a) the conservation status of the site structure and functions; (b) the representativity of the habitat type; and (c) the global assessment of the value of the site for conservation of the natural habitat type concerned.

4.8.1 Conservation status of the site structures and functions

The conservation degree of structures and functions of the habitat types according to the SDF has a different conceptual content than the habitat type's conservation status assessment of the Article 17 of the Directive 92/43/EEC. According to the SDF (European Commission, 2011), the conservation status is assessed on the basis of the:

- i. degree of conservation of the structure
- ii. degree of conservation of the functions
- iii. restoration possibility

The degree of conservation of the structure reflects the current condition of the structures and functions of the habitat type (including the typical species). The degree is classified using a ranking system as follows:

- i. excellent structure
- ii. structure well conserved
- iii. average or partially degraded structure

The degree of conservation of functions reflects the prospects (capacity and probability) of the habitat type concerned on the site in question to maintain its structure for the future. Therefore, it has different conceptual meaning than the habitat functions described by Evans and Arvela (2011) and used for the purposes of the Greek conser-

vation status assessment. The degree of conservation of functions is classified as follows:

- i. excellent prospects
- ii. good prospects
- iii. average or unfavourable prospects

Finally, the criterion restoration possibility is used to evaluate to what extent the restoration of the habitat type concerned on the site in question is possible from a scientific and practical perspective (European Commission 2011). The restoration possibility from a scientific point of view refers to the feasibility of the restoration taking into consideration the current state of knowledge of the structure and functions of the habitat type, as well as the ecology of the species inhabiting it and the web of interactions evolved over time. The main issue is if the scientific knowledge available could provide management plans and practices to restore the habitat. The restoration possibility from a practical point of view focuses on the cost-effectiveness of the restoration actions. The restoration possibility is classified as follows:

- i. restoration easy
- ii. restoration possible with an average effort
- iii. restoration difficult or impossible

The assessment of the conservation status *sensu* SDF is achieved by the synthesis of the above criteria according to the rules described below.

The conservation status of the habitat type concerned on the site in question is considered excellent (A) when the degree of conservation of the structure is excellent, independent of the other two sub-criteria, OR when the degree of conservation of the structure is well conserved and the degree of conservation of functions (i.e. the prospects) is excellent independent of the grading of the third criterion.

The conservation status of the habitat type concerned on the site in question is considered good (B) when the degree of conservation of the structure is well conserved and the degree of conservation of functions (i.e. the prospects) is good independent of the grading of the third criterion, OR when the degree of conservation of the structure

is well conserved and the degree of conservation of functions (i.e. the prospects) is average / maybe unfavourable and the restoration possibility is easy or possible with average effort, OR when the degree of conservation of the structure is average / partially degraded and the prospect excellent and the restoration possibility is easy or possible with average effort, OR when the degree of conservation of the structure is average /partially degraded and the prospect good and the restoration possibility is easy.

The conservation status of the habitat type concerned on the site in question is considered average or reduced conservation (C) for all other combinations of the values of the three criteria.

It appears that the conservation degree of structures and functions according to the SDF is not identical to the conservation degree assessed with this methodological approach for the level of the site of the Nature 2000 network. Still the information collected for the estimation of the conservation degree according to Article 17 could correspond with the information required for evaluating the first two criteria of the conservation status according to the SDF. More specifically, the conservation degree of typical species and specific structures and functions correspond to the criterion degree of conservation of the structure of the SDF, while the prospects of structures and functions correspond with the criterion of degree of conservation of functions according to the SDF. Field work was carried out to collect data on each sampling area for the conservation degree of typical species and specific structures and functions as well as the prospects of structures and functions. In order to evaluate the restoration possibilities, the standardized sampling protocol for field work included a field for assessing the restoration possibility. The latter parameter was evaluated in situ by researchers for each sampling locality. Therefore, it was possible to calculate the conservation status according to the SDFs for each sampling locality. The synthesis of the criteria was based on the algorithm proposed in the European Commission (2011) explanatory notes for the Standard Data Forms (SDFs) and presented above. The calculation of the conservation status according to the SDF was evaluated at the level of the sam-

pling plot to up to the level of the E.E.A. 10x10 km² grid cell, and then at the level of the Natura 2000 site and in particular for the Special Areas of Conservation. The algorithms used for the above synthesis are the same as those used for estimating the conservation status (see section 4.7.3).

4.8.2 Representativity

Representativity of the habitat type is not required for habitat type conservation status assessment according to the guidelines of Evans and Arvela (2011). Representativity gives a measure of 'how typical' a habitat type is, and by definition it is linked to the Interpretation Manual of habitat types (European Commission 2013), since it provides a definition, a list of characteristic species and other relevant information for each habitat type. However, in some cases the above approach may prove problematic in terms of evaluating representativity, because habitat types vary floristically, but also sometimes ecologically, within their geographic range. This problem is greater for habitat types that are highly dispersed and very heterogeneous within the European Union. The Interpretation Manual of the European Union Habitats gives in these cases a general description and does not provide a detailed description of the geographical differentiation. For the aims of Article 17 of the Directive 92/43/EEC, each Member State has to specify the typical species of each habitat type depending on the diversity of the habitat type within the Member State. Typical species is one of the most important criteria for assessing the representativity of a habitat type because most habitat types correspond to specific vegetation types and/or plant communities.

The determination of typical species was one of the key steps of the methodological approach followed for assessing the habitat type's conservation status in Greece (see section 4.4). Furthermore, for each sampling location, a degree of similarity between each sampling surface and habitat subtypes was calculated (see section 4.4.1). These degrees of similarity were used to assess the representativity of each habitat type for each site of the Natura 2000 network in which it occurs. The evaluation of representativity was carried out using the following ranks: a) excellent representativ-

ity, b) good representativity, and c) significant representativity. The three ranks of representativity were designated on the basis of expert judgment and taking into account the degree of similarity of the sampling plots with the habitat subtypes to which the plots were assigned. In this way, a more objective criterion (degree of similarity) was introduced in a purely subjective (expert judgment) way of assessing representativity.

4.8.3 Global assessment of the site for the conservation of the habitat type

Following the explanatory notes for the Standard Data Form (European Commission 2011), the global assessment of the site for the conservation of the habitat type was based on expert judgment but taking into account the representativity, the conservation status and the relative area (i.e. the proportion of the area of the habitat type in the site). The first two criteria were evaluated using the data collected for the assessment of the conservation status and according to the methodology described above. For the calculation of the relative area criterion, maps of the distribution of the habitat type, and especially those produced by the IDHTACI project were used. The global assessment of the site for the conservation of a habitat type was made using the scale proposed by the European Commission 2011: (A) excellent value, (B) good value, and (C) significant value.

5. Article 17 Reporting and Standard Data Forms Updating

The data collected in the field (based on the standardized sampling protocol), as well as data from expert judgment evaluations is used to compile the national conservation status assessment report and to update the Standard Data Forms (SDFs) for the Special Areas of Conservation (SAC) in Greece.

5.1 Article 17 reporting tool

The Article 17 report contains information organized in several fields that Member States are required to complete. A Microsoft Access database application is available on the website of the European Topic Center for Biodiversity¹ to assist the process of completing the fields required to compile the national report (Figure 5.1). The database also has a front-end user interface form to simplify data entry.

The screenshot shows the main panel of the 'Habitats and Birds Directive Reporting Tool v. 1.9'. At the top, it says 'Article 17 - Habitats Directive Reporting Tool v. 1.9'. Below this, there are two main sections. The first section contains a 'Country' dropdown menu set to 'GR', a 'Reporter Code' text box, and a 'Role' section with radio buttons for 'Data reporter' (selected) and 'Coordinator'. A 'Save' button is below the role selection. The second section contains three buttons: 'Species reports', 'Habitats reports', and 'General report'. Below these are 'Species checklist' and 'Habitats checklist' buttons. To the right of these are 'Import MGB', 'Export XML', and 'Exit Tool' buttons.

Figure 5.1 The main panel of the Article 17 reporting tool user interface to assist the data input for the compilation of the national reports.

The screenshot shows the 'Habitat type report' form. At the top, it says 'Habitat type report'. Below this, there are two main sections. The first section contains '0.1 Member State' dropdown set to 'GR', '0.2 Habitat code' dropdown set to '9110', and 'Habitat name' text box containing 'Luzulo-Fagetum beech forests'. There are 'Export' and 'Reporting Mandatory' checkboxes. The second section is titled '1. National level' and contains '1.1. Maps' section with '1.1.1. Distribution map' checkbox, '1.1.2. Method used - map' dropdown, '1.1.3. Year or period' text box, '1.1.4. Additional distribution map' checkbox, and '1.1.5. Range map' checkbox. Below this is the '2. Biogeographical level' section with 'MMED' dropdown set to 'Marine Mediterranean'. At the bottom, there are 'Add region', 'EditRegion', and 'Delete region' buttons. A '> Next step' button is also present. The footer shows the date '5/12/2017 5:48:09 pm' and buttons for 'Notes Report', 'Print Preview', 'Validate Report', and 'Close'.

Figure 5.2 The first step in the data entry process for habitat types. As an example the screenshot refers to the case of habitat type 9110.

1 https://bd.eionet.europa.eu/activities/Reporting/Reporting_Tool/Reporting_Tool_Software

Initially, the data input process requires information on the user entering the data, the Member State and the type of data (species or habitat types) (Figure 5.2). Once the user data is entered, the option of entering data for each habitat type (Figure 5.2) is enabled.

The Article 17 database is structured in a way that coincides with the structure of the national reference form (see Appendix IV). Initially, the user can upload the range and distribution maps that have been created, as well as basic information about the map production methodology (field 1.1 - Figure 5.2). The user then selects the biogeographical zone for which the reference report is prepared (the conservation status is assessed separately for each biogeographical zone within each Member State). Then the user is required to gradually fill in the information in the database fields (Figure 5.3). Some of the fields are obligatory to be filled and are described with **bold fonts**; while other fields are optional.

The data entered in each field may be free text or number (e.g. field 2.2 shown in Figure 5.3 is a free text field where the user should fill in the references used to compile the national reference for the habitat type) or selecting a default value (e.g. field 2.1 also shown in Figure 5.3 consists of selecting a biogeographical zone for which the report is being compiled from a dropdown list).

The data entry process and the type of data required for each field are thoroughly analyzed in the explanatory notes and guidelines for national reporting provided by the European Commission (European Commission, 2006). Only the input of information in the fields directly related to the conservation status assessment is described and discussed below.

5.1.1 Published sources (field 2.2)

In this field the user is required to fill in the bibliographic sources used in the conservation status assessment, as well as in the preparation of the national report. In the case of the Greek national report for the habitat type's conservation status assessment, all the relevant bibliographic references used for each habitat type were listed in this field.

Figure 5.3 User interface of the data entry process of the Article 17 reporting tool. In this screenshot the field for bibliographic information on the references used to compile the national reference.

5.1.2 Surface area – Range (field 2.3)

In this section, the user must enter data on the estimated value of the range of habitat types. This information includes the total estimated range (field 2.3.1), and information regarding any estimated trends (fields 2.3.3 to 2.3.8). Field 2.3.9 refers to the data on the Favourable Reference Value and, in particular one of the three methods related to its assessment is noted: (i) the exact value (ii) the use of operators and (iii) the unknown. Also, the methodology of assessing the FRV should be included in the report.

In the third Greek national report for the period 2007-2013, for each habitat type the estimated value of the parameter range was reported along with summary information on the modeling approach used to estimate this value. Also for each habitat type the FRV was reported not as exact value, but with the use of operators (Table 4.1). Furthermore, comments and explanations on the changes of methodology and the consequent changes in FRV were also included.

5.1.3 Area covered by habitat (field 2.4)

In this section, the user must enter data on the value of the estimated area occupied by the habitat types. The structure of this section of the report is

analogous to the previous section on the parameter range of the habitat type.

In the Greek national report for the period 2007-2013, for each habitat type the estimated value of the parameter area occupied was reported, along with summary information on the modeling approach used to estimate this value. Also for each habitat type, the FRV was reported not as exact value but with the use of operators (Table 4.1). Furthermore, comments and explanations on the changes of methodology and the consequent changes in FRV were also included.

5.1.4 Main pressures (field 2.5)

In this section the user fills in information on:

- a) the main pressures recorded on the habitat type at the national level
- b) the importance of these pressures for the long term conservation of the habitat type in question.

The field could include up to 20 pressures. The pressures are classified in a hierarchical list compiled by the European Commission. In the national report, pressures must be reported at the second level at least.

For the needs of the last national report, pressures were recorded during fieldwork at the sampling locality level. It is therefore conceivable that for some habitat types more than 20 pressures have been recorded. Therefore, it is difficult to estimate the intensity with which every pressure affected the habitat type at national level in order to properly fill the fields. For the purposes of compiling the national report, the frequency of recording of each pressure in each habitat type was calculated as the total number of sampling localities at which each pressure has been recorded, regardless of the importance at which they are recorded. In the national report the 20 most frequently occurring in Greece pressures were reported. The importance of each pressure at the national level was estimated on the basis of the frequency of each pressure, as well as the importance recorded in each sampling locality.

5.1.5 Main threats (field 2.6)

In this section the user fills in information on:

- a) the main threats reported on the habitat type on the national level
- b) the importance of these threats for the long term conservation of the habitat type in question.

In correspondence to the previous section, the user could list up to 20 threats, from the hierarchical list compiled by the European Commission. In the national report, threats must be reported at least at the second level.

For the compilation of the last national report the information for this section was produced in the same way as for the main pressures given above.

5.1.6 Typical species (field 2.7)

In this section the fields are relevant to the typical species, as well as the specific structures and functions of each habitat type. Field 2.7.1 is for the list of typical species of each habitat type. Field 2.7.2 records information on the method used to specify them. Field 2.7.3 is for information on any trends observed regarding the typical species. Field 2.7.4 refers to the method used to assess the specific structures and functions of each habitat type. Finally, field 2.7.5 is an open text field for any comments that the experts think should be recorded.

In this section of the Greek national report, the typical species of each habitat type were reported. Since this section of the report refers to the habitat type and does not distinguish subtypes, for each habitat type the typical species list of the subtypes were integrated and a single list of typical species for each habitat type was reported. The method used to select the typical species is presented in detail in section 4.4 of this book. For the purposes of the report the method was summarized in the appropriate field.

5.1.7 Conclusions (field 2.8)

This section includes summarized information that has been introduced in more detail in previous steps. This summary concerns the range (fields 2.3.1 to 2.3.9c) and the area (fields 2.4.1 to 2.4.12c)

parameters and is presented so as to assist the user to complete the overall assessment of the conservation status.

Field 2.8.1a refers to the habitat type range parameter estimation. Field 2.8.1b is the operator selected to indicate the trend of the parameter range conservation status, if this trend is considered Unfavourable-Inadequate (U1) or Unfavourable-Bad (U2). Corresponding evaluations for habitat type's area parameter are given in the fields 2.8.2a and 2.8.2b. The methodology for assessing the conservation status of the range and area parameters is discussed in section 4.7.3.

Field 2.8.3a refers to the assessment of the conservation status of the parameter structures and functions (including typical species), as assessed at national level by applying the methodology presented in section 4.7.3. Similarly to the previous parameters, field 2.8.3b records an operator indicating the trend of the conservation status of the structures and functions (including typical species), if this trend is considered Unfavourable-Inadequate (U1) or Unfavourable-Bad (U2).

Similarly to the previous fields, field 2.8.4a refers to the assessment of the conservation status of the parameter future prospects, as assessed at national level by applying the methodology presented in section 4.7.3. Furthermore, field 2.8.4b records an operator indicating the trend of the conservation status of the future prospects, if this trend is considered Unfavourable-Inadequate (U1) or Unfavourable-Bad (U2).

Finally, field 2.8.5 refers to the overall assessment of the conservation status of the habitat type as assessed with the methodology presented in section 4.7.3. Furthermore, field 2.8.6 records an operator indicating the trend of the overall habitat type conservation status, if this trend is considered Unfavourable-Inadequate (U1) or Unfavourable-Bad (U2).

5.1.8 Natura 2000 coverage (field 3.1)

In this section the information required refers to the coverage of the habitat type inside the Natura 2000 network of protected areas. Field 3.1.1 is

for the area the habitat type occupies within the Natura 2000 network. Field 3.1.2 is devoted to the description of the method used for this assessment. Field 3.1.3 records the trend of the area occupied by the habitat type inside the Natura2000 network.

For the compilation of the third Greek national report, the data used for extracting the relevant information were the existing habitat type maps inside the sites of the Natura 2000 network in Greece (which were produced by the IDHTACI project in 1999-2001), and where available, the most recent habitat types maps.

5.1.9 Conservation measures (field 3.2)

This section is used for the information on the conservation measures taken or necessary to be taken for each habitat type. The selection is made from a number of drop-down menus in field 3.2.1. In field 3.2.2 the type of required measures is characterized from a series of options, such as "legal", "administrative", "contractual", "recurring" or "one-off". Field 3.2.3 is used for reporting the importance of the measure for the long-term conservation of the habitat type using the scale High-H, Medium-M or Low-L. Field 3.2.5 is used for reporting the purpose of the measure using options the "Maintain", "Enhance", "Long term". It is also possible to select "No Effect", "Unknown", "Not evaluated".

5.1.10 Validation

After the user completes data input, the user could validate the data, for missing information or for errors. The data validation process could be performed for each biogeographic region separately or for the overall assessment of the habitat type. If the automated process locates errors or missing values, a new screen appears with detail information on the errors or missing values located.

5.2 Standard Data Forms

The Standard Data Form (SDF) is used to archive data on each Special Area of Conservation (SAC). SDF is divided into sections concerning (i) site identification, (ii) location, (iii) ecological information, (iv) site description, (v) conservation and the relationship with adjacent areas, (vi) the human impacts and (vii) the delineation of each SAC. Instructions for completing the SDF are provided in the Explanatory Notes prepared for this purpose (European Commission, 2011) and specialized software is available which can be downloaded from the website https://bd.eionet.europa.eu/activities/Natura_2000/N2000_software².

In the following paragraphs of the book, there is a short description only of the SDF fields that were updated during the latest conservation status assessment of the habitat types of Greece, as explained in section 4.8.

5.2.1 Site identification

Field 1.5 (update) is an obligatory field, where the user should enter the date of the latest update. The format of the date is a six digit number, where the first four digits represent the year and the next two the month (i.e. May of 2012 is coded as 201205).

5.2.2 Ecological information

This is the section that covers most of the changes estimated during the latest update. The field campaigns undertaken in the framework of the conservation status assessment led to the amendment of the presence of several habitat types in specific sites of the Natura 2000 network. As a result for these sites of the network the field 3.1 (Habitat types present on the site and assessment for them) had to be updated. The changes cover on the one hand the new knowledge acquired during the field work, but on the other hand they reflect the changes in the habitat classification nomenclature when new Member States joined the EU (for more details see Chapter 3).

As new methodology was adopted for the estimation of the parameters “representativity”, “conservation”, and “global assessment”, the values of these parameters had to be updated for each habitat type present in each site of the Natura 2000 network.

Finally, another parameter that needed updating is the reassessment of the area occupied by each habitat type at the national level (see section 4.2), which in turn led to the reassessment of the parameter “Relative surface” in the habitat types table occurring in each site of the network.

5.2.3 Site description

In some sites of the Natura 2000 network (SCI or SAC or SPA) there was a need to update the information on: (1) field 4.1 General site character - other features, and (2) field 4.2 Quality and importance. This was the result of the new data collected in the field for these sites.

Furthermore, for all sites there was an updating on the list of pressures and threats operating in each site (either SCI or SAC or SPA), based on the fieldwork carried out for the habitat type conservation status assessment. This information was recorded on field 4.3 Threats, pressures and activities with impacts on the site. For this purpose, the data on pressures and threats collected in each sampling locality inside a site of the Natura 2000 network were collated. The importance of each pressure and threat in each site was evaluated based on (a) the number of sampling localities where it was recorded, (b) the importance of it in each locality and (c) expert judgment.

The other fields of the SDF were not updated.

² Last time accessed: December 2017

6. Examples of Application of the Method

This chapter presents the application of the methodology to two habitat types as an example of how the methodology has been applied precisely, as well as of where revision of the results has been required after expert judgment. The examples of conservation status assessment presented is based on the data collected within the Natura 2000 sites (with the exception of sites in the area of responsibility of Managing Authority), as well as data gathered throughout Greece outside the Natura 2000 network.

6.1 Habitat type 6420 Mediterranean tall humid herb grasslands of the *Molinio-Holoschoenion*

For the conservation status assessment of the habitat type 6420, **128 localities** were sampled (i.e. 128 standardized sampling protocols were completed). These sampling locations did not in-

clude Natura 2000 sites in the area of responsibility of the Managing Authorities. Sampling took place in **50 cells** of the E.E.A. reference 10 km grid (Figure 6.1), while the habitat type is also known to occur in additional cells of the E.E.A. reference 10 km grid, where sampling was not carried out.

From the process of evaluating the parameters typical species and structures and functions, the conservation degree of structures and functions (including typical species) for each sampling locality was assessed (Table 6.1). Each sampling location was assigned to the appropriate cell of the E.E.A. reference grid. The evaluation of the conservation degree of each cell of the E.E.A. reference grid was based on upscaling the sampling locality assessments according to the 75-25 rule (for more details consult Table 4.8). The results are shown in Table 6.1.

Figure 6.1 Sampling locations for the conservation status assessment of habitat type 6420.

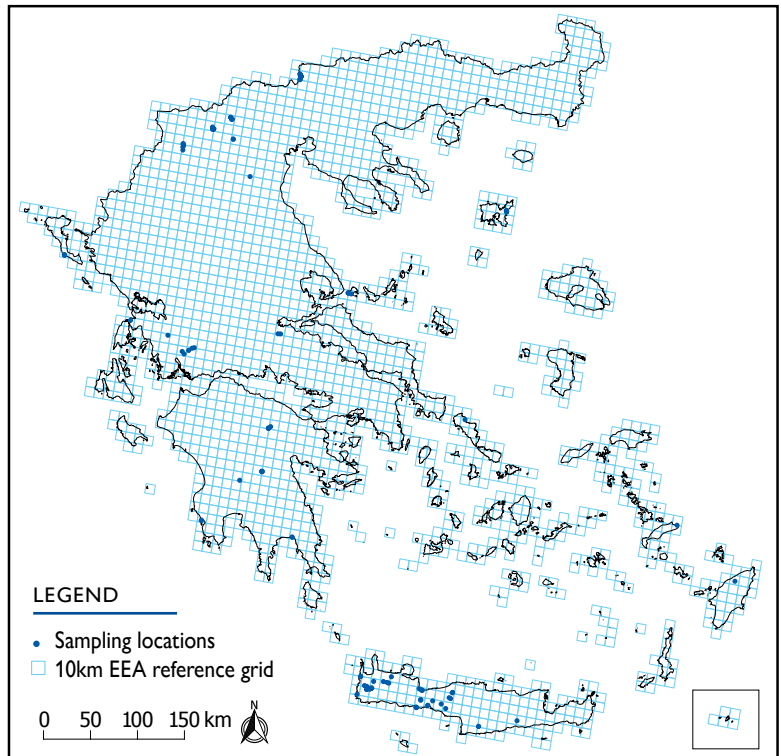


Table 6.1 Assessment of the conservation degree for habitat type 6420 based on the parameter structures and functions (including typical species). The results are presented for each E.E.A. reference grid 10x10 km cell. (*Number of sampling localities)

Natura 2000 site code	E.E.A. reference grid cell code	Conservation degree				* Number	E.E.A. Cell cons. degree
		FV	U1	U2	X		
GR1210001	10kmE533N201	0	0	0	0	0	X
GR1210001	10kmE533N202	2	0	0	0	2	FV
GR1230002	10kmE539N210	10	1	1	0	12	FV
GR1240004	10kmE532N204	5	3	0	0	8	U1
GR1250002	10kmE535N198	0	1	0	0	1	U1
GR1320001	10kmE528N200	3	1	0	0	4	U1
GR1320001	10kmE528N201	2	0	0	0	2	FV
GR1330001	10kmE531N197	0	0	0	0	0	X
GR1340004	10kmE530N203	7	5	1	0	13	U1
GR1340004	10kmE531N203	0	0	0	0	0	X
GR1430003	10kmE547N188	2	0	0	0	2	FV
GR1430003	10kmE548N188	1	0	0	0	1	FV
GR2230002	10kmE517N187	4	0	0	0	4	FV
GR2240001	10kmE525N181	1	0	0	0	1	FV
GR2310007	10kmE529N180	1	0	0	0	1	FV
GR2310009	10kmE531N179	0	2	0	0	2	U1
GR2310009	10kmE532N179	2	0	0	0	2	FV
GR2310009	10kmE532N180	1	0	0	0	1	FV
GR2440006	10kmE541N183	0	2	0	0	2	U1
GR2520002	10kmE541N168	1	3	0	0	4	U1
GR2520002	10kmE542N168	0	1	0	0	1	U1
GR2530002	10kmE541N173	0	4	0	0	4	U1
GR2530002	10kmE542N173	0	1	0	0	1	U1
GR2540003	10kmE545N162	0	0	0	0	0	X
GR2540003	10kmE546N162	1	0	1	0	2	U2
GR2550004	10kmE536N162	2	0	0	0	2	FV
GR4110001	10kmE563N200	7	0	0	0	7	FV
GR4110001	10kmE563N201	0	0	0	0	0	X
GR4210006	10kmE593N166	0	1	0	0	1	U1
GR4210008	10kmE586N171	0	0	1	0	1	U2
GR4220001	10kmE562N177	0	0	1	0	1	U2
GR4220019	10kmE566N174	0	0	0	0	0	X
GR4330003	10kmE564N147	0	1	0	0	1	U1
GR4330004	10kmE564N148	0	0	0	0	0	X
GR4330004	10kmE565N148	1	1	0	0	2	U1
GR4340001	10kmE555N148	0	1	0	0	1	U1
GR4340001	10kmE555N149	0	0	1	0	1	U2
GR4340004	10kmE556N147	1	0	3	0	4	U2
GR4340004	10kmE556N148	2	0	0	0	2	FV
GR4340004	10kmE557N147	5	0	0	0	5	FV

Natura 2000 site code	E.E.A. reference grid cell code	Conservation degree				* Number	E.E.A. Cell cons. degree
		FV	U1	U2	X		
GR4340006	10kmE558N148	1	0	1	0	2	U2
GR4340006	10kmE559N149	0	0	1	0	1	U2
GR4340010	10kmE562N148	1	1	2	0	4	U2
GR4340012	10kmE562N146	2	1	1	0	4	U1
GR4340012	10kmE563N147	0	2	0	0	2	U1
GR4340015	10kmE555N147	0	0	1	0	1	U2
Outside N2000	10kmE539N167	0	0	0	0	0	X
Outside N2000	10kmE539N210	3	0	0	0	3	FV
Outside N2000	10kmE548N188	1	0	0	0	1	FV
Outside N2000	10kmE557N148	0	1	0	0	1	U1
Outside N2000	10kmE558N148	1	0	0	0	1	FV
Outside N2000	10kmE562N147	0	3	0	0	3	U1
Outside N2000	10kmE563N147	0	1	0	0	1	U1
Outside N2000	10kmE565N147	0	1	0	0	1	U1
Outside N2000	10kmE565N149	0	1	1	0	2	U2
Outside N2000	10kmE569N146	0	2	0	0	2	U1
Outside N2000	10kmE573N147	0	0	1	0	1	U2
Total		70	41	17	0		

Summarizing the results of Table 6.1 the distribution of cells assessed as Favourable, Unfavourable - Inadequate, Unfavourable - Bad, and Not assessed are presented in Table 6.2.

Table 6.2 Number of E.E.A. reference grid cells per conservation degree for the parameter structures and functions (including typical species) for habitat type 6420.

Conservation degree	Number of E.E.A. cells	Proportion
FV	17	30%
U1	21	37%
U2	11	19%
X	8	14%
Total	57	100%

According to the majority rule, the national level conservation status assessment for the parameter structures and functions (including typical species) of the habitat type 6420 in Greece is **Unfavourable-Inadequate (U1)**.

Similarly, the methodology was applied to assess the parameter future prospects of structures and functions (including typical species). For each sam-

pling locality (i.e. for each standardized protocol collected), the future prospects were assessed on the basis of the current conditions, the future trend and the future status (Table 6.3). Again the estimates were upscaled to the level of the E.E.A. reference grid 10x10 km cell using the 75-25 rule.

Table 6.3 Assessment of the conservation degree of the future prospects for the parameter structures and functions (including typical species) of the habitat type 6420. The results are presented for each E.E.A. reference grid cell. (*Number of sampling localities)

Natura 2000 site code	E.E.A. reference grid cell code	Conservation degree				* Number	E.E.A. Cell cons. degree
		FV	U1	U2	X		
GR1210001	10kmE533N201	0	0	0	0	0	X
GR1210001	10kmE533N202	2	0	0	0	2	G
GR1230002	10kmE539N210	8	0	4	0	12	B
GR1240004	10kmE532N204	4	0	4	0	8	B
GR1250002	10kmE535N198	0	1	0	0	1	P
GR1320001	10kmE528N200	3	1	0	0	4	P
GR1320001	10kmE528N201	0	0	2	0	2	B
GR1330001	10kmE531N197	0	0	0	0	0	X
GR1340004	10kmE530N203	8	5	0	0	13	P
GR1340004	10kmE531N203	0	0	0	0	0	X
GR1430003	10kmE547N188	2	0	0	0	2	G
GR1430003	10kmE548N188	1	0	0	0	1	G
GR2230002	10kmE517N187	4	0	0	0	4	G
GR2240001	10kmE525N181	1	0	0	0	1	G
GR2310007	10kmE529N180	1	0	0	0	1	G
GR2310009	10kmE531N179	2	0	0	0	2	G
GR2310009	10kmE532N179	2	0	0	0	2	G
GR2310009	10kmE532N180	1	0	0	0	1	G
GR2440006	10kmE541N183	0	2	0	0	2	P
GR2520002	10kmE541N168	4	0	0	0	4	G
GR2520002	10kmE542N168	1	0	0	0	1	G
GR2530002	10kmE541N173	0	4	0	0	4	P
GR2530002	10kmE542N173	0	0	1	0	1	B
GR2540003	10kmE545N162	0	0	0	0	0	X
GR2540003	10kmE546N162	0	0	2	0	2	B
GR2550004	10kmE536N162	2	0	0	0	2	G
GR4110001	10kmE563N200	0	7	0	0	7	P
GR4110001	10kmE563N201	0	0	0	0	0	X
GR4210006	10kmE593N166	0	1	0	0	1	P
GR4210008	10kmE586N171	0	0	1	0	1	B

Natura 2000 site code	E.E.A. reference grid cell code	Conservation degree				* Number	E.E.A. Cell cons. degree
		FV	U1	U2	X		
GR4220001	10kmE562N177	0	0	1	0	1	B
GR4220019	10kmE566N174	0	0	0	0	0	X
GR4330003	10kmE564N147	0	1	0	0	1	P
GR4330004	10kmE564N148	0	0	0	0	0	X
GR4330004	10kmE565N148	1	1	0	0	2	P
GR4340001	10kmE555N148	0	1	0	0	1	P
GR4340001	10kmE555N149	0	0	1	0	1	B
GR4340004	10kmE556N147	1	0	3	0	4	B
GR4340004	10kmE556N148	1	1	0	0	2	P
GR4340004	10kmE557N147	5	0	0	0	5	G
GR4340006	10kmE558N148	0	2	0	0	2	P
GR4340006	10kmE559N149	0	0	1	0	1	B
GR4340010	10kmE562N148	1	3	0	0	4	P
GR4340012	10kmE562N146	1	3	0	0	4	P
GR4340012	10kmE563N147	0	2	0	0	2	P
GR4340015	10kmE555N147	0	0	1	0	1	B
Outside N2000	10kmE539N167	0	0	0	0	0	X
Outside N2000	10kmE539N210	3	0	0	0	3	G
Outside N2000	10kmE548N188	1	0	0	0	1	G
Outside N2000	10kmE557N148	0	0	0	1	1	X
Outside N2000	10kmE558N148	0	0	0	1	1	X
Outside N2000	10kmE562N147	0	0	0	3	3	X
Outside N2000	10kmE563N147	0	0	0	1	1	X
Outside N2000	10kmE565N147	0	0	0	1	1	X
Outside N2000	10kmE565N149	0	0	0	2	2	X
Outside N2000	10kmE569N146	0	0	0	2	2	X
Outside N2000	10kmE573N147	0	0	0	1	1	X

In the case of the future prospects of the structures and functions of habitat type 6420, it is apparent that for many cells of the E.E.A. reference grid there is no assessment of the future prospects. Most of these cells are outside the Natura 2000 network, where data was collected. The distribution of the cells of the E.E.A. reference grid in the assessment of the future prospects of maintaining structures and functions is shown in Table 6.4.

Table 6.4 Number of E.E.A. reference grid cells per conservation degree for the parameter future prospects of structures and functions (including typical species) for habitat type 6420. The data are presented overall for Greece and for the subset including only the sites of the Natura 2000 network.

Assessment	Overall		Inside Natura 2000	
	Number of cells	Proportion	Number of cells	Proportion
G	15	26.3%	13	28.3%
P	15	26.3%	15	32.6%
B	11	19.3%	11	23.9%
U	16	28.1%	7	15.2%
Total	57	100.0%	46	100.0%

If the overall assessment for the prospects of the structures and functions is based on all E.E.A. reference grid cells where habitat type 6420 occurs, then the outcome would be **Unknown (X)**. But this is not in accordance with the judgment of the majority of the experts that worked on the

monitoring project. A closer inspection of the data shows that this majority of unknown assessments originated from sampling locations outside the Natura 2000 network of protected areas, where due to problems arising during the field work, future trend and status were not properly assessed. If the overall is based only on the E.E.A. reference grid cells where habitat type 6420 occurs inside the Natura 2000 sites, then the outcome is clearly different, since in the majority of the cells the status is **Poor** (Table 6.4). This Poor rating is in accordance with the expert judgments, since habitat type 6420 is a type of Mediterranean humid grasslands that is strongly affected by human pressures and wetland conditions. The conservation degree and the prospects of the parameter Structures and Functions of habitat type 6420 at the level of the E.E.A. reference grid cell are shown in Figure 6.2.

For the conservation status assessment of the parameters “range” and “area”, the status of habitat type 6420 is evaluated as **Favourable (FV)** according to the experts’ judgment.

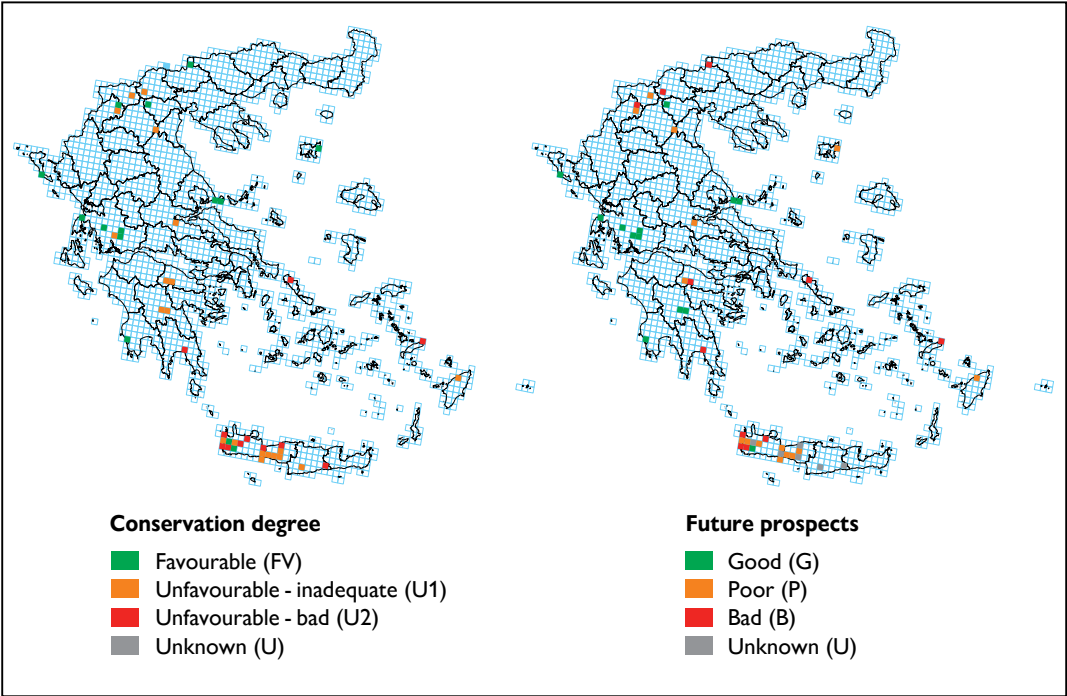


Figure 6.2 The conservation degree (left panel) and the prospects (right panel) of the parameter Structures and Functions for the habitat type 6420 at the level of E.E.A. 10 km reference grid cells.

Finally the parameter “Future prospects” of the habitat type 6420 is evaluated as **Poor**, since it is the product of the three parameter prospects, as described in Chapter 4. For parameters Range and Area the prospects are Good, but for parameter Structures and Functions the prospect is Poor (Table 6.5).

Table 6.5 Evaluation matrix for the conservation status assessment of habitat type 6420 in Greece for the period 2007-2012. The matrix contains the assessments for all parameters and their prospects, as well as the overall status assessment.

	Current status	Prospects
Range	FV	G
Area	FV	G
Structures and functions (including typical species)	U1	P
Future prospects of habitat type 6420	U1	←
Overall conservation status	U1	

6.2 Habitat type 9110 Luzulo-Fagetum beech forests

For the conservation status assessment of the habitat type 9110, 134 localities were sampled (i.e. 134 standardized sampling protocols were completed). These sampling locations did not include Natura 2000 sites in the area of responsibility of the Managing Authorities. Sampling took place in 33 cells of the E.E.A. reference 10 km grid (Figure 6.3).

From the process of evaluating the parameters typical species and structures and functions, the conservation degree of structures and functions (including typical species) for each sampling locality was assessed (Table 6.6). Each sampling location was assigned to the appropriate cell of the E.E.A. reference grid. The evaluation of the conservation degree of each cell of the E.E.A. reference grid was based on upscaling the sampling locality assessments according to the 75-25 rule (for more details consult table 4.8). The results are shown in Table 6.6.

Figure 6.3 Sampling locations for the conservation status assessment of habitat type 9110.

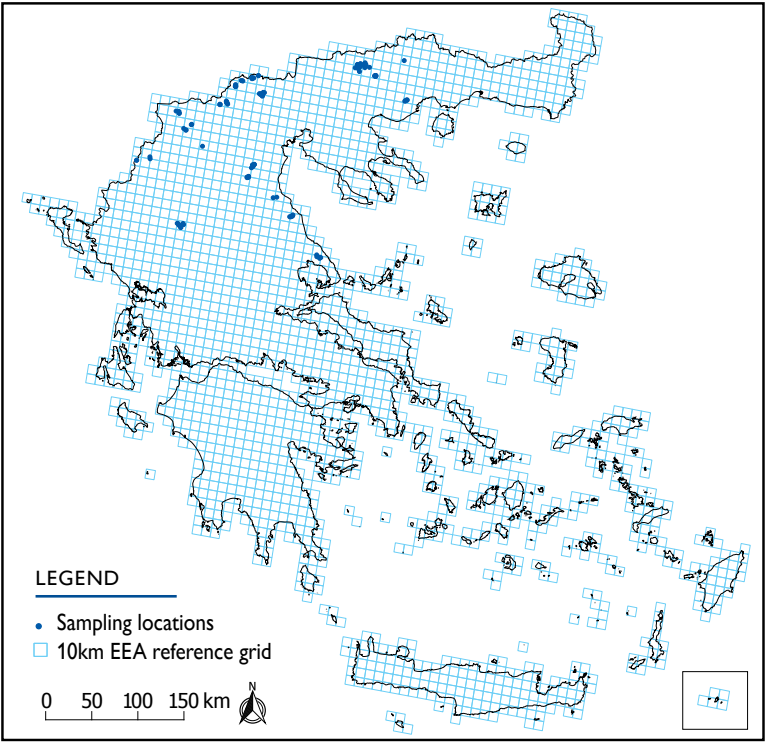


Table 6.6 Assessment of the conservation degree for habitat type 9110 for the parameter structures and functions (including typical species). The results are presented for each E.E.A. reference grid 10x10 km cell. (*Number of sampling localities)

Natura 2000 site code	E.E.A. reference grid cell code	Conservation degree				* Number	E.E.A. Cell cons. degree
		FV	U1	U2	X		
GR1150005	10kmE551N209	5	0	0	0	5	FV
GR1240001	10kmE531N205	3	0	0	0	3	FV
GR1240001	10kmE532N205	6	1	0	0	7	FV
GR1240002	10kmE534N208	6	1	0	0	7	FV
GR1240002	10kmE535N208	1	1	0	0	2	U1
GR1240003	10kmE535N206	2	1	0	0	3	U1
GR1240003	10kmE535N207	4	3	0	0	7	U1
GR1250002	10kmE535N199	1	0	0	0	1	FV
GR1250002	10kmE536N199	4	2	0	0	6	U1
GR1250003	10kmE535N197	2	1	2	0	5	U2
GR1250003	10kmE535N198	0	1	1	0	2	U2
GR1260004	10kmE547N211	9	1	0	0	10	FV
GR1260007	10kmE545N211	10	0	0	0	10	FV
GR1260007	10kmE545N212	8	0	0	0	8	FV
GR1260007	10kmE546N211	1	0	0	0	1	FV
GR1260007	10kmE546N212	4	0	0	0	4	FV
GR1320002	10kmE523N197	2	0	0	0	2	FV
GR1320002	10kmE524N198	2	0	0	0	2	FV
GR1340006	10kmE528N202	2	0	0	0	2	FV
GR1420001	10kmE538N196	1	0	0	0	1	FV
GR1420001	10kmE539N196	0	1	0	0	1	U1
GR1420003	10kmE540N194	1	0	0	0	1	FV
GR1420003	10kmE541N194	6	0	0	0	6	FV
GR1430001	10kmE544N190	2	2	0	0	4	U1
GR1430001	10kmE544N191	1	0	0	0	1	FV
GR1440001	10kmE529N191	7	0	0	0	7	FV
Outside N2000	10kmE526N203	1	0	0	0	1	FV
Outside N2000	10kmE527N203	3	0	0	0	3	FV
Outside N2000	10kmE528N201	3	0	0	0	3	FV
Outside N2000	10kmE529N191	2	0	0	0	2	FV
Outside N2000	10kmE530N200	0	1	0	0	1	U1
Outside N2000	10kmE532N207	7	0	0	0	7	FV
Outside N2000	10kmE533N208	3	0	0	0	3	FV
Outside N2000	10kmE545N211	4	0	0	0	4	FV
Outside N2000	10kmE546N212	1	0	0	0	1	FV
Outside N2000	10kmE550N213	1	0	0	0	1	FV

Summarizing the results of Table 6.6 the distribution of cells assessed as Favourable, Unfavourable - Inadequate, Unfavourable - Bad, and Not assessed are presented in Table 6.7.

Table 6.7 Number of E.E.A. reference grid cells per conservation degree for the parameter structures and functions (including typical species) for habitat type 9110.

Conservation degree	Number of E.E.A. cells	Proportion
FV	27	75%
U1	7	19%
U2	2	6%
U	0	0%
Total	36	100%

According to the majority rule, the national level conservation status assessment for the parameter structures and functions (including typical species) of habitat type 9110 in Greece is Favourable (FV).

Similarly, the methodology was applied to assess the parameter future prospects of structures and functions (including typical species). For each sampling locality (i.e. for each standardized protocol collected), the future prospects were assessed based on the current conditions, the future trend and the future status (Table 6.8). Again the estimates were upscaled to the level of the E.E.A. reference grid 10x10 km cell using the 75-25 rule.

Table 6.8 Assessment of the conservation degree of the future prospects for the parameter structures and functions (including typical species) of habitat type 9110. The results are presented for each E.E.A. reference grid cell. (*Number of sampling localities)

Natura 2000 site code	E.E.A. reference grid cell code	Conservation degree				* Number	E.E.A. Cell cons. degree
		FV	U1	U2	X		
GR1150005	10kmE551N209	5	0	0	0	5	G
GR1240001	10kmE531N205	3	0	0	0	3	G
GR1240001	10kmE532N205	7	0	0	0	7	G
GR1240002	10kmE534N208	7	0	0	0	7	G
GR1240002	10kmE535N208	2	0	0	0	2	G
GR1240003	10kmE535N206	3	0	0	0	3	G
GR1240003	10kmE535N207	7	0	0	0	7	G

Natura 2000 site code	E.E.A. reference grid cell code	Conservation degree				* Number	E.E.A. Cell cons. degree
		FV	U1	U2	X		
GR1250002	10kmE535N199	1	0	0	0	1	G
GR1250002	10kmE536N199	5	1	0	0	6	G
GR1250003	10kmE535N197	4	1	0	0	5	G
GR1250003	10kmE535N198	2	0	0	0	2	G
GR1260007	10kmE545N212	8	0	0	0	8	G
GR1260007	10kmE546N211	1	0	0	0	1	G
GR1260007	10kmE546N212	4	0	0	0	4	G
GR1320002	10kmE523N197	2	0	0	0	2	G
GR1320002	10kmE524N198	2	0	0	0	2	G
GR1340006	10kmE528N202	2	0	0	0	2	G
GR1420001	10kmE538N196	1	0	0	0	1	G
GR1420001	10kmE539N196	1	0	0	0	1	G
GR1420003	10kmE540N194	1	0	0	0	1	G
GR1420003	10kmE541N194	6	0	0	0	6	G
GR1430001	10kmE544N190	4	0	0	0	4	G
GR1430001	10kmE544N191	1	0	0	0	1	G
GR1440001	10kmE529N191	7	0	0	0	7	G
Outside N2000	10kmE526N203	1	0	0	0	1	G

Natura 2000 site code	E.E.A. reference grid cell code	Conservation degree				* Number	E.E.A. Cell cons. degree
		FV	U1	U2	X		
Outside N2000	10kmE527N203	3	0	0	0	3	G
Outside N2000	10kmE528N201	3	0	0	0	3	G
Outside N2000	10kmE529N191	2	0	0	0	2	G
Outside N2000	10kmE530N200	0	1	0	0	1	P
Outside N2000	10kmE532N207	7	0	0	0	7	G
Outside N2000	10kmE533N208	3	0	0	0	3	G
Outside N2000	10kmE545N211	4	0	0	0	4	G
Outside N2000	10kmE546N212	1	0	0	0	1	G
Outside N2000	10kmE550N213	1	0	0	0	1	G

The distribution of the cells of the E.E.A. reference grid in the assessment of the future prospects of maintaining structures and functions for habitat type 9110 throughout Greece is presented in Table 6.9. The classes used are Good, Poor, Bad and Unknown

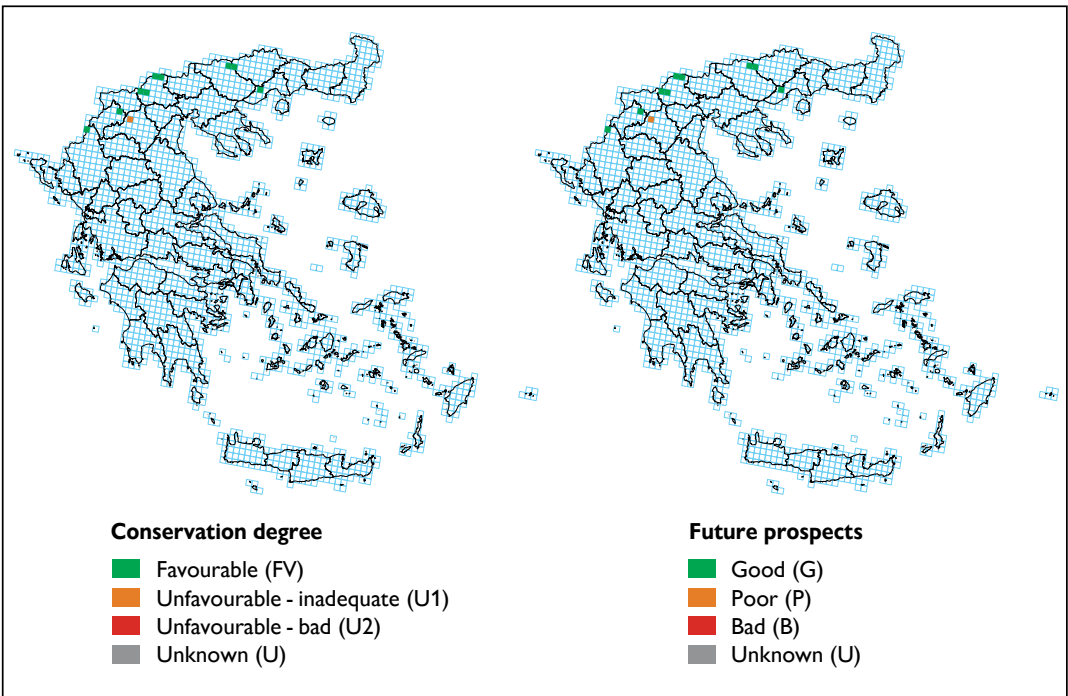


Figure 6.4 Conservation degree (left panel) and prospects (right panel) of the parameter Structures and Functions for the habitat type 9110 at the level of E.E.A. 10 km reference grid cells.

Table 6.9 Number of E.E.A. reference grid cells per class of prospects for the parameter structures and functions (including typical species) for habitat type 9110.

Conservation degree	Number of E.E.A. cells	Proportion
G	33	97.1%
P	1	2.9%
B	0	0%
U	0	0%
Total	34	100%

Based on the results presented, the prospects for the parameter structures and functions (including typical species) are Good at the national level.

The conservation degree and the prospects of the parameter Structures and Functions of habitat type 9110 at the level of the E.E.A. reference grid cell are shown in Figure 6.4.

For the conservation status assessment of the parameters “range” and “area” the status of habitat type 9110 is evaluated as **Favourable (FV)** according to the experts’ judgment (Table 4.1).

Finally the parameter Future prospects of the habitat type 6420 is assessed as **Good**, since it is the product of the prospects of the three parameters (range, area, structures and functions), which are all assessed as **Good**.

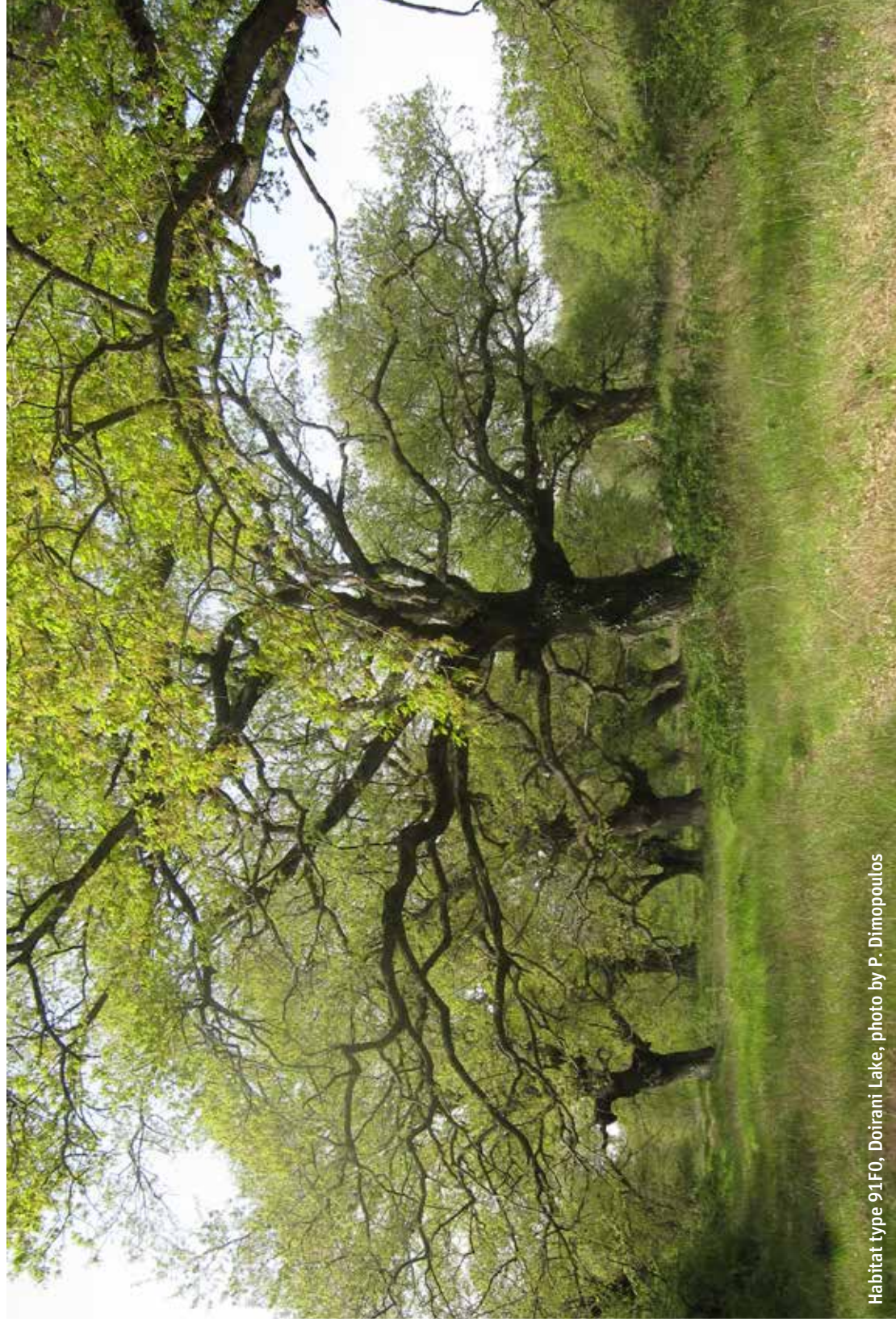
As a final result, the overall conclusion for the habitat type 9110 in Greece for the period 2007-2012 is that its conservation status is **Favourable** (Table 6.10).

Table 6.10 Evaluation matrix for the conservation status assessment of habitat type 9110 in Greece for the period 2007-2012. The matrix contains the assessments for all parameters and their prospects, as well as the overall status assessment

	Current status	Prospects
Range	FV	G
Area	FV	G
Structures and functions (including typical species)	FV	G
Future prospects of habitat type 9110	FV	←
Overall conservation status	FV	



Habitat type 5210, Sifnos island, photo by P. Dimopoulos



Habitat type 91F0, Doirani Lake, photo by P. Dimopoulos

7. Achievements and improvements

The approach adopted for the purposes of the Greek monitoring program for the conservation status assessment of habitat types (2014-2015) is based on the development of a specific methodology for assessing the conservation degree / status of specific structures and functions using quantitative methods. The methodology applied increased the level of objectivity in the assessment process, is cost-effective and at the same time easy to use for most evaluators who possess some scientific experience in the subject of vegetation science. Simultaneously, this approach allows the analysis of data and the assessment of conservation status at different spatial scales.

The first step in this methodology is the use of arithmetic methods to identify the subtypes within each habitat type (at least for the habitat types with important geographic or ecological differentiation in Greece). The identification of the different subtypes within habitat types as means for describing their geographical and ecological diversity is recommended by the Explanatory Notes and Guidelines for the Assessment and Reporting under Article 17 of the Habitats Directive (Evans and Arvela 2011), as well as by the relevant scientific literature (Henry *et al.*, 2008; Kovač *et al.*, 2016).

The second step is the selection of the typical species for each habitat type and subtype. The methodological approach adopted for this task satisfies the characteristics of the approaches used to identify the indicator or diagnostic species of vegetation units (Carignan and Villard, 2002). Numerical methods were used to identify the plant species as “typical species” for each habitat type and subtype. These plant species could be considered as characteristic or diagnostic taxa of the syntaxonomic units (from the level of plant community, to alliance, and to class) which correspond to the habitat type or subtype in question. Applying numerical methods is an objective way of selecting indicator species (Siddig *et al.*, 2016) and contributes to the selection of species that have a more specialized niche, are closely associat-

ed with the habitat type, are sensitive to environmental changes and may provide early warning of environmental changes (Ellenberg, 1988; Carignan and Villard, 2002).

The methodology used for assessing the conservation status / degree of typical species is not based only on their presence / absence, but also takes into account additional information about their coverage and vitality. Assessing the vitality of plant taxa is an effective approach to assess whether these taxa are growing within their optimal ecological conditions or are under some kind of stress. According to Siddig *et al.* (2016), presence / absence, abundance and vitality are the main features of indicator species that are expected to reflect the cumulative effects of environmental conditions and should be measured in monitoring and surveillance of environmental conditions. Furthermore, the assessment of the conservation status / degree of the parameter typical species is based on the analysis of the quantitative index of conservation degree of typical species. The calculation of this index allows the determination of threshold reference values for the assessment of three classes of the conservation degree (FV, U1 and U2). It should be pointed out that neither in the explanatory notes for the assessment of the conservation status of habitat types (European Commission, 2006) nor in any other publication are there instructions or guidelines on how to assess conservation status from typical species presence. For example, there are no available guidelines on how many of the typical species should be present and in good condition, so that the conservation status/degree of that area to be considered as favourable. Similarly, there are no instructions on the size of the area that the typical species should be assessed during fieldwork.

To overcome some of these issues and to standardize the data collected in the field, standardized sampling protocols were prepared for each habitat type and subtype to be assessed. The standardized protocols consist of lists of: (a) typical species, (b)

specific structures & functions, (c) ecological condition descriptors, and (d) pressures & threats for each habitat type and subtype. This standardization of the data required to be collected during the field sampling, significantly reduces the effort and time required to measure or assess these parameters in the field. It also requires that the evaluators have received appropriate training to achieve a common understanding. Measurements of more detailed quantitative indicators of specific structures, such as those presented by Kovač *et al.* (2016) for forest habitat types (e.g. standing wood volume, deadwood volume) would certainly be more objective; but they are time consuming to measure and it would not have been possible to measure them to the extent needed for the national conservation status assessment project, due to cost and time constraints. This time and cost effectiveness of field work was also the reason why checklist of typical species per sampling plot was preferred over recording the entire species composition of the relevé. Complete phytosociological sampling and parallel measurement of additional functional characteristics of the species (e.g. leaf length) could capture more fully their conservation status, but would increase exponentially the time required to collect these data.

Also, the application of numerical methods for the analysis of the collected data minimizes the subjectivity or the potential bias, due to the evaluator or the observation year, on the final evaluation (Hill *et al.*, 2005). This is a desirable feature for monitoring and conservation status assessment projects, because these projects normally run for long periods of time and involve the collection of data by a large number of evaluators with different levels of expertise and skills. A primary examination of the results indicated that the assessment of the conservation status of habitat types per sampling location seem independent of the identity of the evaluator (Tsiripidis *et al.*, 2018). This is an indication that the implementation of the methodology to an extent decreases the subjectivity of the evaluator.

Another significant issue that the methodology had to deal with was scale. Different assessment parameters are evaluated at different spatial scales: Structures and Functions (including typical

species) locally, while Range and Area at the national scale. And the final synthesis of all the data and the overall conservation status assessment takes place at the national level. Therefore, it is apparent that the assessment of the conservation status requires the integration of data from different scales, and possibly to make assessments at different intermediate scales (Rondinini and Chiozza, 2010). Elements relating to the assessment of typical species, structures and functions, as well as pressures and threats, are best assessed locally (Søgaard *et al.*, 2007), as opposed to the parameters range and area that require the analysis of processes taking place on coarser spatial scales. The methodology includes an upscaling step that implements the “bottom-up” evaluation. This upscaling provides the ability to analyze data at different spatial scales, as long as they are appropriately georeferenced. Also, with the appropriate method of integration across scales, some negative effects of a non-homogeneous sampling design may be compensated, as shown by Tsiripidis *et al.* (2018).

The identification of habitat types and subtypes and the selection of their typical species was achieved through the analysis of the largest dataset of phytosociological and vegetation data available for Greece. The dataset included a large number of vegetation relevés (about 16000). However, it is theoretically possible that this data set does not represent the full range of ecological and floristic variation of the habitat types present in Greece. Therefore, it is advised to repeat the analysis (for the classification of the vegetation data and the corresponding identification of the typical species) in the future when new vegetation data become available.

The methodological approach used relies heavily on the application of numerical methods (to identify typical species, to calculate indices of conservation degree). However, the interpretation of those scores to conservation status classes (FV, U1 and U2) is done with the use of threshold values defined by expert judgment. The use of indicators to quantify the conservation status of the structures and functions of habitat types is particularly useful (Kontula and Raunio, 2009), but

the objective choice of thresholds is very difficult, especially for a large number of habitat types.

More research is needed to set the threshold values of these indices for the assessment of typical species and structures and functions based on ecological information and not only experts' judgment. One possible approach in this direction would be to establish reference sites representing different conservation status levels and study them in depth, compare the scores of the assessment protocols of these sites to identify patterns and thresholds (Kovač *et al.*, 2016). Given the ecological differentiation of habitat types, a large number of reference sites may be needed. Furthermore, many habitat types are early or intermediate stages of secondary succession (Halada *et al.*, 2011). In such cases, the choice of reference sites is even more difficult, as these sites are meant to represent intermediate stages of ecological succession, a highly dynamic condition. Another possible approach to setting threshold values is to implement an optimization process. In this case and through collecting additional data, already established threshold values can be fine-tuned to better represent the three conservation status classes. Furthermore, the optimization process should also improve the lists of structures and functions, as well as typical species. If the assessments between time periods are meant to be comparable, these parameters should remain stable. However, small adjustments will most probably be necessary based on their effectiveness to reflect habitat conservation status, as well as on the new knowledge acquired (Yoccoz *et al.*, 2001).

Assessment of the conservation status/degree of habitat types would be more thorough if other groups of organisms (e.g. lichens, mosses, fungi and animals) were included in the list of typical species (Yoccoz *et al.*, 2001). More research is needed in order to identify other groups of organisms that could be considered as indicators of structure or function or as typical species of the habitat type, so as to be used for the conservation status assessment. However, an additional difficulty in incorporating different groups of organisms into the checklist of typical species or in the list

of structures and functions is that the field evaluators will need to possess or acquire expertise in the identification of these additional groups of organisms.

There is also a need to evaluate the parameters range and especially area using objective, numerical methods. The assessment of the future trend of these parameters is particularly difficult to calculate. The use of Geographical Information Systems (GIS) and remote sensing can improve the estimates and support the expert judgment on this matter. The use of remote sensing and GIS is directly applicable in the assessment of the area occupied by the habitat types and could be used to calculate the changes in both the area occupied and in the spatial pattern of their distribution over the recent past, which are necessary to properly evaluate the parameter (Table 2.3). The quantification of the changes in the spatial distribution of habitat types would be more objective with the use of appropriate landscape heterogeneity indicators and metrics (Soille and Vogt, 2008; Vogt and Riitters, 2017). The analysis of the changes in the area and in the spatial pattern of the habitat types requires mapping of the existing distribution of habitat types and comparison with previous maps. This comparison would identify and quantify any changes, information to be used for the preparation of the national Article 17 report at subsequent reporting periods. Particularly at the Natura 2000 site level, mapping should be accurate representation of the location, size and shape of each occurrence of habitat types (Van den Borre *et al.*, 2011). The latest project, "Development of Infrastructures for Large-Scale (1:5000) Spatial Data for the Natura 2000 Terrestrial Protected Areas"¹ offers a reference point on which the above comparisons can be based in the future. It is difficult to produce such detailed habitat maps of the entire Natura 2000 network of protected areas every six years (reporting period for Article 17). Still, a coarser scale map could be produced using Landsat and SENTINEL-2 satellites images with spatial resolution 30 and 10 m respectively in the visible spectrum, to locate hotspots of change. And if deemed necessary, more detailed mapping of these sites of intense changes can be made us-

1 <http://www.ktimatologio.gr/forestmaps/Pages/ebkC5vEAshadenpT.aspx>

ing unmanned aerial vehicles (UAVs) (Gonçalves *et al.*, 2016). The requirements of the evaluation refer to the future trend of the parameters area and range, but the knowledge of the changes of the recent past and of the existing pressures and threats can be used to draw inferences for the foreseeable future. Additional information on remote sensing applications in ecosystem monitoring can be obtained from Hill *et al.* (2005), Van den Borre *et al.* (2011) and Díaz-Delgado *et al.* (2017).

Finally, it is necessary to create a network of permanent sample plots in which changes in the composition of typical species and specific structures and functions will be systematically monitored. As new data emerge, the network of permanent sample plots may expand to cover new locations that need to be systematically monitored. Simultaneously, it is necessary to examine if the existing network of sample plots covers the entire gradient of ecological differentiation of habitat types in Greece (Henry *et al.*, 2008; Kovač *et al.*, 2016). To achieve this, it is necessary to create maps of the ecological stratification of the Greek territory with soil and climatic data and then to examine if all the different conditions are represented by sample plots. If the network of sample plots needs to be expanded, stratified random sampling should be applied, as it is considered the most suitable for habitat type monitoring (Hill *et al.*, 2005).

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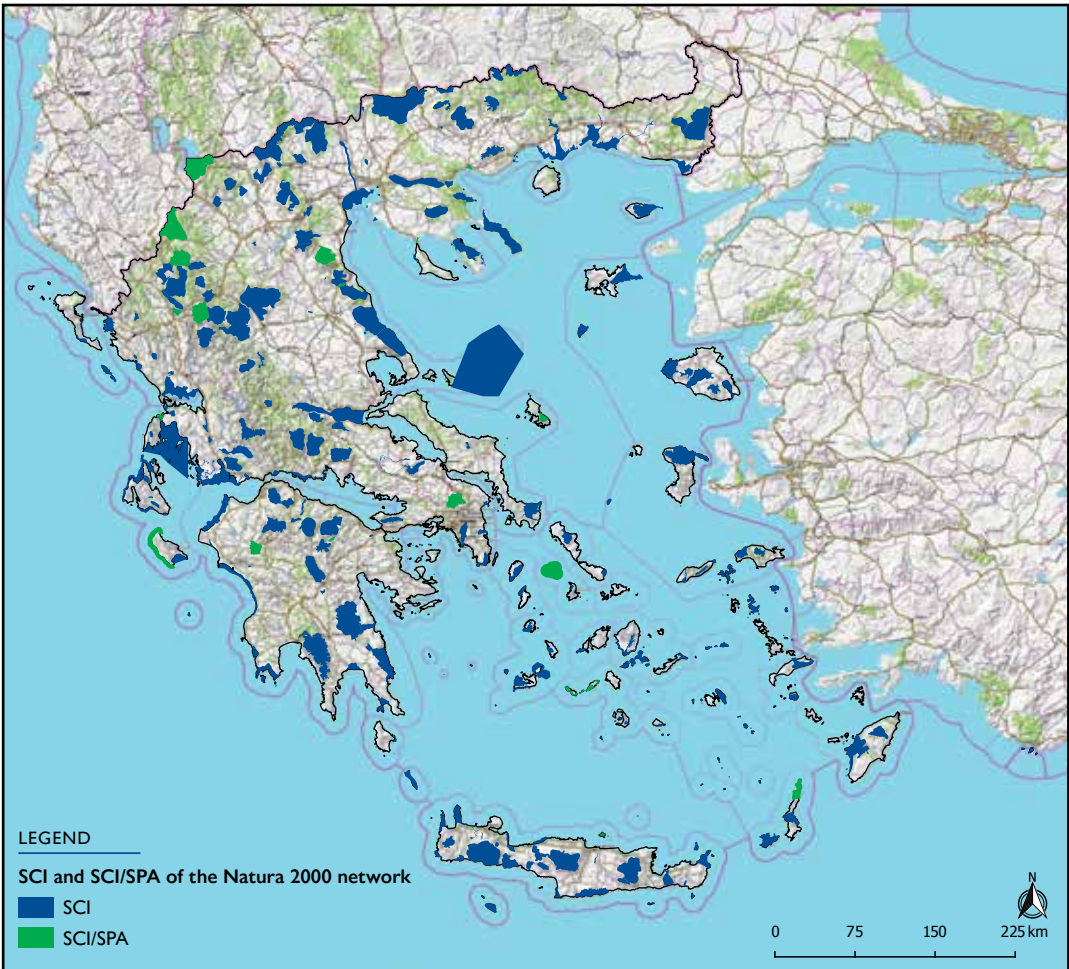
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9. Appendices

Appendix I. Special Areas of Conservation and Special Areas of Conservation/Special Protection Areas of the Natura 2000 network in Greece

Special Areas of Conservation (SAC) and Special Areas of Conservation (SAC) /Special Protection Areas (SPA) of the Natura 2000 network in Greece. Map background: OpenTopoMap.



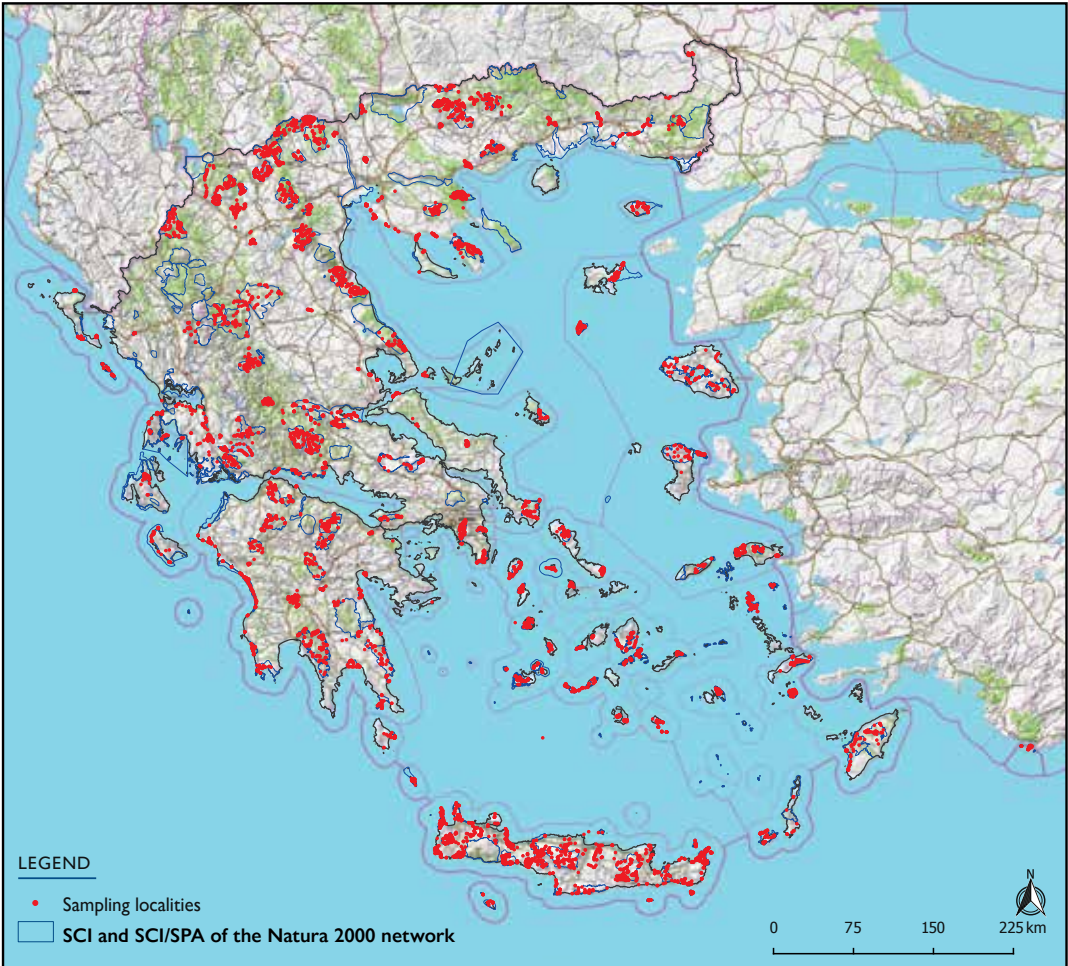
Appendix II. Suggested plot sizes

Suggested plot sizes for the conservation status assessment according to the habitat type assessed.

Habitat type	Suggested plot size for sampling surfaces (m ²)	Suggested area size for assessment (m ²)	Habitat type	Suggested plot size for sampling surfaces (m ²)	Suggested area size for assessment (m ²)
1210	16	100	7230	16	100
1240	16	100	72A0	16	100
1310	16	100	72B0	16	100
1410	16	100	8140	50	100
1420	16	100	8210	25	100
1430	16	100	8220	25	100
1510	16	100	8320	25	100
2110	16	100	9110	200/400	1000
2120	16	100	9130	200/400	1000
2190	16	100	9140	200/400	1000
2220	16	100	9150	200/400	1000
2230	16	100	9180	200/400	1000
2250	16	100	91BA	200/400	1000
2260	16	100	91CA	200/400	1000
2270	16	100	91E0	200/400	1000
3130	4	100	91F0	200/400	1000
3140	4	100	91M0	200/400	1000
3150	4	50	9250	200/400	1000
3170	4	100	9260	200/400	1000
3240	4	100	9270	200/400	1000
3250	4	100	9280	200/400	1000
3260	4	100	9290	200/400	1000
3280	4	100	92A0	200/400	500
3290	4	100	92C0	200/400	500
4060	50	200	92D0	50	500
4090	50	200	9310	200/400	500
5110	50	200	9320	200/400	500
5210	50	200	9340	200/400	1000
5230	50	100	934A	200/400	1000
5310	50	200	9350	200/400	1000
5330	50	200	9370	200/400	1000
5420	50	500	9380	200/400	1000
5430	50	500	9410	200/400	1000
6110	16	100	951B	200/400	1000
6170	16	100	9530	200/400	1000
6220	16	100	9540	200/400	1000
6230	16	100	9560	200/400	1000
6260	16	100	9580	200/400	1000
6280	16	100	95A0	200/400	1000
62A0	16	100			
62D0	16	100			
6420	16	100			
6430	16	100			
6510	16	100			
7140	16	100			
7210	16	100			
7220	16	100			

Appendix III. Sampling locations of the conservation status assessment protocols

Sampling locations for assessing the conservation status of habitat types in the Natura 2000 Special Areas of Conservation (SACs) and Special Areas of Conservation (SACs) / Special Protection Areas (SPAs) not in the jurisdiction of a Management Authority. Map background: OpenTopoMap.



Appendix IV. Suggested EEA reference grid cell size for the assessment of habitat types

Suggested EEA reference grid cell size for the assessment of habitat types. In the column on the spatial pattern of the habitat types distribution, the designation in the brackets (if any) refers to different pattern outside the Natura 2000 network. In the columns on representativity we report the number of SACs and SACs/SPAs not in the jurisdiction of a Management Authority in the following representativity classes: (A) excellent, (B) good, (C) sufficient, or (U) impossible to evaluate. Similarly in the columns on conservation value we report the number of SACs and SACs/SPAs not in the jurisdiction of a Management Authority whose value is (A) excellent, (B) good, (C) moderate, or (U) Unknown -impossible to evaluate. Additional clarifications can be found in the publication of Dimopoulos *et al.* (2006).

Code	Nr. of E.E.A. 10x10 km grid cells	Distribution	Conservation responsibility	Conservation significance	Representativity				Conservation				Suggested grid-cell size
					A	B	C	U	A	B	C	U	
1210	75	Widespread	S	medium	7	12	7	6	5	12	9	6	10
1240	248	Widespread	S T	medium	28	22	5	5	33	19	3	5	10
1310	61	Scattered	S	medium	6	9	6	3	4	12	5	3	10
1410	124	Widespread	S	medium	10	13	12	2	4	18	13	2	10
1420	93	Scattered	S	medium	8	9	5	0	3	11	8	0	10
1430	3	Rare	S R	medium	0	4	0	0	3	1	0	0	1
1510	5	Rare	S	high	0	0	0	1	0	0	0	1	10
2110	123	Abundant	S	medium	14	22	13	5	5	25	19	5	10
2120	67	Scattered	S D	high	7	10	3	1	5	8	7	1	10
2190	24	Infrequent	D R	high	3	2	0	3	2	1	2	3	10
2220	18	Rare	C R	high	1	3	1	2	1	2	2	2	10
2230	4	Rare (Scattered)	R	high	4	1	1	0	2	2	2	0	5
2250	32	Infrequent	R S	high	7	4	2	0	5	4	4	0	10
2260	18	Infrequent	R	high	4	8	3	1	3	10	2	1	10
2270	9	Rare (Infrequent)	D R	high	0	1	1	0	0	0	2	0	5
3130	10	Rare	D R S	high	1	1	0	1	0	2	0	1	5
3140	8	Rare	R S	high	1	2	1	1	0	4	0	1	1
3150	68	Scattered	S	medium	2	9	1	1	0	7	5	1	10
3170	34	Scattered	R T S	high	14	11	1	1	9	14	3	1	10
3240	3	Rare (Scattered)	D	medium	0	2	0	0	0	2	0	0	10
3250	1	Rare	S	medium	1	0	0	0	1	0	0	0	1
3260	10	Rare	S	high	1	3	1	0	1	4	0	0	5
3280	65	Infrequent (Scattered)	S	high	0	5	2	2	0	3	4	2	10
3290	48	Abundant	S	medium	7	23	6	32	9	16	11	32	10
4060	32	Rare (Scattered)	D S	high	4	0	0	0	1	3	0	0	10
4090	144	Widespread	T E	high	11	14	2	0	9	15	3	0	10
5110	4	Rare (Scattered)	R	high	0	0	2	0	0	1	1	0	10
5210	199	Abundant (Scattered)	C	high	18	27	11	2	12	32	12	2	10
5230	-	Rare	R S	high	0	0	1	0	0	0	1	0	10
5310	5	Rare (Infrequent)	C L	high	1	2	0	0	2	1	0	0	5
5330	83	Scattered	C	high	17	10	3	0	14	15	1	0	10

Code	Nr. of E.E.A. 10x10 km grid cells	Distribution	Conservation responsibility	Conservation significance	Representativity				Conservation				Suggested grid-cell size
					A	B	C	U	A	B	C	U	
5420	417	Abundant (Widespread)	C	high	60	23	8	1	39	42	10	1	10
5430	34	Infrequent (Scattered)	E T	high	7	1	2	0	7	2	1	0	10
6110	6	Rare (Scattered)	D T R E	high	-	-	-	-	-	-	-	-	5
6170	58	Infrequent (Widespread)	D T E	high	3	7	3	0	0	12	1	0	10
6220	77	Scattered (Widespread)	S	medium	9	12	4	1	9	10	6	1	10
6230	54	Scattered	D R	high	4	7	0	0	1	9	1	0	10
6260	1	Rare	R D	high	-	-	-	-	-	-	-	-	1
62A0	78	Infrequent	D	high-	2	5	3	0	2	3	5	0	10
62D0	-	Rare	R D	high	-	-	-	-	-	-	-	-	10
6420	58	Scattered	R S	high	7	8	7	0	4	12	6	0	10
6430	16	Rare (Scattered)	R D	high	1	0	0	0	0	1	0	0	10
6510	3	Rare	S	high	0	2	0	0	0	1	1	0	10
7140	-	Rare	D R	-	1	0	0	0	1	0	0	0	1
7210	9	Rare	R D	high	1	1	3	0	1	1	3	0	5
7220	-	Rare	R S	high	1	0	0	0	0	1	0	0	1
7230	9	Rare	R S	high	1	3	2	0	2	3	1	0	10
8140	72	Widespread	E T	medium	10	16	2	1	15	10	3	1	10
8210	306	Abundant (Widespread)	T R E	high	44	28	11	3	48	28	7	3	10
8220	29	Infrequent (Scattered)	T R E	high	5	5	1	2	9	1	1	2	10
8310	1	Widespread	-	medium	15	21	8	2	23	16	5	2	10
8320	3	Rare	R	high	3	0	0	0	3	0	0	0	5
9110	73	Scattered (Widespread)	D	high	6	9	0	1	8	7	0	1	10
9130	80	Scattered (Widespread)	D	high	7	5	0	0	8	3	1	0	10
9140	11	Rare	D	high	1	1	1	0	0	2	1	0	10
9150	28	Widespread	D	high	1	3	1	0	2	3	0	0	10
9180	7	Rare (Scattered)	R D	high	2	1	0	0	2	1	0	0	5
91BA	2	Rare	R D	high	-	-	-	-	-	-	-	-	10
91CA	25	Rare	R D	high	-	-	-	-	-	-	-	-	10
91E0	35	Scattered	D S	high	3	3	4	1	2	6	2	1	10
91F0	11	Rare	R S	high	3	0	0	0	0	2	1	0	5
91M0	250	Widespread	L C	high-	0	0	0	0	0	0	0	0	10
9250	22	Rare (Infrequent)	L C	high	2	0	2	0	0	2	2	0	10
9260	56	Scattered	L	high	6	11	2	0	7	10	2	0	10
9270	72	Scattered	E C	high	4	8	3	1	6	8	1	1	10
9280	75	Scattered	L	high	4	11	2	0	5	11	1	0	10
9290	30	Infrequent (Rare)	E R T	high	6	4	1	0	5	6	0	0	10
92A0	104	Widespread (Scattered)	D S	high	1	9	6	4	1	7	8	4	10
92C0	228	Abundant (Widespread)	L E R C T	high	19	33	14	3	15	36	15	3	10

Code	Nr. of E.E.A. 10x10 km grid cells	Distribution	Conservation responsibility	Conservation significance	Representativity				Conservation				Suggested grid-cell size
					A	B	C	U	A	B	C	U	
92D0	159	Abundant (Widespread)	C	high	8	19	16	12	7	19	17	12	10
9310	7	Rare	R E	high	4	3	0	1	1	6	0	1	5
9320	210	Widespread	C	medium	16	24	7	3	5	35	7	3	10
9340	134	Widespread (Scattered)	L	high	12	13	5	0	9	17	4	0	10
9350	40	Scattered	C L	high	4	3	1	5	3	3	2	5	10
9370	9	Rare	RD	high	3	3	1	0	3	1	3	0	5
9380	-	Rare	R	high	1	0	0	0	1	0	0	0	5
9410	5	Rare	D	high	-	-	-	-	-	-	-	-	10
9530	110	Widespread	E T	high	7	11	4	0	6	12	4	0	10
9540	188	Abundant (Widespread)	L C	medium	16	22	12	1	11	27	12	1	10
9560	27	Infrequent	E R D	-	0	2	1	0	0	2	1	0	10
9580	2	-	-	-	-	-	-	-	-	-	-	-	10
95A0	26	Rare	R	high	-	-	-	-	-	-	-	-	10
934A	158	Widespread	L E C T	high	-	-	-	-	-	-	-	-	10
72A0	173	Widespread	S	medium	-	-	-	-	-	-	-	-	10
GR 91K0		Rare	D	medium									10
GR 91L0	13	Scattered	D	medium	-	-	-	-	-	-	-	-	10
951B	106	Widespread	E	high	-	-	-	-	-	-	-	-	10
72B0	9	Scattered	S	medium	-	-	-	-	-	-	-	-	10

Appendix V. National Reference Form for the habitat type 9110

Report on the main results of the surveillance under article 17 for annex I

CODE: 9110

NAME: Luzulo-Fagetum beech forests

1. National Level

1.1 Maps

1.1.1 Distribution Map

Yes

1.1.2 Distribution Method

Estimate based on partial data with some extrapolation and/or modelling (2)

1.1.3 Year or period

2006-2012

1.1.4 Additional map

No

1.1.5 Range Map

Yes

2. Biogeographical Or Marine Level

2.1 Biogeographical Region

Mediterranean (MED)

2.2 Published

Dimopoulos P., Xystrakis F. and Tsiripidis I. 2014. Deliverable A1. Final Catalogue of Habitat Types – 1st edition. Ministry of Environment, Energy and Climate Change, OIKOM Ltd - E. Alexandropoulou - A. Glavas, Athens, pages 54.

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2.3 Range of the habitat type in the biogeographical region or marine region

2.3.1 Surface area - Range (km ²)	1971
2.3.2 Range method used	Estimate based on partial data with some extrapolation and/or modelling (2)
2.3.3 Short-term trend period	2001-2012
2.3.4 Short-term trend direction	stable (0)
2.3.5 Short-term trend magnitude	minmax
2.3.6 Long-term trend period	
2.3.7 Long-term trend direction	N/A
2.3.8 Long-term trend magnitude	minmax
2.3.9 Favourable reference range	area (km ²) operator approximately equal to (≈) unknown No method
2.3.10 Reason for change	Improved knowledge/more accurate data Use of different method

2.4 Area covered by Habitat

2.4.1 Surface area (km ²)	1342,3
2.4.2 Year or period	2000-2012
2.4.3 Method used	Estimate based on partial data with some extrapolation and/or modelling (2)
2.4.4 Short-term trend period	2001-2012
2.4.5 Short-term trend direction	stable (0)
2.4.6 Short-term trend magnitude	minmax
2.4.7 Short term trend method used	Estimate based on partial data with some extrapolation and/or modelling (2)
2.4.8 Long-term trend period	
2.4.9 Long-term trend direction	N/A
2.4.10 Long-term trend magnitude	minmax
2.4.11 Long term trend method used	N/A
2.4.12 Favourable reference area	area (km) operator approximately equal to (≈) unknown No method
2.4.13 Reason for change	Improved knowledge/more accurate data Use of different method

2.5 Main Pressures

Pressure	ranking	pollution qualifier(s)
Forest and Plantation management & use (B02)	low importance (L)	N/A
Forestry activities not referred to above (B07)	low importance (L)	N/A
Discharges (E03)	low importance (L)	N/A

2.5.1 Method used – pressures mainly based on expert judgement and other data (2)

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2.6 Main Threats

Threat	ranking	pollution qualifier(s)
Forest and Plantation management & use (B02)	low importance (L)	N/A

2.6.1 Method used – threats

expert opinion (1)

2.7 Complementary Information

2.7.1 Species

Abies borisii-regis

Aremonia agrimonoides

Calamagrostis arundinacea

Carex digitata

Corallorhiza trifida

Deschampsia flexuosa

Epilobium montanum

Fagus sylvatica

Hieracium murorum

Hieracium olympicum

Hieracium racemosum

Luzula luzulina

Luzula luzuloides

Luzula pilosa

Luzula sylvatica

Neottia nidus-avis

Orthilia secunda

Picea abies

Poa nemoralis

Prenanthes purpurea

Vaccinium myrtillus

Veronica officinalis

2.7.2 Species method used

Typical species were determined on the basis of a vegetation database, comprised of about 22000 sampling plots. First, a list of possible typical species was determined per habitat type, selecting the ones presenting a high fidelity value to the habitat types according the algorithm of Tsiripidis et al. (2009) and the phi coefficient value (Chytrý et al. 2002). Then typical species per habitat type were selected from the above-mentioned lists by expert judgment and using as criteria species niche breadth, their ability to comprise indicators of habitat types' conservation status and their function as keystone species. The nomenclature of the typical species follows Dimopoulos et al. (2013).

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2.7.3 Justification of % - thresholds for trends
2.7.4 Structure and functions - methods used
2.7.5 Other relevant information

Complete survey/Complete survey or a statistically robust estimate (3)

2.8 Conclusions (assessment of conservation status at end of reporting period)

2.8.1 Range	assessment Favourable (FV) qualifiers N/A
2.8.2 Area	assessment Favourable (FV) qualifiers N/A
2.8.3 Specific structures and functions (incl Species)	assessment Favourable (FV) qualifiers N/A
2.8.4 Future prospects	assessment Favourable (FV) qualifiers N/A
2.8.5 Overall assessment of Conservation Status	Favourable (FV)
2.8.5 Overall trend in Conservation Status	N/A

3. Natura 2000 coverage conservation measures - Annex I habitat types on biogeographical level

3.1 Area covered by habitat

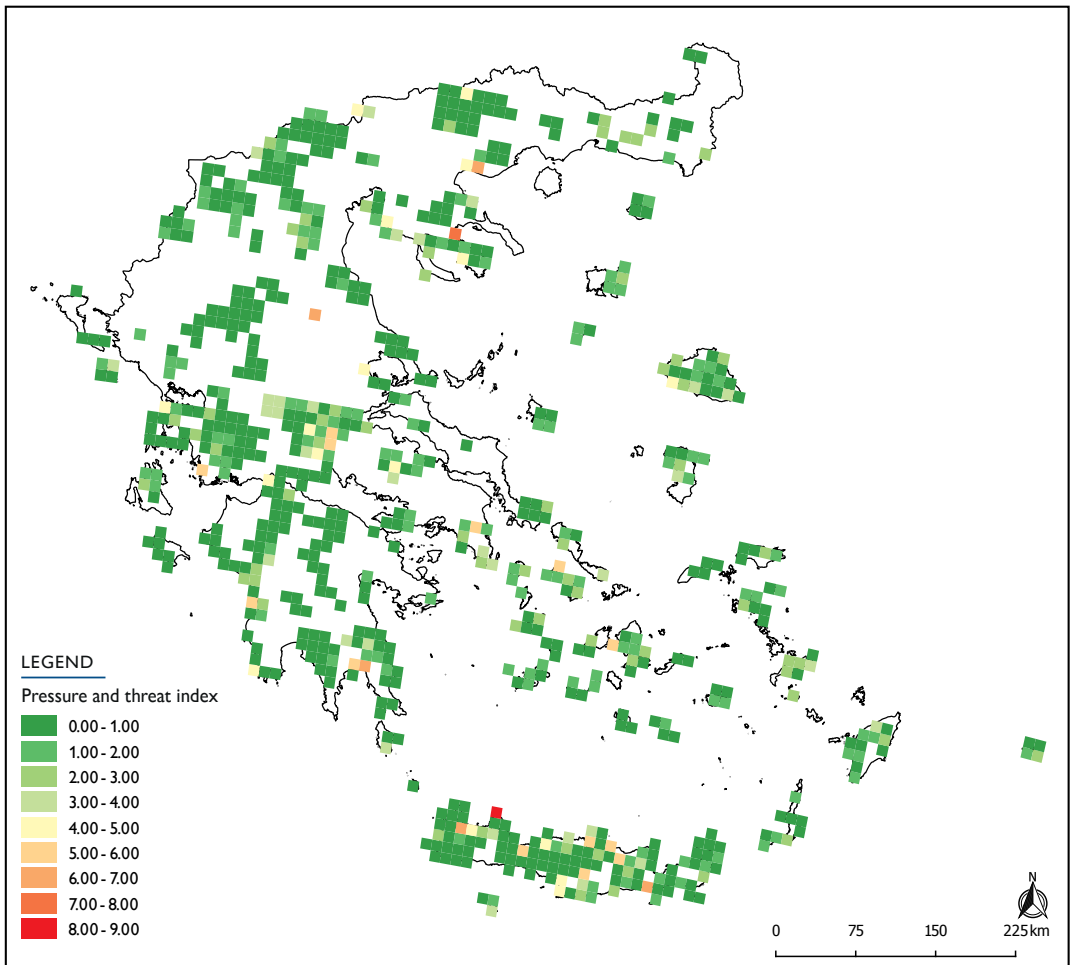
3.1.1 Surface area (km²)	min 553,2 max 553,2
3.1.2 Method used	Complete survey/Complete survey or a statistically robust estimate (3)
3.1.3. Trend of surface area	stable (0)

3.2 Conversation Measures

3.2.1 Measure	3.2.2 Type	3.2.3 Ranking	3.2.4 Location	3.2.5 Broad Evaluation
Establish protected areas/sites (6.1)	Legal Administrative One-off	medium importance (M)	Inside	Maintain Long term

Appendix VI. Distribution of the Pressure & Threat Index at the EEA 10 km grid

The pressure & threat index is a numerical expression of the number and intensity of the pressures & threats that affect each sampling locality. It is estimated as the sum of the pressure & threat coefficients that are recorded at each sampling locality. These coefficients are calculated on the basis of the intensity of each pressure and threat and receive the values 1, 2 or 3 for low, medium or high intensity pressures & threats respectively. Thus, in a sampling location in which one threat of low intensity, one threat of medium intensity, and two threats of high intensity have been recorded, the pressure & threat index receives the value $1 \times 1 + 1 \times 2 + 2 \times 3 = 9$. The estimation of the pressure & threat index at the level of the EEA 10 km grid cell size is achieved by averaging the pressure & threat indices estimated at each sampling locality within each grid cell.



Appendix VII. Habitat types in Greece



Habitat type 1420, Acheloos estuary. Photo by F. Xystrakis.

Habitat types 2190 (foreground) and 2250 (background). Rhodes island, Photo by F. Xystrakis.





Habitat type 3150. Kalodiki wetland. Photo by F. Xystrakis.

Habitat type 4090. Crete. Photo by F. Xystrakis.





Habitat types 5420 (foreground) and 6220 (background). Thymainaki islet, Ikaria. Photo by F. Xystrakis.
Habitat type 5330. Alatonisi islet, Ikaria. Photo by F. Xystrakis.





Habitat types 5420 (foreground) and 9290 (background). Crete. Photo by F. Xystrakis.
Habitat type 6230. Taygetos mountain. Photo by F. Xystrakis.





Habitat type 7140. Elatia, Drama. Photo by I. Tsiripidis.

Habitat type 8140. Crete. Photo by F. Xystrakis





Habitat type 8210. Leonidio gorge. Photo by F. Xystrakis.

Habitat type 9110. Kato Olympos. Photo by Ch. Damianidis.





Habitat type 9180. Kato Olympos. Photo by I. Tsiripidis.
Habitat type 92A0. Acheloos river. Photo by F. Xystrakis.





Habitat type 9290. Kos island. Photo by F. Xystrakis.
Habitat type 9350. Acheloos estuary. Photo by F. Xystrakis.





Habitat type 9530. Taygetos mountain. Photo by F. Xystrakis.
Habitat type 9540. Sithonia, Chalkidiki. Photo by I. Tsiripidis.





Habitat type 9560. Parnonas mountain. Photo by F. Xystrakis.

Appendix VIII. List of abbreviations

IDHTACI: Identification and description of the habitat types in areas of conservation interest

ICD: Index of Conservation Degree

FRV: Favorable Reference Value

M-S: Member-State

SAC: Special Area of Conservation

SCI: Site of Community Importance

SPA: Special Protection Area

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Professor Panayotis Dimopoulos (pdimopoulos@upatras.gr) studied Biology and holds a PhD from the Department of Biology of the University of Patras. Today, he is Professor of Botany and Ecology at the Department of Biology of the University of Patras. His research interests focus on vegetation ecology and especially on plant diversity and community analysis, mapping, monitoring and assessment of the conservation status of natural habitat types and species. He has participated and coordinated 28 national and 12 European research programs. He has served as President of the North Pindos National Park (2003-2005), President of the Hellenic Botanical Society (2007-2010, 2016-2019), Vice-Chairman of the National Committee for Protected Areas Natura 2000 (2010-2013). Since 1991, he has published 100 scientific papers in peer reviewed journals and has participated in a large number of Greek and International Conferences. Between August 2013 and January 2015, he co-chaired a working group at the Ministry of Environment, Energy and Climate Change on Nature Conservation in the Protected Areas of Greece, scientifically edited the publication of the National Biodiversity Strategy and the Action Plan for its Implementation in Greece (ratified by Ministerial Decision in September 2014), and from 2014 has been appointed as National Representative to the European Commission's Working Group on Mapping and Assessment of Ecosystems and their Services.



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