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APPROACHES TO THE ASSESSMENT OF SOME HABITATS OF COMMUNITY IMPORTANCE IN ROMANIA

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Abstract

All European member states must assess the conservation status of the habitats targeted by Habitats Directive 92/43/EEC based on the information on their status and trends and the main pressures and threats affecting them. Our paper presents the assessment of the Romanian community importance habitats (excepting forests) for all five biogeographical regions of Romania on coherence with the member states and with a special emphasis on the Sites of Community Importance (SCIs) of Natura 2000 network. The conservation status of the habitats is determined based on assessment on the parameters and their future prospects. The assessment of the scope and influence of the threat is realized for the evaluation of future prospects.

Key words*: Habitats Directive 92/43/EEC, community importance habitats, Romania, characteristics of habitats.*

INTRODUCTION

In the European Union (EU, the 'Community'), all member states use the Habitats Directive (92/43/ECC) on the conservation of natural habitats and of wild fauna and flora as a key instrument for biodiversity conservation (Mehtälä & Vuorisalo, 2007) and for maintaining and improving the supply of ecosystem services (Maes et al., 2012), directing their efforts toward designation of protected areas (Tucker et al., 2019). Thus, the Natura 2000 network was created, designating areas comprising natural habitat types and species (listed in Annex I and II of the Directive) which occur within the territory of each EU member state and for the conservation of which the Community has special responsibility. It is mandatory for member states to monitor and assess the conservation status of these natural habitat types and species and to report their findings to the Community (Pihl et al., 2001; Evans, 2006; Morris, 2011).
The goal of the Habitats Directive is to halt degradation of natural habitats and species, and to maintain or restore them in favourable conservation status through the implementation of conservation and restoration measures (Art. 2) (Louette et al., 2015), taking account of climate change (Normand et al., 2007) and other anthropogenic pressures (intensive agriculture, forestry and fisheries, urban sprawl, pollution, etc.) (Mihoub et al., 2017; Geldmann et al., 2019). For all EU countries, implementation of the Directive has been a high priority (Brown et al., 1997; Loidi, 1999; Dimopoulos et al., 2005; McLeod et al., 2005; Schneider & Drăgulescu, 2005; Costa et al., 2007; Zingstra et al., 2009; Jeanmougin et al., 2017; Silan et al., 2017). Environmental

assessment procedures under the Directive represent a major tool for controlling activities affecting Natura 2000 sites (Garcia-Ureta, 2018).

Many valuable natural areas and the species that live in them have been greatly degraded or lost, over a quarter of Europe's animal species are at risk of extinction. Biodiversity is also vital for human economy and well-being (Habitats Directive, 1992).

The EU biodiversity strategy for 2030 (B.S. 2023) prioritises the preservation and restoration of Europe's biodiversity (Mammola et al., 2020; Hermoso et al., 2022; B.S., 2023). Even with expansion of the Natura 2000 network, loss of biodiversity continues (Spiliopoulou et al., 2023). To implement the goals of the strategy, biodiversity monitoring represents a central instrument for conservation (Harding et al., 2001; Hlásny et al., 2021), through achieving accountability and progress. Effective policy-making demands sufficient evidence, but the data are fragmented and disconnected because monitoring in Europe suffers from gaps and variation in: taxonomy, spatial coverage, and temporal resolution, regulating mechanisms of biodiversity and the relationship of biodiversity to ecosystem services (De Meester et al., 2011; Maes et al., 2012; Maes, 2013; Moersberger et al., 2023a).

The EU implements policies and legislative frameworks for nature protection through the Habitats and Birds Directives, and has developed habitat (or biotope) classifications: Palaearctic (Devilliers & Devilliers-Terschuren, 1996; Janišová et al., 2016), CORINE (Moss & Wyatt, 1994; Romao, 1996), EUNIS (Davies et al., 2004; Moss, 2008; Chytrý et al., 2020). These provide typologies with definitions of habitat types intended to aid their recognition, mapping, monitoring, and protection (Loidi, 1999; Evans, 2010; 2012; Morris, 2011; Bunce et al., 2013).

Before accession to the European Union in 2007, scientists in Romania defined the habitats/biotopes that had major importance for nature conservation in EU and accession countries, and starting with the CORINE programme in 1985 and EMERALD network, investigated protected areas that could be candidates for integration into international programmes (Mihăilescu et al., 2003).

Strategies were developed for implementation of the Natura 2000 network for protected areas (Munteanu & Mihăilescu, 2005), and habitats identified for proposing Natura 2000 site (Mihăilescu, 2006). During accession, partly through an EU Phare project (EuropeAid/12/12160/D/SV/RO), habitats and sites were described from Annex I of Habitats Directive whose conservation requires designation of special areas of conservation (SAC, SCIs), so that Romanian habitat types could be integrated into the Natura 2000 network (Doniţă et al., 2005; 2006; Schneider & Drăgulescu, 2005). Description of the European habitats (EUR27, 2007) was further enhanced with characterisation of their physical-biogeographic context in Romania and information to facilitate their identification (Combroux et al., 2007; Gafta & Mountford, 2008). Criteria for designation of Natura 2000 sites were delineated (Mihăilescu, 2010).

Classification of habitat types was based partly on phytosociology (defined plant communities or syntaxa), but this is considered complex and sometimes unclear (Angelini et al., 2018; Rodwell et al., 2018). Thus, assessment of the conservation status of habitat types is based partly on structure (typical/characteristic species), function and future habitat trends (Noss, 1990; Bendali & Nellas, 2016; Müller-Kroehling, 2019). In the Habitats Directive, monitoring of Annex 1 habitats and species from Annexes II, IV and V is required in Article 11, with reporting to the Commission every 6 years of their assessed conservation status required by Article 17 (DG Environment, 2017).

Such methods were developed in all European countries both for habitat types (Angelini & Casella, 2015; Chen, 2021) and their conservation status (Mehtälä & Vuorisalo, 2007; Zingstra et al., 2009; Sipkova et al., 2010; Silan et al., 2017; Ellwanger et al., 2018; Strat et al., 2018; Tsiripidis et al., 2018; Velagic-Hajrudinovic, 2019a; 2019b; Prisco et al., 2020; Delbosc et al., 2021; Melart, 2022; Santangelo et al., 2022).

Our aim has been to develop and apply approaches for assessment of some habitats of community importance in Romania, describing evaluation of their conservation status and their value under article 17 of Habitats Directive.

MATERIALS AND METHODS

In response to requests from the European Community, Romanian academic institutions, coordinated by the Ministry of Environment, Water and Forests, developed the POS project "Monitoring of the conservation status of species and habitats from Romania in the framework of article 17 of Habitats Directive" (2011-2015) which was the basis for Romania to report to the European Commission. The next stage of reporting will be based on POIM project "Completing knowledge level of biodiversity through implementing the monitoring system of conservation status of species and habitats from Romania in the framework of article 17 of Habitats Directive 92/43/CEE" (2019-2023). The Article 17 report for Romania has a section with assessments of habitat conservation status in the whole national territory, not only those within Natura 2000 sites (Zaharia, 2013; INCDPM, 2014; Mihăilescu et al., 2015; Trif et al., 2015; Ursu et al., 2020).

We used information on the European Community sites as well as other publications and reports, and expertise developed within the POS and POIM projects, to focus, as required by the Commission, on assessment of the status and trends, with main pressures and threats, for some habitats occurring in the five biogeographic regions present in Romania (Figure 1).

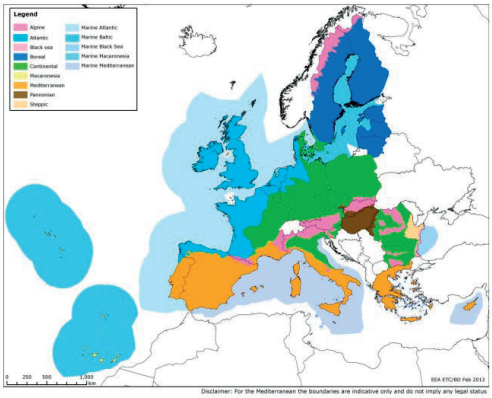

Figure 1. European biogeographical and marine regions for reporting under Article 17 of the Habitats Directive (after ETC/BD, 2014)

Conservation status is assessed using a standard methodology as being either 'favourable', 'unfavourable-inadequate' or 'unfavourable-bad' (Table 1), based on four parameters as defined in Article 1 of the Habitats Directive: 1. range (within the biogeographical region concerned); 2. area covered by habitat type within range; 3. specific structures and functions (including typical species); 4. future prospects (as regards range, area covered and specific structures and functions).

Table 1. Abbreviations and colour codes for Conservation Status classes (after ETC/BD, 2014)

Conservation Status	Colour	Abbreviation
Favourable	Green	FV
Unfavourable-inadequate	Amber	U1
Unfavourable-bad	Red	U2
Unknown	Grey	XX

The definition of 'favourable' conservation status of a habitat is given in Article 1(e) of the Habitats Directive as: a) its natural range and areas are stable or increasing; b) the specific structure and functions which are necessary for its long-term maintenance exist and are likely to continue to exist for the foreseeable future; and c) the conservation status of its typical species is favourable as defined in (i).

We have used the Article 17 Reference Portal for the technical specifications required for reporting to the European Commission. Romania reported to the Commission on all habitats listed in Annex I of the Habitats Directive and their conservation status by biogeographical or marine region, mapping their distribution. The distribution maps provide information about the actual occurrences of the habitats, based on their inventory. Where field data on actual occurrences of the habitat were insufficient, modelling and extrapolation have been used. The distribution map consists of 10x10 km ETRS89 grid cells in the ETRS LAEA 5210 projection.

RESULTS AND DISCUSSIONS

To explain the assessment of habitats of community importance, we highlight attributes defined in the Explanatory Notes and Guidelines of the Habitats Directive (DG Environment, 2017) i.e. **Range (and Surface Area), Habitat structure, Pressures (and**

threats and conservation measures) and **Future Prospects**, all assessed separately for each biogeographical region. In Romania, the five biogeographical regions are Alpine, Continental, Pannonian, Steppic and Black Sea (formerly 'Pontic') and marine region (Marine Black Sea) (Figure 2).

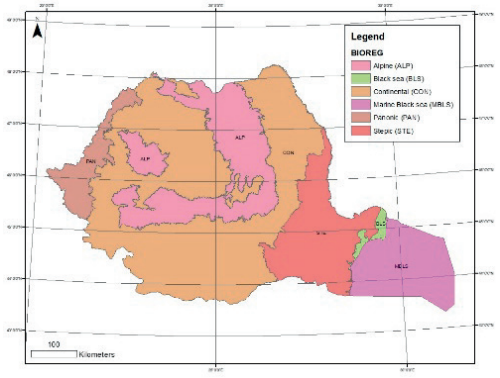

Figure 2. The map of the biogeographic regions

Range is defined as 'the outer limits of the overall area in which a habitat is found at present'. Based on the map of actual distribution, the range is calculated using a standardised process that ensures repeatability for different reporting rounds. Thus, the area covered by the habitat type within the range is assessed including all significant ecological variation for each biogeographical region and testing whether the area is sufficiently large to allow its long-term survival. The 'favourable reference value' must be at least the range (size and configuration) when the Directive was first applied. If this value was not acquired, then the reference for favourable range should be larger or based on information on historic distribution. In the absence of other data, 'best expert judgement' may be used.

The area covered by a habitat type within this range (the '**surface area'**) is based on all sites where it is present in the region, and represents the total area (in km^2) currently occupied. This attribute is calculated and reported as a range (minimum and maximum) and/or as a best available single value. The total surface area of the habitat in a biogeographical region is defined as the minimum necessary to ensure its long-term viability. This attribute should include any necessary areas for restoration or development for which its present coverage is insufficient to ensure long-term viability. As with **range**, the favourable reference value must be at least the surface area when the Directive came into force, and is assessed in the same way.

The short-term trend of habitat area within the Natura 2000 network is categorised as either: stable, increasing, decreasing, uncertain or unknown. It is a measure of directional change over time and should reveal changes within the network. The short-term trend should be evaluated over a period of 12 years (two reporting cycles) and is used in the evaluation matrix to assess the conservation status.

Habitat structure is formed by species, but can also include abiotic features. The typical species (or groups of species) are those occurring regularly in the habitat type and are those which are good indicators of favourable habitat quality. For assessing conservation status, the list of typical species should ideally remain stable across reporting periods, but need not be restricted to those listed in Annexes II, IV and V of the Habitats Directive.

Pressures are factors acting now and/or during the current reporting period (six-year), and have an impact on the long-term viability of the habitat and its typical species. Continuation of such pressures may lead to threats. High pressures have important direct or immediate influence on one or several parameters of conservation status at the biogeographical scale (causing significant decline or deterioration or preventing habitat from reaching favourable status).

Threats are factors expected to act in the future after the current reporting period, with future/foreseeable impacts (within the next two reporting periods) and are likely to affect the long-term viability of the habitat and its typical species.

Conservation measures are taken inside or outside Natura 2000 sites for each habitat type: a) maintaining its current range, surface area or structure and functions; b) expanding its current range; c) increase its surface area; and d) restore the structure and functions, including the status of typical species.

Future Prospects indicate the expected direction of change in conservation status in the near future based on a consideration of current

status, reported pressures and threats, and measures being taken for each of the other three parameters (Range, Area, and Structure and functions).

The concept of favourable reference values is derived from definitions in the Directive, and relates to the "long term natural distribution, structure and functions as well as the long-term survival of its typical species" (Article 1(e)) in their natural range. Overall assessment of conservation status uses four categories: 'favourable', 'unfavourable-inadequate', 'unfavourable-bad' and 'unknown', based on the evaluation matrix for assessing conservation status for a habitat (Table 2).

Table 2. Overall assessment of the conservation status (CS)

Status of parameters	All favourable or few favourable + one unknown	One or more inadequate, but no bad	One or more bad	Two or more unknown + favourable or all unknown
Overall assessment of CS	favourable	unfavourable-inadequate	unfavourable-bad	unknown

If the overall conservation status is 'favourable', 'inadequate' or 'bad', a qualifier is added i.e.: improving or deteriorating or stable or unknown. The qualifier should be based on trends (for range, area covered by habitat, and structure and functions) over the reporting period i.e. a cycle of six years.

Trends are essential in assessing all conservation status parameters except future prospects. Short-term trends are assessed for two reporting cycles. Long-term trends are assessed for four reporting cycles and are likely to be more statistically robust.

In order to set favourable reference values for habitat types, data and information should ideally be gathered on nine factors: a) current situation and assessment of deficiencies (pressures/problems); b) trends (historical, short-term, long-term); c) natural, ecological and geographical variation (including variation in: species composition, conditions in which habitats occur, ecosystems); e) ecological potential (potential extent of range, taking into account physical and ecological conditions, contemporary potential natural vegetation); f) natural range, historical distribution and abundance and causes of change, including trends; g) connectivity and fragmentation; h) dynamics of the habitat type; and i) requirements of its typical species.

For the reporting period 2007-12, the conservation status of the habitats of community interest indicated that, from 743 assessed habitats, the conservation status was: unfavourable-bad (42 habitats), unfavourable-inadequate (433), favourable (216), and unknown (52) (Mihăilescu et al., 2015). For the identification of habitats, the experts used the manuals that placed Romanian habitats in their EU context (Doniță et al., 2005; 2006; Gafta & Mountford, 2008).

For each proposed main objective, those characteristics (attributes) of each targeted habitat were identified that reflect its properties and can be quantified. Where the existing information allows, a range of values for each attribute was defined within which the properties of the analysed habitat do not alter, thus facilitating the interpretation of the results. The monitoring plan used the main general indicators for the levels of research shown in Table 3.

Table 3. The indicators used in the monitoring plan

Levels	**Indicators/Composition**
Habitat	- the proportion of the habitat within the analysed range - types of the component plant associations - identification, distribution, diversity, abundance
Community/ ecosystem	- identification of species and their relative abundance - Frequency, abundance, species diversity inside the communities, proportion of endemic, threatened and near extinct species - Proportion of dominance – diversity
Population/ species	- Relative and absolute abundance - Density

Data aggregation of the information for a monitoring plot is done in two stages: 1) spatial aggregation, map generation according to the reporting format starting from the primary data/field data; and 2) non-spatial aggregation that involves the generation of specific files, according to the reporting format, starting from the primary data. Distribution maps have been created following the standard reporting format. This process is illustrated by an example mapping the range of the habitat 1310 *Salicornia* and other annuals colonising mud and sand (Figure 3).

In order to assess the distribution of the habitats in Romania, we identified the location of each

habitat from historical data (literature or phytosociological records).

To establish conservation/management measures, we gathered supplementary information about the type and intensity of the impacts of every activity on species and habitats. These impacts were further assessed in terms of the entire nature protected area, species of conservative interest, and variation in the habitat types of conservative interest.

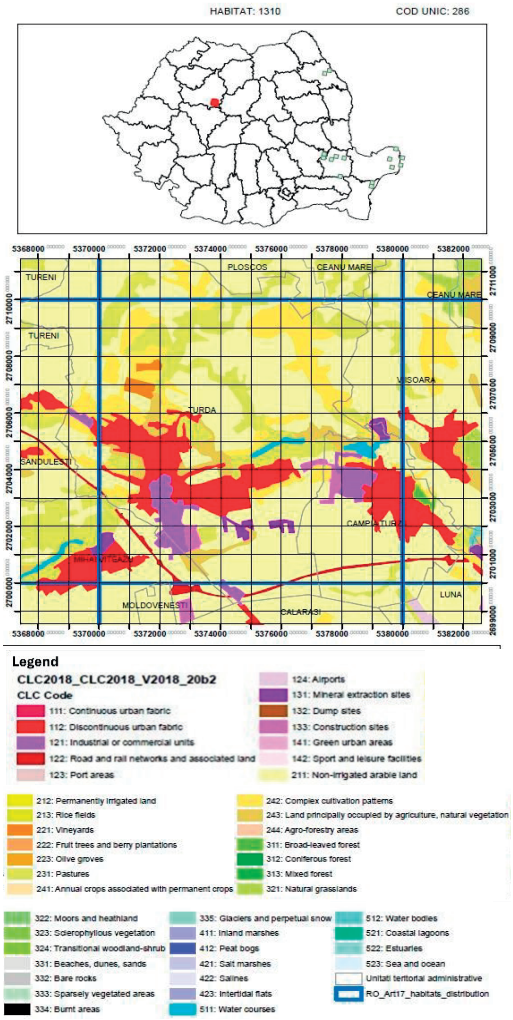

Figure 3. The range of habitat 1310 on Romanian territory (after E.W.F.M.O, 2023)

Monitoring plots were established inside or outside Natura 2000 sites - *Sites of Community Importance (SCIs)* - according to the requirements of EC reporting, and the range and surface area of each habitat. For instance, saline habitats present in Romania have a large distribution in more than one biogeographic region (Table 4).

To assess short-term trends, we used the observed trend for major parameters, such as distribution area and structure and functions, observed over 2 reporting cycles (total 12 years).

Table 4. The establishment of the monitoring plots according with the range of saline habitats

Habitat Cod	ALP	CON	PAN	STE	BLS	Total plots	Plots in two different biogeographic regions
1310	0	3	0	11	7	16	5
1410	0	0	0	0	7	7	0
1530*	0	17	9	11	5	39	3

Legend:
1310 Salicornia and other annuals colonising mud and sand.
1410 Mediterranean salt meadows (*Juncetalia maritimi*).
1530* Pannonic salt-steppes and salt-marshes.
ALP - Alpine bioregion
CON - Continental bioregion
PAN - Pannonian bioregion
STE - Steppic bioregion
BLS - Black Sea (formerly Pontic) bioregion

The trend is described using qualitative indicators such as: stable, recovering, declining and unknown. Evaluation of short-term trends is also the key control for the quality analysis of successive reporting results. In order to establish pressures and threats, we used the nomenclature standardly applied at the European level.

Pressures observed in the field study shall be assessed by determining the specific intensity of each one exerted on the target habitat. The categories of intensity assessment are also qualitative i.e. low intensity, medium intensity, high intensity, unknown intensity.

Following analysis of the existing pressures observed in the field, the expected threats are evaluated, again establishing the specific intensity of each exerted on the target habitat. The intensity assessment categories are precisely similar to those for pressures.

At bioregion level, the information in the 10 x 10 km (plots) grid is summarised for each category of the parameters using a weighted average to provide the final evaluation for the habitat. For example, species composition (one of the essential parameters in assessing habitat structure) will vary from one plot to another,

requiring that they be grouped by classes of different species diversity (large, medium, small), and weighting of each class will lead to the specific evaluation for each bioregion. Thus, if for habitat 1310 we obtain 20 plots within the large specific composition class (12 characteristic species), just 7 plots in the class of average composition (7 characteristic species), and none in the class of small composition (3 characteristic species), we can infer that, for the target bioregion, the habitat is in a favourable state with regard to evaluation of structure. The third level of aggregation is of the national attributes resulting from the aggregation of data at the bioregion level.

The methodology and monitoring plan for the collection of field data and for the assessment of the conservation status are described in Order no. 3352 (28 December 2023) for eight habitat groups: saltmarshes and salt meadows, inland dunes, freshwater, meadows, other grasslands, swamps and peatlands, groves and cliffs.

The field recording sheets for monitoring are completed after establishment of representative samples of phytocoenoses, and components of habitats of community interest. These sheets will contain information on relief, biotope condition, species listed in the sample area, etc.

Monitoring of habitats and the plant species that define them is done using the plots/quadrats method on transects or by permanent plots/quadrats (relevés) method, which has advantages when conducting comparative studies. The plots shall be chosen according to the vegetation gradient present in the habitat of community interest. The minimum number of quadrats (relevés) depends upon the available resources, statistical analysis and habitat surface area. The data and observations gathered from the field represent not only the basis for all analyses but also interpretation in order to obtain objective results of high scientific value.

Threats and pressures for all habitats can be selected from the Reference portal for reporting under Article 17 of the Habitats Directive, usually the most relevant and important ≤10.

At both national and international level, Habitats Directive (92/43/EEC) is the foundation of nature conservation in Europe and the development of EU Biodiversity Strategy for 2030. Bonari et al. (2023) believe that, with the knowledge gained after so many years working on habitats, Annex I of the Habitats Directive should be updated to resolve ambiguities in the definition of Annex 1 habitat types, decrease uncertainties in classification and improve conservation success. These updates would include new habitat types, new subtypes within pre-existing habitat types, and involve preparation of expert systems for automatic classification based on the list of typical species.

To achieve accountability and progress in conservation, in the future biodiversity assessment/ monitoring will be the foundation for achieving the goals of the 2030 Global Biodiversity Framework (Miu et al., 2020), the European Biodiversity Strategy, and the EU Green Deal (Moersberger et al., 2023b). For implementing these goals, one target is to protect 30% of European land by 2030 through a resilient transnational conservation network creating key hubs of the network that might host extensive natural areas and biodiversity hotspots in Europe (Chauvier-Mendes et al., 2024). Furthermore, Toivanen et al. (2024) present European geodiversity data at resolutions of 1 km and 10 km, incorporating aspects of geological, pedological, geomorphological and hydrological diversity, and have demonstrated their potential use in correlating geo-richness with vascular plant species richness (exemplified by two contrasting areas: Finland and Switzerland). So as not to lose biodiversity entirely, scientists believe that it is vital to designate Key Biodiversity Areas (KBAs) which serve as essential habitats for the world's threatened species; the extent and severity of human disturbance in these KBAs must also be assessed (Yang et al., 2024).

CONCLUSIONS

Assessment of conservation status is developed using standard methodology based on four parameters as defined in Article 1 of the Habitats Directive. For reporting to the EC, Romania followed the Reference portal for reporting under Article 17 of the Habitats Directive and created the guide regarding the protocols and unitary methodologies for

monitoring the conservation status of community interest habitats. The guide has been recently introduced in Romanian legislation (E.W.F.M.O, 2023) and must be followed by all scientists reporting the conservations status of habitats to the European Union.

Data resulting from the monitoring should capture where the main objective of the conservation action need to take place. Therefore, in conjunction with the reporting format, one of three options may be chosen: (a) if all, or the vast majority, of the conservation measures are limited to Natura 2000; (b) where there is a proportionate investment in implementation of the measures inside and outside Natura 2000; and (c) if all, or the vast majority, of, of the measures are taken outside Natura 2000 land. At the current stage, most of the habitats that are not in the Natura 2000 network are neither mapped at bioregion level or national level in Romania.

Romania is presently at making its second report under Article 17 of the Habitats Directive. The first report provided the reference level for later reports, including assessment of short-term conservation trends over a single reporting cycle. The short-term nature of the data so far available means that the full appraisal recommended by the standard EU methodology cannot yet be carried out.

The methodology outlined above is not only consistent with that required by the European Commission, allowing fuller appraisals of the condition of Romanian biodiversity in the future, but also should provide data and condition assessments that can be applied by the national government in determining policy. Romania is among the most diverse countries in Europe for its habitats, species and overall environmental value, especially within the Natura 2000 network of sites, but also generally within the wider country. Effective management and conservation of this internationally important resource will demand a robust methodology, which both the EU and Romanian Ministry of Environment, Water and Forests can use.

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REFERENCES

Angelini, P., & Casella, L. (2015). Toward the 4th report under Article 17: methodological proposal for habitat types monitoring. Natura 2000 Biogeographical Process Alpine Grassland Monitoring and Assessment Workshop 20 - 22 May 2015, Unione Montana Feltrina, Feltre (Belluno), Italy.

Angelini, P., Chiarucci, A., Nascimbene, J., Cerabolini, B. E., Dalle Fratte, M., & Casella, L. (2018). Plant assemblages and conservation status of habitats of Community interest (Directive 92/43/EEC): definitions and concepts. *Ecological Questions*, *29*(3). 87-97.

Bendali, F., & Nellas, N. (2016). Conservation status assessment method for habitat types at Site of European Community Interest scale. *International Journal of Innovation and Applied Studies*, *17*(2), 548-555.

Brown, A. E., Burn, A. J., Hopkins, J. J., & Way, S. F. (1997). *The habitats directive: selection of Special Areas of Conservation in the UK*. Report. Joint Nature Conservation Committee, Peterborough.

Bunce, R. G. H., Bogers, M. M. B., Evans, D., & Jongman, R. H. G. (2013). Field identification of habitats directive Annex I habitats as a major European biodiversity indicator. *Ecological Indicators*, *33*, 105-110.

Chauvier-Mendes, Y., Pollock, L. J., Verburg, P. H., Karger, D. N., Pellissier, L., Lavergne, S., ... & Thuiller, W. (2024). Transnational conservation to anticipate future plant shifts in Europe. *Nature Ecology & Evolution*, 1-13.

Chen, Z. (2021). The Tango Between Art. 17 (3) Brussels Ibis and Art. 6 (4)(b) Rome I under the Beat of Package Travel Directive. *Maastricht Journal of European and Comparative Law*, *28*(6), 878-899.

Chytrý, M., Tichý, L., Hennekens, S. M., Knollová, I., Janssen, J. A., Rodwell, J. S., ... & Schaminée, J. H. (2020). EUNIS Habitat Classification: Expert system, characteristic species combinations and distribution maps of European habitats. *Applied Vegetation Science*, *23*(4), 648-675.

Combroux, I., Schwoerer, C., & Cornici, R. (2007). *Assessment of the conservation status of habitats and species of community interest in Romania: methodological guide*. Balcanic Publishing House.

Costa, J. C., Monteiro-Henriques, T., Neto, C., Arsénio, P., & Aguiar, C. (2007). The application of the Habitats Directive in Portugal. *Fitosociologia*, *44*, 23-28.

Davies, C. E., Moss, D., & Hill, M. O. (2004). EUNIS habitat classification revised 2004. Report to: European Environment Agency-European topic centre on nature protection and biodiversity, 127-143.

De Meester, L., Tienderen, P. V., Werger, M., Hector, A., Wörheide, G., Niemelä, J., ... & Keustermans, L. (2011). Challenges for biodiversity research in Europe. *Procedia-Social and Behavioral Sciences, 13,* 83-100.

Delbosc, P., Lagrange, I., Rozo, C., Bensettiti, F., Bouzillé, J. B., Evans, D., ... & Bioret, F. (2021). Assessing the conservation status of coastal habitats under Article 17 of the EU Habitats Directive. *Biological Conservation*, *254*, 108935.

Devilliers, P., & Devilliers-Terschuren, J. (1996). *A classification of Palaearctic habitats (No. 18-78).* Council of Europe.

Dimopoulos, P., Bergmeier, E., & Fischer, P. (2005). Monitoring and conservation status assessment of habitat types in Greece: fundamentals and exemplary cases. *Annals of Botany*, *5*, 7-20.

Doniță, N., Paucă-Comănescu, M., Popescu, A., Mihăilescu, S., & Biriș, I.-A. (2005). *The habitats from Romania*. Bucharest, RO: Tehnică Silvică Publishing House.

Doniță, N., Popescu, A., Paucă-Comănescu, M., Mihăilescu, S., & Biriș, I.-A. (2006). *Changes under the amendments proposed by Romania and Bulgaria to Habitats Directive (92/43/EEC)*. Bucharest, RO: Tehnică Silvică Publishing House.

Ellwanger, G., Runge, S., Wagner, M., Ackermann, W., Neukirchen, M., Frederking, W., ... & Sukopp, U. (2018). Current status of habitat monitoring in the European Union according to Article 17 of the Habitats Directive, with an emphasis on habitat structure and functions and on Germany. *Nature Conservation*, *29*, 57-78.

Evans, D. (2006). The habitats of the European Union Habitats Directive. In *Biology and Environment: Proceedings of the Royal Irish Academy Royal Irish Academy*, 167-173.

Evans, D. (2010). Interpreting the habitats of Annex I: past, present and future. *Acta botanica gallica*, *157*(4), 677-686.

Evans, D. (2012). Building the European union's Natura 2000 network. *Nature conservation*, *1*, 11-26.

Gafta, D. & Mountford, J. O. (2008). *Interpretation manual for Natura 2000 habitats in Romania*. Cluj-Napoca, RO: Risoprint Publishing House.

Garcia-Ureta, A. (2018). Environmental assessment under the Habitats Directive: something other than a procedure? *Journal of Property, Planning and Environmental Law*, *10*(2), 113-125.

Geldmann, J., Manica, A., Burgess, N. D., Coad, L., & Balmford, A. (2019). A global-level assessment of the effectiveness of protected areas at resisting anthropogenic pressures. *Proceedings of the National Academy of Sciences*, *116*(46), 23209-23215.

Harding, E., Crone, E., Elderd, B., Hoekstra, J., McKerrow, A., Perrine, J., Regetz, J., Rissler, L., Stanley, A., & Walters, E. (2001). The scientific foundations of habitat conservation plans: A quantitative assessment. *Conservation Biology*, *15*(2), 488-500.

Hermoso, V., Carvalho, S. B., Giakoumi, S., Goldsborough, D., Katsanevakis, S., Leontiou, S., ... & Yates, K. L. (2022). The EU Biodiversity Strategy for 2030: Opportunities and challenges on the path towards biodiversity recovery. *Environmental Science & Policy*, *127*, 263-271.

Hlásny, T., Mokroš, M., Dobor, L., Merganičová, K., & Lukac, M. (2021). Fine-scale variation in projected climate change presents opportunities for biodiversity conservation in Europe. *Scientific Reports*, *11*(1), 17242.

Janišová, M., Dengler, J., & Willner, W. (2016). Classification of Palaearctic grasslands. *Phytocoenologia*, *46*(3), 233-239.

Jeanmougin, M., Dehais, C., & Meinard, Y. (2017). Mismatch between habitat science and habitat directive: Lessons from the French (counter) example. *Conservation Letters*, *10*(5), 634-644.

Jung, V., Morel, L., Bonthoux, S., & Chollet, S. (2021). Integrating species pools and abundance distribution in habitat conservation status assessment: A new index. *Ecological Indicators*, *121*, 107183.

Loidi, J. (1999). Preserving biodiversity in the European Union: the Habitats Directive and its application in Spain. *Plant Biosystem*, 133(2), 99-106.

Louette, G., Adriaens, D., Paelinckx, D., & Hoffmann, M. (2015). Implementing the Habitats Directive: How science can support decision making. *Journal for Nature Conservation*, 23, 27-34.

Maes, J. (2013). *A model for the assessment of habitat conservation status in the EU*. JRC scientific and policy report. European Commission Joint Research Centre Institute for Environment and Sustainability, Luxembourg, Publication Office of the European Commission, DOI, 10, 27866.

Maes, J., Paracchini, M. L., Zulian, G., Dunbar, M. B., & Alkemade, R. (2012). Synergies and trade-offs between ecosystem service supply, biodiversity, and habitat conservation status in Europe. *Biological Conservation*, 155, 1-12.

Mammola, S., Riccardi, N., Prié, V., Correia, R., Cardoso, P., Lopes-Lima, M., & Sousa, R. (2020). Towards a taxonomically unbiased European Union biodiversity strategy for 2030. *Proceedings of the Royal Society B*, *287*(1940), 20202166.

McLeod, C. R., Yeo, M., Brown, A. E., Burn, A. J., Hopkins, J. J., & Way, S. F. (eds.) (2005) *The Habitats Directive: selection of Special Areas of Conservation in the UK*. 2nd eds. Joint Nature Conservation Committee, Peterborough

Mehtälä, J., & Vuorisalo, T. (2007). Conservation policy and the EU Habitats Directive: favourable conservation status as a measure of conservation success. *European Environment*, *17*(6), 363-375.

Melart, S. (2022). The Finnish transposition of Article 17 of Directive 2019/790: progress or regress? *Journal of Intellectual Property Law and Practice*, *17*(5), 437-442.

Mihăilescu, S. (2006). Habitats identification for the proposal of Piatra Craiului National Park as Natura 2000 site. In: Pop O., Hanganu H. (Eds.) *Research in*

Piatra Craiului National Park, Braşov, RO: Universităţii Transilvania Publishing House, III, 108-113.

Mihăilescu, S. (2010). Criteria for designation Natura 2000 sites in the region Ţării Haţegului-Retezat. in: Otiman P. I. (Eds.), Grigorescu D., Enache M., Bogdan A. (coord.), *Conserving geo- şi biodiversitity and sustainable development in Ţara Haţegului – Retezat*, Bucharest, RO: Academiei Române Publishing House, I, 254-259.

Mihăilescu, S., Ştefănuţ, S., Boşcaiu, N., Oltean, M., Biţă, C., Jalbă, A., Popescu, A., Sanda, V. (2003), Romanian natural protected areas candidate for the international network EMERALD. *Proceedings of the Institute of Biology,* Bucharest, V, 109-118.

Mihăilescu, S., Strat, D., Cristea, I., Honciuc, V. (Coord.) (2015). *Synthetic report on the conservation status of species and habitats of community interest in Romania*. Constanța, RO: Dobrogea Publishing House.

Mihoub, J. B., Henle, K., Titeux, N., Brotons, L., Brummitt, N. A., & Schmeller, D. S. (2017). Setting temporal baselines for biodiversity: the limits of available monitoring data for capturing the full impact of anthropogenic pressures. *Scientific Reports, 7*(1), 41591.

Miu, I. V., Rozylowicz, L., Popescu, V. D., & Anastasiu, P. (2020). Identification of areas of very high biodiversity value to achieve the EU Biodiversity Strategy for 2030 key commitments. *PeerJ*, 8. e10067.

Moersberger, H., Martin, J. G. C., Valdez, J., Junker, J., Georgieva, I., Bauer, S., ... & Bonn, A. (2023a). The future of biodiversity monitoring in Europe. *IIASA Policy Brief* #37.

Moersberger, H., Valdez, J. W., Martin, J. G., Junker, J., Georgieva, I., Bauer, S., ... & Bonn, A. (2023b). Biodiversity monitoring in Europe: user and policy needs. *bioRxiv*. 2023-07.

Morris, R. K. (2011). The application of the Habitats Directive in the UK: compliance or gold plating? *Land Use Policy, 28*(1), 361-369.

Moss, D. (2008). *EUNIS habitat classification–a guide for users*. European Topic Centre on Biological Diversity.

Moss, D., & Wyatt, B. K. (1994). The CORINE biotopes project: a database for conservation of nature and wildlife in the European community. *Applied Geography*, *14*(4), 327-349.

Müller-Kroehling, S. (2019). What are the" characteristic species" of the habitats directive? A new statistics-driven approach connecting species, habitats and key habitat characteristics. In: *ARPHA Conference Abstracts,* Pensoft Publishers, 2. e37430.

Munteanu, D. & Mihăilescu, S. (2005). Strategies for implementation of Natura 2000 network for protected areas in Romania. In Mihăilescu S. (Eds.) *BIOPLATFORM – Romanian National Platform for Biodiversity, II. Inter-institutional protocol for biodiversity research development*. Bucharest, RO: Academiei Române Publishing House, 39-48.

Normand, S., Svenning, J. C. & Skov, F. (2007). National and European perspectives on climate change sensitivity of the habitats directive characteristic plant species. *Journal for Nature Conservation, 15*(1), 41-53.

Noss, R. F. (1990). Indicators for monitoring biodiversity: a hierarchical approach. *Conservation biology*, *4*(4), 355-364.

Pihl, S., Søgaard, B., Ejrnæs, R., Aude, E., Nielsen, K. E., Dahl, K., & Laursen, J. S. (2001). *Habitats and Species Covered by the EEC Habitats Directive: A Preliminary Assessment of Distribution and Conservation Status in Denmark*. National Environmental Research Institute. NERI Technical Report, Vol. 365

Prisco, I., Angiolini, C., Assini, S., Buffa, G., Gigante, D., Marcenò, C., ... & Acosta, A. T. (2020). Conservation status of Italian coastal dune habitats in the light of the 4th Monitoring Report (92/43/EEC Habitats Directive). *Plant Sociology*, *57*, 55-64.

Rodwell, J. S., Evans, D., & Schaminée, J. H. (2018). Phytosociological relationships in European Union policy-related habitat classifications. *Rendiconti Lincei. Scienze Fisiche e Naturali*, *29*(2), 237-249.

Romao, C. (1996). *Interpretation manual of European Union habitats*. HAB 96/2 FINAL - EN Version EUR 15.

Santangelo, A., de Filippo, G., Rossetti, V., & Strumia, S. (2022). Relational databases for plants and habitat types monitoring under Directive 92/43/EEC (Habitat Directive): an example from Campania (Italy). *Plant Sociology*, *59*, 99-106.

Schneider, E., & Drăgulescu, C. (2005). *Habitats and sites of community interest*. Sibiu, RO: Universităţii "Lucian Blaga" Publishing House.

Silan, G. D. S. E. G., Del Vecchio, S., Fantinato, E., & Buffa, G. (2017). Habitat quality assessment through a multifaceted approach: the case of the habitat 2130* in Italy. *Plant Sociology*, *54*, 13-22.

Sipkova, Z., Balzer, S., Evans, D., & Ssymank, A. (2010). Assessing the conservation status of European Union habitats–Results of the community report with a case study of the German national report. *Annali di Botanica*, 1-19.

Spiliopoulou, K., Brooks, T. M., Dimitrakopoulos, P. G., Oikonomou, A., Karavatsou, F., Stoumboudi, M. T., & Triantis, K. A. (2023). Protected areas and the ranges of threatened species: Towards the EU Biodiversity Strategy 2030. *Biological Conservation*, *284*, 110166.

Strat, D., Mihăilescu, S., Sandu, C., Săhlean, T. C. (2018). Conservation status of species and habitats of community importance on the Romanian Black Sea coast. *Acta Zoologica Bulgarica, Supplement*, *11*, 119-124.

Trif, C., Făgăraș, M. M., Hîjdeu, N.-C., Niculescu, M. (2015). *Synthetic guide for monitoring community interest habitats (salty, continental dunes, grasslands, inland waters) from Romania.* Constanța, RO: Boldaș Publishing House.

Tsiripidis, I., Xystrakis, F., Kallimanis, A., Panitsa, M., & Dimopoulos, P. (2018). A bottom–up approach for the conservation status assessment of structure and functions of habitat types. *Rendiconti Lincei. Scienze Fisiche e Naturali*, *29*, 267-282.

Tucker, G., Stuart, T., Naumann, S., Stein, U., Landgrebe-Trinkunaite, R., & Knol, O. (2019). *Study on identifying the drivers of successful implementation of the Birds and Habitats Directives-Report to the European Commission.* Institute for European Environmental Policy (IEEP), Brussels.

Ursu, A., Stoleriu, C. C., Ion, C., Jitariu, V., & Enea, A. (2020). Romanian Natura 2000 network: Evaluation of the threats and pressures through the Corine land cover dataset. *Remote Sensing*, *12*(13), 2075.

Velagic-Hajrudinovic, A. (2019a). Regional Approach to Biodiversity Information Management and Reporting in Southeast Europe. *Biodiversity Information Science and Standards*, 3. e38190

Velagić-Hajrudinović, A. (2019b). Regional Policy Paper on the Biodiversity Information Management and Reporting in Southeast Europe. *Biodiversity Information Science and Standards*. *Biodiversity Information Science and Standards*, 3. e38188

Yang, R., Dong, X., Xu, S., Wang, K., Li, X., Xiao, W., & Ye, Y. (2024). Fragmentation of Key Biodiversity Areas highlights attention to human disturbance patterns. *Biological Conservation*, *290*. 110428.

Zaharia, T. (Coord.). (2013). *Synthetic guide for monitoring community interest marine species and costal habitats from Romania*. Constanța, RO: Boldaș Publishing House.

Zingstra, H. L., Kovachev, A., Kitnaes, K., Tzonev, R., Dimova, D., & Tzvetkov, P. (2009). *Guidelines for assessing Favourable Conservation Status of NATURA 2000 species and habitat types in Bulgaria*. Bulgarian Biodiversity Foundation.

***B.S. (2023). Biodiversity strategy for 2030. https://environment.ec.europa.eu/strategy/biodiversity-strategy-2030_en (accessed in 12.2023).

***DG Environment, 2017. *Reporting under Article 17 of the Habitats Directive: Explanatory notes and guidelines for the period 2013–2018*. Final version – May 2017. Brussels

***ETC/BD (2014). *Article 17 Reporting – Assessments of conservation status at the EU biogeographical level - Public consultation*. ETC/BD Technical paper 3/2014, Paris. https://www.eionet.europa.eu/etcs/etc-be/activities/reporting/article-17/docs/art17-public-consultation-guide.pdf.

***EUR27 (2013). *European Commission, Interpretation Manual of European Union Habitats - EUR28*. DG Environment - Nature and Biodiversity.

***E.W.F.M.O (2023). Ministry of Environment, Water and Forests Order no. 3352 from 28 December 2023 for approving the *Guide on monitoring protocols and unitary methodologies for monitoring the conservation status of habitats of community interest in Romania*, within the project "Complementing the level of knowledge of biodiversity by implementing the system for monitoring the conservation status of species and habitats of community interest in Romania and reporting on the basis of Article 17 of Habitats Directive 92/43/EEC" Cod MYSMIS 2014+ 120009, financed by Operational Program big infrastructure 2014-2020, https://legislatie.just.ro/

***Habitats Directive (1992). Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora. *Official Journal of the European Union*, 206(7), 50.

***INCDPM (Coord.) (2014). *Synthetic guide for monitoring community interest habitats: shrublands, bogs and mires, cliffs, forests*. Universitas, Petroșani.

***PHARE TA project "*Implementation of NATURA 2000 Network in Romania*" (EU Phare EuropeAid/12/12160/D/SV/RO).

***POIM (2023). *Completing knowledge level of biodiversity through implementing the monitoring system of conservation status of species and habitats from Romania in the framework of article 17 of Habitat Directive 92/43/CEE* (2019-2023).

***POS Environment (2011). *Monitoring the conservation status of species and habitats from Romania under article 17 of Habitat Directive*, Contract no. 130537/10.01.2011, https://www.ibiol.ro/posmediu/index.htm.

***Reference portal for reporting under Article 17 of the Habitats Directive, https://cdr.eionet.europa.eu/help/habitats_art17