



New national and regional Annex I Habitat records: from #148 to #157*

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Abstract

This contribution presents new data on the distribution of Annex I Habitats in Italy. A total of 10 records are reported, including 6 within Natura 2000 sites and the addition of 15 new cells to the EEA 10 km × 10 km reference grid. The new records refer to the administrative regions of Apulia, Marche, Piedmont, Sardinia, Sicily, Tuscany and Veneto.

Keywords

2120, 3140, 3240, 4030, 5220*, 5230*, 5330, 7110*, 7220*, 9160, vegetation

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Introduction

This is the 14th contribution in this journal reporting on new occurrences of Annex I Habitats across Europe. All records presented here are new for Italy when compared to the fourth Annex I Habitat Monitoring Report under Article 17, currently the most recent one (Eionet 2019). The associated phytosociological relevés are included in the national vegetation database “VegItaly” (Gigante et al. 2012; Landucci et al. 2012).

Habitats records

In accordance with the guidelines set out by Gigante et al. (2019), we provide vegetation data, site descriptions, and geographic coordinates for each record. A concise summary of these records is presented in Table 1. Mapping was carried out using QGIS (QGIS.org 2020). Supplementary materials 1 and 2 include the relevés and related figures, respectively.

#148. Annex I Habitat: 2120 Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes) (Riveccio G, Caria MC, Bagella S)

EUNIS Classification system: N14 – Mediterranean, Macaronesian and Black Sea shifting coastal dune (EEA 2021).
Biogeographical Region: Mediterranean.

National Habitat Checklist of reference: Italian Interpretation Manual of the Habitats Directive 92/43/EEC (Biondi et al. 2009).

Phytosociological reference: *Ammophilion* Br.-Bl. 1921, *Ammophiletalia* Br.-Bl. and Tx. ex Westhoff et al. 1946, *Ammophiletea* Br.-Bl. and Tx. ex Westhoff et al. 1946 (Mucina et al. 2016).

Geographic information: Italy, Sardinia, Cagliari, Giorgino, 0 m a.s.l., Coordinates: 39.189643°N, 9.056251°E (Suppl. material 1: table S1, Rel. 1); *ibidem*, 1 m a.s.l., Coordinates: 39.189183°N, 9.055783°E (Suppl. material 1: table S1, Rel. 2); *ibidem*, 1 m a.s.l., Coordinates: 39.192108°N, 9.059111°E (Suppl. material 1: table S1, Rel. 3).

Cell ID in the EEA reference grid: 10kmE423N178 (Suppl. material 2: fig. S1).

Natura 2000 Site Code: SAC ITB040023 “Stagno di Cagliari, Saline di Macchiareddu, Laguna di Santa Gilla”.

Phytosociological table: Suppl. material 1: table S1; taxonomic nomenclature according to World Flora Online (2025).

Notes: Along the coastal stretch of Giorgino (Cagliari, Sardinia), *Calamagrostis arenaria* subsp. *arundinacea* forms a spatially organized yet fragmented dune belt (Suppl. material 2: fig. S2). The vegetation retains key structural and floristic traits consistent with the habitat definition. Even in the absence of extensive or fully structured communities, documenting such occurrences allows for the recognition of plant assemblages which, though degraded or incomplete, still represent functional habitats with relevance for management and conservation planning.

Table 1. Synthetic overview of the newly reported data. ([^s] see record #155).

#NHR	Hab ID	Hab name	Cell ID	Country	BR	N2000 Site	Authors
#148	2120	Shifting dunes along the shoreline with <i>Ammophila arenaria</i> (white dunes)	10kmE423N178	Italy	MED	ITB040023	Riveccio G, Caria MC, Bagella S
#149	3140	Hard oligo-mesotrophic waters with benthic vegetation of <i>Chara</i> spp.	10kmE442N226, 10kmE441N226	Italy	MED	-	Fiaschi T, de Simone L, Angiolini C
#150	3240	Alpine rivers and their ligneous vegetation with <i>Salix eleagnos</i>	10kmE443N220	Italy	MED	-	de Simone L, Fiaschi T, Angiolini C
#151	4030	European dry heaths	10kmE412N248, 10kmE413N248	Italy	ALP	-	Lonati M, Mainetti A, Pittarello M
#152	5220*	Arborescent matorral with <i>Zyziphus</i>	10kmE459N161	Italy	MED	ITA040009	Gianguzzi L, La Mantia A, Rocca R
#153	5230*	Arborescent matorral with <i>Laurus nobilis</i>	10kmE476N210	Italy	MED	IT9110015	Carruggio F, Genduso E, Tomaselli V
#154	5330	Thermo-Mediterranean and pre-desert scrub	10kmE444N214	Italy	MED	-	Mascia F, Cannucci S, Bonari G
#155	7110*	Active raised bogs	10kmE412N234, 10kmE411N234, 10kmE410N234, 10kmE409N234 ^[s]	Italy	ALP	IT1160056	Selvaggi A, Gallino B, Miserere L
#156	7220*	Petrifying springs with tufa formation (<i>Cratoneurion</i>)	10kmE452N227	Italy	CON	IT5310017 IT5310030	Mei G
#157	9160	Sub-Atlantic and medio-European oak or oakhornbeam forests of the <i>Carpinion betuli</i>	10kmE449N251, 10kmE449N251	Italy	CON	IT3240031	Iamónico D, Crosato M

#149. Annex I Habitat: 3140 Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp. (Fiaschi T, de Simone L, Angiolini C)

EUNIS Classification system: C1 – Surface standing waters (EEA 2019).

Biogeographical Region: Mediterranean.

National Habitat Checklist of reference: Italian Interpretation Manual of the Directive 92/43/EEC Habitats (Biondi et al. 2009).

Phytosociological reference: *Charetum vulgaris* Corillion 1957, *Charion vulgaris* (Krause ex Krause and Lang 1977) Krause 1981, *Charetalia hispidae* Sauer ex Krausch 1964, *Charetea intermediae* F. Fukarek 1961 (Biondi and Blasi 2015; Mucina et al. 2016).

Geographic information: Italy, Tuscany, Siena, Castellina in Chianti, 371 m a.s.l., Coordinates: 43.4574689°N, 11.2675058°E (Suppl. material 1: table S2, Rel. 1); *ibidem*, 388 m a.s.l., Coordinates: 43.4582487°N, 11.2682293°E (Suppl. material 1: table S2, Rel. 2); *ibidem*, 382 m a.s.l., Coordinates: 43.4603087°N, 11.2737010°E (Suppl. material 1: table S2, Rel. 3); Italy, Tuscany, Siena, Poggibonsi, 182 m a.s.l., Coordinates: 43.4423215°N, 11.2073261°E (Suppl. material 1: table S2, Rel. 4); 186 m a.s.l., Coordinates: 43.4591043°N, 11.2139508°E (Suppl. material 1: table S2, Rel. 5); Italy, Tuscany, Florence, Barberino Tavarnelle, 188 m a.s.l., Coordinates: 43.4881958°N, 11.1933216°E (Suppl. material 1: table S2 Rel. 6).

Cell ID in the EEA reference grid: 10kmE442N226 (Suppl. material 1: table S2, Rels. 1–3); 10kmE441N226 (Suppl. material 1: table S2, Rels. 4–6) (Suppl. material 2: fig. S3).

Natura 2000 Site Code: Currently not included in any Natura 2000 Site.

Phytosociological table: Suppl. material 1: table S2; nomenclature and taxa delimitation according to Portal to the Flora of Italy (2025).

Notes: Relevés 1–5 were surveyed in small ponds located inside a largely agricultural landscape; relevé 6 is located on an artificial lake formed by a dam. All of these water bodies are anthropogenic in origin, having been created originally for irrigation and livestock watering. These water bodies, however, host well-developed *Chara*-dominated communities that align with the diagnostic characteristics of Habitat 3140 – Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp. The occurrence of this habitat in a predominantly Tuscan agricultural context underscores a particularly fragile ecological balance: these water bodies persist only in conditions where they remain relatively undisturbed by intensive land use, nutrient enrichment, or pollution. Although such secondary, artificial sites are often overlooked by official conservation authorities (e.g., national ministries or the EU) as Annex I occurrences, they in fact serve as vital refugia for the occurrence of this habitat in a region where natural oligo-mesotrophic systems are rare or heavily modified. This argument is reinforced by recent work by Cannucci et al. (2025), who studied 45 farmland ponds in Tuscany and showed that small agricultural ponds support high levels of

plant diversity, acting as “unique habitats for plant diversity across different pondscales”. This highlights how individual anthropogenic ponds – even in a heavily modified agricultural matrix – can host significant EU Annex I habitats and therefore deserve inclusion in conservation assessments (Rivieccio et al. 2024, record #124, rel. 3).

#150. Annex I Habitat: 3240 Alpine rivers and their ligneous vegetation with *Salix eleagnos* (de Simone L, Fiaschi T, Angiolini C)

EUNIS Classification system: S911 – Orogenous riverine brush (EAA 2021).

Biogeographical Region: Mediterranean.

National Habitat Checklist of reference: Italian Interpretation Manual of the Directive 92/43/EEC Habitats (Biondi et al. 2009).

Phytosociological reference: *Salicion apennino-purpureae* Biondi and Allegranza in Biondi et al. 2014, *Salicetalia purpureae* Moor 1958, *Salicetia purpureae* Moor 1958 (Mucina et al. 2016).

Geographic information: Italy, Tuscany, Grosseto, Cini-giano, 65 m a.s.l., Coordinates: 42.954697°N, 11.350355°E (Suppl. material 1: table S3, Rel. 1).

Cell ID in the EEA reference grid: 10kmE443N220 (Suppl. material 2: fig. S5).

Natura 2000 Site Code: Currently not included in any Natura 2000 Site.

Phytosociological table: Suppl. material 1: table S3; nomenclature and taxa delimitation according to Portal to the Flora of Italy (2025).

Notes: The habitat was located on a riverbank (Suppl. material 2: fig. S6). Conditions gradually shifted from a mud bank to pebbles and river sands.

#151. Annex I Habitat: 4030 European dry heaths (Lonati M, Mainetti A, Pittarello M)

EUNIS Classification system: S42 – Dry heath (EEA 2021).

Biogeographical Region: Alpine.

National Habitat Checklist of reference: Italian Interpretation Manual of the Directive 92/43/EEC Habitats (Biondi et al. 2009).

Phytosociological reference: *Calluno-Sarothamnium scoparii* Malcuit 1929 (Suppl. material 1: table S4, Rel. 1), *Sarothamnion scoparii* Oberd. 1957, *Spartio juncei-Cytisetalia scoparii* Mucina in Mucina et al. 2016, *Cytisetia scopario-striati* Rivas-Mart. 1974; *Genisto pilosae-Callunetum* Braun 1915 nom. inv. (Suppl. material 1: table S4, Rels. 2–3), *Calluno-Genistion pilosae* P. Duvigneaud 1945, *Vaccinio myrtilli-Genistetalia pilosae* Schubert ex Passarge 1964, *Calluno-Ulicetia* Br.-Bl. and Tx. ex Klika and Hadac 1944 (Mucina et al. 2016).

Geographic information: Italy, Piedmont, Pont Canavese (TO), Loc. Nivoiaje di sopra, 1408 m a.s.l., Coordinates: 45.441042°N, 7.565007°E (Suppl. material 1: table S4, Rel. 1); *ibidem*, 1575 m a.s.l., Coordinates: 45.438198°N,

7.561368°E (Suppl. material 1: table S4, Rel. 2); *ibidem*, 1567 m a.s.l., Coordinates: 45.437877°N, 7.56169°E (Suppl. material 1: table S4, Rel. 3).

Cell ID in the EEA reference grid: 10kmE412N248 (Suppl. material 1: table S4, Rels. 1–2), 10kmE413N248 (Suppl. material 1: table S4, Rel. 3) (Suppl. material 2: fig. S7).

Natura 2000 Site Code: Currently not included in any Natura 2000 Site.

Phytosociological table: Suppl. material 1: table S4 nomenclature and taxa delimitation according to Portal to the Flora of Italy (2025).

Notes: Habitat 4030 is quite frequent in the Alpine biogeographical region and in the Western Alps. In the area addressed in this note, at lower altitudes, the habitat can be ascribed to the *Calluno-Sarothamnetum scoparii* Malcuit 1929 (Suppl. material 1: table S4, Rel. 1), in which *Cytisus scoparius* is the dominant and characteristic species; the association *Calluno-Sarothamnetum scoparii*, according to the Italian Interpretation Manual of the Directive 92/43/EEC Habitats (Biondi et al. 2009), is included in habitat 4030. At higher elevations, *Calluno-Sarothamnetum scoparii* is progressively replaced by the association *Genisto pilosae-Callunetum* (Suppl. material 1: table S4, Rels. 2–3). Both associations, being linked to secondary communities, are subject to vegetation dynamics that will lead the vegetation towards secondary communities (*Luzulo-Fagion*), due to the general abandonment of traditional agricultural practices (Suppl. material 2: fig. S8).

#152. Annex I Habitat: 5220* Arborescent matorral with *Zyziphus* (Gianguzzi L, La Mantia A, Rocca R)

EUNIS Classification system: S54 – Thermomediterranean arid scrub (EEA 2021).

Biogeographical Region: Mediterranean.

National Habitat Checklist of reference: Italian Interpretation Manual of the Directive 92/43/EEC Habitats (Biondi et al. 2009).

Phytosociological reference: *Calicotomo infestae-Rhoetum tripartitae* Bartolo, Brullo and Marcenò 1982; *Periplocion angustifoliae* Rivas-Martínez 1975; *Pistacio lentisci-Rhamnetalia alaterni* Rivas-Martínez 1975; *Quercetalia ilicis* Br.-Bl. ex A. and O. Bolòs 1950 (Mucina et al. 2016).

Geographic information: Italy, Sicily, Sciacca (AG), Monte San Calogero (Monte Kronio) Nature Reserve, 290–330 m a.s.l., Centroid coordinates: 37.518228°N, 13.114472°E (Tab. 2, Rels. 1–6 in La Mantia et al. 2025).

Cell ID in the EEA reference grid: 10kmE459N161 (Suppl. material 2: fig. S9).

Natura 2000 Site Code: SAC ITA040009 “Monte San Calogero (Sciacca)”.

Phytosociological table: Tab. 2, Rels. 1–6 in La Mantia et al. 2025; nomenclature and taxa delimitation according to the Portal to the Flora of Italy (2025), aside from *Searsia tripartita*, for which we referred to Plants of the World Online database (POWO 2025).

Notes: A relict nucleus of xerophilous maquis with *Searsia tripartita* (Ucria) Moffett [= *Rhus tripartita* (Ucria) Grande] was recently reported in Sicily, on Mount San Calogero, near the coast of Sciacca (La Mantia et al. 2025; Suppl. material 2: fig. S10). It is a small calcareous relief (397 m a.s.l.), part of a highly active volcanic region, characterized by the presence of several hydrothermal caves; the site falls within the namesake Nature Reserve “Monte San Calogero” (also a Natura 2000 site: ITA040009). The occurrence of this species is of phytogeographical value, like other maquis aspects reported for the nearby area of Pizzo Telegrafo (Gianguzzi et al. 2014a, 2014b). In fact, *Searsia tripartita* has a predominantly North African distribution, with very few isolated and disjunct stations in the Strait of Sicily, reaching in this area the northern limit of its range.

The habitat covers a surface of about 3000 m², located on a rather steep, rocky, and particularly xeric slope. The vegetation is a summer-deciduous maquis, ascribed to the association *Calicotomo infestae-Rhoetum tripartitae*, endemic along the coasts of southern Sicily. Habitat 5220* is extremely rare in Europe, occurring only in some islands of the Strait of Sicily, in southern Spain, and in Cyprus (Mendoza-Fernández et al. 2019).

Given the rarity of the species and the very small extension of the habitat, it must be catalogued among ecosystems at risk (Capotorti et al. 2020; Casavecchia et al. 2021), threatened by fire and anthropogenic activities, particularly afforestation with alien species (La Mantia et al. 2025).

#153. Annex I Habitat: 5230* Arborescent matorral with *Laurus nobilis* (Carruggio F, Genduso E, Tomaselli V)

EUNIS Classification system: S51 – Mediterranean maquis and arborescent matorral (EEA 2021).

Biogeographical Region: Mediterranean.

National Habitat Checklist of reference: Italian Interpretation Manual of the Directive 92/43/EEC Habitats (Biondi et al. 2009).

Phytosociological reference: *Asparago acutifolii-Laurion nobilis* Gianguzzi, Cuttonaro, Cusimano and Romano 2016, *Quercetalia ilicis* Br.-Bl. ex Molinier 1934, *Quercetalia ilicis* Br.-Bl. ex A. Bolòs and O. de Bolòs in A. Bolòs and Vayreda 1950 (Gianguzzi et al. 2016; Mucina et al. 2016).

Geographic information: Italy, Apulia, Lesina Municipality, Bosco Isola di Lesina, 4 m a.s.l., Coordinates: 41.893706°N, 15.367764°E (Suppl. material 1: table S5, Rel. 1); *ibidem*, 6 m a.s.l., Coordinates: 41.895924°N, 15.355541°E (Suppl. material 1: table S5, Rel. 2); *ibidem*, 4 m a.s.l., Coordinates: 41.895614°N, 15.353695°E (Suppl. material 1: table S5, Rel. 3).

Cell ID in the EEA reference grid: 10kmE476N210 (Suppl. material 2: fig. S11).

Natura 2000 Site Code: SAC IT9110015 “Duna e lago di Lesina-Foce del Fortore”.

Phytosociological table: Suppl. material 1: table S5; nomenclature and taxa delimitation according to Portal to the Flora of Italy (2025).

Notes: Communities dominated by *Laurus nobilis* L. were found in the site “Bosco Isola di Lesina”, where this vegetation type is in catenal contact with holm oak woods, which are the remaining patches of sclerophyllous forests that were probably much more extensive in the past (Suppl. material 2: fig. S12). The present syntaxonomic framework provisionally follows Gianguzzi et al. (2016). Indeed, these authors described the alliance *Asparago acutifolii-Laurion nobilis*, in which they included *L. nobilis* micro-woods that can be found in thermo-hygrophilous stations of sub-coastal, plain, and hilly belts, under a thermo-mesomediterranean bioclimate.

This habitat is very rare in Apulia region and, so far, it was known only for a few, very circumscribed sites in southern Salento and in central Apulia (Beccarisi and Minnone 2012). The presence of *L. nobilis* was reported for the Gargano promontory (northern Apulia) only as scattered individuals in limestone gullies (Hofmann 1961; Filibeck 2009). Moreover, all the previous cases can be referred to the type “laurel gallery forests dominated by evergreen species, in ravines and valleys in Mediterranean context”, whereas the present one has to be referred to “humid lowland forests locally dominated by arboreal laurel” (Filibeck 2009). Indeed, it can be considered as characterizing hygrophilous edaphoseris in contact with other plant communities of the class *Quercetalia ilicis* Br.-Bl. ex A. Bolòs and O. de Bolòs in A. Bolòs and Vayreda 1950 and of mesohygrophilous riparian woods (*Populeta albae* Br.-Bl. ex Tchou 1948).

#154. Annex I Habitat: 5330 Thermo-Mediterranean and pre-desert scrub
(Mascia F, Cannucci S, Bonari G)

EUNIS Classification system: S51L – *Ampelodesmos mauritanica* dominated garrigues (EEA 2021).

Biogeographical Region: Mediterranean.

National Habitat Checklist of reference: Italian Interpretation Manual of the Directive 92/43/EEC Habitats (Biondi et al. 2009).

Phytosociological reference: *Hyparrhenion hirtae* Br.-Bl. and al. 1956 (syn. *Avenulo cincinnatae-Ampelodesmion mauritanici* Minissale 1995), *Cymbopogono-Brachypodietalia ramosi* Horvatić 1963, *Lygeo sparti-Stipetea tenacissimae* Rivas-Mart. 1978 (Mucina et al. 2016).

Geographic information: Italy, Tuscany, Grosseto, Capalbio, 79 m a.s.l., Coordinates: 42.434375°N, 11.451645°E (Suppl. material 1: table S6, Rel. 1); *ibidem*, 120 m a.s.l., Coordinates: 42.439309°N, 11.474812°E (Suppl. material 1: table S6, Rel. 2); *ibidem*, 96 m a.s.l., Coordinates: 42.441163°N, 11.475728°E (Suppl. material 1: table S6, Rel. 3).

Cell ID in the EEA reference grid: 10kmE444N214 (Suppl. material 2: fig. S13).

Natura 2000 site Code: Currently not included in any Natura 2000 site.

Phytosociological table: Suppl. material 1: table S6; nomenclature and taxa delimitation according to Portal to the Flora of Italy (2025).

Notes: The community refers to tall, thermo-xerophilous grasslands dominated by *Ampelodesmos mauritanicus*, associated with sclerophyllous Mediterranean shrubland species and chamaephyte elements of garrigues. The community can be classified under the subtype 32.23 – *Garrigues dominated by Ampelodesmos mauritanicus* of habitat 5330. This formation extends uniformly over more than 1.5 hectares and appears well preserved with features of high physiognomic-structural representativeness (Suppl. material 2: fig. S14).

#155. Annex I Habitat: 7110* Active raised bogs
(Selvaggi A, Gallino B, Miserere L)

EUNIS Classification system: D1.111 – Raised bog hummocks, ridges and lawns (EEA 2021)

Biogeographical Region: Alpine.

National Habitat Checklist of reference: Italian Interpretation Manual of the Directive 92/43/EEC Habitats (Biondi et al. 2009).

Phytosociological reference: *Sphagnion medii* Kästner and Flössner 1933, *Sphagnetalia medii* Kästner and Flössner 1933, *Oxycocco-Sphagnetalia* Br.-Bl. and Tüxen ex Westhoff et al. 1946 (Mucina et al. 2016; Jiroušek et al. 2022).

Geographic information: Italy, Piedmont, Cuneo Province: Gesso Valley, Valdieri, Pian del Valasco, upstream of the Casa di Caccia, 1770 m a.s.l., Coordinates: 44.19638°N, 7.22879°E (Suppl. material 1: table S7, Rel. 1); Gesso Valley; Valdieri, Vallone di Valasco, above the Casa di Caccia, left hydrographic side, 1814 m a.s.l., Coordinates: 44.19497°N, 7.22529°E (Suppl. material 1: table S7, Rel. 2); Gesso Valley, Valdieri, Pian della Casa, 1775 m a.s.l., Coordinates: 44.16170°N, 7.27615°E (Suppl. material 1: table S7, Rel. 3); Gesso Valley, Entracque, Gias Vej del Bouc, 2046 m a.s.l., Coordinates: 44.14227°N, 7.42362°E (Suppl. material 1: table S7, Rel. 4); Vernante, Vermenagna Valley, Lago degli Albergh, NW shore, 2035 m a.s.l., Coordinates: 44.16296°N, 7.50623°E (Suppl. material 1: table S7, Rel. 5); Gesso Valley, Valdieri, Pian del Valasco, upstream of the Casa di Caccia, 1810 m a.s.l., Coordinates: 44.1959362°N, 7.22637445°E (Suppl. material 1: table S7, Rel. 6); Gesso Valley, Valdieri, Pian del Valasco, upstream of the Casa di Caccia, 1810 m a.s.l., Coordinates: 44.1960096°N, 7.22645985°E (Suppl. material 1: table S7, Rel. 7).

Cell ID in the EEA reference grid: 10kmE409N234^[§] (Suppl. material 1: table S7, Rels. 1–2, 6–7), 10kmE410N234 (Suppl. material 1: table S7, Rel. 3), 10kmE411N234 (Suppl. material 1: table S7, Rel. 4), 10kmE412N234 (Suppl. material 1: table S7, Rel. 5). (Suppl. material 2: fig. S15).

^[§] Habitat type 7110* had previously been reported in the grid cell 10kmE409N234 (Eionet 2019), but without supporting vegetation data, which are provided here for the first time.

Natura 2000 Site Code: SAC IT1160056 “Alpi Marittime”.

Phytosociological table: Suppl. material 1: table S7; nomenclature and taxa delimitation in accordance with Bartolucci et al. (2024), for bryophytes with Aleffi et al. (2023).

Notes: The relevés represent the first sightings of the habitat for the Italian Maritime Alps and the Natura 2000 site

IT1160056 “Alpi Marittime”. According to Jiroušek et al. (2022), the diagnostic species for the alliance *Sphagnion medii* (= *Sphagnion magellanicum* Kästner et Flössner 1933) recorded in the relevés are: *Sphagnum magellanicum* s.l. (incl. *S. medium* or *S. divinum*, as noted in Aleffi et al. 2023) and *S. russowii*. In the relevés, *Sphagnum capillifolium*, *S. fuscum*, *S. rubellum*, *S. subnitens*, *S. tenellum*, and *Drosera rotundifolia*, together with some ericaceous plants, are considered characteristic of the class *Oxycocco-sphagnetalia* and/or the Habitat 7110* by Bensetti et al. (2002), Delarze and Gonseth (2008), and Biondi and Blasi (2015). The occurrence of ericaceous species (*Vaccinium* spp., *Calluna vulgaris*) should be considered as a characterizing feature of the habitat. Instead, a high cover in the shrub layer of *Rhododendron ferrugineum* and *Larix decidua* should be interpreted as an indicator of vegetation dynamism or transition. Habitat diagnosis is based on three criteria: (1) high cover and/or frequency of diagnostic species; (2) presence of species indicative of highly oligotrophic and acidic conditions; and (3) microtopographical elevation above the emergent groundwater table, dominated by fen vegetation of the alliance *Caricion fuscae*. (Suppl. material 2: fig. S16). The microtopographic conditions suggest that, regardless of the origin of the “hummocks” or microreliefs, water input derives primarily from precipitation (ombrotrophy). Its presence in the Maritime Alps constitutes an exceptional occurrence at the southern edge of the habitat’s range, where it would be considered relictual; for these reasons, other diagnostic species such as *Sphagnum papillosum*, *Carex pauciflora*, and *Eriophorum vaginatum* (limited to the northernmost part of Piedmont), or *Andromeda polifolia* and *Vaccinium oxycoccos* (limited to the eastern Alps) are missing. In the site, the “hummocks” or microreliefs belonging to 7110* are fragmented and occupy very limited surface areas (from 1 m² to 4 m²) within peatland systems. The habitat is particularly vulnerable to trampling by livestock and the resulting eutrophication due to prolonged animal presence; tourism-related trampling (mechanical disturbance) also affects the floristic composition (Aleffi et al. 2018). Climate change is another critical threat, as changes in precipitation patterns can negatively affect the water supply essential for this habitat. Both due to its priority status under the Habitats Directive 92/43/EEC and its marginal presence in the Alpine chain – hence the degree of threat to which the habitat is subjected, being classified as “Endangered” (EN) at the European level (Janssen et al. 2016) – its conservation must be considered a priority within the protected area and would be considered inseparable from the protection of the ecological complex formed by fens and bogs of various types and origins, as well as by the associated spring and marsh vegetation.

#156. Annex I Habitat: 7220* Petrifying springs with tufa formation (*Cratoneurion*) (Mei G.)

EUNIS Classification system: C2.121 Petrifying springs with tufa or travertine formations (EEA 2019).

Biogeographical Region: Continental.

National Habitat Checklist of reference: Italian Interpretation Manual of the Directive 92/43/EEC Habitats (Biondi et al. 2009).

Phytosociological reference: *Cratoneurion commutati* W. Koch 1928, *Montio-Cardaminetalia* Pawl. 1928, *Montio-Cardaminetalia* Br.-Bl. and Tx ex Klika and Had. 1944 (Mucina et al. 2016).

Geographic information: Italy, Marche, Pesaro e Urbino, Apecchio, Fosso dell’Eremita, 560 m a.s.l., Coordinates: 43.561158°N, 12.486157°E (Suppl. material 1: table S8, Rel. 1); Piobbico, Rio Vitoschio, 405 m a.s.l., Coordinates: 43.575282°N, 12.492506°E (Suppl. material 1: table S8, Rel. 2); *ibidem*, 430 m a.s.l., Coordinates: 43.573014°N, 12.491273°E (Suppl. material 1: table S8, Rel. 3); Val d’Abisso, 385 m a.s.l., Coordinates: 43.582334°N, 12.516450°E (Suppl. material 1: table S8, Rel. 4); Cagli, Pian dell’Acqua – Fiamba, 565 m a.s.l., Coordinates 43.536047°N, 12.571294°E (Suppl. material 1: table S8, Rel. 5); Pian dell’Acqua – Cupi di Fiamba, 625 m a.s.l., Coordinates: 43.538742°N, 12.573375°E (Suppl. material 1: table S8, Rel. 6).

Cell ID in the EEA reference grid: 10kmE452N227 (Suppl. material 2: fig. S17).

Natura 2000 Site Code: SAC IT5310017 “Monte Nerone – Gola di Gorgo a Cerbara”, SPA IT5310030 “Monte Nerone e Monti di Montiego”.

Phytosociological table: Suppl. material 1: table S8; nomenclature and taxa delimitation according to Portal to the Flora of Italy (2025).

Notes: The new records further enrich the knowledge of habitat 7220* “Petrifying springs with tufa formation (*Cratoneurion*)” in the northern part of the Marche region, confirming its presence across six stations within the Natura 2000 site IT5310017 “Monte Nerone – Gola di Gorgo a Cerbara” (Suppl. material 2: fig. S18). These findings align with recent contributions by Mei and Stinca (Riviuccio et al. 2024), who first documented the occurrence of the habitat in both IT5310017 and IT5310019 “Monte Catria, Monte Acuto” sites. The new stations, all located on the Monte Nerone massif, part of the broader Catria-Nerone mountain complex (Province of Pesaro and Urbino), fall within EEA reference cell 10kmE452N227. They include active travertine-forming springs and associated vegetation at Rio Vitoschio, Val d’Abisso, and Pian dell’Acqua localities, the latter encompassing both Fiambà and Cupi di Fiambà, between 385 and 625 m a.s.l. The sites are floristically referable to the alliance *Cratoneurion commutati*, in accordance with the Italian Interpretation Manual (Biondi et al. 2009) and recent syntaxonomic frameworks (Mucina et al. 2016). Despite being within a protected area, these environments are increasingly exposed to anthropogenic pressures. As previously reported for Fosso di Terie, unregulated tourism has caused severe degradation. Similar, though less advanced, impacts are now affecting Pian dell’Acqua, and to a lesser extent Rio Vitoschio and Val d’Abisso, due to continuous and unregulated

visits, often led by hiking guides with limited awareness of site fragility. Trail modifications, vegetation clearing, and the spread of canyoning and sport climbing are emerging as direct threats to the integrity of tufa-forming microsites.

#157. Annex I Habitat: 9160 Sub-Atlantic and medio-European oak or oakhornbeam forests of the *Carpinion betuli* (Iamónico D, Crosato M)

EUNIS Classification system: T1E – *Carpinus* and *Quercus* mesic deciduous forest (EEA 2021).

Biogeographical Region: Continental.

National Habitat Checklist of reference: Italian Interpretation Manual of the Directive 92/43/EEC Habitats (Biondi et al. 2009).

Phytosociological reference: *Carpinion betuli* Issler 1931, *Fagetalia sylvaticae* Pawłowski in Pawłowski, Sokołowski et Wallisch 1928, *Quercus roboris-Fagetalia sylvaticae* Br.-Bl. et Vlieger in Vlieger 1937 (Biondi and Blasi 2015).

Geographic information: Italy, Veneto, Treviso Province, Preganziol Municipality, San Trovaso, 149 m a.s.l., Coordinates: 45.630389°N, 12.224639°E (Suppl. material 1: table S9, Rel. 1); Treviso Municipality, Sant'Artemio di Treviso (Parco della Storga), 148 m a.s.l., Coordinates: 45.692806°N, 12.271389°E (Suppl. material 1: table S9, Rel. 2); *ibidem*, 149 m a.s.l. Coordinates: 45.687583°N, 12.267528°E (Suppl. material 1: table S9, Rel. 3).

Cell ID in the EEA reference grid: 10kmE449N251 (Suppl. material 1: table S9, Rel. 1), 10kmE449N250 (Suppl. material 1: table S9, Rels. 2–3; Suppl. material 2: fig. S19).

Natura 2000 Site Code: SAC IT3240031 “Fiume Sile da Treviso Est a San Michele Vecchio”.

Phytosociological table: Suppl. material 1: table S9, nomenclature and taxa delimitation according to Portal to the Flora of Italy (2025).

Notes: The habitat is represented by *Quercus robur*-dominated forest vegetation on hydromorphic soils and was found at two localities in Treviso Province, one toward north-east of Treviso city (Suppl. material 1: table S8, Rels. 2–3), the second toward south-west (Suppl. material 1: table S8, Rel. 1) (Suppl. material 2: fig. S20). In both cases, the habitat is embedded in an anthropogenic matrix. In this landscape context, the detected habitat could be affected by degradation due to human pressures, mainly for the intensive agriculture and, in San Trovaso locality, for the presence of *Q. rubra* L., a North American alien species (POWO 2025) which is naturalized in the site and represented by several individuals up to 20 m high.

Currently, Habitat 9160 is recorded in Veneto in two cells only [10kmE445N246 (Colli Euganei) and 10kmE447N254 (Piave valley)]. Hence, our discoveries represent the third and fourth in the region. Further, the occurrence of the habitat at Sant'Artemio di Treviso is the easternmost record for Italy.

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Supplementary material 1

Relevés

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Data type: xlsx

Explanation note: table S1: Habitat 2120 – #148; table S2: Habitat 3140 – #149; table S3: Habitat 3240 – #150; table S4: Habitat 4030 – #151; table S5: Habitat 5230* – #153; table S6: Habitat 5330 – #154; table S7: Habitat 7110* – #155; table S8: Habitat 7220 – #156; table S9: Habitat 9160 – #157.

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Supplementary material 2

Suppl. figures S1–S20

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Data type: docx

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