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VEGETATION ECOLOGY AND DIVERSITY

Review Article

An atlas of alien-dominated vegetation in Italy*

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Abstract

In this study, we reviewed the distribution of alien-dominated and co-dominated plant communities in Italy. We updated a former syntaxonomic scheme based on the Italian Vegetation Prodrome and also produced a syntaxonomic scheme based on FloraVeg.EU. For the first time, a cartographic synthesis has been produced. Mapping outputs were standardised using the European Environmental Agency 10 km × 10 km grid. The map visualisation is also available online at: https://comunellod.shinyapps.io/Atlas-of-alien-dominated-vegetation-Italy/. In total, 1,566 occurrences of alien-dominated or co-dominated plant communities were verified and recorded based on 170 bibliographical sources, 147 of which are georeferenced. The number of vegetation classes has increased from 27 to 30, while the number of lower-rank syntaxa has risen from 194 to 294, of which 274 are supported by georeferenced relevés/vegetation plots. The distribution of alien-dominated or co-dominated communities currently present in the database reveals numerous data-deficient areas, which appear to be more prevalent in central and southern Italy. This is most likely due to a lack of investigations rather than actual gaps in distribution. The results are presented according to different vegetation types and occurrence, and are discussed by syntaxonomic classes and their physiognomic and ecological attributes. A list of the alien species that constitute the alien-dominated or co-dominated communities identified here is also provided, with taxa distinguished according to their time of introduction and invasiveness.

Keywords

Biodiversity, conservation, habitat, Invasive Alien Species, phytosociology, plant communities, syntaxonomy

Introduction

Biological invasions are an increasingly widespread global phenomenon and are widely recognised as a significant component of human-driven environmental change (Early et al. 2016; Seebens et al. 2018; Díaz et al. 2019; Pyšek et al. 2020; Montagnani et al. 2022; Richardson et al. 2026). Furthermore, they are among the major threats associated with species extinction in recent times (Bellard et al. 2016). The establishment and spread of Invasive Alien plant Species (IAS) affect multiple ecosystem processes, functions, and services, as well as community composition and biotic interactions (Vilà and Hulme 2017). The presence of IAS increases the probability that natural habitats will reach an unfavourable conservation status, leading to a shift in the functional niche (Zanzottera et al. 2021). This causes a general deterioration of native plant communities as it is already evident in Italy (Gigante et al. 2018; Lazzaro et al. 2020), across Europe (Janssen et al. 2016; Lososová et al. 2016), and globally (Pyšek et al. 2012, 2020; Richardson et al. 2026).

The key role of cover and dominance of alien plant species in understanding invasion patterns has stimulated research into alien-dominated or co-dominated plant communities. This research has also benefitted from datasets of relevés/vegetation plots currently available (e.g., Dengler et al. 2011; Landucci et al. 2012; Del Vecchio et al. 2015; Chytrý et al. 2016; Evangelista et al. 2016; Sperandii et al. 2018; Bonari et al. 2019; Acosta et al. 2025; Cannucci et al. 2025; Denaro et al. 2025; Gholizadeh et al. 2025; Giorgis et al. 2025). Some authors in Europe and Italy began to qualify and quantify the role of alien plants, particularly IAS, in different vegetation and habitat types (Chytrý et al. 2009), pointing out the significant functional role they play (Pyšek and Chytrý 2014; Prisco et al. 2016; Dalle Fratte et al. 2019; Sarmati et al. 2019; Fristoe et al. 2021; Tozzi et al. 2021; de Francesco et al. 2023). However, with notable exceptions (e.g., Lorenzoni 1964; Gentile 1996; Parolo 2000; Carboni et al. 2010; Lazzaro et al. 2018; Allegrezza et al. 2019; Gasperini et al. 2020; Montecchiari et al. 2020; Fanfarillo et al. 2022; Misuri et al. 2025), the majority of vegetation studies in Italy have focused on natural and semi-natural plant communities. Often, plant communities dominated by IAS are understudied or only recorded if they are part of a territorial context that is studied as a whole (e.g., Poldini 1989; Poldini et al. 1998; Brullo et al. 2001; Assini 2004; Lastrucci et al. 2010, 2014; Bolpagni and Piotti 2015; Puglisi et al. 2016; Lastrucci and Viciani 2025). While the understanding of the distribution of alien plant species in Italy has advanced significantly in recent years and there is a long-standing

tradition of phytosociological studies in the country, relatively few studies have specifically addressed alien-dominated and co-dominated plant communities (Musarella et al. 2025). A comprehensive checklist of alien-dominated vegetation types in Italy was relatively recently published (Viciani et al. 2020). The study identified 27 classes of alien-dominated vascular plant vegetation and one class of alien-dominated bryophyte vegetation in Italy, comprising 194 lower-rank syntaxa. However, the local distribution of these plant communities across Italy is largely unknown to both researchers and policymakers. This information is key to conserving native biodiversity, tracking biological invasions, and guiding the management of alien-dominated vegetation and their associated habitats. To address this issue, the Italian Society of Vegetation Science (SISV) has launched a cartographic project open to society members and all scholars interested in the topic. Based on a comprehensive literature review and critical analysis of bibliographical data formerly gathered by Viciani et al. (2020), this collaborative project aims to: 1) update the checklist of alien-dominated vegetation types in Italy, integrating new information; and 2) provide, for the first time, distribution maps for all alien-dominated and co-dominated vegetation types identified in the reviewed literature. This will establish a basis for regularly updating both the checklist and the distribution maps.

Materials and methods

A bibliographic list was created starting from the literature sources prepared by Viciani et al. (2020) to produce the Italian checklist of alien-dominated vegetation and integrated with further references not previously considered or published in 2020. This list was shared among the project participants. Following repeated meetings with the contributors, it was collectively agreed that both dominated communities, in which alien plant cover exceeded 50%, and co-dominated communities, in which alien plant cover reached 40%, should be considered in the database, since communities require attention once alien plant cover exceeded 1/3. The chosen thresholds (40% and 50%) are consistent with previous work by Viciani et al. (2020). However, they are merely operational criteria and could be subject to bias. For example, fixed proportional thresholds on the total may exclude stands where the cover of an alien species is significant. For instance, a stand with 30% cover of one alien species and many native species each exceeding 10% cover, but totalling 100%, would not meet the current dominance or co-dominance thresholds. However, the alien species could be considered the most significant in the community. The decision to consider total alien species cover versus total native species cover was made collectively with the aim of standardising data mining, but is certainly not without limitations. Namely, the dominance of alien species (considering all the taxa present in the relevé/plot) was defined based on their proportional cover relative to the total plant community cover. For example, if the total plant community cover was 100%, the total cover of alien species had to be ≥ 50% (dominated) or ≥ 40% and < 50% (co-dominated). If the total plant community cover was 60%, the total cover of alien species had to be ≥ 30% (dominated) or ≥ 24% and < 30% (co-dominated). For the calculation, the multi-layered relevés were first converted into a single layer by summing the species cover value of each layer. Communities dominated or co-dominated by aliens were treated as a whole in the analyses and discussion, without distinction between them. The surveys considered were preferential (Braun-Blanquet 1979), either probabilistic vegetation plots or similar quantitative data from which species coverage could be derived. Since species covers are often indicated using the semi-quantitative Braun-Blanquet interval scale, the average cover values of the intervals were considered, specified as follows: 5 (cover 75–100%) = 87.5%; 4 (cover 50–75%) = 62.5%; 3 (cover 25–50%) = 37.5%; 2 (cover 5–25%) = 15%; 1 (cover 1–5%) = 2.5%; + (cover < 5%) = 0.5%); r (cover negligible) = 0.1%. We considered the specifications from the original sources if the author had chosen to use a different cover scale. Each contributor selected one or more literature sources and examined them to determine whether they included published vegetation surveys of plant communities dominated or co-dominated by alien species. For botanical nomenclature and alien plant status in Italy, we followed the recent checklists of native and alien Italian vascular flora (Bartolucci et al. 2024; Galasso et al. 2024; Portal to the Flora of Italy 2026) and bryophytes (Aleffi et al. 2023).

For each confirmed relevé or vegetation plot of an alien-dominated or co-dominated plant community, the contributor compiled the following data, in addition to its name and the bibliographic reference:

- syntaxon name, as indicated by the original author; if the original authors did not highlight the presence of a community with dominance or co-dominance of an alien species, the contributor has provided the name (e.g., *Amorpha fruticosa* community if with a single species; e.g., *Parietaria judaica* and *Erigeron bonariensis* community in the case of multiple alien species with equal coverage, up to three species);
- syntaxonomic assignment to the higher levels of alliance, order, and class (as indicated by the original author, if present);
- georeferencing of the survey in decimal degrees, followed by the radius of uncertainty inferred from the information contained in the original work;
- EEA reference grid at a resolution of 10 km × 10 km, aligned with the grid used for mapping Annex I Habitat types under Directive 92/43/EEC (e.g., 10kmE407N244, as in the series 'New national and regional Annex I Habitat records' published in Vegetation Ecology and Diversity journal; see, e.g., Gigante et al. 2019; Rivieccio et al. 2025);
- any explanatory notes.

Relevés/vegetation plots with scarce precision hardly assignable to a 10 km × 10 km grid (i.e., with a radius of uncertainty > 5000 m) were not considered.

As for the phanerophytic communities, attributions to higher ranks have been standardised according to the Prodrome of Italian Vegetation (Biondi et al. 2014; Biondi and Blasi 2015), in line with the classification scheme used by Viciani et al. (2020), to enable comparison of the results with previous work. However, attributions according to the EuroVegChecklist (Mucina et al. 2016; Chytrý et al. 2024; FloraVeg.EU 2026) have also been provided. Bryophytic community attributions follow FloraVeg.EU (2026).

A critical analysis of the original authors' syntaxonomical attributions of plant communities is beyond the scope of this work. Only a few errors have been corrected, and some assignments restored to the currently accepted classification. For instance, communities dominated by tree species which were previously categorised in herbaceous vegetation classes have now been re-classified as forest vegetation. Further, communities dominated by *Robinia pseudoacacia* that were previously attributed to the class *Galio-Urticetea* have now been re-attributed to the class *Robinietea*; likewise, communities dominated by *Robinia pseudoacacia* that were previously categorised at the class level only, or not categorised at all, have also been re-classified as *Robinietea*. For these reasons, in the syntaxonomic scheme, we maintained the original attributions of the *Robinia pseudoacacia*-dominated communities when the original authors specified at least the order in addition to the class. Otherwise, all relevés/vegetation plots were referred to the *Robinietea* class. Other examples of syntaxonomic adjustments include communities that were previously attributed to the alliance *Senecionion fluviatilis* of the class *Artemisietea* (e.g., in Biondi et al. 1997), but which have since been re-classified as belonging to the alliance *Calystegion sepium* (the accepted name for the alliance *Senecionion fluviatilis*) within the class *Filipendulo-Convolvuletea*, according to Biondi et al. (2014) and Biondi and Blasi (2015). The reason for each of the changes is specified in the dataset supplement.

Another challenge was mapping the records of communities with the same name (e.g., *Robinia pseudoacacia*-dominated communities, among others), which have been classified in different ways by different authors over time and attributed to different higher syntaxa. While, from a syntaxonomic perspective, this may lead to some redundancy that is tolerable and even informative, from a cartographic perspective, we decided to aggregate the mapping units as much as possible. Communities with the same name were therefore assigned to the same map, regardless of the higher syntaxonomic level, providing an integrated overview of their distribution. Any different syntaxonomic classification can be derived from the syntaxonomic scheme and is indicated in the bibliography and reference data sheet.

Results and discussion

Overall, we verified and recorded 1,566 occurrences of alien-dominated or co-dominated plant communities in Italy (Suppl. material 1). Most of the relevés/vegetation plots were georeferenced with point coordinates, although with very different uncertainty ranges (from 5 to 5000 m). Just over 7% of the data were georeferenced only at the 10 km × 10 km grid level. The recorded occurrences are based on the verification of 170 bibliographical references, 147 of which provided georeferenceable data (Suppl. material 2).

The updated syntaxonomic scheme, based on the results of this study, is provided in Suppl. material 3, in accordance with the Prodrome of Italian Vegetation (Biondi et al. 2014; Biondi and Blasi 2015). In Suppl. material 4, we provide a syntaxonomic scheme prepared in accordance with Mucina et al. (2016) and subsequent updates (FloraVeg.EU 2026). The comparison between the Italian and European prodromes is certainly not the object of this study. We can only note how the articulations of some classes remain substantially stable (e.g., *Lemnetea*, *Potametea*), while others are extremely different (e.g., *Stellarietea*, *Querco-Fagetea*). However, the following elaborations are all based on a comparison of the situation identified by Viciani et al. (2020) with that of this study according to Suppl. material 3.

Compared to the scheme by Viciani et al. (2020), a significant increase in the number of syntaxa has been observed, particularly among lower-rank units. In line with Viciani et al. 2020, each distinct lower-rank syntaxon (i.e., association, subassociation, variant or undefined community in Suppl. material 3), was considered a different community type. While the number of vascular plant classes involved has increased from 27 to 30, the number of lower-rank syntaxa has increased sharply, from 194 to 294, 274 of which have georeferenced relevés/vegetation plots.

Figure 1 illustrates the overall distribution of all georeferenced data relating to communities dominated or co-dominated by alien species at the Italian level. Each 10 km × 10 km grid containing at least one bibliographic entry is coloured in red. The maps of the various communities, which were in some cases simplified for synthesis purposes as explained in the Methods, were 248 in total and are shown in Suppl. material 5. The map visualisation is also available online at: https://comunellod.shinyapps.io/Atlas-of-alien-dominated-vegetation-Italy/.

Regarding the alien species that constitute the alien-dominated or co-dominated communities identified here, Suppl. material 6 provides a list of taxa, distinguishing between them based on their time of introduction and invasiveness (residence and invasion status following Portal to the Flora of Italy 2026). Each listed taxon has been found to be either dominant or co-dominant in the dataset. The results of this straightforward analysis are summarised in Table 1. In total, there are 106 alien species, 83% of which are neophytes, less than 10% of which are archaeophytes, and approximately 7.5% of which are

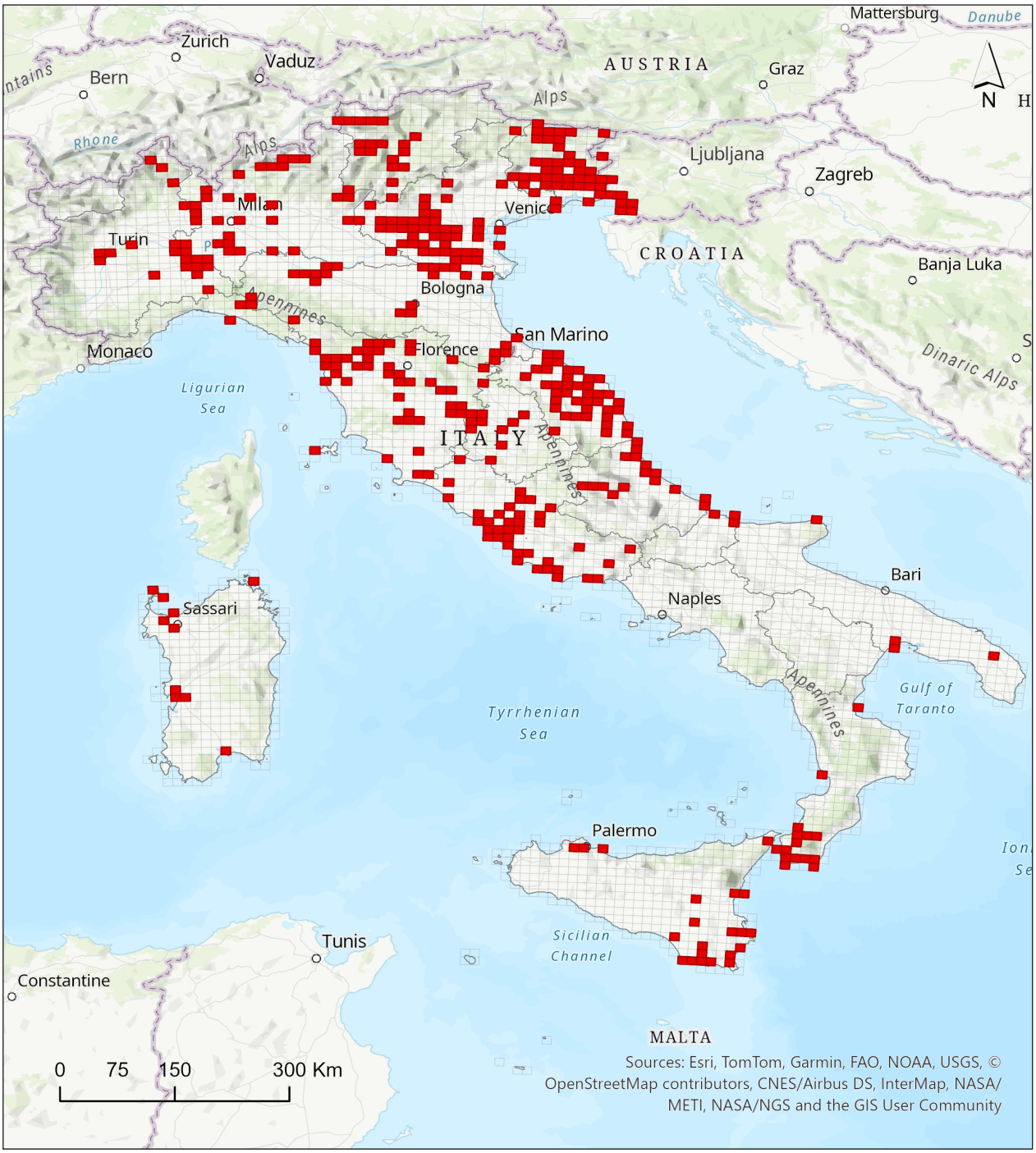


Figure 1. The overall distribution of all georeferenced data relating to plant communities dominated or co-dominated by alien species in Italy. Each 10 km × 10 km grid containing at least one bibliographic entry is coloured red.

cryptogenic. Of these, over 79% are invasive, highlighting their well-known contribution to ecosystem modification (Pyšek et al. 2012, 2020; Richardson et al. 2026).

This study provides the first georeferenced synthesis of plant communities dominated or co-dominated by alien species in Italy, based on a comprehensive verification of phytosociological data across literature. Unlike previous compilations (i.e., Viciani et al. 2020), which were primarily checklist-oriented, our approach enables spatial analyses and cartographic applications, because the presence of all plant communities dominated or co-dominated by alien species was verified in all the considered studies, and all the data were recorded and georeferenced.

The significant increase in the number of communities recorded, from 194 in Viciani et al. (2020) to 294 in the current work, is due not only to the additional bibliography considered, but also to a more detailed verification of the tables and surveys, which revealed communities dominated by aliens that the original authors had sometimes not highlighted.

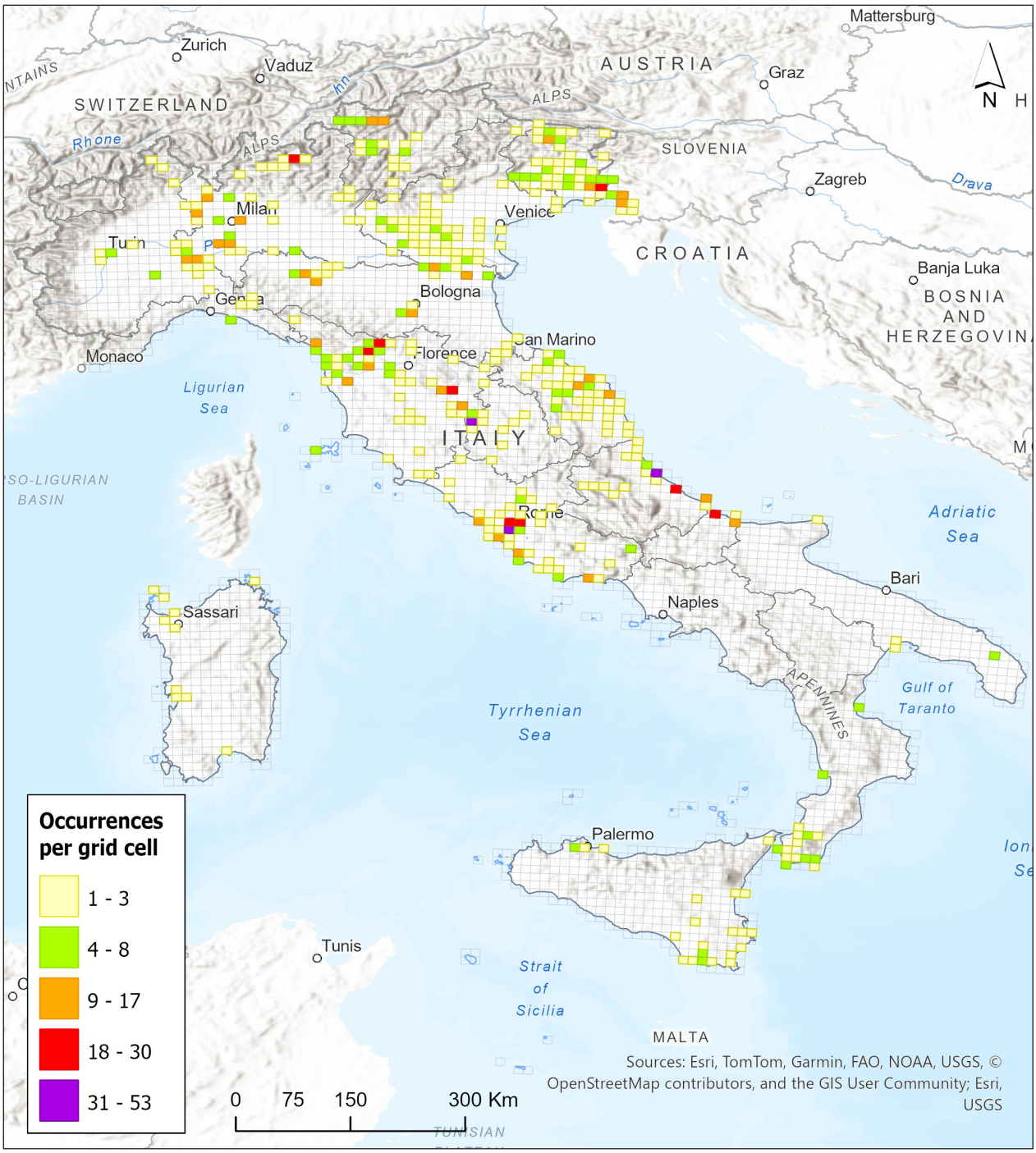


Figure 2. Total number of alien-dominated community occurrences for each 10 km × 10 km grid cell in Italy.

The updated syntaxonomic scheme (Suppl. material 3) highlights the need for in-depth analyses that can produce more robust syntaxonomic frameworks based on a greater number of data, on a wider scale. This is because communities with the same dominant species are often classified at a higher level into very different syntaxa (e.g., *Robinia pseudoacacia* or *Amorpha fruticosa* communities, and many others).

The distribution of alien-dominated or co-dominated communities currently present in the database reveals numerous data-deficient areas, which appear to be more prevalent in central and southern Italy. This is most likely due to a lack of investigations rather than actual gaps in distribution, as previously highlighted for the Italian vascular flora (Domina et al. 2026). This is also confirmed by Figure 2, which shows the total number of alien-dominated community occurrences for each 10 km × 10 km grid, with the vast majority of cells affected by a paucity of data. These knowledge gaps are even more evident when examining the distribution maps of some widespread alien-dominated communities, such as those dominated by *Robinia pseudoacacia* or *Ailanthus altissima* (Suppl. material 5), for which the actual distribution has clearly been poorly documented. Figure 3 shows the number of community types for each class. As

Table 1. The number and percentage of the dominant or co-dominant alien species detected in alien-dominated or co-dominated plant communities in Italy, based on their time of introduction and invasiveness.

Alien species	Residence status			Invasion status	
	Archaeophyte	Neophyte	Cryptogenic	Invasive	Naturalised + Casual
n. 106	10	88	8	84	22
Percentage of the total	9.4	83.0	7.5	79.2	20.7

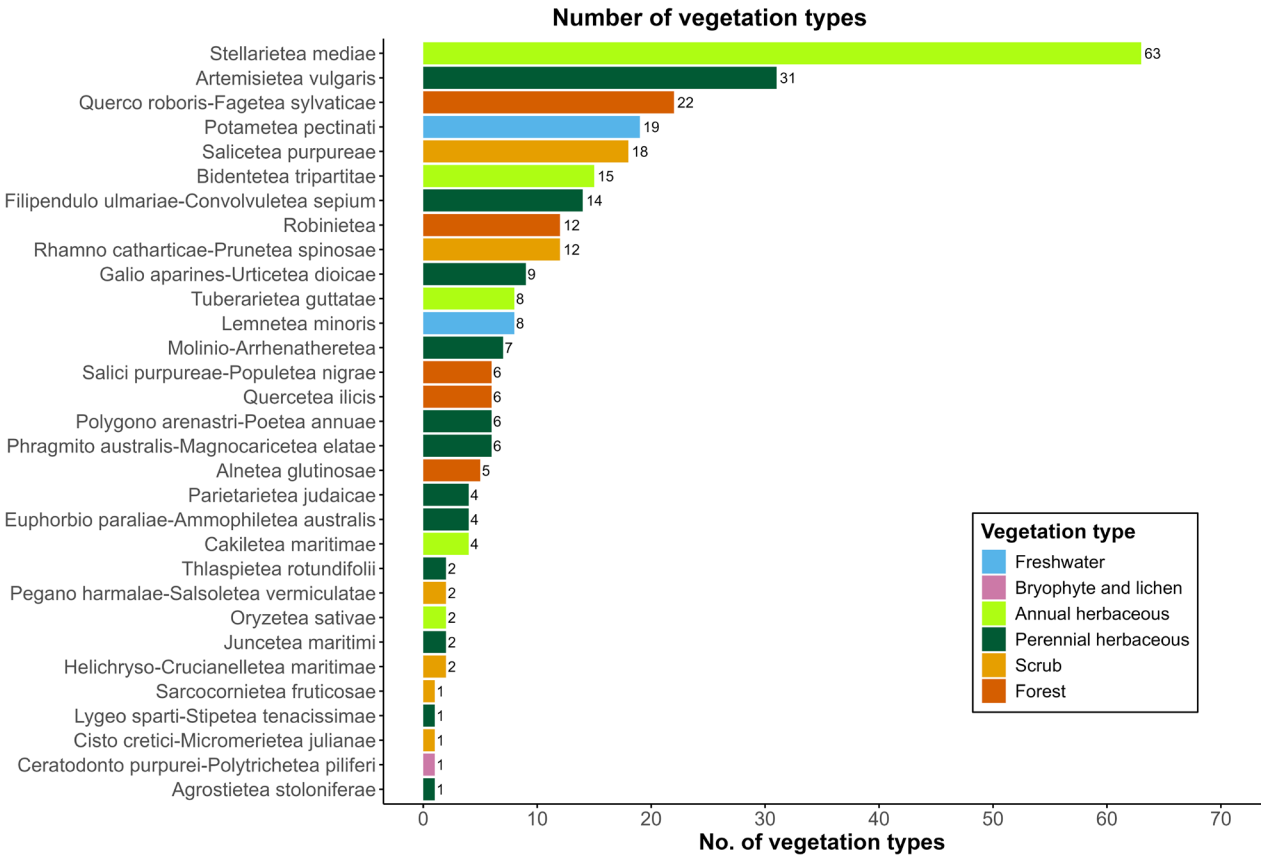


Figure 3. Number of alien-dominated and co-dominated community types (associations, phytocoenoses) for each syntaxonomic class in Italy.

expected, *Stellarietea mediae* had by far the highest number of alien-dominated plant community types, followed by *Artemisietea vulgaris*. When considering the number of georeferenced relevés/vegetation plots for each class (Figure 4), *Stellarietea mediae* remains the most represented class, followed by *Robinietea* and *Bidentetea tripartitae*. As shown in Figure 5, if data are grouped into categories based on physiognomy and ecology according to Viciani et al. (2020), the largest percentage of data present in the literature refers to hygrophilous and mesophilous woody vegetation, followed by annual ruderal herbaceous vegetation, and then perennial herbaceous hygrophilous and hygro-nitrophilous vegetation.

The data acquired in this study reveal evident research gaps, as demonstrated by the absence or scarcity of data relating to certain widespread communities. For example, considering only the Mediterranean coastal habitats, there is a complete lack of records on *Yucca* spp. and *Agave* spp. dominated communities, while *Carpobrotus* spp., *Opuntia* spp., and *Acacia* spp. dominated communities are certainly underrepresented (Del Vecchio et al. 2013; Lazzaro et al. 2014; Mugnai et al. 2022; Misuri et al. 2025; Siccardi et al. 2026). The latter group should also include communities dominated by notable invasive species that were introduced more recently. These include *Boerhavia coccinea* subsp. *viscosa* (Brullo 1984), *Centaurea diluta* (Cambria and Di Gregorio 2024), and *Cenchrus setaceus* (Gianguzzi et al. 1996, 2025; Pasta et al. 2010). These species are expanding rapidly and uncontrollably in southern arid environments, where they pose a serious threat to several native species, habitats, and plant associations. There are other examples related to aquatic and marsh communities, which are among the most widely studied in terms of alien species. However, a substantial amount of information is still lacking, as shown by the scarcity of georeferenced plots for *Myriophyllum aquaticum* communities (the only phytosociological bibliographic reference currently available is Lastrucci et al. 2015), or by the complete absence of surveys relating to *Alternanthera philoxeroides* communities, widespread in some Italian regions (Iamonico et al. 2010; Iamonico and Sánchez del Pino 2016).

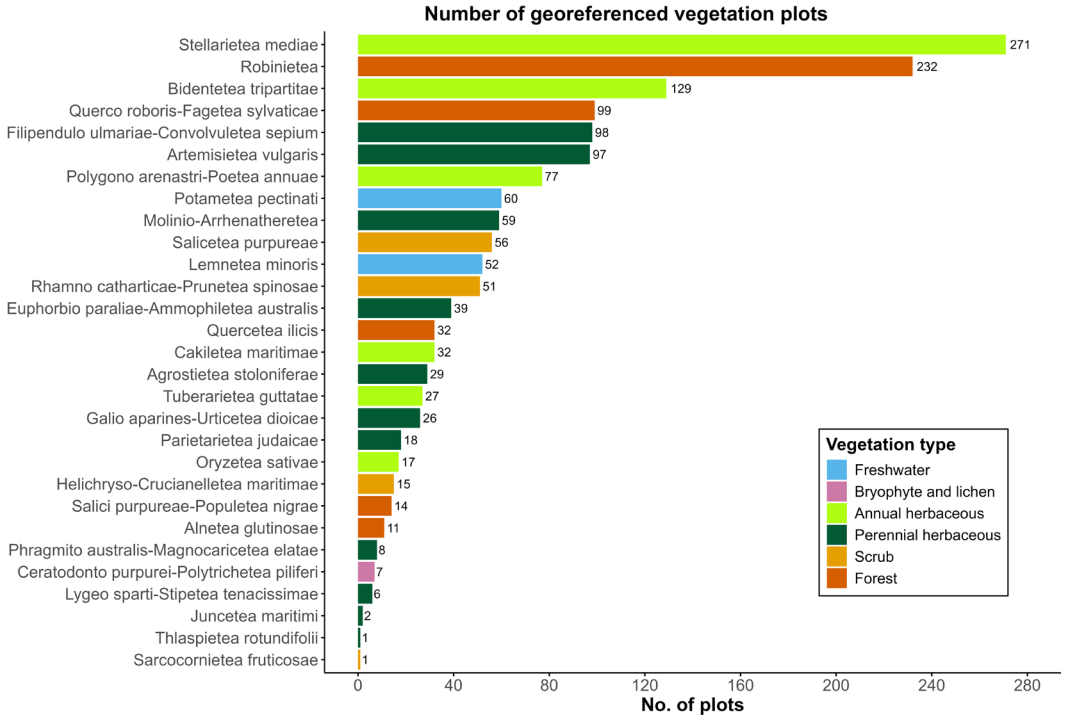


Figure 4. Number of georeferenced relevés/vegetation plots of alien-dominated and co-dominated communities for each syntaxonomic class in Italy.

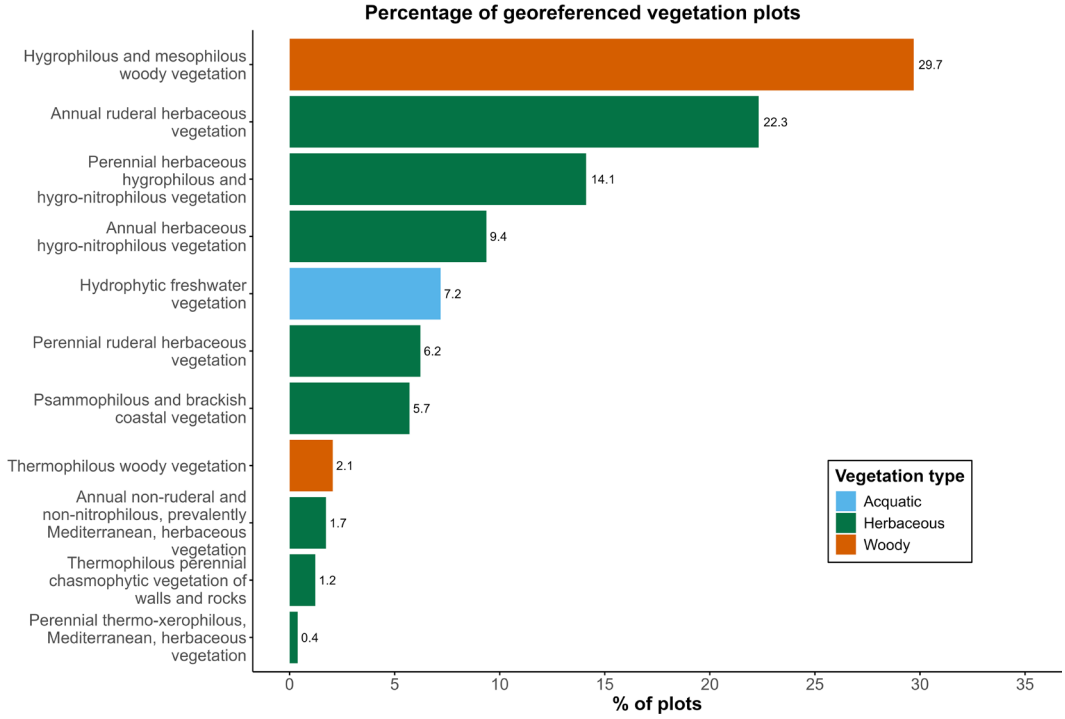


Figure 5. Percentage of georeferenced relevés/vegetation plots concerning alien-dominated and co-dominated communities in Italy subdivided into physiognomic and eco-edaphic groups of classes, according to Viciani et al. (2020). Categories: Hygrophilous and mesophilous woody vegetation (*Alnetea* + *Salici-Populetea* + *Salicetea* + *Robinietea* + *Rhamno-Prunetea* + *Querco-Fagetea*); Annual ruderal herbaceous vegetation (*Polygono-Poetea annuae* + *Stellarietea*); Perennial herbaceous hygrophilous and hygro-nitrophilous vegetation (*Agrostietea* + *Filipenduletea* + *Galio-Urticetea* + *Molinio-Arrhenatheretea* + *Phragmito-Magnocaricetea*); Annual herbaceous hygro-nitrophilous vegetation (*Bidentetea* + *Oryzetea*); Hydrophytic freshwater vegetation (*Potametea* + *Lemnetea*); Perennial ruderal herbaceous vegetation (*Artemisietea*); Psammophilous and brackish coastal vegetation (*Euphorbio-Ammophiletea* + *Cakiletea* + *Helichryso-Crucianelletea* + *Juncetea maritimi* + *Pegano-Salsoletea* + *Sarcocornietea*); Thermophilous woody vegetation (*Cisto-Micromerietea* + *Quercetea ilicis*); Annual non-ruderal and non-nitrophilous, prevalently Mediterranean, herbaceous vegetation (*Tuberarietea*); Thermophilous perennial chasmophytic vegetation of walls and rocks (*Parietarietea* + *Thlaspietea*); Perennial thermo-xerophilous, Mediterranean, herbaceous vegetation (*Lygeo-Stipetea*).

In summary, while the data collected in this study are certainly important, they capture only part of the overall picture. One limitation of this study is that it only considered published data. However, it is likely that there are also data of this type in the form of individual plots in various databases. It would be appropriate to recover and integrate these in the near future. Nonetheless, this dataset represents a valuable baseline for deepening the knowledge of alien-dominated plant communities in Italy.

Conclusions

This work provides, for the first time, a synthesis of cartographic data on the distribution of plant communities dominated or co-dominated by alien species in Italy. Such information is crucial for providing stakeholders with the basic knowledge needed to monitor the impact of alien species on vegetation types and associated habitats. While the data should be considered incomplete, they represent the outcome of an extensive bibliographical survey involving many specialists in the field and covering the large majority of the available literature. The dataset is well suited to be further enriched with additional sources, including literature not considered here or published after 2020. It may also serve as a basis for integrating new field data collected according to a standardised methodology (see the project of the Italian Society of Vegetation Science (SISV) on this subject at https://ved.arphahub.com/topical_collection/287/). Such efforts could confirm or refute existing records, as well as expand the known distribution of individual syntaxa. In the future, this approach may lead to the development of a dedicated database on alien-dominated or co-dominated plant communities in Italy. This database could then support further analyses and provide a robust scientific basis for the design of monitoring strategies and conservation actions aimed at preserving native biodiversity.

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Additional information

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Data availability

The map visualisation is available online at: https://comunellod.shinyapps.io/Atlas-of-alien-dominated-vegetation-Italy/.

Supplementary material 1

A list of occurrences of dominated or co-dominated alien plant communities in Italy, arranged in alphabetical order by class, order, alliance, and association/ phytocoenosis

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Supplementary material 2

References for Syntaxonomic scheme of alien-dominated and co-dominated plant communities in Italy updated to 2020

Authors: Daniele Viciani, Michele Lonati, Ginevra Nota, Pietro Minissale, Alicia Teresa Rosario Acosta, Michele Adorni, Marina Allegrezza, Claudia Angiolini, Silvia Assini, Simonetta Bagella, Rossano Bolpagni, Gianmaria Bonari, Francesco Boscutti, Silvia Cannucci, Simona Casavecchia, Daniela Ciccarelli, Dario Comunello, Michele Dalle Fratte, Leopoldo de Simone, Lorella Dell'Olmo, Silvia Del Vecchio, Letizia Di Biase, Romeo Di Pietro, Emanuele Fanfarillo, Tiberio Fiaschi, Matilde Gennai, Lorenzo Gianguzzi, Daniela Gigante, Rocco Labadessa, Lorenzo Lastrucci, Lorenzo Lazzaro, Alice Misuri, Antonio Morabito, Michele Mugnai, Carmelo Maria Musarella, Glauco Patera, Emanuele Pelella, Mauro Pellizzari, Silvia Poponessi, Irene Prisco, Giovanni Rivieccio, Saverio Sciandrello, Alberto Selvaggi, Eugenia Siccardi, Giovanni Spampinato, Angela Stanisci, Federico Maria Tardella, Stefano Tasinazzo, Giulio Tesei, Giacomo Trotta, Barbara Valle, Marco Varricchione, Mariacristina Villani, Katia Zanatta, Adriano Stinca

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Supplementary material 3

Syntaxonomic scheme of alien-dominated and co-dominated plant communities in Italy updated to 2020, following the Italian Vegetation Prodrome

Authors: Daniele Viciani, Michele Lonati, Ginevra Nota, Pietro Minissale, Alicia Teresa Rosario Acosta, Michele Adorni, Marina Allegrezza, Claudia Angiolini, Silvia Assini, Simonetta Bagella, Rossano Bolpagni, Gianmaria Bonari, Francesco Boscutti, Silvia Cannucci, Simona Casavecchia, Daniela Ciccarelli, Dario Comunello, Michele Dalle Fratte, Leopoldo de Simone, Lorella Dell'Olmo, Silvia Del Vecchio, Letizia Di Biase, Romeo Di Pietro, Emanuele Fanfarillo, Tiberio Fiaschi, Matilde Gennai, Lorenzo Gianguzzi, Daniela Gigante, Rocco Labadessa, Lorenzo Lastrucci, Lorenzo Lazzaro, Alice Misuri, Antonio Morabito, Michele Mugnai, Carmelo Maria Musarella, Glauco Patera, Emanuele Pelella, Mauro Pellizzari, Silvia Poponessi, Irene Prisco, Giovanni Rivieccio, Saverio Sciandrello, Alberto Selvaggi, Eugenia Siccardi, Giovanni Spampinato, Angela Stanisci, Federico Maria Tardella, Stefano Tasinazzo, Giulio Tesei, Giacomo Trotta, Barbara Valle, Marco Varricchione, Mariacristina Villani, Katia Zanatta, Adriano Stinca

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Link: https://doi.org/10.3897/ved.197248.suppl3

Supplementary material 4

Syntaxonomic scheme of alien-dominated and co-dominated plant communities in Italy updated to 2020, following FloraVeg.EU

Authors: Daniele Viciani, Michele Lonati, Ginevra Nota, Pietro Minissale, Alicia Teresa Rosario Acosta, Michele Adorni, Marina Allegrezza, Claudia Angiolini, Silvia Assini, Simonetta Bagella, Rossano Bolpagni, Gianmaria Bonari, Francesco Boscutti, Silvia Cannucci, Simona Casavecchia, Daniela Ciccarelli, Dario Comunello, Michele Dalle Fratte, Leopoldo de Simone, Lorella Dell'Olmo, Silvia Del Vecchio, Letizia Di Biase, Romeo Di Pietro, Emanuele Fanfarillo, Tiberio Fiaschi, Matilde Gennai, Lorenzo Gianguzzi, Daniela Gigante, Rocco Labadessa, Lorenzo Lastrucci, Lorenzo Lazzaro, Alice Misuri, Antonio Morabito, Michele Mugnai, Carmelo Maria Musarella, Glauco Patera, Emanuele Pelella, Mauro Pellizzari, Silvia Poponessi, Irene Prisco, Giovanni Rivieccio, Saverio Sciandrello, Alberto Selvaggi, Eugenia Siccardi, Giovanni Spampinato, Angela Stanisci, Federico Maria Tardella, Stefano Tasinazzo, Giulio Tesei, Giacomo Trotta, Barbara Valle, Marco Varricchione, Mariacristina Villani, Katia Zanatta, Adriano Stinca

Data type: pdf

Explanation note: Text.

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Link: https://doi.org/10.3897/ved.197248.suppl4

Supplementary material 5

Distribution maps with references

Authors: Daniele Viciani, Michele Lonati, Ginevra Nota, Pietro Minissale, Alicia Teresa Rosario Acosta, Michele Adorni, Marina Allegrezza, Claudia Angiolini, Silvia Assini, Simonetta Bagella, Rossano Bolpagni, Gianmaria Bonari, Francesco Boscutti, Silvia Cannucci, Simona Casavecchia, Daniela Ciccarelli, Dario Comunello, Michele Dalle Fratte, Leopoldo de Simone, Lorella Dell'Olmo, Silvia Del Vecchio, Letizia Di Biase, Romeo Di Pietro, Emanuele Fanfarillo, Tiberio Fiaschi, Matilde Gennai, Lorenzo Gianguzzi, Daniela Gigante, Rocco Labadessa, Lorenzo Lastrucci, Lorenzo Lazzaro, Alice Misuri, Antonio Morabito, Michele Mugnai, Carmelo Maria Musarella, Glauco Patera, Emanuele Pelella, Mauro Pellizzari, Silvia Poponessi, Irene Prisco, Giovanni Rivieccio, Saverio Sciandrello, Alberto Selvaggi, Eugenia Siccardi, Giovanni Spampinato, Angela Stanisci, Federico Maria Tardella, Stefano Tasinazzo, Giulio Tesei, Giacomo Trotta, Barbara Valle, Marco Varricchione, Mariacristina Villani, Katia Zanatta, Adriano Stinca

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Link: https://doi.org/10.3897/ved.197248.suppl5

Supplementary material 6

List of the dominant or co-dominant alien species detected in alien dominated or co-dominated plant communities, distinguishing between them based on their time of introduction and invasiveness

Authors: Daniele Viciani, Michele Lonati, Ginevra Nota, Pietro Minissale, Alicia Teresa Rosario Acosta, Michele Adorni, Marina Allegrezza, Claudia Angiolini, Silvia Assini, Simonetta Bagella, Rossano Bolpagni, Gianmaria Bonari, Francesco Boscutti, Silvia Cannucci, Simona Casavecchia, Daniela Ciccarelli, Dario Comunello, Michele Dalle Fratte, Leopoldo de Simone, Lorella Dell'Olmo, Silvia Del Vecchio, Letizia Di Biase, Romeo Di Pietro, Emanuele Fanfarillo, Tiberio Fiaschi, Matilde Gennai, Lorenzo Gianguzzi, Daniela Gigante, Rocco Labadessa, Lorenzo Lastrucci, Lorenzo Lazzaro, Alice Misuri, Antonio Morabito, Michele Mugnai, Carmelo Maria Musarella, Glauco Patera, Emanuele Pelella, Mauro Pellizzari, Silvia Poponessi, Irene Prisco, Giovanni Rivieccio, Saverio Sciandrello, Alberto Selvaggi, Eugenia Siccardi, Giovanni Spampinato, Angela Stanisci, Federico Maria Tardella, Stefano Tasinazzo, Giulio Tesei, Giacomo Trotta, Barbara Valle, Marco Varricchione, Mariacristina Villani, Katia Zanatta, Adriano Stinca

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