

Bund flora in the traditional rice paddy terraces in some foothill landscapes of Guilan Province, N. Iran, towards conservation of phytodiversity in agroecosystems

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ABSTRACT

One of the most important drivers of floristic biodiversity in the agricultural landscapes is semi-natural edge habitats. Rice paddy terraces are mostly found in the foothills and sub-montane parts of Iran's northern provinces, whereas rice is mostly farmed in the country's lowlands. The present study provides information on the floristic distribution of rice-terraced paddy bunds in the foothill areas of northern Iran. A total of 121 species, representing 29 families of vascular plants were recorded. Therophytes (50.4%) were the most frequent life forms, indicating typical ruderal vegetation and environmental disturbances. The most dominant chorotypes of recorded species were pluri-regional (53.7%) and cosmopolitan (15.7%) elements. In terms of conservation status, there are five species on the IUCN Red List that are mainly classified in the "least concern" category. Alien species are estimated to comprise 19.8 % of the flora. The results of the current study can be used as a scientific backbone for developing agricultural landscape management and conservation plans in Iran.

Keywords: Agro-landscape, Alien species, Guilan Province, Marginal habitat, Rice fields.

Article type: Research Article.

INTRODUCTION

Agricultural landscapes are among the most common and important ecosystems on the planet, with prevailing cropping systems containing varying-sized patches of less-managed uncropped regions like grasslands, forests, or wetlands (Bennett *et al.* 2021; Haan *et al.* 2021; Mueller *et al.* 2021). These landscapes are the outcome of interactions between farming operations and the surrounding natural environment (Kizos & Vlachos 2012) and cover about 40% of our planet's total terrestrial surface area and supply more than just a food source (Montoya *et al.* 2020). They also provide a variety of ecosystem services, such as erosion and flooding control, pollinator habitat, carbon sequestration, cultural heritage, and aesthetic perception (Bennett *et al.* 2021). The existence of natural areas, or landscape heterogeneity, and enhancing habitat quality is widely recognized for supporting species diversity and providing ecosystem services in agricultural landscapes. Agricultural spread and intensive management may have resulted in high crop yields during the last half-century, but it has also led to a reduction of diversity and functionality by simplifying habitats and landscapes (Cardarelli & Bogliani 2014; Vanbergen *et al.* 2020). Rice is an annual plant native to Asia and Africa, and it is now grown under various climatic conditions, from temperate to tropical, with different hydrological conditions and soil types across 116 countries (Datta *et al.* 2017; FAOSTAT 2019). Paddy terraces are stair-like fields for the irrigated cultivation of rice and have been constructed on the sloped terrains of hilly and mountainous regions (Mori *et al.* 2019; Chen *et al.* 2021). These

agro-ecosystems, which are one of the most outstanding agricultural landscapes, are well known in Asian countries (Koyanagi *et al.* 2014; Chen *et al.* 2018; Everard 2018). Semi-natural grasslands surrounding paddy terraces are found between paddies (also referred to as bunds, dikes, or levees) and other features, including irrigation ditches or woodlands. They are built and maintained to keep water in the paddies while also functioning as footpaths and transportation, as well as defining the boundaries of possessions. Semi-natural grasslands can also serve as a refuge for agricultural landscapes to preserve natural vegetation. However, alien weed and pest species represent a threat to these semi-natural edge habitats (Bambaradeniya & Amerasinghe 2004; Matsumura & Takeda 2010; Uematsu & Ushimaru 2013; Koyanagi *et al.* 2014). Alien plant species have been introduced to new places as a result of human activities. They establish, thrive, and spread, outcompeting and affecting the native plants of the invaded region, which are species that have evolved in a specific area without human interference and are growing through natural means (Halmy 2019; Dehshiri 2021; Zhailybayeva *et al.* 2024). Cultivated lands are one of the centers for the alien species introduction, which has an impact on agricultural production and the surrounding ecosystem (Yamamoto & Kusumoto 2008; Memariani 2021; Ajamian *et al.* 2024). In particular, as mentioned above, the bund habitat of the rice production ecosystem is a good example of these centers. Although there have been extensive studies on the floristic composition and vegetation of paddies (Bolòs & Masclans 1955; Piccoli & Gerdol 1981; Turki & Sheded 2002; García & Benzal 2009; Nowak *et al.* 2013; Nowak *et al.* 2015; Nowak *et al.* 2016; Fried *et al.* 2017; Kim *et al.* 2019; Irakiza *et al.* 2021), little is known about the vegetation characteristics of paddy bunds (Fukamachi *et al.* 2005; Kawano *et al.* 2009; Matsumura & Takeda 2010; Uematsu & Ushimaru 2013; Koyanagi *et al.* 2014; Nemoto & Otsuka 2014; Fried *et al.* 2018). Iran has more than 600,000 ha of planted rice land, with over 80% concentrated in the two northern provinces, i.e., Mazandaran and Guilan (FAO 2019). Rice is grown predominantly in the lowlands of Iran. Paddy terraces, on the other hand, are only found in the north of the country, in the foothills and sub-montane areas. The aim of this study was to identify the floristic composition, life form, chorology, and endangered plant species of selected terrace paddies' bund habitats in Guilan Province, North Iran.

MATERIALS AND METHODS

Study area

The study area included terraced paddy fields located in the Rudbar and Rudsar counties, Guilan Province, Northern Iran (Fig. 1). The province is divided into two different regions based on altitude: the lowlands, which are adjacent to the Caspian Sea, and the mountainous sector, which covers over 70% of the province's total territory. The plains, or coastal lowlands, which are located at an altitude of less than 100 m above sea level, are the most important rice farming centers in the province. However, leveling and terracing are used to a lesser extent in the province's mountainous and sloping areas to produce rice (Eghbal *et al.* 2012). The summers in Guilan Province are hot and humid, while the winters are generally mild, with average monthly temperatures ranging from 3 °C in January to 30 °C in July. The mean annual precipitation is about 1506 mm, with October to December receiving 41% of the annual rainfall (Ashrafzadeh *et al.* 2016). The sampling sites range in elevation from 259 m to 394 m above sea level. Herbicide application in paddy levees is uncommon, and weeding is mostly done by hand.

Data collection

Vegetation was surveyed in paddy fields bunds and other surrounding grasslands during spring and summer 2018–2020. The voucher specimens were preserved in the herbarium of Guilan University (GUH). Flora Iranica (Rechinger 1963–2010), Flora of Iran (Assadi *et al.* 1988–2018), and Flora China (<http://www.efloras.org>; accessed 2021) are used for plant identification. The names of scientific plant taxa were standardized in accordance with The Plant List (<http://www.theplantlist.org>, viewed 2 October 2021) and International Plant Name Index (<http://www.ipni.org>, viewed 2 October 2021). Life-forms were determined according to Raunkiaer's classification (1934), and geographical distribution was based on Zohary (1973), Takhtajan (1986), and Léonard (1989). In the present study, the following abbreviations were used: ES (plants distributed in the Euro-Siberian region), IT (plants distributed in the Irano-Turanian region), M (plants distributed in the Mediterranean region), PL (pluri-regional elements, plants that cover over three of the above-mentioned phytogeographical regions); and COS (cosmopolitan refers to plants that are distributed all over the world). The IUCN Red List Categories were used to assess threatened species in the study area (IUCN 2021). The identification of non-native plants was based on the Global Naturalized Alien Flora (GloNAF, <http://www.glonaf.org>, viewed 14 October 2021; Van Kleunen

et al. 2019), the Global Register of Introduced and Invasive Species (GRIIS <http://www.griis.org>, viewed 14 October 2021) databases, the above Flora Books, and all other floristic literature accessible.

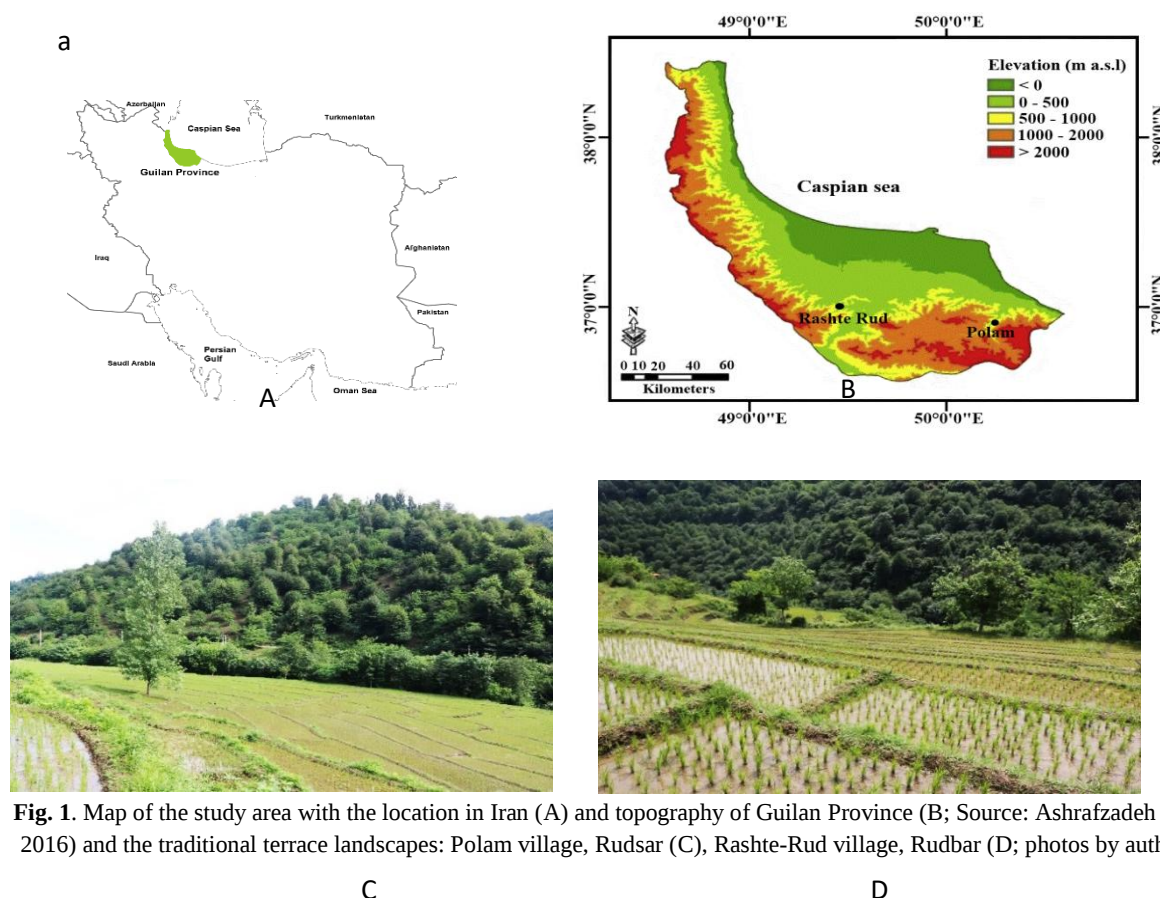


Fig. 1. Map of the study area with the location in Iran (A) and topography of Guilan Province (B; Source: Ashrafzadeh *et al.* 2016) and the traditional terrace landscapes: Polam village, Rudsar (C), Rasht-e Rud village, Rudbar (D; photos by authors)

RESULTS

A total of 121 species of vascular plants were identified from terraced paddies bunds, and other adjacent vegetation, belonging to 29 families and 84 genera (Appendix 1). The most represented families were Poaceae (19 taxa, 15.7%), Asteraceae (15 taxa, 12.4%), Fabaceae (12 taxa, 9.9%) and Cyperaceae (10 taxa, 8.3%). The genera with the most taxa were *Cyperus* (8), *Trifolium* (7), and *Rubus* (4). The most prevalent living forms were therophytes, which account for 50.4 % (61 taxa) of the investigated flora, followed by hemicryptophytes (27 taxa, 22.3%) and geophytes (19 taxa, 15.7%) (Fig. 2a). The chorological spectrum revealed pluri-regional (65 taxa, 53.7%) and cosmopolitan (19 taxa, 15.7%) elements with the most distribution in the area (Fig. 2b). Five taxa were Hyrcanian (sub) endemics, all of which were classified as "least concern" on the IUCN red list. (Table 1). Furthermore, the contribution of alien taxa was 19.8%, of which 5.8% was invasive. Five taxa were Hyrcanian (sub) endemics and red listed by IUCN, all in the "least concern" category (Table 1). The paddy bund habitats of the studied traditional rice paddies represent relatively a high species pool. Several exotic species are present in our research area. With the expansion of agriculture, dense human activities, and environmental degradation during the last 200 years, the detrimental impacts of non-native plant species around the world have increased (Shimura *et al.* 2010). Invasive alien species induce vegetative homogenization, community boundary modifications, and biodiversity loss. Because invasive alien species are often highly competitive, they have a negative impact on ecosystem function as well as significant economic consequences (Pungar *et al.* 2021). In our study, natives have been recorded more than aliens. However, the loss of native species diversity and the effects of aliens, particularly invasive taxa, should be monitored on a regular basis in order to achieve sustainable management on these farmlands (Rai 2020). Agricultural landscapes, like natural areas, have a high potential for biodiversity due to the different habitat types (Waide *et al.* 1999). Generally, the rice ecosystem is structurally made up of three components: (i) flooded paddy, (ii) paddy levee, and (iii) irrigation canals and ditches, each supports microhabitats with distinct vegetation and ecological functions (Matsumura *et al.* 2014; Choi *et al.* 2021).

Paddies are highly managed anthropogenic habitats characterized by tillage, flooding, and extended herbicide application, resulting in a species-poor and uniform flora (Miyawaki 1960; Kim *et al.* 2019).

Table 1. (Sub) endemic Hyrcanian species of the research area. All taxa are listed by IUCN in the "least concern" category.

Family	Taxa
Lamiaceae	<i>Teucrium hyrcanicum</i>
Polygonaceae	<i>Polygonum hyrcanicum</i>
	<i>Rubus hyrcanus</i>
Rosaceae	<i>Rubus persicus</i>
Rubiaceae	<i>Phuopsis stylosa</i>

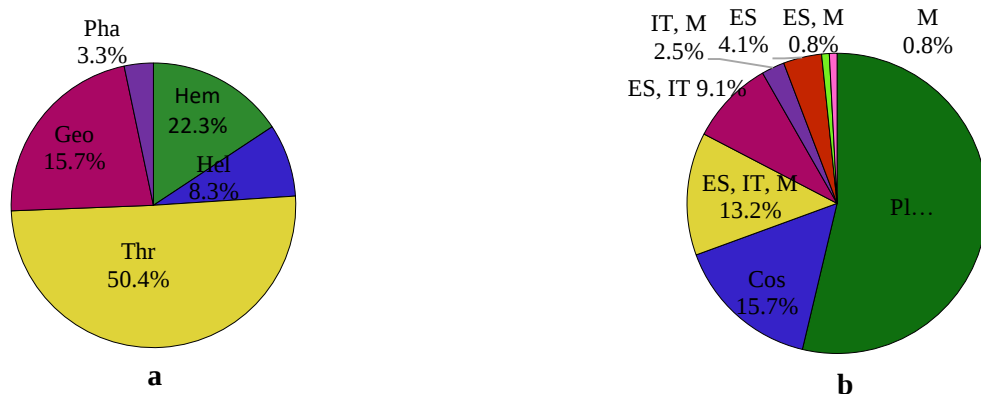


Fig. 2. Life form (a) and chorological (b) spectra in the paddy terrace landscapes of Guilan Province. Abbreviations: a) Thr: Therophyte, Hem: Hemicryptophytes, Pha: Phanerophytes, Hel: helophytes, Geo: geophyte. b) Pl: Pluri-regional, Cos: Cosmopolitan elements, IT: Irano-Turanian elements, M: Mediterranean elements, ES: Euro-Siberian.

In contrast, several studies have found that the flora and vegetation on levees differ and are more diverse than in paddy habitats (Bambaradeniya *et al.* 2004; Nemoto & Otsuka 2014; Kumalasari & Bergmeier 2014; Fried *et al.* 2018). Bund plant communities are mostly terrestrial, but in the early stages of the rice cultivation cycle, aquatic plants and, prior to harvesting, terrestrial plants thrive in paddies. Traditional levees are important in our terrace paddies to maintain the plant biodiversity of the surrounding semi-natural elements. Due to the slopes of the topography, terrace paddy fields have lower paddy sizes and broader levees than lowland paddy fields (Miyashita *et al.* 2014). For biological control and integrated pest management, the well-managed vegetation of the bund may provide a valuable habitat for natural enemies of rice pests. However, they can be important entry points for weed seeds or propagules into the paddy if not properly maintained (Rao *et al.* 2017). Tertiary relict tree species or seedlings (Akhani *et al.* 2010; Naqinezhad *et al.* 2022), such as *Alnus subcordata*, *Gleditsia capsica*, and *Parrotia persica*, can be found scattered in some parts of our investigated bunds, between forest and paddies. This woody vegetation makes hedgerows for agricultural systems (Burel 1996). Hedgerows reduce water and wind erosion by deterring surface runoff and acting as effective windbreaks to protect surrounding fields from severe weather, respectively. They provide a diverse habitat for many plant species while also integrating other fragmented forest ecosystems and maintaining biodiversity (Litza *et al.* 2022). Despite the importance of hedgerows, farmers destroy them by cutting the trees to avoid disease or insect infestations and shade for the rice. The predominance of therophytes in the bund flora of this study highlights adaptations to strong disturbances such as frequent trampling. Studies by Kawano *et al.* (2009) in Japan and Fried *et al.* (2018) in Vietnam and the Philippines' paddy bund of agricultural systems have confirmed the present findings. Plant survival strategies with burning or mowing are represented by the biological spectra of geophytes and hemicryptophytes (Kawano *et al.* 2008). Studies of the geographical distribution of plants are very important for biodiversity conservation and management (Zeb *et al.* 2021). The high proportion of pluri-regional and cosmopolitan taxa in the current research is attributed to weeds and ruderal species in the vegetation (Akhani *et al.* 2010), indicating substantial human influences.

CONCLUSION

This research examined the vegetation bunds in the rice terrace agro-ecosystems in Northern Iran. Bund habitat has a moderate level of human intervention, resulting in a dynamic vegetation in which both human and environmental variables influence species persistence (Pitkänen *et al.* 2016). The results from this study should be considered to establish management schemes to conserve these valuable habitats. We recommend that future studies be conducted on the paddy bund vegetation and compare the results with other similar ecosystems. The conservation of rare and endangered species, assessing the presence and implications of aliens in order to promote ecological resilience and the improvement of ecosystem services are the major objectives of these initiatives. We came to the conclusion that preserving the biodiversity of these semi-natural habitats, along with agricultural regions, would enhance overall biodiversity maintenance and support.

ACKNOWLEDGEMENTS

This paper is dedicated to the memory of Dr. Shahryar Saeidi Mehrvarz, professor of botany at the University of Guilan. The authors would like to express their thank to the farmers who graciously permitted them access to their land. We appreciate all the support of the Guilan Province Agricultural Jihad Organization during the sampling interval.

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Appendix 1

List of recorded species in the surrounding semi-natural vegetation of terrace paddies of Guilan Province during the years 2018-2019. abbreviations used, Life forms: Geo geophyte, Hel helophyte, Hem hemicryptophyte, Pha phanerophyte, Thr therophyte; Chorotypes: Cos cosmopolitan, ES EuroSiberian, Hyr hyrcanian, IT Irano-Turanian, M Mediterranean, Pl pluri-regional; Status: Al alien, In invasive, Na native.

Bibliographic information of this paper for citing:

Ashouri, M, Naqinezhad, A, Norastehnia, A 2025, Bund flora in the traditional rice paddy terraces in some foothill landscapes of Guilan Province, N. Iran, towards conservation of phytodiversity in agroecosystems. *Caspian Journal of Environmental Sciences*, 23: 849-859.

Taxa	Life form	Chorotype	Status
Monilophytes			
Dennstaedtiaceae			
<i>Ashouri et al.</i> <i>Pteridium aquilinum</i> (L.) Kuhn.	Geo	Cos	Al/In
Angiosperms			
Eudicots			
Adoxaceae			
<i>Sambucus ebulus</i> L.	Geo	ES, IT, M	Na
Amaranthaceae			
<i>Alternanthera sessilis</i> R.Br.	Thr	Pl	Al
<i>Amaranthus lividus</i> L.	Thr	Pl	Na
<i>Amaranthus retroflexus</i> L.	Thr	Pl	Al
<i>Amaranthus viridis</i> L.	Thr	Pl	Al
<i>Chenopodium album</i> L.	Thr	Cos	Al
Apiaceae			
<i>Pimpinella affinis</i> Ledeb.	Hem	Pl	Na
<i>Berula erecta</i> (Huds.) Coville	Hel	Pl	Na
<i>Centella asiatica</i> (L.) Urban	Hem	ES, IT	Na
<i>Cyclospermum leptophyllum</i> (Pers.) Sprague	Thr	Pl	Al
<i>Torilis heterophylla</i> Guss.	Thr	Pl	Na
<i>Torilis leptophylla</i> (L.) Gaertn.	Thr	Pl	Na
Asteraceae			
<i>Anthemis cotula</i> L.	Thr	Pl	Na
<i>Artemisia annua</i> L.	Thr	ES, IT, M	Na
<i>Artemisia vulgaris</i> L.	Hem	Pl	Na
<i>Bidens tripartita</i> L.	Thr	Pl	Na
<i>Centaurea iberica</i> Trev. ex Spreng.	Thr	Pl	Na
<i>Conyza bonariensis</i> (L.) Cronq.	Thr	Cos	Al
<i>Conyza canadensis</i> (L.) Cronquist	Thr	Cos	Al
<i>Conyzanthus squamatus</i> (Spreng.) Tamamsch.	Hem	Pl	Na
<i>Crepis micrantha</i> Czerep.	Thr	ES, IT, M	Na
<i>Eclipta prostrata</i> (L.) L.	Thr	Pl	Al
<i>Erigeron annuus</i> (L.) Pers.	Thr	Pl	Na
<i>Lapsana communis</i> L.	Hem	ES, IT	Na
<i>Sonchus asper</i> (L.) Hill. subsp. <i>glaucescens</i> (Jordan) Ball	Hem	Pl	Na
<i>Sonchus oleraceus</i> L.	Thr	Pl	Na
<i>Xanthium strumarium</i> L.	Thr	Pl	Al
Boraginaceae			
<i>Myosotis Palustris</i> (L.) Nathh.	Geo	Cos	Na
Brassicaceae			
<i>Cardamine hirsuta</i> L.	Thr	Cos	Na
<i>Nasturtium officinale</i> W.T. Aiton	Hel	Pl	Na
<i>Rorippa islandica</i> (Oeder) Borbás	Geo	Pl	Na
Caryophyllaceae			
<i>Cerastium glomeratum</i> Thuill.	Thr	Cos	Na
<i>Cerastium semidecandrum</i> L.	Thr	ES, IT, M	Na
<i>Stellaria media</i> Cirillo	Thr	Cos	Al/In
Convolvulaceae			
<i>Calystegia sepium</i> (L.) R.Br.	Geo	Pl	Na
Euphorbiaceae			
<i>Acalypha australis</i> L.	Thr	Pl	Al
<i>Euphorbia helioscopia</i> L.	Thr	ES, IT, M	N
<i>Euphorbia maculata</i> L.	Thr	Pl	Al
Fabaceae			
<i>Medicago lupulina</i> L.	Thr	Pl	Na
<i>Medicago minima</i> (L.) L.	Thr	Pl	Na
<i>Medicago polymorpha</i> L.	Thr	IT, M	Na
<i>Melilotus indicus</i> L. (All.)	Thr	Pl	Na
<i>Securigera varia</i> (L.) Lassen.	Thr	ES, IT, M	Na
<i>Trifolium arvense</i> L.	Thr	Pl	Na

<i>Trifolium campestre</i> Schreb.	Thr	ES, IT, M	Na
<i>Trifolium fragiferum</i> L.	Geo	Pl	Na
<i>Trifolium pratense</i> L.	Hem	Pl	Na
<i>Trifolium repens</i> L. var. <i>repens</i>	Geo	ES, IT, M	Na
<i>Trifolium resupinatum</i> L.	Thr	ES, IT, M	Na
<i>Trifolium scabrum</i> L.	Thr	ES, M	Na
Geraniaceae			
<i>Geranium dissectum</i> L.	Hem	ES, IT	Al
Hypericaceae			
<i>Hypericum perforatum</i> L.	Hem	Cos	Na
Lamiaceae			
<i>Calamintha officinalis</i> Moench	Geo	ES, IT	Na
<i>Lycopus europaeus</i> L.	Geo	Pl	Na
<i>Mentha aquatica</i> L.	Hel	ES	Na
<i>Mentha longifolia</i> L.	Hem	Pl	Na
<i>Prunella vulgaris</i> (L.) L.	Geo	Pl	Na
<i>Teucrium hyrcanicum</i> Steud.	Geo	ES	Na
Lythraceae			
<i>Ammannia baccifera</i> L.	Hel	Pl	Na
<i>Lythrum salicaria</i> L.	Hem	Cos	Na
Onagraceae			
<i>Epilobium hirsutum</i> L.	Hem	Pl	Na
<i>Ludwigia palustris</i> (L.) Elliott	Hel	Cos	Na
Oxalidaceae			
<i>Oxalis corniculata</i> L.	Thr	Cos	Na
Phytolaccaceae			
<i>Phytolacca americana</i> L.	Hem	Pl	Na
Plantaginaceae			
<i>Plantago major</i> L.	Hem	Pl	Na
<i>Veronica anagallis-aquatica</i> L.	Hel	Pl	Na
<i>Veronica polita</i> L.	Thr	Cos	Na
Polygonaceae			
<i>Persicaria lapathifolia</i> (L.) S.F. Gray subsp. <i>lapathifolia</i>	Thr	ES, IT	Na
<i>Polygonum aviculare</i> L.	Thr	ES, IT	Al/In
<i>Polygonum hyrcanicum</i> Rech. F.	Thr	ES, IT	Na
<i>Rumex sanguineus</i> L.	Hem	ES, IT	Na
<i>Rumex Pulcher</i> L.	Hem	ES, IT, M	Na
Primulaceae			
<i>Anagallis arvensis</i> L. var. <i>arvensis</i>	Thr	Cos	Al
<i>Centaureum pulchellum</i> (Sw.) Druce	Thr	ES, IT, M	Na
Ranunculaceae			
<i>Ranunculus marginatus</i> d'Urv.	Thr	Pl	Na
<i>Ranunculus muricatus</i> L.	Thr	IT, M	Na
<i>Ranunculus scleratus</i> L.	Thr	Pl	Na
Rosaceae			
<i>Agrimonia eupatoria</i> L.	Hem	ES, IT, M	Na
<i>Potentilla reptans</i> L.	Hem	ES, IT, M	Na
<i>Rubus caesius</i> L.	Pha	ES, IT	Na
<i>Rubus hyrcanus</i> Juz.	Pha	ES (Hyr)	Na
<i>Rubus persicus</i> Boiss.	Pha	ES (Hyr)	Na
<i>Rubus sanctus</i> Schreb.	Pha	ES, IT	Na
Rubiaceae			
<i>Galium ghilanicum</i> Stapf.	Thr	ES, IT, M	Na
<i>Galium humifusum</i> M.B.	Geo	ES, IT, M	Na
<i>Oldenlandia capensis</i> var. <i>pleiosepala</i> Bremek.	Thr	M	Na
<i>Phuopsis stylosa</i> (Trin.) Hook.f. ex B.D. Jacks.	Geo	ES (Hyr)	Na
Verbenaceae			

<i>Phyla nodiflora</i> (L.) Greene	Hem	Pl	Na
<i>Verbena officinalis</i> L.	Hem	Pl	Na
Monocots			
Alismataceae			
<i>Alisma plantago-aquatica</i> L.	Hel	Pl	Na
Cyperaceae			
<i>Cyperus difformis</i> L.	Thr	Pl	Na
<i>Cyperus esculentus</i> L.	Geo	Cos	Al
<i>Cyperus fuscus</i> L.	Thr	Pl	Na
<i>Cyperus glaber</i> L.	Thr	Pl	Na
<i>Cyperus longus</i> L.	Geo	Pl	Na
<i>Cyperus odoratus</i> L. subsp. <i>transcaucasicus</i> (Kuk.) Kukkonen	Geo	ES, IT	Na
<i>Cyperus rotundus</i> L.	Geo	Cos	Na
<i>Cyperus serotinus</i> Rottb.	Hel	Pl	Na
<i>Eleocharis uniglumis</i> Schult.	Hel	Pl	Na
<i>Fimbristylis bisumbellata</i> (Forssk.) Bubani	Thr	Pl	Na
Juncaceae			
<i>Juncus effusus</i> L.	Geo	Cos	Na
Poaceae			
<i>Alopecurus myosuroides</i> Huds.	Thr	Pl	Na
<i>Arthraxon hispidus</i> (Thunb.) Makino var. <i>hispidus</i>	Thr	Pl	Al
<i>Catabrosa aquatica</i> (L.) P. Beauv.	Hel	Pl	Na
<i>Cynodon dactylon</i> (L.) Pers.	Hem	Pl	Al/In
<i>Dactylis glomerata</i> L.	Hem	Pl	Na
<i>Digitaria sanguinalis</i> (L.) Scop. subsp. <i>pectiniformis</i> Henrard	Thr	Pl	Na
<i>Echinochloa colona</i> (L.) Link.	Thr	Pl	Al
<i>Echinochloa crus-galli</i> (L.) P.Beauv.	Thr	Cos	Al/In
<i>Eleusine indica</i> (L.) Gaertn.	Thr	Pl	Al
<i>Lolium perenne</i> L.	Hem	Pl	Na
<i>Lolium rigidum</i> Gaudin	Thr	ES, IT, M	Na
<i>Microstegium vimineum</i> (Trin.) A. Camus	Hem	Pl	Na
<i>Paspalum dilatatum</i> Poir.	Hem	Pl	Al/In
<i>Paspalum distichum</i> L.	Hem	Cos	Al/In
<i>Poa annua</i> L.	Thr	Pl	Na
<i>Poa trivialis</i> L.	Hem	Pl	Na
<i>Setaria glauca</i> (L.) P. Beauv.	Thr	Pl	Na
<i>Sorghum halepense</i> Pers.	Geo	Pl	Na
<i>Vulpia myuros</i> (L.) C.C. Gmel.	Thr	IT, M	Na